Dietary Guidelines for Children and Adolescents in Australia

incorporating the

Infant Feeding Guidelines for Health Workers

Endorsed 10 April 2003

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National Health & Medical Research Council
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- applying research evidence to health issues thus translating research into better health practice and outcomes; and
- promoting informed debate on health and medical research, health ethics and related issues.

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Reliable information about food, nutrition and health is also available from:

- Nutrition Australia — www.nutritionaustralia.org
- Dietitians Association of Australia (DAA) — www.daa.asn.au
- Food Standards Australia New Zealand (FSANZ) — www.foodstandards.gov.au who also produce The official shopper's guide to food additives and labels: know what you are eating at a glance (published by Murdoch)
- Local community health centres
- State Departments of health
- Baby, child and youth health centres
- Accredited practising dietitians in private practice (look in the yellow pages) or in hospitals and community centres
- National Heart Foundation of Australia — www.heartfoundation.com.au
- Diabetes Australia — www.diabetesaustralia.com.au

Disclaimer

This document is a general guide to appropriate practice, to be followed only subject to the clinician's judgement in each individual case.

The guidelines are designed to provide information to assist decision-making and are based on the best information available at the date of compilation.

It is planned to review this Guideline in 2008. For further information regarding the status of this document, please refer to the NHMRC web address: http://www.nhmrc.gov.au

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**INFANT FEEDING GUIDELINES FOR HEALTH WORKERS**
The Australian government has been providing nutrition advice for more than 75 years. In the past two decades the National Health and Medical Research Council has developed and disseminated public health guidelines providing dietary advice for Australians. The first edition of the Dietary Guidelines for Children and Adolescents in Australia was published in 1995. This current document is the first revision of those guidelines; it also incorporates the revised Infant Feeding Guidelines for Health Workers, which were originally published in 1996. The Dietary Guidelines for Australian Adults and the Dietary Guidelines for Older Australians have been published separately. All these guidelines seek to promote the potential benefits of healthy eating, not only to reduce the risk of diet-related disease but also to improve the community’s health and wellbeing.

The Australian Food and Nutrition Policy, endorsed in 1992, aims to improve the health of Australians and reduce the burden of preventable diet-related death, illness and disability through strategies that support the dietary guidelines. It is estimated that the current economic cost to the nation of the principal diet-related conditions—coronary heart disease, stroke and cancer—is about $6 billion a year, so the potential economic benefit of an effective nutrition-based preventive strategy is enormous.

The Australian Food and Nutrition Policy is based on the principles of good nutrition, ecological sustainability and equity. This edition of the Dietary Guidelines for Children and Adolescents is consistent with these principles. The food system must be economically viable and the quality and integrity of the environment must be maintained. In this context, among the important considerations are conservation of scarce resources such as topsoil, water and fossil energy and problems such as salinity. Other important considerations have been noted in Food for Health, the Nutrition Taskforce’s report to the New Zealand Ministry of Health. They include change in consumer demand towards foods that are fresher and lower in fat and the recent restructuring of the food industry from a protected industry to an open, competitive one. Although this has led to greater concentration of ownership, pricing strategy and policy development in the food sector, it has also given health policy makers greater access to the industry. In addition, globalisation is playing an increasing role in framing the management of the Australian food supply.

This book describes the scientific rationale for the guidelines and is intended for health professionals. Other documents will be produced in a format that is more suitable for children, adolescents and their carers. The guidelines may also be useful for health professionals wanting to develop diets for children and infants in other health circumstances: it must always be remembered, however, that
these guidelines are for healthy children and adolescents and may not satisfy the specific nutritional requirements of children and adolescents with particular diseases or conditions. For the purposes of these Guidelines for Children and Adolescents, infants are defined as children under the age of 12 months, toddlers as children aged 1 to 2 years and preschoolers as children aged 3 to 5 years; young child means a child aged 1 to 5 years, primary school age is 6 to 11 years, and an adolescent is someone aged 12 to 18 years.

The Dietary Guidelines are an essential tool to support broader strategies to improve nutrition outcomes in Australia as outlined in Eat Well Australia: An Agenda for Action in Public Health Nutrition which was endorsed in 2001 by the Australian Health Ministers. Compared with the previous edition, this edition of the guidelines focuses more on food groups and lifestyle patterns, moving away from specific nutrients. In particular, the references to the Australian Guide to Healthy Eating will make it easier for children, adolescents, carers and nutrition educators to implement the guidelines. The Australian Guide to Healthy Eating is not the only food guide in use in Australia, and the Working Party recognises the potential for using other suitable guides to promote diets consistent with these guidelines.

The guidelines apply to the total diet: they should not be used to assess the ‘healthiness’ of individual food items, nor should individual guidelines be taken in isolation. Some of the guidelines detail the relationships between different food groups as part of the total diet; others deal with aspects of nutrition where more care is needed and further aspects of nutrition and a healthy lifestyle.

Two of the guidelines relate to the quantity and quality of the food needed by children and adolescents—getting the right types of foods in the appropriate amounts to grow and to meet the body’s nutrient needs. The ‘variety’ guideline creates a positive setting for nutrition and reflects the fact that good, nutritious food is one of the great pleasures of life. The sections of this guideline detail the relationships between different food groups as part of the total diet. Given the major epidemic of obesity we are currently experiencing in Australia, especially among children, the other of these two guidelines deals with appropriate amounts of food for growth whilst also encouraging children and adolescents to be active. Another of the guidelines stresses the need to be vigilant in terms of food safety and, given the increasing awareness of the importance of early nutrition, there is a guideline encouraging everyone to support and promote breastfeeding.

The guidelines are not ranked in order of importance; rather, they form a consistent and complete package when considered together. Detailed information about requirements for specific nutrients in the Australian diet is provided in the NHMRC’s Recommended Dietary Intakes for Use in Australia. The recommended dietary intakes and the dietary guidelines complement each other in providing comprehensive nutrition advice for the Australian community.

The revision process involved extensive consultation with the Australian community, the food industry and experts. The guidelines are based on the best
evidence available, although the Working Party notes that in some cases the evidence for each guideline statement is not complete. In these instances, guidance is provided with the community’s safety and health as the primary concern. The guidelines are a distillation of current knowledge about the relationship between diet, growth and development, and disease; the nutrients available in the Australian food supply; and the contribution diet can make to optimising quality of life and reducing the levels of morbidity and mortality among Australians. Their implementation will result in significant health gains for the community.

Each guideline is supported by background information prepared by members of the Working Party, with some additional assistance, as detailed in the next section. Dr Katrine Baghurst, from CSIRO Health Sciences and Nutrition, and Professor Colin Binns, from the School of Public Health at Curtin University of Technology, chaired the Working Party.

Katrine Baghurst
Colin Binns

September 2002
THE WORKING PARTY

The Working Party developed the guidelines in accordance with National Health and Medical Research Council procedures and in keeping with the following terms of reference established by the NHMRC.

TERMS OF REFERENCE

• Undertake a review of the Dietary Guidelines for Australians … and the Dietary Guidelines for Children and Adolescents … and other related NHMRC dietary guidelines as identified.

• Undertake broad consultation to develop a suite of resources for both sets of guidelines including:
  – comprehensive scientific background papers explaining the rationale for each guideline
  – appropriate consumer resources.

• Produce a Dissemination and Evaluation Plan for both sets of guidelines.

• Report to the Health Advisory Committee.

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The Working Party expresses particular thanks to Ms Dympna Leonard (Tropical Public Health Unit, Queensland Health, Cairns) for her contribution to the section on the nutrition of Aboriginal and Torres Strait Islander peoples.

Ms Leanne Lester (School of Public Health, Curtin University of Technology), and Ms Sally Record (CSIRO Health Sciences and Nutrition) helped with statistical analysis of the results of the 1995 National Nutrition Survey.
ASSESSING THE EVIDENCE

The National Health and Medical Research Council has released a guide called *How to Use the Evidence Assessment and Application of Scientific Evidence*. This guide relates, however, to evidence assessment in connection with clinical practice. In many cases evidence-based guidelines for clinical practice deal with evidence associated with a specific disease and a specific therapeutic agent. Similar criteria are not easily used for evidence assessment related to food and the maintenance of general community health and wellbeing, which is the primary focus of dietary guidelines.

A number of initiatives are under way around the world to try to develop an evidence-based approach to nutrition and health, but this has generally been in response to the need for ‘proof’ in relation to health claims for food components. Food Standards Australia New Zealand (formerly the Australia New Zealand Food Authority) has developed a set of proposed levels of evidence for food or health claims that is similar to, but somewhat broader in scope than, the NHMRC approach for clinical guidelines. Nevertheless, the FSANZ set is still primarily intended for assessing evidence of the efficacy of individual nutrients or food components in relation to a specific health outcome.

The Working Party considered, however, that it would still be useful to consider the NHMRC designation of levels of evidence for clinical practice in relation to the scientific data discussed in this document. These levels of evidence are outlined in the box.

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Six levels of evidence are designated by the NHMRC. Level I is based on a systematic review of all relevant randomised controlled trials and Level II is based on evidence obtained from at least one properly designed randomised controlled trial. There are very few Level I and Level II food-based nutrition trials, although some nutrient-supplement trials fall into these categories. Most food–health studies fall into Level III, the level of evidence that includes study designs such as cohort studies, case-control studies, and comparative ecological studies with historical controls.

Because of the nature of the dietary guidelines, the background papers were developed as a result of a process of comprehensive, rather than systematic, reviewing of the literature. At the conclusion of each guideline, there is a summary of the NHMRC levels of evidence for the literature cited.

The NHMRC notes, ‘A decision should be made about what is feasible and appropriate in a given situation and the extent to which reasonable standards have been met by the available body of evidence’.

The evidence base for the background papers was developed using a variety of data bases and search terms. The literature was assessed using data bases and abstracting systems including the Cochrane Data Base for Randomised Control Trials; Medline, HealthStar, CINAHL using ‘systematic review’ filter, PubMed, Embase, Food & Technology Abstracts, Emerald, BioSis, Australasian Medical Index, Science Direct, Current Contents and searches of citations found in identified papers. Terms used in searches included food groupings such as fruits, vegetables, nuts & seeds, legumes, cereals, meat, poultry, fish, dairy, milk, yoghurt, cheeses, soy, water, alcohol, breastmilk (and breast feeding) and dietary/food intake patterns as well as nutrients such as fats (total and types), carbohydrates sugars, starches, protein, iron, zinc, B12, calcium and salt as well as physical activity. These were investigated where relevant in relation to health outcomes such as overweight, obesity, growth, heart disease, cancers of various sorts, diabetes, bone density and osteoporosis, cognition and ageing. Whilst searches concentrated on human studies and those available in the English language, findings from some animal studies were included to provide evidence on possible mechanisms. The reviews were completed in January 2002 but some key papers published since then have been included.
THE CONSULTATION PROCESS

Development of the Dietary Guidelines for Children and Adolescents, incorporating the Infant Feeding Guidelines for Health Workers, involved consultation with the Australian community and with experts working in the fields of public health and nutrition. Preliminary consultation took place from December 2000 until May 2001 and involved the following:

- analysis of 104 completed and returned questionnaires dealing with the content and use of the first edition of the dietary guidelines
- establishment of an interactive website providing information about the review of the guidelines
- several meetings with stakeholders.

The public consultation process took place between July and August 2001, allowing about six weeks for consideration of the draft guidelines and preparation and lodgment of submissions. Notification was published in the Commonwealth of Australia Gazette and on the NHMRC website. Copies of draft documents and supporting information were available free of charge from the Office of the NHMRC and the website. In addition, notices were placed in other publications and with media such as newspapers and radio and circulated to bodies expected to be interested.

The Dietary Guidelines for Children and Adolescents in Australia, incorporating the Infant Feeding Guidelines for Health Workers, were jointly submitted for consultation with the Dietary Guidelines for Australian Adults. Ninety-three submissions were received. The Working Party met in September 2001 to consider the submissions; initial revisions were made by the end of December 2001 and were then reconsidered by the Working Party.

Additional specialist comment was obtained from Dr Peter Hartman (University of Western Australia), Dr Jane Scott (University of Glasgow), Dr Karen Cashell (University of Canberra), Ms Anne Croker (Australian Breastfeeding Association—formerly the Nursing Mothers Association of Australia), Ms Judy Seal (Strategic Inter-Governmental Nutrition Alliance and Tasmania Health), Dr Wendy Oddy (NHMRC fellow, Curtin University of Technology) and Dr Gulnara Semonova (Director, Australian Breastfeeding Association Lactation Resource Centre).

The document was then technically edited by Ms Chris Pirie.
Food for health
Encourage and support breastfeeding

Children and adolescents need sufficient nutritious foods to grow and develop normally

- Growth should be checked regularly for young children
- Physical activity is important for all children and adolescents

Enjoy a wide variety of nutritious foods

Children and adolescents should be encouraged to:

- Eat plenty of vegetables, legumes and fruits
- Eat plenty of cereals (including breads, rice, pasta and noodles), preferably wholegrain
- Include lean meat, fish, poultry and/or alternatives
- Include milks, yoghurts, cheese and/or alternatives
  - Reduced-fat milks are not suitable for young children under 2 years, because of their high energy needs, but reduced-fat varieties should be encouraged for older children and adolescents
- Choose water as a drink
  - Alcohol is not recommended for children

and care should be taken to:

- Limit saturated fat and moderate total fat intake
  - Low-fat diets are not suitable for infants
- Choose foods low in salt
- Consume only moderate amounts of sugars and foods containing added sugars

Care for your child’s food: prepare and store it safely

These guidelines are not in order of importance.

Each one deals with an issue that is key to optimal health.

Two relate to the quantity and quality of the food we eat—getting the right types of foods in the right amounts to meet the body’s nutrient needs and to reduce the risk of chronic disease. Given the epidemic of obesity we are currently experiencing in Australia, one of these guidelines specifically relates to the need to be active and to avoid overeating.

Another guideline stresses the need to be vigilant about food safety, and, in view of the increasing awareness of the importance of early nutrition, there is a further guideline that encourages everyone to support and promote breastfeeding.
Background information
I ENCOURAGE AND SUPPORT BREASTFEEDING

Colin Binns

Terminology

Exclusive breastfeeding

Exclusive breastfeeding means that an infant is receiving only breastmilk, which includes expressed breastmilk and milk from a wet nurse. The infant might also receive medications and vitamins or minerals, as required.

Complementary food

Complementary food means any food—be it manufactured or locally prepared—that is suitable as a complement to breastmilk or infant formula when either becomes insufficient to satisfy an infant's nutritional requirements. Such food is also commonly called weaning food or breastmilk supplement.

Research methodology and data collection

A variety of methods are used to study and record breastfeeding rates. Reported studies use different sampling methods and may rely on mothers’ memory of past events. Studies that use frequent interviews of a representative cohort and use standard definitions are more accurate.

Background

Breastfeeding is the normal and most appropriate method for feeding infants and is closely related to immediate and long-term health outcomes. Exclusive breastfeeding to the age of six months gives the best nutritional start to infants and is now recommended by a number of authorities. The World Health Organization reviewed breastfeeding duration and identified more than 3000 references. The WHO Expert Consultation then recommended exclusive breastfeeding for six months, then introduction of complementary foods and continued breastfeeding thereafter. It is recommended that breastfeeding continue until 12 months of age and thereafter as long as mutually desired. In many societies breastfeeding continues well beyond the age of 12 months, with benefit to both infant and mother.

If for any reason breastmilk is discontinued before 12 months of age, a commercial infant formula should be used—instead of cow’s milk—as the main source of milk. Breastmilk from a healthy, well-nourished mother is adequate as...
I. **Encourage and Support Breastfeeding**

The sole source of nutrients for full-term infants from birth until about six months of life. Low-birthweight infants should have their nutritional needs assessed by a paediatrician.

Apart from their nutritional suitability, colostrum and mature human milk are hygienic and provide immunoglobulins and other anti-infective agents, which play a major role in protecting infants against infection and disease. Breastmilk also contains a number of unique growth factors and is a convenient, inexpensive food source posing no environmental cost. (See the Infant Feeding Guidelines for Health Workers, which are incorporated in the Dietary Guidelines for Children and Adolescents in Australia, for a more detailed discussion of breastfeeding.)

**Current practices**

Although the majority (80–90 per cent) of women in Australia commence breastfeeding, just under a third of them have introduced other foods or have stopped breastfeeding by three months. There is also evidence of considerable variation between socio-economic groups in terms of both the acceptance and the maintenance of breastfeeding in the Australian community: women in higher socio-economic groups are more likely to breastfeed. Support and encouragement from family members, friends and the whole community are required if breastfeeding rates and the duration of breastfeeding are to be maximised.

From a public health viewpoint, there is considerable room for improvement in both the rates and the duration of breastfeeding in Australia; such improvements offer benefits for maternal, infant and child health. An initiation rate in excess of 90 per cent, and 80 per cent of mothers breastfeeding at six months, are achievable goals in Australia. Of the developed countries, Norway consistently reports the highest breastfeeding rates, ones that Australia should strive to achieve:

- Ninety-two per cent of mothers are breastfeeding their child when it is three months of age.
- Eighty per cent are breastfeeding their child at six months.
- Forty per cent are still breastfeeding their child at 12 months.

The advantages of breastfeeding continue beyond the six-month period, and Australians other than mothers can play an important part in making breastfeeding an easy and viable option. Encouragement and support—from a combination of hospitals and health centres, families, friends, social groups and places of work—will ensure that women can breastfeed successfully.

Breastfeeding is included in these Dietary Guidelines for Children and Adolescents in acknowledgment of the nutritional, health, social and economic benefits it provides for the Australian community and of the need for family and community support. Breastfeeding promotion should be combined with other health-promotion programs.
Historically, breastfeeding or the use of a wet nurse was the only way to feed an infant. Rickets, scurvy and hypernatraemia were associated with early artificial feeding; knowledge of infant requirements was limited before the development of modern infant formula. In reviews of infant feeding in Australia, Hitchcock and Lund-Adams and Heywood\textsuperscript{14} describe the decline in breastfeeding rates in Australia and other developed countries that occurred during the 20th century.

Breastfeeding reached a low point in Australia in the 1960s; records from Victoria show that only 50–60 per cent of mothers were breastfeeding on discharge from hospital and only 21 per cent after three months.\textsuperscript{16} In the early 1970s breastfeeding rates started to rise again in Australia and comparable overseas countries, beginning in the higher socio-economic groups. By 1983 both the prevalence and the duration of breastfeeding in Australia were among the highest in the western world, with 85 per cent at discharge and 54–55 per cent three months later.\textsuperscript{17} Breastfeeding has remained around this level for the past two decades. In 1984–85 a joint survey in Western Australia and Tasmania indicated a continued trend to increasing breastfeeding rates and duration. During the preceding five years, prevalence rates at hospital discharge rose from 82 to 86 per cent in Western Australia and from 72 to 81 per cent in Tasmania. At six months after discharge 45 per cent of mothers in both states were still breastfeeding.\textsuperscript{18}

In 1992–93 in Western Australia and in 1995–96 in Queensland, Scott et al.\textsuperscript{11} conducted a survey that found a continuing trend to increased breastfeeding rates and duration in those states. In the preceding years the hospitals had a breastfeeding discharge rate of 82 per cent, and at six months 46 per cent of mothers were still breastfeeding. Women born in Australia or New Zealand were almost twice as likely to be breastfeeding at discharge compared with women born in other countries.

Donath and Amir\textsuperscript{10} analysed the data from the 1995 National Nutrition Survey and found that breastfeeding rates were 81.8 per cent on discharge from hospital and 57.1 per cent fully breastfed at three months. At six months, it is estimated that 18.6 per cent of babies are fully breastfed and 46.2 per cent fully or partially breastfed. At one year of age, 21.2 per cent of infants are receiving some breastmilk. Thus, in Australia at present fewer than 20 per cent are achieving the goal of being exclusively breastfed to age six months.

Australia has a long history of promoting and supporting breastfeeding in its public health policy. The importance of breastfeeding led to its inclusion in the Dietary Guidelines for Australians endorsed by National Health and Medical Research Council in June 1982. In 1981 Australia became a signatory to the WHO International Code of Marketing of Breast-milk Substitutes, the stated aim of which was:

\textit{... to contribute to the provision of safe and adequate nutrition for infants, by the protection and promotion of breastfeeding and by ensuring the proper use of breastmilk substitutes, when these are necessary, on the basis of adequate information and through appropriate marketing and distribution.}\textsuperscript{14}
1. Encourage and support breastfeeding

The Infant Feeding Guidelines for Health Workers provide more information on the WHO Code and its implications for health workers. In 1987 the Nutrition Taskforce of the Better Health Commission set targets for the year 2000 of increasing the prevalence of breastfeeding at discharge from hospital to 95 per cent and increasing the proportion still breastfeeding at three months to 80 per cent. The rationale behind the targets was to continue the promotion of breastfeeding, so that rates in at-risk groups would increase, the average period of breastfeeding would be lengthened, and overall levels of breastfeeding would be maintained. With current knowledge of the benefits of breastfeeding and the health risks for infants not receiving breastmilk, extending the goal to 80 per cent breastfeeding at six months would be appropriate.

Scientific basis

Breastfeeding physiology

Milk production and secretion are under endocrine and autocrine control. When the infant suckles at the breast, mechano-receptors are stimulated, resulting in the release of oxytocin and prolactin into the blood, from the posterior and anterior pituitary respectively. Oxytocin stimulates the contraction of cells and secretion of milk from the alveolus; prolactin is responsible for milk production in the alveolus. The commonly termed let-down reflex can also be stimulated by seeing the infant or hearing its cries; it can be inhibited by stress such as pain or anxiety. Close mother–child contact immediately after birth helps to establish lactation, and frequent suckling or feeding on demand helps to maintain it. Milk synthesis is related to the rate at which the breast is emptied.

A review of early contact practices found, ‘Mothers should have contact with their babies as soon after birth and for as long as they wish. Interventions aimed at either delaying or speeding up the time of the first feed should be avoided’. Hospital practices at the time of birth can be the first line of support for a new mother: difficulties encountered can be quickly resolved by staff with appropriate experience, and hospitals can encourage ‘rooming-in’ to facilitate frequent mother–child contact.

Breastmilk is uniquely suited to the needs of infants throughout the duration of lactation and provides all the nutrients required for at least the first six months of life. The composition of breastmilk is compromised only in mothers with severe malnutrition. Breastmilk is a living tissue that cannot be duplicated by any other means. It is very important for pre-term infants.

Colostrum, the secretion produced in the first few days after giving birth, provides all the nutrients, including water, required by the neonate. In composition, it differs from both transitional milk and mature milk, containing higher levels of protein, vitamin A and vitamin B₁₂ and less fat. It also contains lactoferrin, immunoglobulin A, enzymes, maternal antibodies, living cells—leukocytes, neutrophils and macrophages—and non-pathogenic bacteria, which
The composition of this first secretion after birth gradually changes as lactation is established and production of milk begins in the breast tissue. By seven to fourteen days after birth, lactation should be established and the transition from colostrum to mature milk should be under way. The nutrient composition of mature expressed human milk shows variation in and between individuals—depending on maternal diet and the stage of lactation—although mean ranges are remarkably consistent for the species. The energy content is based on the fat, protein and carbohydrate levels and varies between 270 and 315 kilojoules (65–75 kcal) per 100 millilitres, largely as a result of variation in the fat content. Fat typically increases three- to four-fold during a single feed and also shows diurnal variation. It provides much of the energy and omega-3 and omega-6 long-chain polyunsaturated fatty acids; it also carries the fat-soluble vitamins A, D, E and K, as well as prostaglandins.22,25 This fat is typically better absorbed by the infant’s gastrointestinal tract than the fat in cow’s milk, and the lipase present increases the efficiency of absorption. Mature milk continues to provide immune factors and enzymes to the infant. (For details of milk composition see the Infant Feeding Guidelines for Health Workers.)

Breastmilk also provides all the major minerals and trace elements known to be essential for healthy full-term infants. Although the levels of some micronutrients appear to be low in comparison with other milks, the high bioavailability of these components in human milk ensures that no deficiencies occur. Infants’ actual nutrient requirements are not precisely known, but the nutrients in human milk have obviously been adequate for infants for thousands of years. As a result, the composition of infant formula26 and the recommended dietary intakes for groups of infants in Australia are based on the nutrient composition of human milk.27 No infant formula can exactly mimic breastmilk, though. Breastmilk is constantly changing—throughout lactation and throughout the feed. In addition, constituents of breastmilk are still being discovered, and many of them cannot be replicated.28

**The health benefits of breastfeeding**

There are many benefits to be gained from breastfeeding—for the infant, the mother and the community. These benefits are summarised in Box 1.1 (see also the Infant Feeding Guidelines for Health Workers for an expanded version). Costs to the community of not breastfeeding are also discussed later in this section. Increasingly, there is interest in the long-term effects of perinatal nutrition, commonly referred to as the *foetal origins of disease*, or *Barker hypothesis*. Inadequate or inappropriate foetal and early infant nutrition has been linked with subsequent chronic disease in adulthood.29,30
Dietary Guidelines for Children and Adolescents in Australia

1. ENCOURAGE AND SUPPORT BREASTFEEDING

Breastfeeding’s protective effects against mortality are obviously of greater magnitude in countries with higher infant mortality rates. A pooled study by a WHO working group has illustrated just how valuable the protection conferred by breastfeeding can be, especially in developing countries, where these studies were undertaken (see Figure 1.1). The odds ratios for mortality from all causes and from infectious diseases show substantial benefit until the age of six months.

The Promotion of Breastfeeding Intervention Trial (or PROBIT), undertaken in Belarus, is the largest cluster-randomised controlled trial of breastfeeding promotion and outcomes to have been published. A total of 17,046 mother–infant pairs—consisting of full-term singleton infants weighing at least 2500 grams and their healthy mothers, who intended to breastfeed—were studied. The 31 hospitals involved were randomised to receive a health-

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**Box 1.1 Health advantages of breastfeeding for infants and mothers**

**Infant**
- reduced incidence and duration of diarrhoeal illnesses
- protection against respiratory infection and reduced prevalence of asthma
- reduced occurrence of otitis media and recurrent otitis media
- possible protection against neonatal necrotising enterocolitis, bacteraemia, meningitis, botulism and urinary tract infection
- possible reduced risk of auto-immune disease, such as type 1 diabetes and inflammatory bowel disease
- reduced risk of developing cow’s milk allergy
- possible reduced risk of adiposity later in childhood
- improved visual acuity and psychomotor development, which may be caused by polyunsaturated fatty acids in the milk, particularly docosahexaenoic acid
- higher IQ scores, which may be the result of factors present in the milk or of greater stimulation
- reduced malocclusion as a result of better jaw shape and development.

**Mother**
- promotion of maternal recovery from childbirth—accelerated uterine involution and reduced risk of haemorrhaging (thus reducing maternal mortality) and preservation of maternal haemoglobin stores through reduced blood loss, leading to improved iron status
- prolonged period of post-partum infertility, leading to increased spacing between pregnancies
- possible accelerated weight loss and return to pre-pregnancy body weight
- reduced risk of pre-menopausal breast cancer
- possible reduced risk of ovarian cancer
- possible improved bone mineralisation and thereby decreased risk of post-menopausal hip fracture.
I. ENCOURAGE AND SUPPORT BREASTFEEDING

promotion program based on the WHO–UNICEF Baby Friendly Hospital initiative. Compared with the control group, the infants from the intervention group were much more likely to be breastfed at 12 months and exclusively breastfed at three and six months. The intervention group also showed a significant reduction in the risk of one or more gastrointestinal tract infections (9.1% vs 13.2%; adjusted OR:0.60; 95%CI: 0.40–0.91) and of atopic eczema (3.3% vs 6.3%; adjusted OR: 0.54; 95%CI: 0.31–0.95) but no significant reduction in episodes of respiratory tract infection.

The psychological and behavioural aspects of breastfeeding are also important. Breastfeeding is largely a pleasurable and positive interaction between mother and baby. The maternal hormones prolactin and oxytocin stimulate the development of maternal behaviour and bonding and also reduce the response to stress.37

Breastmilk has also been shown to be the most suitable way of feeding low-birthweight infants in a trial of 108 infants. The unique properties of human milk promote an improved host defense and gastrointestinal function compared with infant formula. The benefits of improved health (less sepsis and necrotising enterocolitis) associated with feeding of fortified breastmilk outweighed the slower rate of growth observed, suggesting that feeding of fortified breastmilk should be actively promoted in premature infants.38 Other types of human milk fortifier can enhance growth rates.39

Figure 1.1 Odds ratio for not breastfeeding: all mortality and mortality from infection, by age
Pre-lacteal feeds are commonly given in some cultures. Best practice in Australia is to place the infant at the breast as soon as practicable after delivery and to offer it colostrum. Although respect is always due to other cultures, an infant has no need for any other solid or liquid for around six months.

**Factors affecting the initiation and duration of breastfeeding**

An extensive review of the literature has documented the demographic, social and economic factors associated with breastfeeding. There is a higher prevalence and a longer duration of breastfeeding among mothers from higher socio-economic groups who are better educated, are older, and have previously breastfed. In the Australian studies, age was not found to increase breastfeeding in the rural sample.

In a longitudinal study, Scott, Aitken et al. confirmed the known demographic factors (as just mentioned) that influence breastfeeding rates and duration. Among other factors that were found to have influenced a mother's decision to breastfeed and the duration of breastfeeding were the perceptions of partners and other family members, the mother's decision to breastfeed prior to pregnancy, and the mother's age and country of birth. Scott, Gowans et al. also found that a mother who had more than one child, intended to return to work or study within six months, or had an infant in a special care nursery was less likely to breastfeed. In Australia, boys are breastfed for a shorter time than their sisters. Further research is needed to understand the reasons for this.

Box 1.2 summarises the factors involved in the initiation and duration of breastfeeding in the two Australian studies and that by Landers et al., which all used the same methodology (cohort studies with frequent interviews). The studies demonstrate the importance of family support, particularly from the father, and of early parental education about the benefits of breastfeeding. McIntyre et al. analysed social support and found that social support for breastfeeding—as provided by fathers, grandmothers and the general community—in a low socio-economic area is not strong, particularly in relation to breastfeeding in public, combining breastfeeding and work, and appropriately managing breastfeeding.

Most women experience a number of other difficulties while breastfeeding (see the Infant Feeding Guidelines for Health Workers). If appropriate advice and support are not given, a mother may prematurely terminate breastfeeding. In studies in Australia and other developed countries, the main reason for termination cited by women is a perceived insufficient milk supply. The actual number of mothers who may be physiologically incapable of providing sufficient milk is, however, extremely low. For the remainder of women who prematurely terminate breastfeeding, there are numerous causes—both biological and psychological—the majority of which are temporary and can be resolved with experienced advice or avoided by better preparation, hospital management or appropriate support. For example, rooming-in of infants while in hospital facilitates frequent feeding and thus the establishment of lactation.
Breastfeeding is disrupted when the infant is housed away from the mother in the hospital, so the rooming-in option is offered by most hospitals today.\textsuperscript{52}

<table>
<thead>
<tr>
<th>Box 1.2 Factors associated with the initiation and duration of breastfeeding in a rural population compared with an urban population\textsuperscript{11,46,47}</th>
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</thead>
<tbody>
<tr>
<td><strong>Factors associated with the decision to breastfeed</strong></td>
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<tr>
<td>In a Rural area, breast feeding was more likely if:</td>
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<tr>
<td>• fathers preferred breastfeeding</td>
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<tr>
<td>• mothers were younger</td>
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<tr>
<td>• mothers decided pre-pregnancy to breastfeed</td>
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<tr>
<td>• mothers were primiparous.</td>
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<tr>
<td><strong>Factors associated with risk of ceasing breastfeeding</strong></td>
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<tr>
<td>In a Rural area risk of early cessation of breastfeeding was higher:</td>
</tr>
<tr>
<td>• in younger mothers</td>
</tr>
<tr>
<td>• in mothers who planned to breastfeed for less than two months</td>
</tr>
<tr>
<td>• where fathers did not prefer breastfeeding</td>
</tr>
<tr>
<td>• in mothers who did not decide to breastfeed before becoming pregnant</td>
</tr>
<tr>
<td>• in mothers whose infants received complementary formula feeds in hospital.</td>
</tr>
<tr>
<td>In an Urban area, breast feeding was more likely if:</td>
</tr>
<tr>
<td>• fathers preferred breastfeeding</td>
</tr>
<tr>
<td>• maternal grandmothers preferred breastfeeding</td>
</tr>
<tr>
<td>• mothers decided pre-pregnancy to breastfeed</td>
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<tr>
<td>• mothers were primiparous</td>
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<tr>
<td>• mothers were born in Australia, the United Kingdom, Asia, the Middle East or North Africa</td>
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<tr>
<td>• husbands were professional or administrators.</td>
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<tr>
<td>In an Urban area, risk of early cessation of breastfeeding was higher:</td>
</tr>
<tr>
<td>• in younger mothers</td>
</tr>
<tr>
<td>• in less educated mothers</td>
</tr>
<tr>
<td>• in mothers born in Australia, New Zealand or the United Kingdom compared with mothers born in the Middle East or Africa</td>
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<tr>
<td>• in mothers who planned to breastfeed for less than four months</td>
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<tr>
<td>• when maternal grandmothers were ambivalent or preferred formula feeding</td>
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<tr>
<td>• when mothers received conflicting advice on infant feeding while in hospital.</td>
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Note: See reference 46 for details of odds ratios and their confidence intervals.

Another difficulty is that modern hospital practice involves discharging mothers too early (often within 24–48 hours of delivery); this means hospital staff will have had insufficient time to help establish breastfeeding. A cohort study has
demonstrated the importance of a supportive health system in successful breastfeeding.\textsuperscript{53} A review of negative hospital practices—such as distribution of commercial publicity packs—has shown that these can have a detrimental effect on breastfeeding.\textsuperscript{54} (See the Infant Feeding Guidelines for more details.)

Frequent stimulation and frequent emptying are required to maintain breastmilk production, which is a very good reason for discouraging the use of complementary food or pacifiers (dummies). Feeding according to need—that is, feeding on demand—offers the best way of maintaining lactation, and if this is prevented by lack of facilities or social acceptance, lactation can be adversely affected.

The Australian Breastfeeding Association (formerly the Nursing Mothers Association of Australia) and other similar organisations have an important role to play within the health care system, providing the one-to-one support that is needed to overcome transient problems with lactation, particularly after hospital discharge.\textsuperscript{55} The association also provides breastfeeding education classes, access to a local network of mothers and group discussion meetings, and a variety of publications dealing with all aspects of breastfeeding. In addition, it has a range of strategies designed to promote breastfeeding in the community, among them the following:

- community education sessions run by local groups all around Australia
- promotion of breastfeeding in local areas during Breastfeeding Awareness Month
- encouragement to the community to support breastfeeding through ‘Baby Care Room’ awards, ‘Mother Friendly Workplace’ accreditation, and ‘Breastfeeding Welcome Here’ stickers
- participation in consultations relating to policies affecting breastfeeding
- access for the community and health professionals to comprehensive and readily usable information and resources dealing with all aspects of human lactation through the Lactation Resource Centre. <www.aba.asn.au>

Breastfeeding and paid employment need not be mutually exclusive, although in some cases work may be a reason for women not to commence breastfeeding.\textsuperscript{21,56,57} A longitudinal study of 10 500 mothers found that planning to return to employment earlier than six weeks post-partum reduces the likelihood of initiating breastfeeding.\textsuperscript{58} For successful lactation to continue after returning to work, supportive worksite health-promotion policies are required that provide education and facilitate either frequent feeding or frequent expression and storage of breastmilk, as required. A recent publication provides helpful information for mothers and employers (see \textit{Balancing Breastfeeding and Work} <www.health.gov.au/hfs/pubhith/strateg/brfeed/index>). Although it is not an ideal situation, many mothers who return to work are unable to breastfeed exclusively and, rather than using expressed breastmilk, carers use infant formulae for some feeds. Although mothers should be supported in this decision—any breastfeeding is better than none—every effort should be made to change the conditions of our society and so make exclusive breastfeeding feasible.
Encourage and support breastfeeding

possible for working mothers. The message should be that many mothers successfully combine breastfeeding and paid employment.

Breastfeeding and special circumstances

[This subject is discussed in detail in the Infant Feeding Guidelines for Health Workers.]

There are few contra-indications to breastfeeding. Most medications a mother might need are compatible with breastfeeding, but each drug should be specifically checked in a reliable reference or with your GP.

Some disease situations—for example, if a mother has HIV or AIDS—can be absolute contra-indications. Research is progressing rapidly, however, and this may change. Studies have now shown that exclusive breastfeeding to six months, combined with the use of antiretroviral drugs, substantially reduces the risk of HIV transmission.

Exclusive breastfeeding for periods much beyond six months of age may result in under-nutrition and micro-nutrient deficiency. Supplementation with solid foods is necessary after about this time. In particular, beyond the age of six months additional sources of iron are required, usually from iron-fortified cereals and pureed foods containing meat. Mothers who are vegans or strict vegetarians can be at risk of vitamin B12 and other nutrient deficiencies. (See Sections 3.2 and 3.3 for more information about this.)

Breastfeeding and community support

Community efforts associated with breastfeeding should focus on strategies and policies that will:

- influence the proportion of mothers who intend to breastfeed—the earlier the decision is made, before or during the pregnancy, the greater the likelihood of successful breastfeeding
- influence the intended duration of breastfeeding through education, example and support
- influence the attitudes and beliefs of the mother’s support network, particularly the father
- provide antenatal and postnatal education about the day-to-day practicalities of breastfeeding
- promote breastfeeding as the social norm, with support and the provision of adequate facilities in social situations and the workplace
- include the father and/or other support people in as much of the antenatal preparation as possible
- provide post-discharge support for minor problems—from community services, the medical profession and support organisations
- enhance support for lactation in the workplace, to allow working mothers to continue to breastfeed.
In a meta-analysis of postnatal support for mothers in the community, Sikorski and Renfrew showed that ‘one more mother will breastfeed for two months if support is provided for nine women and one more woman will breastfeed exclusively if support is given to nine women’.63

The media have an important role in portraying the importance of breastfeeding and in supporting it in the community as the norm. The Australian media often portray breastfeeding in a negative way.64 In the United Kingdom it was found that television and press coverage routinely implies that breastfeeding is problematic, funny or embarrassing or associates it with ‘particular types of women’. On the other hand, bottle-feeding is seen as ‘largely normalised, socially integrated, associated with “ordinary” and “normal” families and represented as being problem-free’.65

Provision of physical facilities that are adequate for breastfeeding is important; such facilities are often lacking in places mothers and their infants need to visit—for example, shopping centres and other public places.66

Recent research has shown how important it is for fathers to encourage the initiation and duration of breastfeeding. The fathers of infants who were breastfed were found to have three particular characteristics:

- They had other children who had been breastfed.
- They attended antenatal classes.
- They discussed breastfeeding antenatally with their partner.

In general, however, fathers have poor knowledge about the practical aspects of breastfeeding44, and it is important to include them in discussion about breastfeeding. Fathers also need to provide practical help—such as occupying other children and doing household chores—and emotional support for breastfeeding mothers. They should attend antenatal classes and learn about the nutritive and protective advantages of breastfeeding and some of the potential practical difficulties.

All health professionals need to constantly promote the benefits of breastfeeding. The benefits should be discussed with mothers (or potential mothers) at the earliest opportunity, such as the first antenatal visit. Health professionals should ensure that their patients know about the protective properties of breastmilk and the risks involved when infants do not receive it. They should also ensure that their activities do not discourage mothers from breastfeeding. In a program to promote ‘baby-friendly doctors’ offices’, workshops were conducted for office staff and resulted in positive changes in breastfeeding promotion. The changes were maintained at six and 12 months after the intervention.67 In a controlled trial in an obstetrician’s office, the negative effect of exposure to formula-promotion materials was also demonstrated. Educational materials about infant feeding should unequivocally support breastfeeding as optimal nutrition for infants.68

The Health Technology Assessment Program69 has undertaken a systematic review of health promotion for breastfeeding (see Table 1.1). The reviewers were very strict about inclusion criteria. For example, the introduction of paid
I. ENCOURAGE AND SUPPORT BREASTFEEDING

maternity leave in Norway (one year on 80 per cent of pay or 46 weeks on full pay) has been associated with an increase in breastfeeding by working mothers. Similarly, introduction of the WHO International Code of Marketing of Breast-milk Substitutes has been associated with improved breastfeeding outcomes, yet no studies meeting the reviewers' criteria were found. Despite this, the reviewers found three types of intervention to be effective: small-group health education (antenatal); peer support programs (antenatal and postnatal); and one-to-one health education (low-income groups).69

Table 1.1 Classification of breastfeeding health-promotion studies69

<table>
<thead>
<tr>
<th>Areas of health-promotion action</th>
<th>Types of intervention to promote the uptake of breastfeeding</th>
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<tbody>
<tr>
<td>Public policy</td>
<td>No studies identified</td>
</tr>
<tr>
<td>Supportive environments</td>
<td>No studies identified</td>
</tr>
<tr>
<td>Community action</td>
<td>Peer support activities</td>
</tr>
<tr>
<td>Development of personal skills</td>
<td>Health education and media programs</td>
</tr>
<tr>
<td>Reorientation of health services</td>
<td>Health sector initiatives</td>
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<tr>
<td></td>
<td>Multi-faceted studies</td>
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</tbody>
</table>

a. Using the classification of the Ottawa Charter framework for health promotion studies, plus an additional category of multi-faceted studies.

A meta-analysis found that distribution of commercial information packs (with or without samples of formula) to mothers while in hospital reduces the number of women exclusively breastfeeding but does not affect the earlier termination of non-exclusive breastfeeding.54

Costs to the community of not breastfeeding

There have been many studies of the economic benefits to be gained from breastfeeding. On the basis of longitudinal studies in Arizona and Scotland, it was estimated that for each 1000 infants who were never breastfed there is an excess of 2030 doctor visits and more than 200 inpatient days and 600 prescriptions compared with infants exclusively breastfed for more than three months.71 In addition, in the first year of life the total health care costs for infants who were not breastfed were estimated to be $331 000 greater than those for breastfed infants. Ball and Bennet have proposed a comprehensive model for documenting the economic impact of breastfeeding; they showed that a breastfeeding education program reduced medical claims by $1435 per infant and saved three days a year of maternal sick leave.72 (Note: costs are in 2001 US dollars and are not adjusted for inflation.)

In another study in the United States, Weimer73 estimated that a minimum of $3.6 billion would be saved if breastfeeding were increased from current US
levels (64 per cent breastfed in hospital, 29 per cent breastfed at six months) to the targets recommended by the US Surgeon General (75 per cent and 50 per cent respectively). This figure of $3.6 billion is probably an underestimation of the total savings because it represents cost savings from the treatment of only three childhood illnesses—otitis media, gastroenteritis and necrotising enterocolitis.

The health costs of weaning 30 per cent of infants onto infant formula by three months of age could be around $290 million a year in Australia; this is based on an analysis of just five illnesses for which breastfeeding is proven to have protective effects.

The total value of breastfeeding to the community makes it one the most cost-effective primary prevention measures available and well worth the support of the entire community.

RELATIONSHIP TO OTHER GUIDELINES

The Infant Feeding Guidelines for Health Workers, provide detailed advice on adolescent pregnancy and breastfeeding; indications for the introduction of solids; breastfeeding initiation and management; problems encountered in breastfeeding; health professionals' responsibilities under the WHO Code; and the use of infant formula.

CONCLUSION

Breastfeeding is very important for infant nutrition. Exclusive breastfeeding until around six months should be the aim for every infant. If that is not possible, mothers should be encouraged to breastfeed as much, and for as long, as they can. Breastfeeding beyond six months is of continuing value to baby and mother, although the maximum benefits of breastfeeding are in the earliest months of life.

Promotion of breastfeeding is an important public health strategy. Support and encouragement at all levels of the community are essential to maintaining and improving initiation rates and the duration of breastfeeding by Australian women, particularly those who are disadvantaged. Breastfeeding is included in both the Dietary Guidelines for Australian Adults and for Children and Adolescents because it will contribute to the health of all Australians from birth.

EVIDENCE

There are three relevant Cochrane reviews which support this guideline and further National Technology Centre reviews of health education for breastfeeding.
For ethical reasons, it is not possible to do randomised control trials of breastfeeding.

There is Level III and Level IV for the following:

- the effect of early, as opposed to delayed, initiation of breastfeeding (reference 24)
- the effect of commercial hospital discharge packs for breastfeeding women (reference 54)
- community support for breastfeeding (reference 63)
- the biological suitability of breastmilk (reference 5)
- exclusive breastfeeding to about six months (reference 6)
- the role of breastfeeding in prevention of infant mortality in less developed countries (reference 35)

There is Level III evidence for the effect of baby-friendly initiatives (reference 67); for the effect of prenatal advertising of formula (reference 68); and for factors associated with breastfeeding in women in Australia (references 11, 47 and 48).

References


1. **Encourage and Support Breastfeeding**


I. Encourage and Support Breastfeeding


2 CHILDREN AND ADOLESCENTS NEED SUFFICIENT NUTRITIOUS FOODS TO GROW AND DEVELOP NORMALLY

- Growth should be checked regularly for young children
- Physical activity is important for all children and adolescents

Colin Binns, Geoff Davidson and David Forbes

TERMINOLOGY

Growth

*Growth* refers to the acquisition of tissue and the consequent increase in body size.

Development

*Development* refers to the increased ability of the body to function physically and intellectually. Physical and intellectual development proceed at different rates in different individuals.

Age ranges

As noted in the preface, the terminology used for the various age ranges is as follows:

- *infant*—up to 12 months
- *toddler*—1 to 2 years
- *preschool child*—3 to 5 years
- *young child*—1 to 5 years
- *primary school age*—6 to 11 years
- *adolescent*—12 to 18 years.

CDC growth reference

The CDC growth reference is a data set based on several US studies. It has been adopted by the World Health Organization and in Australia by the National Health and Medical Research Council.
BACKGROUND

Weight gain and an increase in body size are integral parts of normal growth and development during childhood and adolescence. At this life stage the focus is on maintaining a rate of physical growth that is consistent with the expected norms for age, sex and stage of physiological maturity. Physical growth is best assessed by the conventional measures of weight, length or height, and head circumference. Maintenance of a positive energy and nutrient balance is critical in achieving and sustaining normal growth and development. During periods of rapid growth, any intentional restriction of weight gain—through dieting, for example—is usually inappropriate.

In recent years there has been increasing awareness of the importance of perinatal nutrition in terms of the development of disease in adulthood; this is known as the *foetal origins of disease* or *Barker hypothesis*—see part A of the ‘Special considerations’ section. In addition, there is increasing evidence of the importance of growth and nutrition in relation to cognitive development. Growth during infancy also influences future bone mass.

SCIENTIFIC BASIS

Growth

Between birth and 18 years of age, a person’s body weight increases about twenty-fold. During early childhood, the rate of increase in weight and length is essentially linear: the rate of increase in weight generally keeps pace with the rate at which length increases. During infancy and adolescence, however, the rate of growth changes rapidly over time; for example, it decelerates rapidly during the first year of life, while during adolescence it first accelerates over a period of one to three years and then decelerates rapidly until growth in height ceases at about 16 years of age in girls and 18 years in boys. Secular changes in growth and maturation have been well documented in many countries, and Australia is no exception. Loesch et al. compared the data on height and body weight obtained in 1992 to 1993 from 1804 Melbourne school students aged 5 to 17 years with historical data collected from white Australians during the last 100 years. Australians have been getting taller every decade and, although the increase in height has significantly slowed down during the last two decades, the increase in body weight is continuing and is more pronounced in females.

Children

[For information about infants and nutrition, see Chapter 1.]

Children between the ages of 1 and 5 years are still considered nutritionally vulnerable, although their growth rate is slower than in infancy and their nutritional needs in relation to their body size are proportionally reduced. Relative to their body weight, however, children’s nutrient and energy requirements are still greater than those of adults.
Children & Adolescents Need Sufficient Nutritious Foods to Grow and Develop Normally

Compared with adults, young children are unable to exert as much control over what they eat. Too little or too much food, or an imbalance of nutrients or energy over a period, can alter the natural progress of physical growth. A child’s rate of growth is a fundamental indicator of dietary adequacy and health, and parents and other carers must be aware of and responsive to the developmental and nutritional needs of children. Growth is the most important indicator of good nutrition. In Australia, if a child’s growth follows expected norms it is unlikely that nutrition is a problem.

Childhood is a period of continuous education about eating and good nutrition, and appropriate use of food is important in establishing lifetime nutrition practices. Food intake may drop off during the second year of life, and parents’ skills of encouragement and example will be needed. After starting school, children are subject to an increasing array of influences from outside the home. They experience peer pressure in many areas, including food, and group behaviour becomes the norm.

Adolescents

During adolescence there is a marked increase in the rate of gain in both weight and length—referred to as the adolescent growth spurt. The spurt in height begins on average at 10 to 11 years in girls and at 12 to 13 years in boys, although there is wide variation in this. During the adolescent growth spurt boys gain an average of 20 centimetres in height and 20 kilograms in weight and girls around 16 centimetres and 16 kilograms respectively. The peak velocity for weight gain tends to occur about three months after that for height. In girls, the onset of menstruation generally occurs after the peak in height velocity; in boys, the development of secondary sexual characteristics is less closely related to the adolescent growth spurt.

Adolescence is an important period for calcium absorption and the optimum period for gaining bone density, particularly for girls. The efficiency of calcium absorption increases during puberty, and the majority of bone formation occurs at this time. Data from balance studies suggest that for most healthy adolescents the maximal net calcium balance (plateau) is achieved with intakes of between 1200 and 1500 milligrams a day; that is, at intake levels above this almost all the additional calcium is excreted and not used.

In the United States adolescents’ milk consumption declined by 36 per cent between 1965 and 1996, being replaced by increased consumption of soft drinks and juices. A similar decline has occurred in Australia. The increased phosphorus excretion associated with this change in diet may compromise bone building and maintenance.

Assessment of body weight and growth rate

The most practical measures of nutritional status in childhood are comparisons with reference growth charts that show the normal ranges for weight for age, height for age and weight for height, by sex. When only a single measurement of
weight and height is available, the traditional method has been to establish the percentile of the growth reference. In some situations it is more appropriate to use the Z scores (standard deviations above or below the mean), and growth reference charts are available in both formats or a calculator is available on the internet.\textsuperscript{17,18} If weight and height are measured on several occasions, the measurements are most usefully interpreted by plotting them on reference growth charts.\textsuperscript{19} In Australia, the US National Center for Health Statistics (NCHS) growth charts are recommended for this purpose for all ethnic groups. The charts are included in the personal health records produced by various organisations for use as a continuing record of a child’s health. The US Centers for Disease Control recently revised the growth reference to eliminate some minor anomalies around 2 years of age\textsuperscript{2,20}—see part B of the ‘Special considerations’ section.

The suitability of the WHO–NCHS values for use as an international standard has been debated because many of the children on whom the values were based were not breastfed. In an international study, which included Australian children, the growth of breastfed infants was slightly below the WHO–NCHS reference. In 1993 the World Health Organization established a working group to develop new internationally applicable standards based on the growth of infants who were breastfed according to the WHO protocol.\textsuperscript{21,22} In Australia, however, the growth rate for Indigenous infants who are exclusively breastfed follows the WHO–NCHS reference until 6 months of age then begins to fall away.\textsuperscript{23,24} This suggests that the difference between breastfed infants and the CDC–WHO reference is not very significant for Australia, particularly if it is used as a reference for monitoring growth and not as a standard.

Generally, if a child is growing normally the lines connecting the plotted values will proceed along or parallel to one of the percentile lines on the charts. If the plotted values show a markedly irregular pattern, this could signify a problem, although some of the measurements might have been inaccurate or the data might have been plotted incorrectly. This possibility should always be checked at the first opportunity. The extent to which serial data for a child can deviate from a given percentile range before concern is warranted depends on the age of the child, the child’s position in the percentile range, the length of time for which the rate of growth deviates from the norm, and the coexistence of any medical condition. In general, the more pronounced the change in growth rate, the younger the child and the more extreme the percentile, the greater is the concern.

Skinfold measurements—a measure of the amount of fat in the subcutaneous compartment—is another index of under- or over-nutrition, although generation of reliable measurements depends to a large extent on the use of trained operators and calibrated instruments, and not all are reliable. DEXA (dual energy X-ray absorptiometry) and ultrasound provide the most accurate measurements, but cost limits their application to experimental use and to clinical settings where more accurate diagnosis is required for management. Measurement and recording of weight and height at regular intervals remain the best way of monitoring growth.
Body mass index—weight (kg) / height (m)²—is the most common measurement used to define overweight and obesity in adults, and centile charts for children are now available. In children, BMI has now become accepted as a useful tool for identification and monitoring of obesity. Deitz and Bellizzi suggested using the common adult cut-off points of 25 (overweight) and 30 (obese) as the cut-off points for children. However, Cole et al. used pooled data on 192,727 subjects aged from birth to 25 years from a number of countries to develop for each age cut-off points that reflect the changes in BMI with age and correspond with the adult levels of overweight and obesity. These cut-off points are a big improvement on current alternatives and should help to provide internationally comparable prevalence rates for overweight and obesity in children (see Table B.2 in the ‘Special considerations’ section). The results of three studies of Australian children and adolescents (a total of about 11,000 subjects) were re-analysed using the Cole criteria, and the prevalence of overweight and obesity was found to be between 19 and 23 per cent. BMI has not been validated in the assessment of under-nutrition in children and adolescents but may prove a useful screening measure.

Physical activity

Physical activity is a normal component of everyday life for children and adolescents, including those with physical and other handicaps. It plays an important part in physical growth and the development of a wide range of skills, and it provides a mechanism for balancing energy intake and energy output. Physical activity in girls is related to subsequent bone density in adulthood. The Western Australian Child Health Survey found a cross-sectional association between mental health and physical activity in children and adolescents.

In sedentary societies, obesity that develops during childhood or adolescence is often thought to be a consequence of a high energy intake in association with reduced energy expenditure, although there is relatively little evidence that obese children as a group consume more energy than their non-obese peers. There is, however, evidence that obese children are less active than lean children and that inactivity is associated with an increased prevalence of obesity.

Between the ages of 12 and 18 years the average amount of regular physical activity decreases by 50 per cent; boys are consistently more active and fitter than girls. A similar pattern of fitness was evident in the Health and Fitness Survey of Australian Schoolchildren in 1985: when compared with boys, girls had a significantly lower mean level of aerobic fitness, and 15-year-old girls were the least fit of all. Activity patterns that develop during childhood and adolescence carry over to later life and affect morbidity and longevity. It is obviously important to ensure that children and those who interact with them are aware of the role that regular physical activity can play—not only in terms of ‘fitness’ and ‘fatness’ in childhood and adolescence but also in terms of later susceptibility to chronic diseases.
The US Surgeon General reached the following conclusions about the importance of physical activity:

Children become far less active as they move through adolescence. Obesity is increasing among children, at least in part related to physical inactivity. Data indicate that obese children and adolescents have a high risk of becoming obese adults, and obesity in adulthood is related to coronary artery disease, hypertension, and diabetes. Thus, the prevention of childhood obesity has the potential of preventing cardiovascular disease in adults.39

The Surgeon General also made the point that all children, adolescents and young adults—both male and female—benefit from physical activity.

Physical activity does not need to be strenuous to be beneficial. A moderate amount of daily physical activity is recommended for everyone. This amount can be attained in longer sessions of moderately intense activities (such as brisk walking for 30 minutes)39 or in shorter sessions of more intense activities (such as jogging or playing basketball for 15 to 20 minutes).39 The Physical Activity Guidelines for Australians <www.health.gov.au/hfs/pubhlth/strateg/active/index.htm> make the following recommendations:

- Think of movement as an opportunity, not an inconvenience.
- Be active every day in as many ways as possible.
- Put together at least 30 minutes of moderate-intensity physical activity on most, preferably all, days.
- If possible, also enjoy some regular, vigorous exercise for extra health and fitness. (Children and teenagers under 18 should follow this guideline routinely.)

The guidelines also emphasise the importance of maintaining a physical environment where it is convenient and safe for children to exercise: ‘Encourage opportunities for children to be physically active out of school hours by supporting the development and maintenance of safe school routes and parks’.40

**Physical activity and the impact of television, computers and video games**

A study of Geelong adolescents41 found that the average number of hours of television viewing per week (16 hours for boys and 18 for girls) greatly exceeded the number of hours spent in physical activity, although the time spent watching television was not as high as that reported for 11–12 year olds in Pennsylvania.42 Williams and Handford43 noted a direct inverse relationship between the time spent watching television and the time spent engaged in active sport, while Tucker44 found that adolescent boys who watched television for less than two hours a day had significantly greater cardiovascular fitness than their peers who watched more than four hours of television daily. In a study of 4069 children in the United States, the prevalence of obesity was found to be lowest
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in children watching one hour or less of television a day and highest among those watching four hours or more a day. In girls, television watching was positively associated with obesity, even after controlling for age, race/ethnicity, family income, weekly physical activity, and energy intake. A randomised controlled trial of reducing children’s television and video watching—which did not specifically target physical activity—found a reduction in BMI and other indices.

The American Academy of Pediatrics has recently reviewed the role of television from the paediatrics perspective, including its impact on the nutritional status of children and adolescents. It concluded, ‘Research has shown primary negative health effects on violence and aggressive behaviour; sexuality; academic performance; body concept and self-image; nutrition, dieting, and obesity; and substance use and abuse patterns.’ The academy makes a number of recommendations for health care workers and parents, among them limiting television viewing to one to two hours a day, which is less than half current viewing patterns in the United States. The increasing prevalence of computers and video games in the home also has an impact on children’s activity levels.

Overweight and obesity

Australia is part of a worldwide obesity epidemic, which is affecting children of all ages as well as adults. Detailed comparisons of obesity rates in children are often difficult to obtain because different criteria have been used to define overweight and obesity in different age groups and different growth references have been used. Lazarus et al. compared data from two population-based surveys (in 1985 and 1997) of 7–12 year old children in Victoria; they found that the children had become more obese in the 12 years between the surveys and, of particular concern, that the increase in BMI was most marked at the heavier end of the distribution. Mean BMI increased by 1.03kg/m² for boys and 1.04kg/m² for girls. In the United States in the past two decades the prevalence of overweight has increased by 80 per cent in children and 100 per cent in adolescents. In the United Kingdom rates of overweight in children have doubled over a similar period.

Prevention remains very important because obesity is hard to treat and has adverse physical and psychological outcomes. Overweight children are more likely to become obese adults, and an overweight school-aged child with an obese parent has more than a 70 per cent chance of being obese in young adulthood.

Metabolic consequences of obesity

Obese children and adolescents can show early signs of metabolic and clinical consequences—such as hyperinsulinaemia and hypertriglyceridaemia—that are well recognised in obese adults. Additionally, obese children and adolescents have been shown to have reduced exercise tolerance and so obtain reduced
benefits from exercise. Non-alcoholic steatohepatitis is well recognised in adults as a complication of obesity; it is now occurring in children and adolescents and is related to the increasing prevalence of obesity and associated insulin resistance.

Psychological problems of obesity

The main ill-effects of obesity during childhood are social and emotional. Obese people are stigmatised and labelled with undesirable behavioural characteristics ranging from social deviance to an inordinate desire for self-gratification. In 1967 Stunkard and Burt (cited by Johnston) suggested that the disturbance of body image reported among obese adults seems to have its origin during adolescence, when belittlement and peer pressure have particularly deleterious effects.

Underweight, failure to thrive and dietary restriction

The most serious consequences of an inappropriate food intake in infancy and early childhood are underweight and failure to thrive. In Australia, in recent years, concern about the prevalence of underweight and failure to thrive in infancy and childhood has largely focused on Indigenous communities, where the aetiology of the problem rests in a complex mix of social and economic factors. Failure to thrive among other sections of the community is also most commonly a result of psychosocial factors, including poor living conditions. Psychosocial failure to thrive—which at its most extreme is a manifestation of child neglect—is the most common form of failure to thrive in both inpatient and outpatient populations in the non-Indigenous community. The literature provides evidence that from time to time cases of failure to thrive also occur in more affluent sections of the community as a consequence of parents inappropriately restricting the dietary intake of young children because of fears about obesity and atherosclerosis or the development of ‘unhealthy’ dietary habits. Such cases are, however, relatively rare compared with the problem of dietary restriction in older children and adolescents.

Perception of body image

A Sydney study of 133 girls aged 12 to 14 years found that while 18 per cent could be classified as ‘underweight’ and 26 per cent as ‘overweight’, 37 per cent thought they were too fat and 42 per cent were on a diet to lose weight. Data from the 1985 National Dietary Survey of Schoolchildren showed that girls increased their energy intake by less than 10 per cent between the ages of 10 and 15 years, whereas over the same age range boys increased theirs by some 45 per cent. Although the data probably exaggerate the real extent of the energy restriction because of the tendency for reported dietary intakes to underestimate habitual intakes, the data do suggest that there is a need for information and support to combat the fear of weight gain in this age group. First, adolescents
need reassurance that appreciable weight gain, changes in body shape and increases in food intake are quite normal at this time; second, they need to be aware that any extreme dietary practices that limit the intake of nutrients are highly undesirable in relation to both their current and their longer term health.

**Dieting and concerns about body size**

Characteristics of disordered eating—such as restrained eating, binge eating, fear of fatness, purging and distortion of body image—are commonly reported in adolescents.66,67 There are also reports of children exhibiting similar weight-related behaviours.61 These characteristics are more prevalent in females than males. A Melbourne study of year 11 students found that 57 per cent of the females had dieted to lose weight, while only 18 per cent of the males had done so.68 Another study of women aged 15 to 27 years found that most of the study population had dieted at some time. Several strategies were adopted to lose weight; they ranged from exercising and not eating between meals to self-induced vomiting and abuse of laxatives and diuretics.69 Similar weight-control practices have been reported among 15-year-old New Zealand girls70 and Adelaide women aged 18 to 86 years.71 Abraham and Mira69 consider that most adolescent females experience a phase of ‘disordered’ or ‘abnormal’ eating behaviour, which they attribute to the social pressure on young women to be slim and the association of slimness with health, happiness and attractiveness. This pressure is combined with the biological changes—widening of the hips and deposition of fat on the hips and breasts—that females experience during adolescence.

There are only limited estimates of the prevalence of anorexia nervosa and bulimia nervosa in Australia. These conditions are often described as affecting large numbers of adolescent girls and young women, although, in a study of the prevalence of anorexia nervosa in a population of 5705 South Australian girls aged 12 to 18 years, Ben-Tovim and Morton72 found that true anorexia nervosa was a relatively rare disorder, with a prevalence of 1.05 cases per 1000 of the population studied. This study adopted quite rigorous criteria for the definition of anorexia nervosa and did not describe the prevalence of more general eating disorders that might lead to the development of anorexia nervosa or bulimia nervosa. Nevertheless, the study lasted a year and the authors stated that none of the milder variants of anorexia nervosa in the study population became more severe during the study period.

An earlier study, by Ben-Tovim et al.73, of the prevalence of bulimia nervosa found a similar situation. When the widely used criteria for the diagnosis of bulimia (a syndrome of secretive and subjectively hard-to-control binge over-eating) were used with three community and two hospital populations in South Australia, 13 per cent of females aged 16 to 45 years in the community samples could be categorised as bulimic. In contrast, when the term was defined with reference to the behaviour of patients undergoing treatment for bulimia nervosa (who not only binge over-ate but also acted to prevent the weight gain caused by their overeating), a very different picture emerged: the prevalence of bulimia among females in the community samples was about 1 to 2 per cent.
More recently, Patton et al.\textsuperscript{74} have reported that 3.3 per cent of female adolescents and 0.3 per cent of male adolescents in a Victorian cohort exhibited features of an eating disorder. Over the three-year study period the rate of development of new eating disorders was 21.8 per 1000 person-years of observation in females and 6.0 in males. The most important predictors of the development of eating disorders were early dieting and psychiatric morbidity. Thus, it would appear that, although only a small proportion of the female population develops clinical eating disorders, a great many more display disrupted eating behaviour and weight-control problems. There are indications that children also exhibit some characteristics of disordered eating and concerns about body weight, so preventive action should be aimed at children and young women. Such action would be designed to help young women to accept a wide range of weights and body shapes as normal and to develop mechanisms for coping with the prevailing societal attitudes to weight and body shape\textsuperscript{69}, as well as dealing with more general matters relating to self-esteem, healthy family function and recognition of the early features of psychiatric disability\textsuperscript{69,75,76}.

**PRACTICAL ASPECTS OF THIS GUIDELINE**

**Development**

Children’s nutritional needs should be considered in the context of normal childhood development. The following characteristics of normal childhood development are identified in the Canadian guidelines *Promoting Nutritional Health During the Preschool Years*\textsuperscript{1}.

Throughout early childhood, children are:

- rapidly *changing*, not only growing in stature but developing in ability and personality.
- keenly curious and *learning* at a rapid rate. Exploring the environment through play takes up a large part of the young child’s time.
- continually *challenging* the relationship with the primary caregiver, asserting independence while needing guidance and protection.
- gradually *moving beyond* the parent’s primary care to others in the family, community and society.
- *exploring* food as part of their development.

Boxes 2.1 and 2.2 summarise the developmental characteristics of toddlers and preschoolers in relation to food.
How is normal development assessed?

Unlike growth, there are no simple measures of development. A range of tests can be used for assessing aspects of psychosocial development such as intelligence, personality and emotional adjustment, but they require special training. Such assessment is done by primary health care workers, with reference to developmental milestones or screening tests (see, for example, reference 78). Each child is unique, and this is reflected in individual rates of normal development. Development is a gradual process of growth and expansion of skills, moving from a low level of complexity to a more advanced level. It is achieved through the processes of growth, maturation and learning.

Understanding how children and young people approach eating

The role of caregivers

The early years of life are critical in establishing food attitudes and habits.75 Caregivers can foster the formation of sound food habits by understanding eating behaviour as part of a child’s normal pattern of development. They play a central role in providing a safe environment that offers opportunities for exploration and learning. The feeding and nutritional care of a child are an integral part of the complex interaction between the primary caregiver and the child and are vital to the child’s physical and emotional development.1,77 Contemporary lifestyle patterns may mean that children have several different caregivers: good communication between these caregivers helps to ensure that they can assess and respond to a child’s individual needs.

Box 2.1 Developmental characteristics of toddlers1,78

The toddler years bring:

- a time of exploration. Toddlers explore their surroundings by touching, seeing, listening, smelling and tasting. Food is of immense interest to most of them—but not always to eat
- greater autonomy but at the same time a fear of new experiences. Between 18 and 24 months most toddlers can handle a spoon and cup for feeding themselves, although spills often occur. ‘No’ becomes a favourite word. Inconsistency is also a common feature: one day they insist on feeding themselves and the next day they insist on being fed
- a need for a sense of security. The need for ritual and a sense of security is very strong in toddlers. A desire for the familiar—a special toy or food—often dictates their daily routine. This is an integral part of the normal transition from infancy to childhood
- a limited attention span. Easily distracted, toddlers may be unable to sit at the family table for the normal duration of a meal
- awareness of others. Although not skilled in cooperative play, 2- and 3-year-olds are gradually developing social skills. They often imitate people close to them. Watching another child or adult who enjoys the food is a powerful influence on the toddler’s acceptance of foods.
2. **Children & Adolescents Need Sufficient Nutritious Foods to Grow and Develop Normally**

**Box 2.2 Developmental characteristics of preschoolers**

In general, in preschoolers there is:

- **progressive acquisition of new skills.** Preschoolers are striving for independence and gaining competence in such activities as tying their shoes, brushing their teeth and pouring milk. A preschooler’s oral motor development and manual dexterity should be considered so that foods of appropriate texture, consistency and ease of eating are chosen for them.

- **energy.** Sitting still for more than a few minutes might be difficult. Preschoolers need plenty of time for active play and opportunities to develop gross motor coordination.

- **more effective communication.** Language is important. Peers become increasingly important. Most preschoolers enjoy sharing food with friends and carers.

- **a keen curiosity.** ‘Why’ has usually replaced ‘no’ as the favourite spoken word. The kitchen provides an opportunity for experiments, crafts, and participation in food preparation.

- **comfort with the familiar but willingness to try new challenges.** Food fads are common at this time. Preschoolers might insist on having a particular food prepared in a particular way for several days then, once it has been experienced to the full, become infatuated with another food. This has been called ‘fussiness’, but it is actually characteristic of normal development. Although variety may be limited while the fad persists, the preschooler is gradually expanding their food choices.

**Food intake**

Caregivers often appear to be more concerned with the amount of food consumed rather than the type of food offered or even the feeding environment. But obviously a balance between the amount, type and variety of foods is necessary. Caregivers’ responsibility lies in buying the food, setting the times of meals and snacks, preparing meals, presenting foods in suitable forms, maintaining standards of behaviour at the table, and making meal times pleasant. The nutritional quality of the diet is important to ensure that the child receives the levels of nutrients specified in the recommended dietary intakes.

The following are general characteristics of a child’s developing eating pattern:

- **Small amounts of foods eaten frequently.** Because their stomach capacity is small, children tend to eat small amounts frequently throughout the day.

- **Routine in daily life.** Most children need some structure and routine to their day. Generally, they prefer meals and snacks at regular times, as governed by the family’s lifestyle.

- **Considerable variation in appetite.** Children’s appetites normally fluctuate from day to day, depending on their rate of growth and level of physical activity. Many parents find their children eat better at certain times of the day. Tiredness and irritability can prevent children from eating, especially at the evening meal.

- **A preference for simplicity.** Many children like simply prepared, mild-tasting foods that they can easily identify. They prefer foods they can manage—for example, cut-up vegetables they can eat with their fingers and soups they can drink from a cup.
2. Children & adolescents need sufficient nutritious foods to grow and develop normally

- **An association of food with more than eating.** Foods have specific meanings determined by a child’s associations with them; for example, sweets may mean a reward for good behaviour in the supermarket. Caregivers should be aware that early impressions associated with various uses of food affect food-related attitudes and practices that can last throughout life.

- **Dawdling over meals.** It is quite normal for children—who have no concept of time—to lose interest in an activity very quickly. A number of strategies can be adopted to encourage good eating habits and monitor food intake:
  - Establish routines where the child and caregiver sit down together and talk during meal times and snacks.
  - Establish habits—such as milk with a meal and water at bedtime—that will help ensure variety and nutritional adequacy.
  - Keep in the fridge or on the kitchen bench a ‘snack-box’—containing healthy snack foods such as pieces of fruit, vegetables, cheese and small sandwiches—that the child can either use independently or have offered to them. This helps to monitor what the child is eating between meals.
  - Introduce the practice of having the child at the table for meal times as soon as he or she is able to sit up and grasp foods.
  - Do not give the child too large a serving. It is better to offer small amounts and have more available if they want it.
  - Provide foods the child likes, plus a new food to try. Be accepting if the child does not like particular foods, but remember that likes and dislikes change over time. Do not avoid serving a food that the child dislikes but that the rest of the family likes: continue to serve it, placing only a small amount on the child’s plate, and accept it if they do not eat it.

‘Fussy eating’ is common among toddlers and often worries parents. Usually it is a stage in normal development, but it can be aggravated by parental response. When growth and development are normal and a variety of foods are offered to the child, simple reassurance from the child’s parents may be all that is needed.

An adequate intake of fluids is important at all ages. Children should be encouraged to drink as much water as possible, in preference to other fluids. Milk is an important source of calcium and, because it has a high protein content, has a greater satiating effect than other drinks.

**Food preferences**

**Parents and peers**

Parental influences on food patterns are critical in the development of food preferences, and parental pressure, even if it is positive, can affect a child’s food acceptance. Using foods as rewards or presenting them paired with adult attention increases a child’s preference for that food (Birch, cited by Sigman-
Grant\textsuperscript{79}); when foods are simply presented at snack time or when they are offered without a social context, food preferences do not appear to be influenced. Another influence on food preferences is the frequency with which children see a particular food. It is important for caregivers to present new foods frequently: continued exposure promotes acceptance. Further, when children observe adults consuming a food, it is more likely that the children will start to consume the food.\textsuperscript{79} Peer influence can also affect children’s food preferences as they age\textsuperscript{79}; adolescents are particularly susceptible to peer pressure.\textsuperscript{84}

**Television advertising**

In addition to its effects on physical activity, television exposes children to numerous food advertisements. There has been much speculation in recent years about the effects of that advertising, and of the media in general, on children’s food preferences and intakes. Public health experts and nutrition educators have expressed concern that many of the food advertisements on television directed at children are for a narrow range of products that are high in fats, sugars and/or salt and low in dietary fibre.\textsuperscript{85,86} Producers of basic foods such as vegetables and fruits and agencies involved in promoting healthy diets often lack the funds to advertise and so provide some balance in the range of products promoted.

A US study found that television commercials were important influences on the types of food children ask their parents to buy and the foods they buy for themselves.\textsuperscript{87} (Otherwise, why would advertisers bother?) Sweetened breakfast cereals, candy, desserts, low-nutrient beverages, and salty snack foods were the products most commonly advertised to children and are also the items most frequently requested of parents. Kraak and Pelletier suggest that building children’s and teenagers’ skills in processing consumer information is one strategy—when combined with parental guidance and environmental support (including government–industry partnerships)—that can help young consumers make ‘healthful’ dietary choices before undesirable dietary behaviours have developed.

Table 2.1 outlines some typical physical and social/personal characteristics related to the eating practices of preschool children.
## Table 2.1  Typical physical and social/personal characteristics related to eating during the preschool years

<table>
<thead>
<tr>
<th>Age</th>
<th>Physical characteristics</th>
<th>Social/personal characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>12–18 months</td>
<td>Grasps and releases foods with fingers</td>
<td>Wants food others are eating</td>
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<tr>
<td></td>
<td>Holds spoon but use poor</td>
<td>Loves performing</td>
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<tr>
<td></td>
<td>Turns spoon in mouth</td>
<td></td>
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<tr>
<td></td>
<td>Uses cup but release poor</td>
<td></td>
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<tr>
<td>18 months–2 years</td>
<td>Appetite decreases</td>
<td>Ritual becomes important</td>
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<td></td>
<td>Likes eating with hands</td>
<td>Displays food preferences</td>
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<tr>
<td></td>
<td>Likes experimenting with textures</td>
<td>Distracts easily</td>
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<td></td>
<td></td>
<td>Develops negative behaviour</td>
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<tr>
<td>2–3 years</td>
<td>Holds glass in hand</td>
<td>Definite likes and dislikes</td>
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<tr>
<td></td>
<td>Places spoon straight in mouth</td>
<td>Insists on doing it ‘myself’</td>
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<tr>
<td></td>
<td>Spills a lot</td>
<td>Ritualistic</td>
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<tr>
<td></td>
<td>Chews more foods but choking</td>
<td>Dawdles</td>
</tr>
<tr>
<td></td>
<td>still a hazard</td>
<td>Food fads</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Demands foods in certain shapes and whole foods</td>
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<tr>
<td></td>
<td></td>
<td>Likes to help in the kitchen</td>
</tr>
<tr>
<td>3–4 years</td>
<td>Holds handle on cup</td>
<td>Improved appetite and interest in food</td>
</tr>
<tr>
<td></td>
<td>Pours from small jug</td>
<td>Favourite foods requested</td>
</tr>
<tr>
<td></td>
<td>Uses fork</td>
<td>Likes shapes, colours, ABCs</td>
</tr>
<tr>
<td></td>
<td>Chews most foods</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Able to choose between two alternative foods</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Influenced by television commercials</td>
<td></td>
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<tr>
<td></td>
<td>Likes to copy food preparer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Imaginative play</td>
<td></td>
</tr>
<tr>
<td>4–5 years</td>
<td>Uses knife and fork</td>
<td>Rather talk than eat</td>
</tr>
<tr>
<td></td>
<td>Good use of cup</td>
<td>Food fads</td>
</tr>
<tr>
<td></td>
<td>Good self-feeder</td>
<td>Motivated to eat by incentives</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Likes to help</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Interested in nature of food and where it comes from</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Peer influence increasing</td>
</tr>
<tr>
<td>5–6 years</td>
<td>Independent at feeding</td>
<td>Conforming</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Less suspicious of mixtures but still prefers plain foods</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Social influence outside home increasing</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Food important part of special occasions</td>
</tr>
</tbody>
</table>
2. CHILDREN & ADOLESCENTS NEED SUFFICIENT NUTRITIOUS FOODS TO GROW AND DEVELOP NORMALLY

Changing adolescents’ diets

Adolescents continue to eat diets that do not meet the dietary guidelines. The following factors are important determinants of adolescent eating behaviour:

- peer-group norms that devalue healthy eating behaviour
- participation in other risky behaviours
- low competency—actual and perceived—in sports, food selection and food preparation
- familial and cultural expectations.

Management of obesity

The National Health and Medical Research Council’s Acting on Australia’s Weight provides information about recognising and managing different types of obesity during childhood and adolescence and about preventing nutritional obesity. It stresses the need for full assessment of all children who appear to be obese, in order to obtain a diagnosis that adequately explains the obesity and determines the most suitable management strategy.

Inappropriate advice—such as a recommendation to participate in weight-loss programs designed for adults—is likely to be not only harmful but also ineffective. The most successful weight-reduction programs are those that combine diet and exercise within a framework of behaviour modification. Children should be encouraged to reduce their consumption of sweetened beverages and eat fewer high-fat snacks. Programs designed to reduce the amount of time engaged in sedentary activity—television watching, for example—have been successful in reducing weight gain and improving fitness.

Social change

Some social trends can also influence the food preferences and intakes of children and adolescents:

- the increasing number of meals bought and consumed outside the home. Children and adolescents, either as part of the family or independently, buy and consume foods from a wide variety of outlets, including childcare centres and school canteens—see Chapter 3 for more discussion of this
- the many foods and beverages that now come into the home in ready-to-eat or convenience form. Packages of snack foods, biscuits and drinks are all easily accessible in the home
- working parents, increased use childcare facilities and the diversity of cuisines available (including packaged and ready-to-eat meals).
Relationship to other guidelines

This guideline on growth and development relates to almost all of the other guidelines: a balanced, nutritious diet is the basis of healthy growth and development.

Encourage and support breastfeeding

Chapter 1 discusses failure to thrive in breastfed infants.

Include milks, yoghurts, cheeses and/or alternatives

Section 3.4 discusses the importance of adequate intakes of calcium and of physical activity in achieving peak bone mass.

Conclusion

An appropriate diet and plenty of physical activity are essential for growth and development that optimise health during childhood, adolescence and the later years of life.

Evidence

There is Level III evidence of the relationship between foetal and perinatal nutrition and adult type 2 diabetes (reference 4), heart disease (references 3 and 4) and cognition (reference 6). There is Level II (ref 10) and Level III evidence for the effect of calcium intakes and exercise throughout the development period on subsequent bone density (references 7, 15 and 16; see also ‘Evidence’ in Section 3.4). There is also Level III evidence of the relationship between body fatness, inactivity and selected dietary factors in children (references 45, 47 and 91).

References

2. CHILDREN & ADOLESCENTS NEED SUFFICIENT NUTRITIOUS FOODS TO GROW AND DEVELOP NORMALLY


2. CHILDREN & ADOLESCENTS NEED SUFFICIENT NUTRITIOUS FOODS TO GROW AND DEVELOP NORMALLY


2. **Children & adolescents need sufficient nutritious foods to grow and develop normally**


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2. **CHILDREN & ADOLESCENTS NEED SUFFICIENT NUTRITIOUS FOODS TO GROW AND DEVELOP NORMALLY**


2. Children & adolescents need sufficient nutritious foods to grow and develop normally


3 ENJOY A WIDE VARIETY OF NUTRITIOUS FOODS

Colin Binns and Mi Kyung Lee

Terminology

Food variety

*Food variety* can be defined in terms of foods that are biologically diverse or foods that are nutritionally distinct from each other. *Eating a variety of nutritious foods* means consuming different food types in appropriate amounts—as illustrated by the *Australian Guide to Healthy Eating* (see Figure 3.1)—to obtain all the required nutrients without excess energy intake. Variety further refers to choosing a range of items from within each food group, particularly from the plant-based food groups (vegetables, fruits and cereals). Although variety is an important nutritional principle, the evolution of modern sedentary society means that if variety is to be maintained a reduction in serving sizes needs to be considered, particularly for more energy dense foods with limited nutrient content (see ‘Practical aspects of this guideline’).

Nutritious foods

The term *nutritious foods* is used to describe foods that make a substantial contribution to providing a range of nutrients, have an appropriate nutrient density, and are compatible with the overall aims of the dietary guidelines. The nutrients that are essential for human life are found in varying amounts in many different foods, and a varied diet is essential to obtain sufficient quantities of all required nutrients (known and not yet known), to increase consumption of protective factors (phytochemicals), and to minimise exposure to toxicants.

Weaning

The word *weaning* can confuse because it is used in various contexts in the literature. In this guideline the term *introduction of solids* is used instead.

Background

Eating a wide variety of nutritious foods is important in childhood, when growth and maturation are occurring and future eating habits are being established. Variety is a primary factor in the development of lifelong healthy eating behaviours. Consumption of a wide variety of foods makes it less likely that excessive or inadequate amounts of any particular nutrient or other food
component will be consumed. Adolescence is a period of rapid growth and lifestyle changes, but it is also an important period for maintaining optimal nutrition. The first word of this guideline is \textit{enjoy}, and eating should be an enjoyable activity for all children. Childhood is a time when an appreciation of the pleasures of good food can be developed, in a context of healthy nutrition.

Good eating habits begin in childhood. Parents and other caregivers can set an example for children by offering a wide variety of foods, setting regular meal patterns, and providing sufficient ‘training’ to establish good dietary behaviour. The word \textit{mother} is often used in this guideline when referring to infants and young children. In all cases other than in connection with breastfeeding, \textit{parent} or \textit{caregiver} could be substituted.

\section*{Scientific Basis}

\subsection*{Infants}

In infants up to the age of 6 months, breastmilk universally provides the ideal food, meeting all nutritional requirements (for scientific rationale, see Section 1 of this document and the accompanying \textit{Infant Feeding Guidelines for Health Workers}). There is no universal model of feeding for older infants, but a growing number of studies provide guiding principles. Different cultures introduce different foods at different ages.

\textit{Introduction of solid foods}

The expression \textit{introduction of solids} describes the process whereby an infant, having previously been fed solely milk, gradually becomes accustomed to a variety of other foods until he or she can deal with the general family diet. The expression is preferable to \textit{weaning} because it more accurately conveys the idea that the process does not involve cessation of breastfeeding.\textsuperscript{2}

Four main questions arise in connection with the introduction of solid foods:

\begin{itemize}
  \item At what age should solid foods be introduced?
  \item What foods should be introduced?
  \item How should foods be introduced?
  \item How can the risk of infection be reduced?
\end{itemize}

\subsection*{When should solid foods be introduced?}

Breastfeeding provides sufficient nutrients until around the age of 6 months for most infants. There is almost universal agreement that solids should not be started before the age of 4 months and that they should not be delayed much beyond the age of 6 months. Resolutions from the World Health Assembly in 1990 and 1992 advise ‘4–6 months’, while a 1994 resolution recommends ‘about 6 months’. In several more recent publications from WHO and UNICEF both
expressions have been used. In a 1992 WHO review, Lutter\(^5\) concluded that the scientific basis for recommending 4–6 months was not adequately documented; in a 1998 WHO report on complementary feeding in developing countries, it was recommended that full-term infants be exclusively breastfed to about 6 months of age.\(^4\) A number of observational studies and two randomised trials have not identified any benefits from the introduction of solid foods before the age of 6 months.\(^4–6\)

The debate about the timing and extent of exposure to complementary foods focuses on immune function, the acquisition of immuno-tolerance, and the functional imprinting of intestinal function, its microflora and systemic metabolism.\(^7\)

In the past when the term 4–6 months has been used, some mothers may have felt that their child was more advanced and introduced solids at an earlier age. Using 6 months promotes an improved public health outcome. In 1999 the WHO European Region Division summarised the recent thinking thus:

All infants should be exclusively breastfed from birth to about 6 months of age, and at least for the first 4 months of life. Breastfeeding should preferably continue beyond the first year of life, and in populations with high rates of infection continued breastfeeding throughout the second year and longer is likely to benefit the infant.\(^8\)

In 2001 the report of a WHO Expert Consultation recommended exclusive breastfeeding for about 6 months, with the introduction of complementary foods and continued breastfeeding thereafter <www.who.int>. The 2001 World Health Assembly brought together these various recommendations in one resolution recommending exclusive breastfeeding until 6 months of age.

Six months of age is a suitable time for most infants to begin to adapt to different foods, food textures and modes of feeding.\(^9\) Gradual inclusion of solid foods allows an infant to become used to different foods and textures. Six months of age has been identified as a time when:

- An infant’s appetite and nutritional requirements are generally no longer satisfied by breastmilk or infant formula alone.\(^10\) At this time stores of several nutrients—for example, iron and zinc—are often falling in exclusively milk-fed infants (both breast- and formula-fed).\(^11\) Iron status is a particular concern; it is discussed in detail in Section 3.3.
- The development of feeding behaviour has progressed from sucking to biting—and, by 7–9 months, chewing.\(^10\) This is attributable to the disappearance of the tongue-extrusion reflex\(^2,12\) and the infant’s increasing ability to sit without support, which allows greater manipulation of food before swallowing, so that thicker foods can be handled.\(^9,12,15\)
- The digestive system matures. An infant’s digestive system cannot cope with foods other than milk in the early months. Salivary amylases are present at birth, but it appears that pancreatic amylases are essentially absent up to at least 3 months of age and remain inadequate up to 6
months. As a result, the ability to digest starches is limited, if not absent, until the middle of the first year of life.\(^2\)

- Most infants have developed an interest in their environment, and this prompts a willingness to accept new textures and flavours. It is useful to exploit this exploratory phase by gradually introducing new food tastes and textures.

Cultural, social and medical factors also appear to influence the age at which solids are introduced. Different cultures have their own traditions about what food is most suitable to begin with, and culturally appropriate foods and preparation methods should be encouraged when they are nutritionally adequate.

Introducing solid foods too soon can lead to several problems:

- If less time is spent on the breast, maternal milk production may decline because of reduced stimulation. In extreme cases under-nutrition could result.\(^14\)
- If solid foods are introduced before an infant is developmentally ready—while the tongue-extrusion reflex is still strong—the infant will reject the spoon (a hard object). The mother might then feel that the infant is rejecting the food, when in fact it is rejecting the object placed in its mouth. Early introduction of foods does not lead to earlier loss of the tongue-extrusion reflex: it just prolongs the length of introduction.
- Food allergies can develop.
- Exposure to pathogens present in foods can cause increased rates of diarrhoeal diseases and other problems.

Introducing solid foods too late can also cause problems:

- Growth can falter because breastmilk alone is insufficient after 6 months.
- Immune protection can be compromised.
- Micronutrient deficiencies—especially of iron and zinc—can develop because of breastmilk’s inability to meet requirements.
- Optimal development of motor skills such as chewing can be delayed and the infant may be unwilling to accept new tastes and textures.

Although exclusive breastfeeding to 6 months of age is recommended, more experience is needed to identify any subgroups that require earlier introduction of solids (but never before 4 months).\(^15\) Six months should be regarded as a group recommendation.

A longitudinal study of 506 Swedish infants showed how long it can take to introduce solid foods. Infants took a median of 28 days from the first introduction of solids to consumption of more than 10 millilitres daily; it was 46 days before the infants ate 100 millilitres of solids in one day for the first time. Most infants in this study were given solids at ages between 4 and 6 months. The younger the infant was at the time of introduction of solids, the longer it took to introduce them.\(^10\) Delaying the introduction of solids until 6 months will considerably shorten this period.
3. Enjoy a wide variety of nutritious foods

**Current Australian practices**

In a study of infants in Melbourne, Graham et al.\(^7\) found that the majority of mothers were following the 4–6 months recommendation current at the time of the study: the mean age for the introduction of solids was 4.3 months. The average age for the introduction of cow’s milk was 10.3 months, although some ethnic groups introduced it earlier. The groups most likely to introduce solids before 4 months were very young mothers, first-time mothers and mothers speaking languages other than English. In an Adelaide study, 40 per cent of infants under 4 months of age were having solid foods and the majority of these were not being breastfed.\(^8\)

**Infant formulas and other milks**

Modern infant formulas provide a suitable form of nutrition when an infant, for whatever reason, does not have access to breastmilk. Traditional formulas are based on cow’s milk, with varying proportions of casein and whey proteins. More recently, formulas based on soy or goat’s milk and lactose-free formulas have been developed for infants who cannot tolerate cow’s milk or lactose. Chapter 1 discusses the advantages of breastmilk as opposed to infant formulas. Table 3.1 shows the composition of human milk and cow’s milk and the recommended composition of infant formulas.

<table>
<thead>
<tr>
<th>Component</th>
<th>Mean value for mature human milk</th>
<th>Cow’s milk</th>
<th>Infant formula(^a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy (kJ)</td>
<td>280</td>
<td>276</td>
<td>273–285</td>
</tr>
<tr>
<td>Energy (kcal)</td>
<td>67</td>
<td>66</td>
<td>65–68</td>
</tr>
<tr>
<td>Protein (g)</td>
<td>1.3(^b)</td>
<td>3.2</td>
<td>1.5–1.7</td>
</tr>
<tr>
<td>Fat (g)</td>
<td>4.2</td>
<td>3.9</td>
<td>3.6–3.9</td>
</tr>
<tr>
<td>Carbohydrate (g)</td>
<td>7.0</td>
<td>4.6</td>
<td>7.0–7.6</td>
</tr>
<tr>
<td>Sodium (mg)</td>
<td>15</td>
<td>55</td>
<td>14–17</td>
</tr>
<tr>
<td>Chloride (mg)</td>
<td>43</td>
<td>97</td>
<td>40–68</td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>35</td>
<td>120</td>
<td>42–55</td>
</tr>
<tr>
<td>Phosphorus (mg)</td>
<td>15</td>
<td>92</td>
<td>21–32</td>
</tr>
<tr>
<td>Iron (µg)</td>
<td>76(^c)</td>
<td>60</td>
<td>700–1200(^d)</td>
</tr>
<tr>
<td>Vitamin A (µg)</td>
<td>60</td>
<td>35</td>
<td>60–92</td>
</tr>
<tr>
<td>Vitamin C (mg)</td>
<td>3.8</td>
<td>1.8</td>
<td>5.4–7.1</td>
</tr>
<tr>
<td>Vitamin D (µg)</td>
<td>0.01</td>
<td>0.08</td>
<td>0.85–1.40</td>
</tr>
</tbody>
</table>

\(^a\) Acceptable range.  
\(^b\) True protein = 0.85g per 100ml (excluding non-protein nitrogen), although a proportion of the non-protein nitrogen is used for maintenance and growth in infants.  
\(^c\) Iron in breastmilk is highly bioavailable, with absorption of 50–70 per cent.  
\(^d\) Iron in infant formula is poorly bioavailable, with absorption of only about 10 per cent.  

Note: Appendix G in the Infant Feeding Guidelines for Health Workers provides more detailed information.
Follow-on formulas

Breastmilk is the preferred milk for infants up to at least 12 months of age and offers benefits beyond this time. When, for whatever reason, breastmilk cannot be offered, a standard infant formula should form the main milk component of the diet for infants up to 12 months of age. The main advantage of ‘follow-on formulas’ lies in their iron content: infants at this age should ideally be getting iron from a varied and expanding range of solid foods, including meat-containing products. But, although the iron fortification contained in follow-on formulas is an advantage for infants who are receiving inadequate amounts of solid food, other compositional changes in protein, fat, carbohydrate, sodium and calcium have no clearly established superiority over ordinary formula provided together with appropriate solid foods. The Infant Feeding Guidelines for Health Workers provide more information about infant formulas.

Cow’s milk

Cow’s milk is not recommended for infants younger than 12 months of age for a number of reasons:

- It is a poor source of iron and the iron it does contain is poorly absorbed. Introducing cow’s milk before 12 months of age predisposes an infant to iron deficiency at an age when their iron stores become depleted.
- The composition of cow’s milk is not ideal for infants. Compared with breastmilk and infant formula, cow’s milk contains higher levels of protein, sodium, potassium, phosphorous and calcium and lower levels of iron, vitamin C and linoleic acid, adding to the difficulty of providing a balanced diet for older infants.
- The high phosphorous and calcium content of cow’s milk may decrease the bioavailability of iron from other dietary sources such as infant cereals.
- The higher levels of protein, sodium and potassium in cow’s milk have been associated with an increase in renal solute load in infants fed cow’s milk.
- Feeding with cow’s milk has been shown to lead to increased gastrointestinal tract blood loss in a large proportion of normal infants, exacerbating the problem of iron deficiency. The problem can be severe enough to result in unnecessary surgery. In a longitudinal study of 6209 Swedish infants, 1.9 per cent were found to develop IgE cow’s milk antigens; the proportion was lower for exclusively breastfed infants.
- Early introduction of cow’s milk may be associated with increased rates of subsequent adult disease such as type 2 diabetes.

A prospective study in Adelaide showed no association between the duration of breastfeeding or the introduction of cow’s milk and the development of islet auto-immunity in high-risk children. Overall, infants fed cow’s milk have low intakes of iron, linoleic acid and vitamin E and excessive intakes of sodium, potassium and protein. Iron status and deficiency is discussed in more detail in Section 3.3.
Given all these factors, cow’s milk is not recommended for use as the main source of milk for infants aged less than 12 months. Small amounts of cow’s milk in foods such as breakfast cereal, yoghurt, cheese and custards that are prepared for the rest of the family can, however, be given after about 9 months.

**Practical aspects of this guideline**

**Infants**

In terms of the practicalities of this guideline as it relates to infants, the questions of what foods to introduce and how to introduce them arise.

*What foods should be introduced?*

Generally, in Australia the introduction of solid foods starts with iron-enriched infant cereals at about 6 months. Vegetables, fruits, meats, poultry and fish are then added gradually. There are no set rules about the order in which the latter group should be introduced. Nutrient content is most important; another important determinant is the food’s texture. The foods that are introduced should be of high nutrient density. Fruit and vegetable purees are of low energy density, and choices should be varied even at this early age to ensure adequate energy and nutrient supply. An increasing range and quantity of foods should be offered as the infant moves towards 12 months of age. Table 3.2 shows examples of foods suited to an infant’s developmental stages.

Solid foods should provide an increasing proportion of the energy intake because infants continue to grow rapidly during this time. Variety is likely to meet the need for most nutrients and provide a basis for healthy eating habits. By the end of the first year of life, an infant should be consuming a wide variety of family foods, having progressed from pureed or mashed foods to foods that are chopped into small pieces.\(^{2,12}\)
3. Enjoy a wide variety of nutritious foods

Table 3.2 Developmental stages and examples of foods

<table>
<thead>
<tr>
<th>Age (months)</th>
<th>Reflexes and skills</th>
<th>Types of food</th>
<th>Examples of foods that can be consumed</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–6</td>
<td>Suckling, sucking and swallowing</td>
<td>Liquids</td>
<td>Breastmilk</td>
</tr>
<tr>
<td>6–7 (if needed earlier, not before 4 months)</td>
<td>Appearance of early chewing Increased strength of suck Movement of gag reflex from mid to posterior third</td>
<td>Pureed foods</td>
<td>Start with gluten-free cereals (e.g. rice), then add other foods such as vegetable (e.g. carrot) and fruit (e.g. apple, banana) purees, mashed potato, and well-cooked pureed liver and meat Toast fingers, rusks</td>
</tr>
<tr>
<td>8–12</td>
<td>Clearing spoon with lips Biting and chewing Lateral movements of tongue and movement of food to teeth</td>
<td>Mashed or chopped foods and finger foods Interested in an extended range of foods and textures</td>
<td>Well-cooked fish, minced liver and meat Mashed cooked vegetables and fruit Chopped raw fruit and vegetables (e.g. banana, melon, tomato) Egg yolk, cereals (e.g. wheat, oats), bread, pasta, cheese, custards, yoghurt</td>
</tr>
<tr>
<td>From 12 months</td>
<td>Rotary chewing movement Jaw stability</td>
<td>Family foods</td>
<td>Plain pasteurised milk</td>
</tr>
</tbody>
</table>

Note: Table shows the types of food that can be consumed and swallowed successfully; it does not necessarily show precisely when they should be offered.

If there is a strong history of family allergy, introduction of cheese, yoghurt, ice-cream, fish and wheat cereal should be delayed until 12 months of age. If there is a strong history of peanut allergy, peanut products (including peanut butter) should be avoided until after 3 years of age. Peanut allergy is common and can be very severe. Peanut allergen can be found in breastmilk, and if there is a family history of peanut allergy breastfeeding mothers should avoid peanuts.

How should foods be introduced?

The following are general recommendations for the introduction of foods:

- Foods should be introduced individually, and no salt, sugar or other flavourings should be added. Water, breastmilk or infant formula can be mixed with cereals. If cow’s milk is used at all, only small amounts of it should be used for mixing with foods.

- Initially, new foods should be offered no more often than each five to 10 days, to avoid confusion and rule out the (remote) possibility of food allergy or sensitivity.
• Once most foods have been successfully introduced, the types of foods offered should be changed frequently. This helps to ensure that the infant receives a good balance of nutrients. It may also play a part in their choosing a broader range of foods later on. Using family foods will help the child become used to eating like the rest of the family.9

• Care should be taken early on to choose foods of a texture that is suitable for the child’s age and stage of development.9 Small, hard pieces of food, such as nuts and seeds, should be avoided because they can be inhaled and cause choking.35 In the absence of allergy, however, nut pastes can be given.

• Persistence may be required; in one study infants given 10 opportunities to try foods increased their acceptance.

The first foods introduced should be soft and smooth-textured. An infant will quickly learn to cope with foods of different textures and will accept food that has been mashed with a fork or minced. It is important at this stage to encourage the infant to chew. Once they are able to hold things, ‘finger foods’ such as pieces of fruit, vegetables and bread can be offered. Other foods, such as meats, can be chopped into small pieces. Feeding bottles are best used only for breastmilk or infant formula. ‘Comfort sucking’ on a bottle can become a habit that is hard to reverse. Feeding cups or lidded cups are preferred for liquids other than breastmilk or formula from 6 months of age.

**Foods that are unsuitable or that should be used with care**

A number of foods are unsuitable for infants or should be used with care. Among them are honey, tea, nuts, fruit juices and reduced-fat milks.

**Honey**

Honey can contain the spores of *Clostridium botulinum* and—unless it has been carefully sterilised during processing—has been prohibited in foods for infants in Australia for many years. After the age of 12 months, children are less susceptible to this bacterium.37,38

**Tea**

Tea contains tannins and other compounds that bind iron and other minerals, thereby reducing their bioavailability. Furthermore, sugar is often added to tea, which increases the risk of dental caries.

**Nuts**

Foods such as nuts pose a problem for small children because of the risk of inhalation and choking. In addition, peanuts present a risk of allergy: it is estimated that 0.6 per cent of the US population (that is, 1.6 million people) suffer from peanut allergy.34 Nut pastes are in common use, however, for children who do not come from atopic families.
Fruit juices

Fruit juices produced from compressed fruit contain all the nutrients present in fruits but not the dietary fibre. Historically, fruit juices have been given to children to prevent vitamin C deficiency and scurvy.

An Adelaide study found that, in addition to milk, fruit juice and water were the main fluids given to infants aged less than 8 months. This was especially the case for non-breastfed infants. Eighty-five per cent of the infants drinking juice had started to do so by the age of 6 months.

In spite of this, fruit juice offers no nutritional benefits to infants under 6 months of age and its consumption may lead to a reduced nutrient intake from breastmilk. After 6 months, consumption of whole fruit is recommended instead. Fruit juices are suitable for children in modest quantities, but excessive consumption by young children has been associated with gastrointestinal symptoms, failure to thrive, decreased appetite and loose stools. If pure fruit juice is given to infants, it can be diluted with an equal amount of water. Fruit juices that are commercially prepared for infants and young children have usually been already diluted to less than 4 per cent total sugars. For older children and adolescents, questions about sugar-containing drinks and the risk of obesity arise. Milk drinks or water are good substitutes.

The following recommendations apply to the use of fruit juice:

- Juice should not be introduced into the diet of infants before 6 months of age.
- Infants should not be given juice from bottles or easily transportable covered cups that allow them to consume juice easily throughout the day.
- Infants should not be given juice at bedtime.
- For children aged 1 to 6 years, the intake of fruit juice should be limited to about 150 millilitres a day. For children aged 7 to 18 years, juice intake should be limited to 240–360 millilitres a day (two servings a day).
- Children should be encouraged to eat whole fruits to meet their recommended daily fruit intake.

Reduced-fat milks

In Australia reduced-fat milks are recommended for older children and for all adults as part of a healthy diet. They are not generally recommended for very young children. In the United Kingdom, for example, semi-skimmed milk is not normally recommended before the age of 2 years, and fully skimmed milk is not recommended until a child is more than 5 years old. (See Sections 3.4 and 3.6 for a more detailed discussion.)

By the time children reach 2 years of age they can share in the reduced-fat dairy products consumed by the rest of the family.
Summary

A number of recommendations have been made to help parents meet the nutritional needs of breastfed infants and young children aged 6 months to 2 years:44

- Continue to breastfeed as often as the infant desires—to avoid displacement of breastmilk by complementary foods and to maximise nutrients and immunological benefits.
- Aim for a variety of complementary foods—fruit, vegetables, meat, fish, poultry and eggs. Iron-fortified infant cereals are good sources of iron. Iron in meat is bioavailable, and meat is also a good source of zinc and vitamin B12.
- The best source of calcium is dairy products, although cow’s milk should generally be avoided before 12 months.
- Avoid too much fruit juice—a maximum of 120 millilitres a day before 12 months and 240 millilitres a day after 12 months.
- Seek advice if the infant’s appetite, growth or developmental milestones are impaired and further assessment is required.
- Infants eating a balanced, varied diet do not usually require nutritional supplements. Low-birthweight infants are an exception to this.
- Meals are to be enjoyed. Parents who model enjoyment of good dietary practices set the scene for good nutrition throughout childhood and beyond.
- Reduce the risk of infection. Attention to food hygiene is very important when preparing foods for infants and children. See Chapter 4 for more details.

Children

Toddlers and preschoolers

As discussed in Chapter 2, the period between a child’s first and fifth birthdays is a time of rapid social, intellectual and emotional growth.45 It is also characterised by a slowdown in the child’s growth rate, which may be reflected in a less reliable appetite. In addition, at this age children are discovering their independence and testing their choice in food selection, and this can lead to reduced interest in eating what the rest of the family eats.

These factors combine to give the impression that some younger children are ‘poor’, ‘difficult’ or ‘fussy’ eaters.45 Generally, this does not compromise normal growth or health, but if additional constraints are placed on the diet—such as the application of restrictive diets (including cholesterol-lowering diets) and the exclusion of particular foods for some reason—nutritional deficiencies can occur.

It is typical for children of this age to exhibit enormous variation in the amount of food they eat at different meal times. However, although their intake varies from meal to meal, their daily energy intake is relatively constant because they...
adjust their energy intake at successive meals.\textsuperscript{46} Food intake also varies greatly between individuals.\textsuperscript{45}

To grow normally, toddlers and preschoolers must regularly consume adequate amounts of energy. Caregivers should be reassured that a child’s perceived ‘erratic’ eating behaviour is not unusual for this age and that the best way of dealing with the situation is to offer and encourage consumption of a wide variety of foods. A number of diets that are recommended for and consumed by adults in the interest of good health may be unsuitable for young children. This applies particularly to inadequate intakes of fat for this age group—see Section 3.6 for details. Good eating habits begin at home, but consideration should also be given to foods consumed outside the home.

Many children in this age group are being cared for outside the home in a variety of settings—by relatives or family friends or in day-care centres (including long day–care centres). In 1996, 177 700 children attended long day–care centres in Australia; when compared with the 113 100 children in 1990, this is a 36 per cent increase.\textsuperscript{47,48}

In two separate studies, weight records were used to determine whether long day–care centres were meeting the 50 per cent of the recommended dietary intakes for nutrients advised by the New South Wales Department of Health. With the exception of energy, iron, calcium and zinc, both studies showed that the nutrient content of the food served in the centres met the department’s guidelines.\textsuperscript{49,50} A survey of all 330 long day–care centres in Western Australia resulted in a series of recommendations to improve nutrition and food safety.\textsuperscript{51} In a further study, involving children attending long day–care centres and a control group of non-attending children, three-day weighed food intake records were collected for each child in order to determine the nutrient intake provided by food in the different care environments. The results showed no statistically significant difference in the total daily intake of energy, protein and carbohydrate between the two groups of children.\textsuperscript{52} The authors concluded that the current recommendation that children receive 50 per cent of the recommended dietary intakes at long day–care centres should stand.

\textbf{School children}

The period between a child’s fifth birthday and the onset of puberty is characterised by slow, steady growth. Thus, all a child’s nutritional needs should be met by the continued consumption of a wide variety of foods, the amounts consumed being increased gradually to meet increasing energy needs.

Two important considerations apply to this age group:

\begin{itemize}
  \item \textit{School children select and consume food without supervision}. Unlike preschoolers, whose food consumption is determined and supervised by caregivers, school children experience new-found independence in food consumption, and at times food selection, for at least one meal of the day. This is also an age at which children often earn pocket money, which provides them with the means to buy foods they find desirable. A variety
of factors will influence this perception of desirability, among them family, friends and the media.

- The school canteen gives children the opportunity to choose their own food. Depending on the frequency with which children buy their food from the canteen, this could make an important contribution to their views about food and to their nutrient intake. In recent years there has been a shift towards offering healthier food choices in school canteens. This has often been combined with the introduction of broader school education programs on nutrition and health, which provide the information that helps children choose and consume a healthy, varied diet.51,53

### Adolescents

Adolescence is a transitional stage when the structure of food habits loosens.11 It is a time of new independence and diminished family influence, especially over food intake. Variety is of primary importance to this age group, which is characterised by the pubertal growth spurt that leads to an increase in requirements for energy and almost every nutrient. This is recognised in the Australian Guide to Healthy Eating.1 The increasing prevalence of obesity in adolescents is a concern; at this age, prevention of excessive weight gain is important (see Chapter 2).

Adolescence is often perceived as a time of erratic eating behaviour. Truswell11 identified those facets of eating behaviour that are different or more pronounced in adolescents than in other people and may cause adults to be concerned; these are listed in Table 3.3.

<table>
<thead>
<tr>
<th>Behaviour</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Missing meals</td>
<td>Especially breakfast</td>
</tr>
<tr>
<td>Eating snacks and confectionery</td>
<td>The major snack is usually in the afternoon after school</td>
</tr>
<tr>
<td>Takeaway foods, unconventional meals</td>
<td>Those eaten in combinations and permutations that other members of the family do not approve of but that often add up to adequate nutritional mix</td>
</tr>
<tr>
<td>Experimentation with alcohol, soft drinks and other ‘fun’ drinks</td>
<td>Soft drinks and other ‘fun’ drinks are preferable if they are an alternative to alcohol, but otherwise they displace water and milk</td>
</tr>
<tr>
<td>Distinctive likes and dislikes, high energy intakes</td>
<td>Occurs near peak height velocity in girls (age 12) but in boys may come later than peak height velocity (age 14)</td>
</tr>
<tr>
<td>Low levels of intake of some nutrients, dieting</td>
<td>Iron, calcium and, in some studies, vitamins A and C and zinc</td>
</tr>
</tbody>
</table>
There are two matters of particular concern in adolescence: dieting and concerns about body image (discussed in Chapter 2) and pregnancy.

**Pregnancy in adolescence**

Adolescence is a period of high nutrient needs, and dietary intakes below the recommended amounts are commonly reported for both pregnant and non-pregnant adolescent girls. Nutrient demands are higher and the consequences of inadequate nutrition more serious for pregnant adolescents than they are for pregnant adults. In particular, pregnant adolescents face increased risks of pre-eclampsia, low-birthweight infants and perinatal infant death.

Studies of the individual effects of maternal factors—socio-economic and behavioural factors, reproductive maturity, maternal emotional stress, nutritional deficiencies, and so on—on birthweight indicate that maternal weight gain is one of the most important indicators of infant birthweight, especially among adolescents. It has been proposed that encouraging adolescents to gain more weight than the standard recommendation of 9 to 14 kilograms during pregnancy may be one way of decreasing their risk of delivering low-birthweight infants. This proposal is based on an assumption that, compared with adult mothers, adolescent mothers may need to gain more weight during pregnancy because they might still be growing and have nutritional requirements that compete with and pre-empt those of the foetus. This concept is, however, controversial: it is not known whether adolescents continue to grow during pregnancy.

Deficient intakes of iron, calcium, zinc, vitamins A and C and folate are commonly reported to be of concern in the diets of pregnant adolescents. This would appear to reflect inadequate intakes of fruit, vegetables, cereals and dairy products. Deficiencies of iron and folate increase the risk of anaemia during pregnancy and are associated with a higher risk of low birthweight. Additionally, the reported low intakes of folate are of concern given the relationship between low intakes of dietary folate and the higher risk of neural tube defects such as spina bifida. Because these deficiencies have been reported to occur with increased frequency in adolescent pregnancies, it has been suggested that a safer and more appropriate way of reducing the incidence of low-birthweight deliveries among adolescents would be to deal with these specific nutritional deficiencies rather than aim to increase total maternal weight gain.

There is limited evidence to suggest that adolescents improve the quality of their diets during pregnancy. Skinner and Carruth compared dietary data from different groups of pregnant and non-pregnant adolescents and found that the former group consumed more milk and dairy products, citrus fruits and juices; it was suggested that these foods substituted for carbonated beverages and tea and coffee. Pregnant adolescents also consumed more breads, cereals, vegetables and confectionery. The study did not, however, measure the actual changes that adolescents make to their diets once they become pregnant.
**Nutrition supplements**

Vitamin and mineral supplements are not necessary for healthy, full-term infants or children. The only exception to this may be fluoride for children living in areas without fluoridated water.

If infant formula is used, it is assumed that the formula will be prepared using fluoridated water. Where fluoridated water is not available the fluoride content of the formula is consequently lower. In the absence of fluoridated water or if bottled water is used to prepare feeds, further supplementation will be required.

**Special diets**

**Vegetarianism**

A vegetarian diet that is adequate for adults is not necessarily suitable for infants and young children, who face constraints such as limited stomach capacity and higher needs for nutrients per unit weight. Each diet must be assessed separately for its suitability for children; if the regimen is very restrictive in terms of the type and amount of animal proteins consumed, it is essential to plan a diet carefully so as to avoid deficiencies. In general, lacto-vegetarian and lacto-ovo-vegetarian diets provide adequate nutrition if they are properly planned. Vegan diets pose a risk if care is not taken to ensure that the diet provides adequate energy, vitamin B₁₂, protein and iron. Plant foods can provide some iron and zinc, albeit with lower bioavailability, but vitamin B₁₂ is found only in animal products. Chapter 1 discusses the vitamin B₁₂ status of vegan mothers and its effect on the B₁₂ status of breastfed infants.

**Food allergy and intolerance**

The subject of food and drink allergies in children has received widespread attention in recent years. This has resulted in a number of misconceptions about the manifestations and incidence of such disorders and the use of elimination diets. The National Health and Medical Research Council recommends as follows:

- The diagnosis of a food or drink allergy can only be based on a reproducible response to a controlled challenge with the suspected allergen, following an adequate period of exclusion (at least 1 week).
- The relationship between behaviour and food allergies is unclear. The reliance on dietary manipulation as an initial step in the management of behavioural problems may delay the use of more appropriate strategies and exacerbate the problem.
- There are no laboratory tests on which to base a diagnosis of food allergy. It is inappropriate to undertake the management of children on the basis of laboratory test results alone without consideration of a properly supervised clinical challenge with suspected foods.
- Foods should only be eliminated from the diet after these diagnostic procedures have been carried out.
3. Enjoy a wide variety of nutritious foods

- If it is necessary to adopt an elimination diet or to exclude nutritionally significant foods from the diet, then nutritional advice should be sought to ensure that elimination is complete and that the diet is nutritionally adequate.

Healthy eating for children and adolescents

The Australian Guide to Healthy Eating provides guidance on the types of foods that can be included in a typical Australian diet to meet the dietary guidelines and the recommended dietary intakes. Table 3.4 shows sample servings for children and adolescents, as suggested in the guide.
3. Enjoy a wide variety of nutritious foods

### Table 3.4 The Australian Guide to Healthy Eating: suggested sample servings for children and adolescents

<table>
<thead>
<tr>
<th>Age group</th>
<th>Cereals (including breads, rice pasta and noodles)</th>
<th>Vegetables (including legumes)</th>
<th>Milk, yoghurt, cheese</th>
<th>Lean meat, fish, poultry, nuts and legumes</th>
<th>Extra foods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children 4–7 years</td>
<td>5–7</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>1–2</td>
</tr>
<tr>
<td></td>
<td>3–4</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>1–2</td>
</tr>
<tr>
<td>Children 8–11 years</td>
<td>6–9</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>4–6</td>
<td>4–5</td>
<td>1–2</td>
<td>3</td>
<td>1–1 ’</td>
</tr>
<tr>
<td>Adolescents</td>
<td>5–11</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>12–18 years</td>
<td>5–11</td>
<td>3–4</td>
<td>3–4</td>
<td>3–5</td>
<td>1–3</td>
</tr>
</tbody>
</table>

Notes: The sample serves allow for two different eating patterns in each age group: the top row includes a relatively large amount of cereals the bottom row includes less cereals and more of the other food groups.

Examples of serving sizes are 2 slices (60g) bread, 1 medium bread roll, 1 cup cooked rice, pasta or noodles; 1 cup (75g) cooked vegetables or legumes, 1 cup salad vegetables, 1 small potato; 1 medium-sized piece (150g) of fruit, 1 cup diced pieces or canned fruit, 1 cup fruit juice; 1 cup (250ml) fresh milk, 2 slices (40g) cheese, 1 small carton (200g) yoghurt; and 65–100g cooked meat or chicken, 80–120g cooked fish fillet, 2 small eggs, 1 cup cooked legumes, 1/3 cup nuts, 1 cup sesame seeds.

**Relationship to other guidelines**

**Encourage and support breastfeeding**

Chapter 1 discusses the use of infant formulas if for some reason breastmilk is not available.

**Children and adolescents need sufficient nutritious food to grow and develop normally**

Chapter 2 discusses concerns relating to dieting and body image among adolescents.

**Include lean meat, fish, poultry and/or alternatives**

Section 3.3 discusses iron deficiency in childhood and adolescence.

**Include milks, yoghurts, cheese and/or alternatives**
Limit saturated fat and moderate total fat intake

Inappropriate restriction of fat in infancy and early childhood is discussed in Section 3.6.

The Dietary Guidelines for Australian Adults

The guideline discussed here should be read in conjunction with Chapter 1 in the Dietary Guidelines for Australian Adults. A varied diet, in keeping with the Australian Guide to Healthy Eating is the cornerstone of good nutrition. In early childhood it is important to establish patterns of eating that promote good nutrition. These should then continue through to adulthood.

Conclusion

Apart from infancy where exclusive breastfeeding is recommended until about 6 months of age, variety in the diet is important for children and adolescents. In Australia, a range of cuisines is available that add variety to the ‘traditional’ Australian diet and have been associated with health gains. Recommending that children and adolescents ‘enjoy a wide variety of nutritious foods’ will not only help ensure appropriate intakes of major dietary components such as protein, carbohydrates and fats but also help ensure adequate and appropriate intakes of vitamins and minerals, individual fatty acids and amino acids. Enjoying a variety of nutritious foods remains an important message for all age groups. Experimenting with other cuisines, and incorporating new and traditional foods will encourage variety in the diet, help meet nutrient requirements, and provide some protection against non-communicable chronic diseases later in life. Serving sizes of more energy dense foods may need to be reduced to accommodate variety (see the Dietary Guidelines for Australian Adults for a more detailed review of the links to chronic disease patterns).

Evidence

For ethical reasons, randomised control trials cannot be undertaken in relation to breastfeeding. For evidence levels related to the suitability of breastmilk as the normal food for infants see Section 1. There is Level II evidence for the optimal age of introduction of complementary foods (references 5 and 6), and Level III (references 28 to 30) and Level IV (reference 26) evidence linking some infant feeding practices with subsequent disease.

References


3. Enjoy a wide variety of nutritious foods


3. Enjoy a wide variety of nutritious foods


3.1 EAT PLENTY OF VEGETABLES, LEGUMES AND FRUITS

Ivor Dreosti

Terminology

Vegetables

Vegetables includes all leafy green vegetables (for example, spinach, lettuce, silver beet and bok choi), members of the crucifer family (for example, broccoli, cabbages and brussels sprouts), all root and tuber vegetables (for example, carrots, yams and potatoes), edible plant stems (for example, celery and asparagus), gourd vegetables (for example, pumpkin and cucumber), allium vegetables (for example onion, garlic and shallot) and corn, although this last food is usually regarded as a cereal. Some vegetables are eaten raw; others are best cooked because this makes them more palatable and digestible.

Fruits

The term fruit generally applies to the sweet, fleshy edible portion of a plant that arises from the base of the flower and surrounds the seeds; apples, oranges, plums, berries, tomatoes and avocados are examples. Most fruit is eaten raw, although in some cases cooking can offer a tasty alternative.

Legumes

Legumes refers also to pulses and includes all forms of prepared beans and peas—dried, canned and cooked legumes, bean curd, tofu, and legume-flour products such as pappadams. Among the well-known edible legumes are butter beans, haricot (navy) beans, red kidney beans, soybeans, mung beans, lentils, chick peas, snow peas and various other fresh green peas and beans. Legumes are generally cooked; this improves their nutritional value and reduces the risk of toxicity that occurs with some legumes because of the presence of heat-labile toxins. Occasionally, however, they can be eaten raw; snow peas are an example. Strictly speaking, legumes are specialised forms of fruit since the pod surrounds the seeds and arises from the base of the flower, as occurs with fruit. But, because the main food material in legumes is the seeds, they are generally placed in a separate category.
3.1 Eat plenty of vegetables, legumes and fruit

**BACKGROUND**

Each year in Australia about 40 per cent of all deaths can be attributed to diseases of the circulatory system and 27 per cent to cancer, accounting for annual health care costs of around $4 billion and $2 billion respectively.¹

Scientific surveys of populations around the world have consistently provided good epidemiological evidence that people who regularly eat diets high in fruits and vegetables (including legumes) have substantially lower risks of coronary heart disease²–⁴, stroke²,⁵, several major cancers⁶,⁷ and possibly hypertension⁸,⁹, type 2 diabetes mellitus¹⁰,¹¹, cataract¹²,¹³, and macular degeneration of the eye.¹⁴,¹⁵ A large number of experimental studies with model systems have afforded further evidence of a protective effect of fruits and vegetables against these non-communicable chronic diseases and offer some clues about the actual substances in these foods that may be protective as well as the mechanisms by which they may act. Accordingly, a new term, *phytochemicals*, has been added to the vocabulary of nutritionists; it refers to the many different substances occurring in plant foods in small amounts (in addition to the well-established nutrients) and which appear to contribute significantly to reducing the risk of non-communicable chronic diseases.

The *Australian Guide to Healthy Eating*¹⁶ recognises the importance of fruits and vegetables in a healthy diet for all sections of the population and recommends consumption of between one and two servings of fruit and two to four of vegetables each day for children aged 4–7 years; one to two servings of fruit and three to five of vegetables each day for children aged 8–11 years; and three to four servings of fruit and four to nine of vegetables each day for adolescents (12–18 years).

For older children and adolescents, this is generally in keeping with the minimum five servings of vegetables and two of fruit established by the core food group analysis endorsed by the National Health and Medical Research Council.¹⁷ It should be noted, however, that average current fruit and vegetable consumption in Australia falls significantly short of this recommendation, as shown in Table 3.1.1.
Table 3.1.1 Mean intakes of fruits and vegetables in Australian children and adolescents in relation to the NHMRC core food group recommendations

<table>
<thead>
<tr>
<th>Age group</th>
<th>Fruit</th>
<th>Mean intake</th>
<th>Vegetables</th>
<th>Mean intake</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Including juice</td>
<td>Excluding juice</td>
<td>Including potato/legumes</td>
<td>Excluding potato/legumes</td>
</tr>
<tr>
<td></td>
<td>M F</td>
<td>M F</td>
<td>(g/day)</td>
<td>M F</td>
</tr>
<tr>
<td>4–7</td>
<td>165 154</td>
<td>98 92</td>
<td>150</td>
<td>76 80</td>
</tr>
<tr>
<td>8–11</td>
<td>62 57</td>
<td>37 33</td>
<td>300–450</td>
<td>71 73</td>
</tr>
<tr>
<td>12–15</td>
<td>57 63</td>
<td>34 36</td>
<td>300–450</td>
<td>74 64</td>
</tr>
<tr>
<td>16–18</td>
<td>49 65</td>
<td>26 29</td>
<td>300–450</td>
<td>98 66</td>
</tr>
</tbody>
</table>

Note: Mean intake data are from the 1995 National Nutrition Survey. One serve of fruit equals 150g; one serve of vegetables equals 75g; where recommendations are a range, the mid-point has been used for calculations.

Scientific basis

Original and recent studies

Cardiovascular disease

In 1997, 28 studies in humans of fruit and vegetable consumption and the risk of cardiovascular disease were reviewed, and good evidence was found of a protective effect associated with higher intakes of plant foods. Some years earlier, in 1993, the US Food and Drug Administration allowed a health claim to the effect that diets low in saturated fat and cholesterol and rich in fruits, vegetables and grain products containing fibre, particularly soluble fibre, may reduce the risk of coronary heart disease, although a similar claim was not allowed by the Canadian food authority. A subsequent large study in females also reported a significant inverse association between fruit and vegetable intake and cardiovascular disease.

Recent experimental studies suggest that protection against heart disease may arise in several ways, including through the presence of antioxidant phytochemicals (for example, bioflavonoids and carotenoids) and antioxidant vitamins (for example, vitamins E and C) at significant levels in fruits and vegetables, which may reduce the risk of cholesterol becoming oxidised in coronary blood vessels and deposited to form atheromatous plaques. Importantly, a review of the effect of beta-carotene on coronary heart disease in several observational and intervention studies suggests protection only in the observational studies, highlighting the possibility that the benefit reported in some studies may be related to foods rich in beta-carotene and other...
3.1 Eat plenty of vegetables, legumes and fruit

Antioxidants and micro-nutrients—or indeed other confounding factors—rather than to the beta-carotene alone. Also important is the apparent capacity of vegetable protein to reduce blood cholesterol levels in people habitually consuming an omnivorous diet.

Particular emphasis is being focused at present on the importance of the vitamin folate in reducing blood levels of the compound homocysteine, which is a possible risk factor for coronary heart disease. Especially noteworthy is the fact that a major source of dietary folate is green, leafy vegetables, and studies suggest that many adults have folate intakes well below the level needed to minimise the risk associated with raised levels of homocysteine.

Stroke

A systematic review of 14 studies including ecological, case-control and cohort studies dealing with stroke and fruit and vegetables found strong evidence of a protective effect associated with higher intakes of plant foods. The mechanism for this apparent protection is not clear, but it appears to exist for strokes of both haemorrhagic and ischaemic origin. In one large study extending over eight years, protection was associated with vegetable intake rather than fruit, although generally both types of plant food are considered to be likely protective agents.

Hypertension

Because plant foods contribute significantly to the intake of potassium and magnesium—both of which have been proposed to be associated with a lower blood pressure—diets high in fruits and vegetables will increase the daily intake of both minerals and may help prevent or control hypertension. In a study with women in the United States, lowered blood pressure was found to be associated with higher intakes of fruits and vegetables, fibre and magnesium; more recently, data from the Dietary Approaches to Stop Hypertension (DASH) randomised clinical trial have indicated that diets rich in fruits and vegetables, with or without low-fat dairy products, significantly reduced ambulatory blood pressure after an eight-week intervention period, especially in African-Americans and people with hypertension. Similar results were found with US adolescents who had elevated blood pressures: blood pressure was lower in those subjects with higher intakes of a combination of nutrients including potassium, calcium, magnesium and vitamins, as provided by diets rich in fruits and vegetables and low-fat dairy products.

Cancer

Health researchers have estimated that at least 30 per cent of many major cancers have a strong dietary link and that the link may be even stronger for some cancers. Among the dietary factors underlying this association are substances that may aggravate the development of cancer and, very importantly, substances that reduce cancer risk. Dietary components in the latter group include fibre, fruits and especially vegetables. In fact, the association between fruits and vegetables is sufficiently widely recognised that the US Food and Drug
Administration has allowed a health claim to the effect that diets low in fat and rich in fruit and vegetables may reduce the risk of some cancers.19

Not surprisingly, the protective effect of fruit and vegetables has been noted especially in relation to the oral cavity, oesophagus, stomach and large bowel, where local contact may be a factor, although significant risk reduction has also been observed for cancers of the lung and possibly the breast, endometrium and pancreas.6,7 Many factors in fruit and vegetables have been proposed to account for the foods’ protective effect and many potential mechanisms suggested. Much emphasis is currently placed on the many novel phytochemicals found in plant foods (for example, carotenoids, bioflavonoids, isothiocyanates and indole carbinols) and on several established vitamins and minerals (for example, vitamins C and E, folate, selenium and calcium). Proposed mechanisms range from reduced formation of cancer-promoting substances in the gastrointestinal tract (through antioxidant activity) to the part played by phytochemicals and micro-nutrients in detoxification of carcinogenic substances, and to functions relating to the containment and destruction of existing cancer cells by means of a variety of physiological processes and improved immunological activity against cancer cells.6,7,31

In the 1997 World Cancer Research Fund and American Institute for Cancer Research (WCRF–AICR) global review of nutrition and cancer prevention, prevention by fruit and vegetables was rated to be ‘convincing’ for cancers of the mouth, pharynx, oesophagus, stomach, colon, rectum and lung; ‘probable’ for the larynx, pancreas, breast and bladder; and ‘possible’ for the ovaries, cervix, endometrium, thyroid, liver, prostate and kidney. Since that report, data generally confirming these findings have become available from a number of further case-control and cohort studies. In particular, lower risks of cancer have again been found for the oral cavity32,33, stomach34 and colon and rectum35 in relation to higher vegetable and fruit intake, although a recent study found no evidence that one extra serving of fruit and vegetables provides any measurable additional protection.36

Two recent studies on lung cancer also consistently indicate that a high intake of fruit and vegetables is protective, particularly with respect to brassicae vegetables, tomatoes, lettuce and cabbage.37,38 Further suggestive evidence of protection by fruits and vegetables has been noted for cancer of the bladder39,40, breast41,42 and, to a lesser extent, prostate, notably in relation to the carotenoid lycopene.43,44

It should be noted, however, that although considerable emphasis has been placed on the WCRF–AICR review, attention should be paid to the study by the UK Department of Health Committee on the Medical Aspects of the Food Supply (COMA), which also reviewed the evidence concerning the potential protection against cancer afforded by fruit and vegetables.45 The COMA study ranked the evidence into four categories, the top two being ‘strong’ and ‘moderate’. No ‘strong’ association was found between fruit and vegetable consumption and cancer at any site, while a ‘moderate’ association was noted for cancers of the stomach, colon and rectum. In contrast, the WCRF–AICR rated as ‘convincing’ the
3.1 Eat plenty of vegetables, legumes and fruit

evidence for an association for the mouth/pharynx, stomach, colon, rectum and lung.7 Convincing was defined to mean that the evidence of causal relationships was conclusive and sufficient for making dietary recommendations. Clearly, COMA’s interpretation of the data is more cautious than the WCRF–AICR interpretation, but both bodies recognise the importance of these foods in reducing cancer risk. The WCRF–AICR is currently updating its analysis to incorporate studies published since 1997.

Type 2 diabetes mellitus

At the population level, an association has been noted between increased consumption of plant foods and lower incidence of obesity (which is a risk factor for diabetes) and type 2 diabetes itself, although it is not clear at this stage whether this apparent protection arises principally from a lower body weight. In the dietary control of type 2 diabetes, vegetables are likely to be of particular value because of their content of fibre and low-energy density carbohydrates and their possible hypoglycaemic activity.6,10 Recently, a cross-sectional study in the United Kingdom revealed an inverse association between the risk of type 2 diabetes and frequent consumption of vegetables throughout the year, although the effect did not appear to be significant during the summer months.46

Cataract and macular degeneration of the eye

Several studies in humans have reported that the risk of developing ocular cataracts is significantly higher in people with low dietary intakes of fruit and vegetables, vitamins C and E, and beta-carotene.12,47 A similar increased risk was observed in people with low levels of vitamins C and E in their blood. Experimental studies with model systems have added further support to the notion that above-average intakes of antioxidant nutrients may delay the onset of senile cataract.12 More recently, a modest protective effect against the development of cataracts has been observed for higher intakes of the carotenoids lutein and zeaxanthin.48

Age-related degeneration of the macula—the colour-sensitive yellow spot on the retina of the eye—is another serious cause of acute blindness in the elderly and is not reversible. Findings from a number of human studies suggest that people with low levels of carotenoids and the antioxidant vitamins C and E in their blood, and who smoke, are at increased risk of developing macular degeneration. Experimental studies indicate that two carotenoids in particular—lutein and zeaxanthin—appear to be accumulated by the macula, and in a human study when the dietary intake of carotenoids was analysed the sum of the intake of lutein and zeaxanthin had the strongest protective effect against macular degeneration. Taken together, these findings suggest that in many cases macular degeneration may be prevented by eliminating smoking and ensuring an adequate intake of fruit and vegetables.14 Of particular interest are several recent reports that highlight the presence of lutein and zeaxanthin in precise but different orientations in the membranes of the macula, which suggests that these two carotenoids may serve a special role in reducing the risk of age-related macular degeneration.49,50
3.1 Eat plenty of vegetables, legumes and fruit

Practical aspects of this guideline

For toddlers, the generally lower energy density of fruits and vegetables in comparison with cereal and animal products should be borne in mind: very young children have a higher energy requirement than older children and their stomach capacity is smaller. Nevertheless, development of healthy eating habits needs to be encouraged progressively in this age group.

For children and adolescents, fruits and vegetables each contribute about 7 per cent to total energy and 14–22 per cent and 25 per cent respectively of dietary fibre. Generally, fruit consumption increases with age—especially for boys—but there is a tendency in this group to consume a high proportion of fruit juices, which are of lower nutritional value than the whole fruit. Young people should be encouraged to eat salads, stir-fried vegetables and fruits because it is likely that the protection afforded by these foods against the degenerative diseases of adulthood begins at an early age.

A wide variety of fruits is recommended, including apples and pears, citrus fruits, melons, tomatoes, berries, grapes, bananas, and stone fruits such as apricots and peaches. The Australian Guide to Healthy Eating's recommendations for fruit include raw, stewed or canned varieties, with rather less emphasis on fruit juices and dried fruit since they tend to be lower in fibre and more energy dense respectively, although a modest intake of both (say, one serving a day) is acceptable.

A variety of vegetables is also recommended, including dark green vegetables such as spinach and broccoli; orange or yellow vegetables such as pumpkin and carrots; crucifers such as broccoli, cauliflower and cabbage; starchy vegetables such as potatoes, yams and the cereal food corn; and salad vegetables and fruits such as lettuce, tomato, cucumber and capsicum.

Vegetable consumption increases with age in children, but the dominance of potatoes as a source of vegetables in Australia—among both children and adults—is of some concern: they are not as rich in phytochemicals as many other vegetables and some of the more popular forms (such as French fries and chips) can also be relatively high in fat.

Where do nuts and seeds fit in?

Many nuts and seeds are similar to fruits except that the seed is the main edible component and the whole structure becomes dry on maturing. Most nuts and seeds provide a wide range of nutrients and are generally pleasantly flavoured, so they can usefully be included with fruits and vegetables in plant-based dishes or other dishes such as stir-fries and in desserts. These foods are of particular value in providing significant levels of protein and essential fatty acids, both the n-6 fatty acids and, in some cases (such as walnuts, canola and flaxseed), the n-3 fatty acids.
Whole nuts are not recommended for young children because of the possibility of choking; they can, however, be fed as a paste.

**Preparation of fruit and vegetables**

Certain nutrients and phytochemicals in plant foods are damaged by cooking; others are not. In fact, in some cases the availability of a nutrient may be increased by the cooking process; for example, carotenoids are absorbed better from cooked tomatoes than raw ones. As a general rule, fruit and vegetables may be eaten in the manner most palatable to the consumer, although a good proportion should always be eaten raw.

When vegetables are cooked they should not be overcooked since this will cause loss of nutrients. Stir-frying is an effective method of cooking vegetables: it tends to minimise nutrient loss and provides a tasty product with good texture. Light microwaving and steaming are also better than deep-frying or prolonged boiling. Generally, when cooking vegetables it is useful to use a small amount of oil because this enhances absorption of the fat-soluble vitamins (for example, vitamins A and E) as well as other fat-soluble dietary components such as the carotenoids.

It should be noted that eating the variety of fruits and vegetables recommended in the *Australian Guide to Healthy Eating* will ensure an adequate intake of some of the less widely distributed dietary components—for example, green leafy vegetables for folate; yellow and orange fruits and vegetables for carotenoids; cruciferous vegetables for dithiolthiones and isothiocyanates, which improve the body’s detoxification capacity; the allium vegetable family for allyl sulfides, which also improve detoxification processes; fruit for bioflavonoids, which appear to serve many beneficial functions in the body, including acting as antioxidants; and citrus fruit and capsicum for vitamin C. Where necessary, frozen and canned fruits and vegetables are acceptable since good levels of nutrients are retained by both processes, especially freezing.

**Vegetarians**

The objective of the fruit and vegetable guideline is not to encourage people to eat only vegetarian meals; rather, it is to highlight the important health benefits to be derived from regular consumption of plant-based meals together with individual fresh and cooked fruits and vegetables. For vegetarians, however, particular emphasis should be given to regularly including legumes and nuts, in order to increase the iron and protein intake from plant sources. It is also important that fruit juices or fruits be consumed in the same meal as cereals, legumes or other sources of iron, in order to provide vitamin C, which will increase iron absorption.
**Relationship to other guidelines**

**Enjoy a wide variety of nutritious foods**

In order to obtain optimal health benefits from fruit and vegetables, a wide variety of nutritious foods should be consumed.

**Eat plenty of cereals (including breads, rice, pasta and noodles), preferably wholegrain**

Apart from providing a good source of energy, cereal-based foods contribute a number of protective factors to the diet, complementing and extending many of the benefits derived from fruit and vegetables.

**Limit saturated fat and moderate total fat intake**

Fruit and vegetables are low in saturated fat.

**Choose foods low in salt**

Fruits and vegetables are low in salt (sodium) but are good suppliers of potassium.

**Conclusion**

Strong evidence now exists that many compounds in fruit and vegetables (phytochemicals) help to protect against a number of non-infectious degenerative diseases, among them cancer, cardiovascular disease, type 2 diabetes, and cataract and macular degeneration of the eye.

Children are encouraged to consume on average at least two helpings of fruit and five of vegetables each day; both the fruits and the vegetables should be selected from a wide variety of types and colours and be served cooked or raw, as appropriate.

**Evidence**

There is Level II evidence (reference 9) and Level III evidence (references 3, 4, 8 and 27) in relation to the benefits of fruit and vegetable consumption and coronary heart disease, hypertension and stroke. There is Level III evidence (references 29 to 41) in relation to fruit and vegetable consumption and cancer of various kinds.
Although current evidence concerning the benefit of vegetables and fruit in protecting against several degenerative diseases is strongly persuasive, it is largely based on retrospective observational studies. Further prospective intervention studies are needed, although it is recognised that these are difficult, and costly, to carry out. Nevertheless, a considerable number are already under way and they will provide invaluable information in the coming decade. In addition, more needs to be established concerning the roles of the various phytochemicals in disease prevention, as well as their interaction with the range of genotypes found in the human population.

REFERENCES


3.1 Eat plenty of vegetables, legumes and fruit


3.2 **EAT PLENTY OF CEREALS** (INCLUDING BREADS, RICE, PASTA AND NOODLES), PREFERABLY WHOLEGRAIN

*Peter Williams*

**Terminology**

**Cereals**

*Cereals* refers to the entire class of cereal foods, including whole or partially processed cereal grains (for example, rice, oats, corn and barley), breads, breakfast cereals, pasta, noodles, and other plain cereal products such as flour, polenta, semolina, burgul, bran and wheatgerm. It excludes cereal-based products with a significant amount of added fat and sugar—cakes, pastries, biscuits, and so on.

**Breads**

*Breads* refers to leavened and unleavened wholemeal, white, mixed-grain, rye and fruit breads, as well as rolls, bagels, English muffins, crispbreads, crumpets and low-fat crackers.

**Pasta and noodles**

*Pasta and noodles* includes a wide range of Italian and Asian products based on sheets of dough made from flours—usually wheat or rice flour—and water, sometimes with egg added. Examples are plain spaghetti, lasagne, fettuccine, udon and Hokkien noodles, rice paper and wonton wrappers. The term excludes some instant noodles and flavoured pasta mixes with significant amounts of added fat and salt.

**Wholegrain**

*Wholegrain* refers to cereal foods that incorporate all the components of the natural grain, including the bran and germ. Foods that contain at least 51 per cent by weight of any combination of whole grains can be termed *wholegrain.* This definition includes such foods as wholemeal breads and crispbreads, many high-fibre breakfast cereals, oatmeal, wholemeal pasta, brown rice and popcorn.
3.2 Eat plenty of cereals (including breads, rice, pasta and noodles), preferably wholegrain

Background

From an evolutionary perspective, consumption of cereal grain is relatively recent, dating from only 5000 to 10,000 years ago, yet today eight cereals—wheat, maize, rice, barley, sorghum, oats, rye and millet—provide more than 56 per cent of the energy and 50 per cent of the protein consumed on earth. Many traditional hunter-gatherer societies had diets with a relatively low proportion of energy from carbohydrate (22–40 per cent) and only small amounts of grain, although Indigenous Australians may have consumed large quantities of grain in some areas. However, it is difficult to base conclusions about desirable dietary patterns for modern societies simply from an assessment of traditional eating patterns of hunter-gatherers. Many things such as activity patterns, availability of various foods and genetic background can influence food consumption patterns or dietary needs. Recommendations made in a recent UN report recommends that carbohydrate should provide more than 55 per cent of energy for optimal health.

Cereal grains form the basis of diets in many different cultures and cuisines. They are generally an excellent source of carbohydrate and dietary fibre and are also an important source of protein (ranging from 8 to 16 grams per 100 grams). They are mostly low in fat and are good sources of B-group vitamins, vitamin E and many minerals, notably iron, zinc, magnesium and phosphorus. Eating enough cereal foods helps ensure an adequate nutritional intake. They can also be stored safely for long periods and are relatively inexpensive: in 1998–99 purchases of cereal products accounted for only 7 per cent of household food expenditure. Ecologically, a high-carbohydrate diet based on cereals makes good use of the world’s resources, since grain crops require relatively few input resources per unit of food energy produced. For these reasons all current dietary guides have cereal foods as the largest component of the recommended daily food intake.

Apparent consumption of cereal foods in Australia (an estimate of intake based on national food-disappearance data), has remained relatively constant since the 1930s. In 1998–99 apparent consumption was 138.1 kilograms per person. There have, however, been changes in the mix of products since the 1930s. Consumption of rice and breakfast cereals has increased significantly and consumption of flour has fallen. The 1995 National Nutrition Survey, which used 24-hour diet recall, found that over 95 per cent of children and adolescents had eaten cereal foods on the day of the survey, the most commonly consumed cereal foods being bread and breakfast cereals. Table 3.2.1 shows the mean daily intakes for children and adolescents.

<table>
<thead>
<tr>
<th>Gender</th>
<th>2–3</th>
<th>4–7</th>
<th>8–11</th>
<th>12–15</th>
<th>16–18</th>
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</thead>
<tbody>
<tr>
<td>Male</td>
<td>136</td>
<td>168</td>
<td>208</td>
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<tr>
<td>Female</td>
<td>132</td>
<td>140</td>
<td>176</td>
<td>176</td>
<td>195</td>
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</tbody>
</table>

Table 3.2.1 Mean intake of cereal foods (grams/day): children and adolescents, by age and gender, 1995

Dietary Guidelines for Children and Adolescents in Australia
3.2 Eat plenty of cereals (including breads, rice, pasta and noodles), preferably wholegrain

The National Nutrition Survey also found that for children and adolescents cereal foods are important sources of energy, carbohydrate, dietary fibre, thiamin, iron and magnesium, providing about 20 per cent or more of the total daily intake of these nutrients (see Table 3.2.2). They also provided more than 10 per cent of the daily intakes of protein, polyunsaturated fat, riboflavin, niacin, folate, calcium, phosphorus and zinc.

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>2–11</th>
<th>12–18</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Energy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>20.1</td>
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</tr>
<tr>
<td>Female</td>
<td>19.4</td>
<td>19.2</td>
</tr>
<tr>
<td><strong>Carbohydrate</strong></td>
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<td></td>
</tr>
<tr>
<td>Male</td>
<td>28.9</td>
<td>29.7</td>
</tr>
<tr>
<td>Female</td>
<td>28.1</td>
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<tr>
<td><strong>Dietary fibre</strong></td>
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<tr>
<td>Male</td>
<td>34.2</td>
<td>34.1</td>
</tr>
<tr>
<td>Female</td>
<td>32.1</td>
<td>31.0</td>
</tr>
<tr>
<td><strong>Thiamin</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>44.3</td>
<td>44.3</td>
</tr>
<tr>
<td>Female</td>
<td>42.4</td>
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<tr>
<td><strong>Riboflavin</strong></td>
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<td>25.1</td>
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<td>Female</td>
<td>20.8</td>
<td>17.3</td>
</tr>
<tr>
<td><strong>Niacin</strong></td>
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<td></td>
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<td>18.3</td>
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<tr>
<td><strong>Folate</strong></td>
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<tr>
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</tr>
<tr>
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<td>19.1</td>
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<tr>
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<td>24.6</td>
</tr>
<tr>
<td>Female</td>
<td>23.5</td>
<td>23.2</td>
</tr>
</tbody>
</table>

Note: Biscuits, cakes and other cereal-based items are excluded.

**Scientific basis**

Although it is uncommon for many of the chronic diseases discussed in this section to express themselves in childhood or adolescence, for many of them the precursors and risk factors—for example, elevated cholesterol or blood
pressure—can be identified at an early age. In addition, establishment of good eating practices at an early age is recommended to avoid development or expression of these conditions in later life.

There have been many experimental studies with individual nutritional components provided by cereal foods—such as dietary fibre, starch and vitamin E—but relatively few prospective studies or controlled experimental trials have used whole foods to find support for this dietary guideline. It is difficult to gain people’s acceptance of long-term changes to the largest staple component of their diets—and generally impossible to do so in a double-blind manner. As a result, most of the available evidence comes from ecological, cross-sectional, case-control and cohort studies. Even in these the dietary methodology is often inadequate for analysing the consumption of different types of cereals or quantifying dose-responses.

All recent reviews have supported the beneficial effects of cereal fibre and whole grains in relation to decreased risk of coronary heart disease and some cancers1,10–13, and data from several countries suggest that higher intakes of breads and cereals help people achieve dietary targets for lower fat consumption.14,15 Cereals are also a major source of resistant starch in the diet, which is important for colon health. In 1999 the US Food and Drug Administration approved the health claim that ‘diets rich in whole-grain foods and other plant foods and low in total fat, saturated fat and cholesterol may reduce the risk of heart disease and certain cancers’.13

**Coronary heart disease**

The published results of over 200 human trials have led to the general conclusion that foods rich in soluble fibre can lower plasma cholesterol.17–19 The National Heart Foundation of Australia has stated, ‘The consumption of dietary fibre, especially cereal fibre, is associated with a lower risk of CHD’.20 Meta-analyses of intervention trials with two cereal foods, oats and psyllium, have shown that these are particularly effective in reducing serum cholesterol.21,22 By contrast, controlled human trials with supplements of isolated wheat fibre have consistently shown no effect on plasma cholesterol.17

A large prospective study of male health professionals in the United States found that dietary fibre intake was strongly associated with reduced rates of myocardial infarction and that cereal fibre was apparently more protective than fibre from fruits or vegetables.23 The study reported a 29 per cent reduction in coronary heart disease for every 10-gram increase in daily intake of cereal fibre. Other studies have also found a stronger association between cereal fibre and reduced risk of coronary heart disease than with fibre from fruit or vegetables.24–26 Analysis of a prospective study of 31 284 post-menopausal women in Iowa found the relative risk of CHD was 0.76 (95%CI: 0.55–1.05) among women in the highest quintile of dietary fibre intakes compared with the lowest.10

The principal mechanism is probably viscous polysaccharides acting in the gastrointestinal tract to decrease reabsorption of biliary cholesterol27, but other
components may be involved in the protective effect of wholegrain cereals: vitamin E, folate, selenium, phytoestrogens and phytic acid may all be important.\textsuperscript{28} In the Nurses Health Study, wholegrain consumption was associated with significant reductions in risk of both CHD\textsuperscript{29} and ischaemic stroke.\textsuperscript{30}

Dietary carbohydrates may also exert an influence on cardiovascular disease risk via their effect on insulin response. High–glycaemic index (or high-GI) carbohydrates are characterised by rapid absorption and high post-prandial glucose and insulin responses and may result in decreased insulin sensitivity\textsuperscript{31}, a risk factor for CHD.\textsuperscript{32} At least three cross-sectional studies have also found an inverse relationship between HDL cholesterol and the dietary glycaemic load.\textsuperscript{33–35} (The glycaemic index is discussed in detail in Appendix I to the Dietary Guidelines for Older Australians.)

**Obesity**

Although total energy intake and overall nutrient density appear to be the most important factors affecting weight regulation, a high-fibre, low-fat diet is recommended for maintenance of body weight and prevention of obesity.\textsuperscript{36–38} Obesity is associated with low fibre intake.\textsuperscript{39} When high-starch, high-sucrose and high-fat ad libitum diets were compared, energy intake was lowest on the high-starch, high-fibre diet.\textsuperscript{40} In children, strict diets or rigid fat restriction are not desirable, but choosing lower fat foods and eating a wide variety of breads and cereals, fruits and vegetables is encouraged.\textsuperscript{41}

There are several ways high-fibre cereals can reduce energy intake and help maintain weight: they take longer to eat; they decrease the energy density of a meal; and some fibres may slow gastric emptying and affect gastrointestinal hormones that influence food intake.\textsuperscript{42} Compared with low-GI choices, consumption of high-GI carbohydrates promotes a more rapid return of hunger and increases subsequent energy intake, and slower digestion of carbohydrate is associated with higher satiety.\textsuperscript{43} Thus, consumption of wholegrain and lower GI cereals, instead of highly refined cereals, may help prevent excess weight gain.\textsuperscript{44,45}

**Diabetes**

The joint WHO–FAO consultation on carbohydrates concluded that foods rich in slowly digested, or resistant, starch or high in soluble fibre might be protective against diabetes.\textsuperscript{4} Recent large prospective studies of men and women have found cereal fibre intake was inversely associated with the risk of developing type 2 diabetes and that the protective effect was even greater when combined with a low total glycaemic load.\textsuperscript{26,46}

A large prospective study of adult women in the United States found that a lower risk of type 2 diabetes was associated with higher intakes of all cereal grains (RR 0.75; 95\%CI: 0.63–0.89) and wholegrains in particular (RR 0.73; 95\%CI: 0.63–0.85), whereas a higher intake of refined grain was related to increased risk (RR
The individual foods associated with the strongest protective effects were wholegrain breakfast cereal, brown rice and bran. However, in that study refined grain included a wide range of higher fat cereal-based foods such as cakes, desserts and pizzas, and wholegrain foods included some that are relatively refined (such as couscous).

**Cancer**

Two major reviews of the relationship between cereal consumption and cancer prevention have been published. It is difficult to evaluate many studies because of the paucity of biological markers; the inadequacy of many food-intake measurements, which often do not distinguish the degree of refinement of cereal foods; and the low overall intakes of cereal fibre in many of the studies from the United States. There is, however, emerging agreement on the probable protective role of cereals in relation to some important cancer types. In particular, it appears that wholegrain intake confers benefits. In a review of 40 case-control studies of 20 cancers, the pooled odds ratio for high versus low wholegrain intake was 0.66 (95%CI: 0.60–0.72). Among the protective components in wholegrains may be fermentable carbohydrates, oligosaccharides, flavonoids, phenolics, phytoestrogens, lignans, protease inhibitors, saponins and selenium.

**Colorectal cancer**

Prospective data from the large Health Professionals Follow-up Study suggest that dietary fibre intake is inversely associated with the risk of colorectal adenoma in men, the relative risk in the highest versus the lowest quintile being 0.36. All sources of dietary fibre were protective, but the effect was stronger for grain sources than for fruit or vegetables. The World Cancer Research Fund review concluded that diets high in both starch and dietary fibre could possibly decrease the risk of colorectal cancer, and a recent consensus statement from the European Cancer Prevention Organisation, based on a review of 58 epidemiological studies, concluded, ‘A diet rich in high-fibre cereal is associated with a reduced risk of colorectal cancer’. This conclusion is supported by a meta-analysis of case-control studies of wholegrain intake and colorectal cancer, which calculated a pooled odds ratio of 0.79 (95%CI: 0.69–0.89) when high and low intakes of wholegrains were compared.

Resistant starch may also favourably affect some of the faecal markers of colon cancer risk, in a way similar to dietary fibre. Cereal foods are estimated to provide 42 per cent of the resistant starch in the Australian diet. The most recent Cochrane Database systematic review of five intervention studies concluded that there is currently no evidence from RCTs to suggest that increased dietary fibre intake will reduce the incidence of adenomatous polyps within a two to four year period. However, most of the studies that were considered used isolated dietary supplements rather than whole foods and the consistent findings of a protective association from high fibre diets in the case-
control and cohort studies suggest that the mechanisms may not be fully understood at this stage.

Breast cancer

Fibre may reduce the intestinal reabsorption of oestrogen, and bioactive cereal components such as lignans may be protective through their action as weak phytoestrogens. A comparison of national consumption data from various countries suggests that energy from cereals is inversely related to breast cancer risk, and a meta-analysis of 12 case-control studies found a significant reduction in risk with increasing dietary fibre. The World Cancer Research Fund report concluded that dietary fibre possibly decreases the risk of breast cancer and the European Cancer Prevention Organisation consensus meeting agreed that there is evidence to suggest cereal fibre provides protection against breast cancer, although this is still uncertain.

Stomach cancer

In relation to stomach cancer, the World Cancer Research Fund report concluded from the evidence of six case-control studies that there was a possible protective association for consumption of wholegrain cereals and cereal products but that the evidence for cereals as a whole was inconsistent and inconclusive.

Other cancers

One large cross-national study has found that prostate cancer mortality is inversely associated with estimated consumption of cereals, and case-control studies suggest that wholegrain foods are protective. A few case-control studies report a protective effect of wholegrain consumption on oral and pharyngeal cancers, but data from human intervention studies are not available for any of these cancers.

Constipation and diverticular disease

Constipation is a common clinical complaint in childhood. There is a strong correlation between dietary fibre intake and mean daily stool weight, and cereal fibre has been found to improve bowel function by increasing faecal bulk and reducing transit time, resulting in softer, larger stools and more frequent bowel action. For children aged 2 years and over, a minimal dietary fibre intake of (age + 5) grams a day up to a maximum of (age + 10) grams a day has been recommended. The mean intakes recorded in the 1995 National Nutrition Survey were at the upper end of this range, but the lowest quartile of intakes was below the minimum recommendation, especially for adolescents. Diets rich in insoluble fibre—such as that present in wholegrain cereals and breads—are associated with a low prevalence of constipation and diverticular disease.
Hypertension

Hypertension remains an important risk factor for cardiovascular and cerebrovascular morbidity and mortality, and a reduction in sodium intake is one of the primary preventive measures. Cereals in their natural state are very low in salt and have a favourable potassium–sodium ratio, but processed cereal foods, especially bread, are major sources of salt in the Australian diet. Both dietary fibre and magnesium may be protective against hypertension, and cereal foods are important sources of both these nutrients; but fruit sources of fibre appear more protective than cereal sources.\textsuperscript{70,71}

Nutrient density

Two of the main cereal foods, breakfast cereals and breads, are often fortified with vitamins and minerals that can be marginal in the diet. Children who eat breakfast cereals generally have better overall nutrient intakes.\textsuperscript{72–76} Bread has long been a useful staple for fortification, and some breads are now sources of additional fibre, iron, folate and omega-3 fats. Because they are generally low in fat and energy but nutrient dense, cereal foods used as snacks are ideal for helping to meet the higher energy needs of growing children and adolescents.\textsuperscript{78}

Practical Aspects of this Guideline

Relationship to the Australian Guide to Healthy Eating

The Australian Guide to Healthy Eating recommends that breads, cereals, rice, pasta and noodles form the basis of a healthy diet, with the greatest proportion of food coming from this group.\textsuperscript{79} The recommended number of cereal servings for children aged 4–7 years is three to seven a day; for children aged 8–11 years it is four to nine; and for adolescents aged 12–18 years it is four to 11, depending on energy needs and the preferred pattern of eating. A serving equates to two slices of bread; one cup of cooked rice, pasta or noodles; one cup of porridge; one-and-a-third cups of breakfast cereal; or half a cup of muesli. Cereal-based foods such as cakes, biscuits and pastries—which can have high levels of added fats and sugars—are not included in this recommendation and should be regarded as occasional treats only.

There are some easy ways of achieving these recommended targets:

- consuming breads with each meal
- regularly using rice, couscous, pasta or noodles to accompany hot dishes
- eating breakfast cereals daily
- including wholegrain cereals as extenders to soups and casseroles
- using oats in crumble toppings on desserts
- choosing grain-based snacks such as low-fat cereal bars, muffins and popcorn.
3.2 Eat plenty of cereals (including breads, rice, pasta and noodles), preferably wholegrain

Sodium intake

Bread is the most commonly consumed cereal food in Australia; it has a typical sodium content of around 450 milligrams per 100 grams. The mean daily consumption of regular and fancy breads by children and adolescents reported in the 1995 National Nutrition Survey ranged from 60 to 110 grams a day (see Table 3.2.3), which would contribute from 271 to 496 milligrams of sodium—around 20 per cent of the recommended maximum sodium intake\(^8\), this compared with these foods' contribution of only 10 per cent to the daily energy intake.\(^9\) Greater consumption of cereal foods with high salt levels could make it more difficult for people to limit their sodium intake, but this is not a reason to recommend against plentiful consumption of cereals. Children and adolescents seeking to increase their cereal intake should opt for cereals that are lower in salt—such as rice, oats, couscous, pasta, and many lower salt varieties of breakfast cereals and breads.

| Table 3.2.3 Contribution of breads to sodium intake of children and adolescents, 1995\(^9\) |
|---------------------------------|-----|-----|-----|-----|-----|
| Intake                          | 2–3 | 4–7 | 8–11| 12–15| 16–18|
| Mean bread intake (g/day)       | 60.3| 79.1| 96.6| 100.1| 110.2|
| Sodium (mg) from breads         | 271 | 356 | 435 | 451  | 496 |
| RDI (mg/day)                    | 320–1150| 460–1730| 600–2300| 920–2300| 920–2300|
| Sodium from breads as % of maximum RDI | 24 | 21 | 19 | 20 | 22 |

Note: RDI = recommended dietary intake.

Glycaemic index

The glycaemic index of a food is a physiologically based classification of carbohydrate-containing foods according to their potential to raise blood glucose. Various factors can affect the GI value of a food, among them the particle size of milled grains; the ratio of amylose to amylopectin; the degree of starch gelatinisation; and the presence of other food components such as viscous soluble fibres, fat, protein and organic acids. Lower GI diets may possibly be protective against both diabetes and heart disease and low-GI diets may help with weight control.

Many processed starchy cereal foods—such as most breads, rices and breakfast cereals—tend to have high GI values. This does not mean that high-GI cereal foods need to be avoided altogether: the glycaemic load of a diet can be balanced by combining high- and low-GI carbohydrate sources in the same meal. Exchanging half the carbohydrate from high to low GI will lower the GI of the overall diet by about 15 units, sufficient to bring about clinical improvements in glucose metabolism in people with diabetes.\(^8\)
3.2 Eat plenty of cereals (including breads, rice, pasta and noodles), preferably wholegrain

To achieve a lower GI diet, consumption of slowly digested cereal foods, such as grainy breads, pasta, low-GI breakfast cereals and high-amylose rice, is preferred. Choosing lower GI foods from wholegrain foods with low levels of saturated fat will also increase the protective cereal fibre and phytochemical content of the diet.

Relationship to other guidelines

In the 1995 edition of the Dietary Guidelines for Children and Adolescents, the guideline relating to cereal foods was ‘Eat plenty of breads and cereals (preferably wholegrain), vegetables (including legumes) and fruits’. The 2002 guidelines make two separate recommendations, one relating to vegetables and fruit and one relating to cereals—to give both groupings greater prominence. The emphasis on ‘wholegrain’ has been retained because of the growing evidence of the health benefits of wholegrain cereal products as compared with refined ones.

Enjoy a wide variety of nutritious foods

Different cereals provide differing amounts and types of dietary fibre, as well as differing levels of potentially active phytochemicals and nutritive antioxidants. The levels of some nutrients (such as selenium) in cereals vary considerably according to the growing region: it is important to eat a wide variety of cereal foods to maximise their nutritional benefits.

Limit saturated fat and moderate total fat intake

Cereals are naturally very low in saturated fat, so increased cereal consumption is consistent with this guideline as long as the amount of fat added—in the form of fat spreads on bread, oil added to pasta, fried rice, and so on—is limited. Care also needs to be taken to limit the intake of other cereal-based foods such as biscuits, cakes and pastries and some instant noodles: they can contain high levels of added saturated fat and are treated as ‘extra foods’ in the Australian Guide to Healthy Eating.

Choose foods low in salt

Standard commercial breads and some breakfast cereals are major sources of salt in the diet. To cut down on salt intake, lower salt cereal products and unprocessed whole grains should be preferred.
Conclusion

All breads and cereals are economical foods that are an important source of essential macro- and micro-nutrients. Wholegrain cereal choices, which generally are higher in dietary fibre, and cereals with a lower glycaemic index should be preferred. The words ‘eat plenty’ are used to encourage children and adolescents to choose these foods liberally as the basis of their daily diet.

Evidence

There is Level I evidence of the cholesterol-lowering properties of oats and psyllium (references 21 and 22), of the cholesterol-lowering properties of cereal fibres generally (reference 19) and of the preventive effect of dietary fibre on constipation (reference 66).

There is Level III evidence for the following:

• low-GI diets and improved lipid profile and glycaemic control in diabetics (references 33 to 35 and 84 to 86)
• cereal fibre and reduction in risk factors for colorectal cancer (reference 87)
• wholegrain cereal and reduced risk of coronary heart disease (references 29, 30 and 88)
• wholegrain cereal and reduced risk of diabetes (reference 47)
• cereal fibre and reduced risk of coronary heart disease (references 10, 23 to 25 and 46)
• cereal fibre and reduced risk of breast cancer (references 56, 57 and 89)
• wholegrain cereal and reduced risk of cancers (references 50, 54, 58 to 61 and 90 to 92)
• cereal and weight control (references 40 and 93)
• dietary fibre and reduced risk of diverticular disease (reference 94).

References

3.2 Eat plenty of cereals (including breads, rice, pasta and noodles), preferably wholegrain


3.2 Eat plenty of cereals (including breads, rice, pasta and noodles), preferably wholegrain


37. Franklin J, Caterson I. *Setting the record straight—the role of carbohydrates in weight control.* Sydney: Grains Research and Development Corporation & BRI Australia, 1999.


3.2 *Eat plenty of cereals (including breads, rice, pasta and noodles), preferably wholegrain*


3.2 Eat Plenty of Cereals (including breads, rice, pasta and noodles), Preferably Wholegrain


3.2 Eat plenty of cereals (including breads, rice, pasta and noodles), preferably wholegrain


86. Clapp J. Effect of dietary carbohydrate on the glucose and insulin response to mixed caloric intake and exercise in both nonpregnant and pregnant women. *Diab Care* 1998;21(suppl. 2):B107–B112.


3.3 INCLUDE LEAN MEAT, FISH, POULTRY AND/OR ALTERNATIVES

Katrine Baghurst

Terminology

Meat

*Meat* includes all or part of the carcass of any cattle, sheep, goat, buffalo, kangaroo, camel, deer, goat, pig or rabbit. For the purpose of this guideline, the term refers to the muscle component only; it excludes offal such as liver and kidney.

Red meat

For the purpose of this guideline, *red meat* refers to the muscle meat from cattle, sheep, goat and kangaroo. It does not include pork, ham or bacon; in other parts of the world—such as the United States, the United Kingdom and Europe—*red meat* includes pig meat.

Poultry

*Poultry* refers to chicken, duck, turkey and all other avian foods except eggs.

Alternatives

*Alternatives* refers to other protein-rich foods, such as eggs, liver and kidney, shellfish, legumes, nuts and nut pastes, and certain seeds, such as sunflower and sesame seeds.

Anaemia

There are a number of forms of anaemia. Microcytic anaemia (referring to small red blood cells) is a deficiency of red blood cells or their haemoglobin; it is often, but not always, related to iron deficiency. Macrocytic anaemia (referring to large red blood cells) is prevalent in some groups (such as Indigenous Australians) and may in some cases be associated with deficiencies of other nutrients, especially folate and vitamin B₁₂.
Iron deficiency

Iron deficiency refers to a condition of low body iron, which may manifest itself as low serum iron, low serum ferritin, high serum iron–binding capacity, a reduced transferrin saturation index and/or high–free erythrocyte protoporphyrin. It can cause fatigue, listlessness and pallor and may progress to anaemia. It can also have widespread non-haematological effects on behaviour, cognition and motor development, physical work performance, and body temperature regulation.

Background

Meats, fish, poultry and their alternatives contribute a number of important nutrients, some of which are marginal in the Australian diet. The foods in this food group are very valuable sources of protein as well as being a major source of a number of minerals and vitamins, such as iron, zinc, vitamin B$_{12}$ (see Table 3.3.1) and, in the case of fish, n-3 fats.

Red meats

Red meats are a valuable source of dietary protein and the best source of bioavailable iron in the Australian diet. They provide substantial amounts of zinc and vitamin B$_{12}$ and the lean varieties provide from 2 to 5 grams per 100 grams of dietary fat, with almost equal contributions from saturated and mono-unsaturated fats and a small amount of polyunsaturated fat.

Pork and poultry

Pork and poultry contain amounts of protein equivalent to those in red meats—about 20 grams per 100 grams. They are also valuable sources of bioavailable iron and zinc, but their content of these minerals is less than half that of the red meats per unit weight. Their vitamin B$_{12}$ content is also substantially less (see Table 3.3.1). The fat content of lean pork and skinless chicken is in the same range as that for lean red meats; lean pork has equal amounts of saturated and mono-unsaturated fats but a higher proportion of polyunsaturated fats compared with lean red meats. Skinless chicken has a higher proportion of both mono-unsaturates and polyunsaturates compared with the other meats.

Fish

Fish contain amounts of protein equivalent to those in red meats, pork and poultry. They also provide bioavailable iron and zinc, but at markedly lower levels than red meats. In contrast, the vitamin B$_{12}$ level of fish is similar to that of red meat or even higher, depending on the species. Fish are also a valuable source of iodine, which is in marginal supply in some areas of Australia. The fat
content of fish is variable (see Table 3.3.1), ranging from 1 per cent to 10 per cent or more by weight for oily fish. Fish, particularly the oily fish, are a very rich source of n-3 polyunsaturated fats, which are also found in some other muscle meats but at very much lower levels. These n-3 fats have been shown to provide specific health benefits, notably in relation to brain development and function and cardiovascular health (see ‘Scientific basis’ in this guideline and Section 3.6).

**Alternatives**

A number of foods can provide some of the key nutrients found in meats, fish and poultry, among them eggs, liver and kidney, shellfish, and plant foods such as legumes, nuts and some seeds. These foods are generally good sources of protein but have highly variable amounts of bioavailable iron, zinc and vitamin B_{12}. Consumption of legumes, nuts and seeds is encouraged for everyone; for vegetarians, additional serves of these foods, together with cereals, can also contribute many of the nutrients provided by meats, poultry and fish in an omnivore diet.

**Eggs**

Eggs have slightly lower protein content than the muscle meats. They are a good source of vitamin B_{12} and provide substantial amounts of iron and zinc, although the iron is not as bioavailable. They also contain substantial amounts of cholesterol, which might be important for some individuals, but they represent a valuable occasional protein alternative to muscle foods.

**Shellfish**

Shellfish have a nutrient profile similar to that of eggs, although the cholesterol content is variable, with prawns and squid having relatively high levels, mussels, crab and lobster being intermediate, and scallops having low levels.

**Liver and kidneys**

Liver and kidneys are also good protein sources, very high in bioavailable iron and zinc and particularly high in vitamin B_{12}; they are, however, somewhat high in cholesterol.

**Legumes, nuts and certain seeds**

Legumes, nuts and certain seeds are also valuable sources of protein and, to a lesser degree, iron and zinc. Whole nuts are not suitable for young children because of potential problems with choking, but they can be fed in paste form. Iron and zinc from plant sources are less bioavailable than they are from animal sources. Legumes, nuts and certain seeds, along with other plant foods, have been shown to offer specific health benefits (see Section 3.1) and their inclusion in the diet is recommended for everyone. They are particularly valuable in a vegetarian diet as an alternative source of protein and other important nutrients.
Other health benefits are thought to relate to their glycaemic properties (legumes), their phytoestrogen content (soybeans) or their fatty acid profile (nuts and certain seeds). The plant-based alternatives to meat, fish and poultry do not naturally provide any vitamin B₁₂, but fortified products are available. For vegetarians, these foods, together with cereal foods, can provide most (but not all) of the nutrients provided by meats, fish and poultry. Other key nutrients, such as vitamin B₁₂ and n-3 fatty acids, may need to be obtained through fortified foods or supplements.

**Current intakes of meat, fish, poultry and alternatives**

The *Australian Guide to Healthy Eating*¹—which is based on the NHMRC’s core food group model²—recommends between a half and one serving of this food group a day for children aged 4–7 years, depending on the pattern of intake of other foods; one to one-and-a-half servings for 8–11 year olds; and one to two servings for adolescents. A sample serve equates to 65–100 grams of cooked meat or chicken; half a cup (cooked) of dried beans, lentils, chick peas, split peas or canned beans; 80–120 grams of cooked fish fillet; two small eggs; one-third of a cup of almonds or peanuts; or a quarter of a cup of sunflower or sesame seeds.

The *Australian Guide to Healthy Eating* recommends that red meat be eaten three to four times a week; less than this and high-iron replacement foods will be required. The guide adds that this is especially important for girls, women, vegetarians and athletes.

The National Nutrition Survey of 1995³ showed that children aged 2–7 years were consuming 60–80 grams/day of meat, poultry and game products and dishes with this rising to about 108 g/day at 8–11 yrs, 130g/day at 12–15 yrs and 160 g/day at 16–18yrs. Of this, muscle meat contributed 10–15g in 2–7 yr olds, 25g in 8–11yr olds and about 40g/day in 12–18yr olds. Poultry ranged from 8–10 g/day in 2–11yr olds, to 18g/day in 12–15 yr olds and 31g/day in 16-18yr olds. Sausages and processed meats combined, ranged from 13–17g/day at all ages.

Fish and seafood products and dishes intake averaged 6.7g/day in 2–3yr olds, 12–13g/day in 4–11yr olds and 16–18g/day in 12–18yr olds with eggs averaging 4–6g/day in 2–15 yr olds and 8g/day in 16–18yr olds. Legumes and pulse products and dishes averaged about 7g/day in 2–7yr olds, 4g/day in 8–11yr olds and 10–13g/day in 12–18yr olds.
### Table 3.3.1  Nutrient content per 100 grams of sample lean meats, fish, poultry and alternatives

<table>
<thead>
<tr>
<th></th>
<th>Energy (kJ)</th>
<th>Protein (g)</th>
<th>Iron (mg)</th>
<th>Zinc (mg)</th>
<th>Vitamin B12 (µg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lean beef</td>
<td>450</td>
<td>21.6</td>
<td>2.40</td>
<td>3.6</td>
<td>2.50</td>
</tr>
<tr>
<td>Lean lamb</td>
<td>501</td>
<td>20.4</td>
<td>2.30</td>
<td>3.4</td>
<td>0.96</td>
</tr>
<tr>
<td>Lean pork</td>
<td>438</td>
<td>21.6</td>
<td>1.00</td>
<td>2.2</td>
<td>0.70</td>
</tr>
<tr>
<td>Fresh flathead</td>
<td>395</td>
<td>21.1</td>
<td>0.20</td>
<td>0.6</td>
<td>1.50</td>
</tr>
<tr>
<td>Canned red salmon</td>
<td>815</td>
<td>21.9</td>
<td>1.20</td>
<td>0.9</td>
<td>4.00</td>
</tr>
<tr>
<td>Skinless chicken</td>
<td>466</td>
<td>20.4</td>
<td>0.95</td>
<td>1.4</td>
<td>0.41</td>
</tr>
<tr>
<td>Liver—lamb</td>
<td>680</td>
<td>21.4</td>
<td>9.40</td>
<td>4.3</td>
<td>84.00</td>
</tr>
<tr>
<td>Eggs</td>
<td>632</td>
<td>13.2</td>
<td>1.80</td>
<td>0.9</td>
<td>1.10</td>
</tr>
<tr>
<td>Soybeans (dry-cooked)</td>
<td>537</td>
<td>13.5</td>
<td>2.20</td>
<td>1.6</td>
<td>–</td>
</tr>
<tr>
<td>Canned baked beans</td>
<td>285</td>
<td>4.6</td>
<td>1.60</td>
<td>0.5</td>
<td>–</td>
</tr>
<tr>
<td>Almonds</td>
<td>2455</td>
<td>20.0</td>
<td>3.50</td>
<td>3.6</td>
<td>–</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Total fat (g)</th>
<th>Saturated fat (g)</th>
<th>Mono-unsaturated (g)</th>
<th>Poly-unsaturated (g)</th>
<th>Total n-3 (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lean beef</td>
<td>1.8</td>
<td>0.87</td>
<td>0.82</td>
<td>0.21</td>
<td>0.07</td>
</tr>
<tr>
<td>Lean lamb</td>
<td>4.2</td>
<td>1.35</td>
<td>1.41</td>
<td>0.34</td>
<td>0.13</td>
</tr>
<tr>
<td>Lean pork</td>
<td>1.7</td>
<td>0.50</td>
<td>0.51</td>
<td>0.36</td>
<td>0.04</td>
</tr>
<tr>
<td>Fresh flathead</td>
<td>1.0</td>
<td>0.36</td>
<td>0.29</td>
<td>0.52</td>
<td>0.43</td>
</tr>
<tr>
<td>Canned red salmon</td>
<td>12.0</td>
<td>2.21</td>
<td>2.46</td>
<td>2.69</td>
<td>2.50</td>
</tr>
<tr>
<td>Skinless chicken</td>
<td>3.3</td>
<td>0.92</td>
<td>1.37</td>
<td>0.39</td>
<td>0.04</td>
</tr>
<tr>
<td>Liver—lamb</td>
<td>7.5</td>
<td>2.20</td>
<td>2.00</td>
<td>1.30</td>
<td>1.13</td>
</tr>
<tr>
<td>Eggs</td>
<td>10.9</td>
<td>3.10</td>
<td>4.30</td>
<td>1.00</td>
<td>0.06</td>
</tr>
<tr>
<td>Soybeans (dry-cooked)</td>
<td>7.7</td>
<td>1.10</td>
<td>1.20</td>
<td>4.80</td>
<td>0.17</td>
</tr>
<tr>
<td>Canned baked beans</td>
<td>0.5</td>
<td>0.10</td>
<td>0.10</td>
<td>0.30</td>
<td>0.03</td>
</tr>
<tr>
<td>Almonds</td>
<td>55.3</td>
<td>3.55</td>
<td>36.05</td>
<td>13.10</td>
<td>–</td>
</tr>
</tbody>
</table>

– Zero.

Note: Figures are for raw meats.

Sources: National Nutrition Survey nutrient data file; Nuttab '95; NZ food database; T Spadek, Chemistry Centre, WA (fatty acids in soybean); reference 50.
3.3 **Include lean meat, fish, poultry and/or alternatives**

**Scientific basis**

Although this food group is a major provider of a number of important nutrients—protein, zinc, vitamin B\textsubscript{12} and, for fish, n-3 fatty acids—it is as a source of bioavailable iron that it plays its most unique public health role.

**Iron**

The effects of anaemia and iron deficiency on brain development in infancy and very early childhood are well documented\textsuperscript{4–7}; randomised trials are also producing evidence of their effects on cognitive processes—verbal learning and memory—in adolescence.\textsuperscript{8} Iron deficiency in childhood and adolescence may also be associated with reduced work capacity, a less efficient response to exercise, and impaired immune function.\textsuperscript{9,10}

As part of the haemoglobin in red blood cells, iron helps to transport oxygen around the body. As part of the enzymes of the electron transport chain, it is necessary for the production of energy from glucose, the main fuel for both the brain and the rest of the body. Iron is also a vital component of enzymes responsible for brain development and essential for the synthesis of key neurotransmitters required for normal brain function.\textsuperscript{11} Low iron intakes—coupled with increased requirements among population subgroups such as adolescent girls, vegetarians and pregnant women—make iron deficiency a significant public health concern.

**Infancy and early childhood**

From birth to the age of 6 months, iron stores are heavily influenced by the mother’s iron status during pregnancy. Between the ages of 6 and 12 months, a stage of rapid psychomotor development, poor feeding practices place many infants at risk of iron deficiency. The effects of anaemia and iron deficiency on brain development in infancy and very early childhood are well documented.\textsuperscript{4–7} Toddlers and preschoolers often have limited food habits, yet their energy and iron demands for growth are high. Iron stores can be affected by the duration of exclusive breastfeeding, delayed introduction of solids, and excessive use of cow’s milk.

Iron intakes appear to be low in the diets of very young children in Australia: the 1995 National Nutrition Survey found that one in three 2–3 year olds had intakes below the recommended dietary intake on the day of the survey and one in 10 were below 70 per cent of the RDI. About 50 per cent of adolescent girls and 20 per cent of adolescent boys also did not meet the RDI for iron on the day of the survey; further, some 25 per cent of the girls and 6–8 per cent of the boys had intakes below 70 per cent of the RDI.\textsuperscript{12}

Studies of the extent of the problem of iron deficiency in children and adolescents in Australia have been done only on relatively small groups of children to date, but the results suggest that significant numbers of children (up to 35 per cent), particularly young children, may be iron-depleted. Aboriginal
children appear to be especially at risk. A study of Adelaide children found that 20 per cent of 6–12 month old infants and 35 per cent of 12–24 month old toddlers were ‘iron deficient’, with serum ferritin levels less than 16 micrograms per litre. Another study, of 479 young Australian children aged 1–3 years, found that a lower intake of haem iron (found in muscle meat) was a major risk factor for iron depletion—depletion being defined as plasma ferritin less than or equal to 10 micrograms per litre. In this study, children eating less than 0.7 milligrams a day of haem iron (the amount provided by about 50 grams of lean beef) were three times more likely to be iron-depleted. A recent Sydney study of 403 children of mothers born in Arabic-speaking countries found rates of 23 per cent for iron depletion, 9 per cent for iron deficiency without anaemia, and 6 per cent for iron deficiency anaemia.

**Adolescence**

There are only limited statistics on the prevalence of iron deficiency in Australian adolescents, and there has been no recent national assessment of iron status in this group. However, if the results obtained from two surveys of adolescent girls and young women in Western Australia and data from a national survey from the mid-1980s can be generalised to the current adolescent and young adult population in Australia, low iron stores or iron deficiency without anaemia could be relatively common in adolescent girls and young women (see Table 3.3.2).

**Table 3.3.2** Percentages of females with low iron status from three Western Australian studies

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Status</th>
<th>% of subjects</th>
</tr>
</thead>
<tbody>
<tr>
<td>265 female university students aged 15–30 years&lt;sup&gt;18&lt;/sup&gt;</td>
<td>Iron deficiency</td>
<td>Serum ferritin &lt;16mg/L 19.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Serum ferritin ≤12mg/L 12.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Serum ferritin ≤12mg/L and transferrin saturation &lt;16% 7.2</td>
</tr>
<tr>
<td></td>
<td>Anaemia</td>
<td>Hb&lt;12g/dL 10.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hb&lt;12g/dL serum ferritin ≤12mg/L and transferrin saturation &lt;16% 4.5</td>
</tr>
<tr>
<td>211 women aged 15–30 years&lt;sup&gt;19&lt;/sup&gt;</td>
<td>Low iron stores</td>
<td>Serum ferritin &lt;30mg/L 42.7</td>
</tr>
<tr>
<td></td>
<td>Iron deficiency</td>
<td>Serum ferritin &lt;16mg/L 14.2&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>National Dietary Survey of Schoolchildren, 1985 15-year-old girls&lt;sup&gt;20&lt;/sup&gt;</td>
<td>Iron deficiency</td>
<td>Serum ferritin &lt;12mg/L 9.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Serum ferritin &lt;12mg/L 20.0</td>
</tr>
</tbody>
</table>

<sup>a</sup> Of these, 1.4% were anaemic.

During adolescence an adequate supply of iron is critical, not only for maintaining haemoglobin levels but also for increasing the total iron mass during
this period of rapid growth. Iron requirements for boys increase during the ‘growth spurt’ as new muscle is laid down; with the slowing of growth at the end of puberty, iron requirements decline. Although girls develop less extra muscle tissue than boys, the onset of menstruation increases the need for iron and this increased need continues throughout reproductive life. Adolescent girls are therefore at risk of developing iron deficiency as a consequence of the combined effects of continuing growth, menstrual iron losses, and a low intake of dietary iron.

A South Australian study has shown that adolescent girls have a tendency to restrict their intake of meat—a major source of bioavailable iron—or avoid it altogether, often because of an interest in vegetarianism, environmentalism, fashion or body appearance. The study showed that up to 37 per cent of teenage girls restricted their intake of meat, particularly beef and lamb.

**Sources of iron, promoters, inhibitors and bioavailability**

Western mixed diets contain 1.0 to 1.4 milligrams of iron per 1000 kilojoules. Hence most adults will ingest over 10 milligrams of iron daily, which, theoretically, should be sufficient to meet the needs of most of the population. But only a small, and variable, proportion (5–20 per cent) of dietary iron is absorbed. Haem iron is approximately 25 per cent absorbed, and non-haem iron (found in plants) is about 15 per cent absorbed. Consumption of meat, fish or poultry increases absorption of haem iron and, even in relatively small amounts (50–75 grams) in a mixed meal, can increase absorption from the plant foods in the meal up to twofold. Non-tissue animal foods such as eggs and milk do not appear to enhance iron absorption and can decrease non-haem iron absorption. Addition of foods rich in vitamin C or fruit juices to a meal can also greatly increase the absorption of iron from that meal in a dose-dependent manner—a factor of five or greater.

Conversely, certain plant foods can contain inhibitors to absorption. Bothwell et al. have extensively reviewed the bioavailability of iron from various natural plant sources. Polyphenols (such as tannins), which are a component of all plant tissue, have an inhibitory action, the degree of inhibition correlating well with the polyphenol content of individual vegetables. Tea and, to a lesser extent, coffee also profoundly inhibit iron absorption by binding the iron to form insoluble compounds with tannins. Whilst most alcoholic drinks appear to assist iron absorption, this does not apply to some red wines, because of the tannin content. Phytates are also inhibitory and are present in substantial quantities in many cereals and legumes; the quantitative relation between these compounds and iron absorption is, however, less clear cut.

Calcium supplements have been shown to inhibit iron absorption, and some practitioners recommend consumption of primary iron and calcium sources on different meal occasions to optimise absorption. However, addition of milk to a cereal-based meal has been shown to have no effect on iron absorption in a group of young women, and long-term calcium supplementation has been shown not to lower plasma ferritin concentration in human subjects.
Where the plant-based foods from this category are preferred, care is therefore necessary, so that iron intake is sufficient to overcome the lower bioavailability and the inhibitory components in plant foods. A wide range of iron-fortified food products are now available—with varying, but often unknown, iron bioavailability.

**Recommended intakes and current consumption of iron**

The current Australian recommended dietary intakes of iron\(^\text{24}\) for infants, children and adolescents range from 0.5 milligrams a day for breastfed infants to 3mg/day for formula-fed infants, 9mg/day for 7–12 month olds, 6–8mg/day for 1–11 year olds, and 10–13mg/day for 12–18 year olds.

The recent review of the US recommended dietary allowances (RDAs) set an adequate intake for iron of 0.27mg/day for infants aged 0–6 months because it was felt that sufficient data were not available to set an estimated average requirement (EAR) or RDA. The review set an EAR of 6.9mg/day and an RDA (EAR+2SD) of 11mg/day for infants aged 7–12 months; an EAR of 3mg/day and an RDA of 7.0mg/day for children aged 1–3 years; an EAR of 4.1mg/day and an RDA of 10.0mg/day for 4–8 year olds; EARs of 5.9mg/day for boys aged 9–13 years and 5.7mg/day for girls of that age and, for both genders, an RDA of 8.0mg/day; an EAR of 7.7mg/day and an RDA of 11.0mg/day for boys aged 14–19 years and an EAR of 7.9mg/day and an RDA of 15.0mg/day for girls of that age. The US recommended dietary allowance for vulnerable adolescent girls is thus considerably higher than the current Australian recommended dietary intake for iron.

The US review also set recommended dietary allowances for vegetarians, at almost double those for omnivores because of the lower bioavailability of iron from plant sources.

In the 1995 National Nutrition Survey in Australia\(^\text{35}\), the ‘meat, poultry, game, products and dishes’ category provided 14–19 per cent of the iron in the diets of children and adolescents, depending on age and gender, and fish and seafood provided an additional 1–2 per cent. Red meats were the main contributor, and they also contributed over 55 per cent to haem iron.\(^{12}\) The other important contributor to iron intake (mostly non-haem iron) was the ‘cereal and cereal products’ category (at about 40 per cent); vegetables contributed 8–12 per cent.

**Zinc**

Zinc is important in a number of major metabolic processes, among them the synthesis of protein and nucleic acid and the synthesis and action of insulin. It is involved in immune function and cell growth and repair. The long-term effects of mild zinc deficiency are unclear but may include delayed wound healing, impaired immune function, and problems with taste and smell acuity.\(^{36}\)

Strong homeostatic mechanisms regulate zinc, and this, together with a lack of sensitive indicators of zinc status, means it is difficult to determine the
3.3 Include lean meat, fish, poultry and/or alternatives

prevalence of zinc deficiency in a community and to set recommended intakes. Furthermore, the bioavailability of zinc varies markedly between foods and, as with iron, is affected by the composition of the diet. Zinc from animal sources, including eggs, is generally better absorbed than zinc from plant foods. For example, 21–26 per cent of the zinc in beef is absorbed, compared with 11–14 per cent of the zinc in wholemeal bread. Absorption of zinc is reduced by phytate in plant foods such as peanuts and soybeans. While calcium and iron can potentially reduce zinc absorption, the effect caused by food intake of these minerals is likely to be relatively small.

Recommended and current intakes of zinc

The Australian recommended dietary intake for zinc ranges from 3.0 milligrams a day for breastfed infants and 3–6mg/day for formula-fed infants to 4–5mg/day for children aged from 7 months to 3 years, 6.0mg/day for 4–7 year olds, 9.0mg/day for 8–11 year olds, and 12.0mg/day for 12–18 year olds.

The recent review of the US recommended dietary allowances concluded that only an estimate could be made of the adequate intake for infants aged to 6 months; this was set at 2.0mg/day. For infants and young children aged 7 months to 3 years, an EAR of 2.2mg/day and an RDA of 3.0mg/day were set; for children aged 4–8 years, an EAR of 4.0mg/day and an RDA of 5.0mg/day were set; for 9–13 year olds, the EAR was 7.0mg/day and the RDA 8.0mg/day; and for 14–18 year olds, an EAR of 8.5mg/day and an RDA of 11mg/day were set for boys and an EAR of 7.5mg/day and an RDA of 9.0mg/day were set for girls. In contrast to the iron recommendations, the US recommended dietary allowances for adolescent girls are markedly lower than the current Australian recommended dietary intake for zinc and slightly less for adolescent boys.

The 1995 National Nutrition Survey showed that nearly three-quarters of adolescent girls and women had zinc intakes less than the recommended dietary intake of 12.0mg/day and almost half had intakes below 70 per cent of the RDI on the day of the survey. For 2–3 year olds, 8 per cent of boys and 7 per cent of girls had intakes less than 70 per cent of the RDI, and the proportion rose steadily up to the age of 12–15 years, where 24 per cent of boys and 56 per cent of girls consumed less than 70 per cent of the RDI on the day of the survey.

It is of interest to note that the new US recommended dietary allowance of zinc for women (8.0mg/day) is one-third lower than the current Australian recommended dietary intake for women (12mg), which was set in 1991. The figures for men are about the same—11.0mg in the United States and 12.0mg in Australia. It is therefore possible that the large proportion of women in Australia apparently at risk of low zinc intake might, in part, be due to an overestimate of requirements as a consequence of the limited data available at the time of setting the Australian RDIs.

In the National Nutrition Survey, the ‘meat, poultry and game products and dishes’ category provided 28–35 per cent of the zinc in the diets of children and adolescents. Muscle meats provided 10–15 per cent; poultry, 2–3 per cent; and fish and seafood, 1–2 per cent. The proportion of the population recording a low...
zinc intake in the survey was inversely related to red meat consumption on the day of the survey.\textsuperscript{12}

\textbf{Vitamin B\textsubscript{12}}

Vitamin B\textsubscript{12} plays an important biochemical role in the maintenance of myelin in the nervous system and, in conjunction with folate, in the synthesis of DNA. CSIRO research has demonstrated the importance of vitamin B\textsubscript{12} in maintaining genetic stability: chromosome damage was shown to be lower with higher plasma vitamin B\textsubscript{12} levels and lower plasma homocysteine levels. Supplementation with folate and vitamin B\textsubscript{12} (at 3.5 to 10 times the recommended dietary intake) can also reduce such chromosome damage.\textsuperscript{40} It is not clear, however, what the overall health implications are in relation to the associations seen between vitamin B\textsubscript{12} and genetic damage.

Another CSIRO study demonstrated that non-vegetarian males aged 20–40 years had a significantly lower rate of genetic damage than vegetarian males of the same age.\textsuperscript{41} This is thought to be a result of the protective effects of vitamin B\textsubscript{12} in the diet of non-vegetarians.

The main forms of vitamin B\textsubscript{12} available to humans come from animal products in which the vitamin has accumulated from bacterial synthesis. Although occasional contamination of soil or water with microbes that produce vitamin B\textsubscript{12} occurs, plant foods are usually devoid of the active form of the vitamin. Because of the importance of animal foods as a source of this vitamin, dietary vitamin B\textsubscript{12} deficiency can be a problem in vegetarians.\textsuperscript{42}

The most prevalent deficiency of vitamin B\textsubscript{12} is sub-clinical deficiency, recognised by changes in biochemical levels in the blood. The normal serum vitamin B\textsubscript{12} is usually taken as 200 picograms per millilitre (or 150 picomoles per litre). Low vitamin B\textsubscript{12} levels (as well as low folate and low B\textsubscript{6}) have been shown to correlate with raised plasma homocysteine\textsuperscript{43,44}, which is a risk factor for cardiovascular disease. However, the importance of dietary intake of vitamin B\textsubscript{12} in prevention (or correction) of raised plasma homocysteinuria is not clear.

In one Melbourne study, Mann et al. measured serum vitamin B\textsubscript{12}, homocysteine and folate in healthy men aged 20–55 years\textsuperscript{45} eating a wide range of diets, from high-meat to vegan, and found a strong negative correlation (r = –0.37) between serum vitamin B\textsubscript{12} and plasma homocysteine in the combined subjects of the four groups. All meat-eaters in the study had serum vitamin B\textsubscript{12} in the normal range (200–1100pg/ml), but 23 per cent of the lacto-ovo-vegetarians and 65 per cent of the vegans had serum vitamin B\textsubscript{12} below 200pg/ml. It is not certain how representative these figures might be of the sub-populations involved since they were based on 18 vegans, 43 lacto-ovo-vegetarians, 60 meat-eaters and 18 high meat-eaters, but they do indicate marked differences across eating styles. If homocysteine levels are higher in vegetarians or vegans as a result of lower B\textsubscript{12} levels, it is unclear whether normalising this would bring them cardiovascular benefits additional to those sometimes seen with vegetarian diets.
3.3 Include lean meat, fish, poultry and/or alternatives

Low vitamin B\textsubscript{12} status has also been associated with impaired cognitive function\textsuperscript{46} in relation to fluid intelligence (the ability to assimilate and use new information) in adolescents who had previously been long-term vegans, and in relation to memory performance in adult women from the Australian population. There are, however, only limited data on the vitamin B\textsubscript{12} status of Australian children and adolescents.

**Recommended and current intakes of vitamin B\textsubscript{12}**

The Australian recommended dietary intake of vitamin B\textsubscript{12} is 0.3 micrograms a day for breastfed and formula-fed infants, 0.7\(\mu\)g/day for infants aged 7–12 months, 1.0\(\mu\)g/day for 1–3 year olds, 1.5\(\mu\)g/day for 4–11 year olds, and 2.0\(\mu\)g/day for 12–18 year olds.\textsuperscript{24}

The recent review of the US recommended dietary allowances\textsuperscript{48} established an adequate intake of 0.4\(\mu\)g/day for infants aged to 6 months and 0.5\(\mu\)g/day for infants aged 7–12 months. An estimated average requirement of 0.7\(\mu\)g/day and an RDA of 0.9\(\mu\)g/day were set for 1–3 year olds; for 4–8 year olds the EAR was set at 1.0\(\mu\)g/day and the RDA at 1.2\(\mu\)g/day; for 9–13 year olds the EAR was set at 1.5\(\mu\)g/day and the RDA at 1.8\(\mu\)g/day; and for 14–18 year olds the EAR was set at 2.0\(\mu\)g/day and the RDA at 2.4\(\mu\)g/day.

An analysis of the 1995 National Nutrition Survey\textsuperscript{12}, using the vitamin B\textsubscript{12} food database from the United States, gave an estimated daily intake of 3.0\(\mu\)g for 2–3 year olds, 2.8\(\mu\)g for 4–7 year olds, 3.6\(\mu\)g for 8–11 year olds, 4.3\(\mu\)g for 12–15 year olds, and 4.6\(\mu\)g for 16–18 year olds.

**Protein**

Proteins are the fundamental structural compounds of cells, antibodies, enzymes and many hormones. An adequate intake of protein containing all the essential amino acids is therefore crucial for optimal growth and development in children and adolescents. Protein may also play a role in satiety, and it constitutes almost the sole form in which humans can replace nitrogen. Twenty-three amino acids are used to construct proteins; of these, eight are classified as essential since they must be supplied in food.

Proteins vary in their digestibility. The protein from meats, fish and poultry is highly digestible (90 per cent or more); this compares with a digestibility of 78 per cent in beans and 86 per cent in whole wheat.\textsuperscript{49}

Net protein utilisation\textsuperscript{49} is generally higher for animal protein sources (NPU 0.75–0.8) compared with many, but not all, plant foods (NPU 0.5–0.6).

**Recommended and current intakes of protein**

Protein recommendations for children and adolescents must take account of maintenance requirements as well as the increasing assimilation requirements of young children and the growth spurts of older children and adolescents. There is no recommended intake for breastfed infants aged less than 6 months, but for
formula-fed infants the RDI is 2.0 grams per kilogram of body weight and for all infants aged 7–12 months it is 1.6g/kg. By 1–3 years of age, the RDI is 14–18 grams per day, rising to 18–24g/day at 4–7 years, 27–39g/day at 8–11 years, 42–60g/day for boys aged 12–15 years and 44–55g/day for girls of this age, and 64–70g/day for 16–18 year old boys and 57g/day for girls of this age. The Australian RDI was developed in the late 1980s. The US review set an adequate intake figure of 9.1g/day or 1.52g/kg/day for infants aged 0–6 months; an RDA of 1.5g/kg/day for infants aged 7–12 months; and an RDA of 13g/day for children aged 1–3 years, 19g/day for those aged 4–8 years, and 34g/day for those aged 9–13 years. For boys aged 14–18 years, an RDA of 52g/day was set, and for girls of that age the RDA was set at 46g/day.

According to the 1995 National Nutrition Survey, 2–3 year olds were consuming on average 55 grams of protein a day; 4–7 year olds some 64g/day; 8–11 year olds 82g/day; 12–15 year old boys 88g/day and girls that age 74g/day; and 16–18 year old boys 101g/day and girls of that age 80g/day. The survey found that the ‘meat, poultry and game products and dishes’ category provided a mean of 25 per cent of the protein in 2–11 year olds and just over 30 per cent in 12–18 year olds. Other major sources were the dairy group (25 per cent in 2–11 year olds and 19 per cent in 12–18 year olds), and cereal and cereal products (18 per cent in 2–11 year olds and 16 per cent in 12–18 year olds).

**Total and saturated fats**

Meats are often perceived as a major source of dietary fat and saturated fat. However, although some individual cuts or products can be relatively high in fat, an analysis of the 1995 National Nutrition Survey showed that meats do not contribute as much fat as is commonly believed. For instance, the analysis showed that red meat per se contributes an average of only 6 per cent of the total fat in adults’ diets, 9 per cent of the saturated fat, 12 per cent of the unsaturated fats (mainly mono-unsaturated), and 17 per cent of the cholesterol. Changes in both the meat supply and consumer preferences in Australia are affecting the contribution of meats to fat and saturated fat intakes.

Excess dietary fat (and saturated fat) intake has been linked to a number of adverse health outcomes (see Chapter 2 and Section 3.6). However, the confounding of fat intake with the intake of certain components of this food group, notably meats, has led to some confusion in interpretation of epidemiological data linking dietary components to chronic disease outcomes, particularly in relation to cancer. In the United States, where much of the epidemiological research data comes from, the fat content of meat is considerably higher than in Australia, and meats contribute more markedly to overall fat and saturated fat intake.

An important 1997 publication claimed a role for fat and meat in colon cancer, but the recent European Conference on Nutrition and Cancer concluded there was no association between fresh red meat and colorectal cancer. In addition, three recent Australian reviews of the cancer epidemiology literature have largely
exonerated fresh meats per se from a role in cancer causation and, in particular, colon cancer. An expert panel review of the role of red meat in colon cancer concluded that the balance of epidemiological evidence indicates that prevailing levels of lean red meat consumption in Australia are not linked with the development of cancer. This conclusion is consistent with that of the National Health and Medical Research Council concerning diet and colorectal cancer—which recommends a reduction in total fat intake but makes no recommendation about meat intake—and with that of an earlier review of red meat and various cancers. The Cancer Council of Australia’s National Cancer Prevention Policy 2001–2003 also supports this view. Recent research in Europe suggests, however, that caution may still be necessary in connection with certain food-preparation techniques and the consumption of cured and smoked meats, although the Cancer Council of Australia concluded that there was insufficient evidence at present to support a causal relationship.

An expert review of red meat and health also concluded that diets rich in lean red meat could still be low in fat and saturated fat and not adversely affect plasma cholesterol levels and that lean red meat could be included in management strategies for the prevention and treatment of obesity. The conclusions of the review concur with nutrition statements from the National Heart Foundation of Australia and have the support of the Dietitians Association of Australia as a useful summary of the contribution of red meat to healthy eating.

**n-3 fats**

Found predominantly in fish, n-3 fats appear to have a number of beneficial actions, notably in relation to brain development and function and cardiovascular health. (The role of n-3 fats in the diet is discussed in more detail in Section 3.6.) Australians’ intake of long-chain n-3 fatty acids has been estimated to be less than 200 milligrams a day (an average of about 100mg), and most authorities recommend an intake of 214–650mg/day. Fish and seafood are by far the richest sources of n-3 fats. However, Ollis et al. found in a study of 83 healthy Australian adults that meat was also a major contributor to the dietary intake of very long chain n-3 fats—contributing 29 per cent of the total. They attributed this to what they called the ‘relatively high’ meat intake of the group, which averaged 164 grams a day. The principle n-3 fatty acid from vegetables is alpha-linolenic acid. Vegetarians have significantly lower plasma and platelet n-3 levels since alpha-linolenic acid is not as effective a source of long-chain n-3 fatty acids as is the direct consumption of eicosapentaenoic acid (EPA), docosapentaenoic acid (DPA) and docosahexaenoic acid (DHA) from fish and meat. There is, however, no evidence that this results in higher cardiovascular risk in vegetarians: other beneficial dietary factors might offset the low n-3 levels.
3.3 Include lean meat, fish, poultry and/or alternatives

**Special groups**

**Adolescent girls**

In comparison with boys, men and post-menopausal women, menstrual loss virtually doubles the iron requirement of adolescent girls. Adolescents have the added demands of growth. Iron balance in these circumstances is problematic and requires a substantial food intake, as well as an appropriate composition of meals. The National Nutrition Survey data suggest that some females may be limiting their overall food intake, possibly because of concerns about body weight. Increased activity would allow greater food intake, thus increasing the likelihood of adequate iron intake whilst maintaining a desirable body weight.

**Pregnancy in adolescence**

Pregnancy places females at higher risk of inadequate iron and zinc intake because of their increased needs and the potential for morning sickness to reduce nutrient availability. Pregnant adolescents are at additional risk because of their own growth needs.67

Infants born to women with low iron stores will themselves have low iron stores and, if exclusively breastfed for a prolonged period, will be more likely to develop anaemia. In addition, low iron status in early pregnancy is more likely to result in premature birth and low birthweight.69,70

Low maternal serum zinc levels have been associated with congenital malformations, prematurity, foetal growth retardation (leading to low-birthweight babies) and maternal morbidity.36 However, the results have not always been consistent.

**Vegetarians**

With the exception of vitamin B12, a balanced vegetarian diet can be adequate in all nutrients; indeed, some vegetarian communities have been shown to have health advantages over the general population—notably in the cardiovascular area, with reductions in risk factors such as plasma cholesterol, antioxidant status, clotting factors and blood pressure.71–81 It is thus possible to have a healthy diet without using foods derived from animal sources. There are, however, several micro-nutrients for which meat, fish and poultry are the dominant and most bioavailable source and, as discussed, care needs to be taken if these foods are excluded. The American Dietetic Association recommends that vegetarians regularly consume B12-fortified food products. Protein from diverse sources—legumes, nuts, cereals and dairy (if eaten)—should be included to attain the appropriate mix of amino acids and give variety.

Legumes are a valuable source of protein, fibre and micronutrients—not only for vegetarians but also for the wider community. Included in the legume category are beans such as soybeans, kidney beans, broad beans and haricot beans, as well as mature dried peas, lentils and chick peas, and foods made from this produce; for example, hummus, falafel, bean burrito, soy and lentil burgers, soy
3.3 Include lean meat, fish, poultry and/or alternatives

Schnitzels, vegetarian sausages, soy slices, nutmeat, textured vegetable protein, baked beans and tofu. The evidence of potential benefits for cardiovascular and bone health conferred by isoflavones (found in soybeans) has recently been reviewed by Messina\textsuperscript{82}, but there has been very little research on children and adolescents.

Nuts and certain seeds also provide some protein and other nutrients and can help improve the unsaturated–saturated fat ratio in the diet. Because of their fatty acid profile, nut consumption has been investigated in relation to the potential to promote heart health. Several large prospective cohort studies have examined the relationship between nut consumption and the risk of coronary heart disease, and all found an inverse relationship.\textsuperscript{83-85} These findings and related epidemiological and clinical studies have been reviewed by Sabate\textsuperscript{86} and Hu and Stampfer.\textsuperscript{87} Nuts and seeds are, however, energy dense, so should be consumed in moderate amounts. Whole nuts should not be given to young children because of the risk of choking.

**Athletes**

Recent heightened interest in the relationship between iron status and athletes’ performance has revealed an increased requirement for iron in that group, mainly because of increased intestinal losses.\textsuperscript{88,89} Because of their overall requirements, female athletes are particularly vulnerable.

**Practical aspects of this guideline**

This guideline specifically refers to the inclusion of lean cuts of meat and poultry. Some meats and some meat and poultry products or dishes that are popular in Australia—such as pies; sausages; crumbed and fried meats, fish or poultry; and mettwurst and salami—can contain significant amounts of saturated fat, either from the ingredients themselves (including non-meat components such as pastry or fillers) or from added cooking fats. These foods can be included occasionally in a balanced diet, but care does need to be taken with the rest of the diet, so as to avoid overconsumption of saturated fats. In addition, these types of products do not provide the same level of iron, zinc and vitamin B\textsubscript{12} as the lean cuts. Selection of lean mince and removal of visible fat from meat and poultry cuts before cooking can also help to limit fat intake.

Whilst consumption of a variety of foods from this food group is encouraged, the *Australian Guide to Healthy Eating*\textsuperscript{4} recommends inclusion of red meat three to four times a week; otherwise, high-iron replacement foods will be needed. This is especially the case for females and athletes. One Australian study\textsuperscript{90} showed that in young female students an intake of 1.6 milligrams of haem iron a day (the amount in about 100 grams of lean beef) reduced the odds of having low iron stores in the body by 60 per cent. There was no relationship between iron status and total iron intake.
Inclusion of two to three meals a week of fish high in n-3 fats—pilchards, sardines, salmon, tuna, herring, mackerel, and so on—has also been recommended by some health authorities. However, with limited fish supplies, this recommendation may not be attainable, or sustainable, at a population level, and n-3 fatty acid intake may have to be achieved through foods fortified with n-3 fats, in addition to natural fish sources.

Vegetarians should choose from a variety of legumes, nuts and seeds to obtain protein, iron and zinc. Wholegrain or wholemeal cereals are also good sources of zinc and iron, and supplemented varieties are available. Drinking fruit juice or eating fruit at the same meal increases absorption of iron and zinc.

**Relationship to other guidelines**

Earlier editions of the dietary guidelines included a guideline encouraging the consumption of ‘iron-rich foods’. In this revision—to more clearly define the concept of variety, to provide advice consistent with the *Australian Guide to Healthy Eating*, and to take a more consistent food-based approach—this guideline has been replaced by one encouraging inclusion of lean meats and fish, poultry or their alternatives, with an emphasis on these foods’ value as a source of dietary iron, zinc and B₁₂ as well as protein.

**Physical activity is important for all children and adolescents**

Obesity is increasing in many countries. Although many genetic, environmental and lifestyle factors contribute to this, dietary fat intake can also be a major factor in the development of obesity through its effect on the energy density of the diet.¹¹ A CSIRO analysis of the National Nutrition Survey showed a high correlation between energy density and fat content of the diet on the day of survey, with dietary fat (both grams per day and percentage of fat) being a major determinant of energy density. Choosing low-fat varieties and low-fat cooking techniques is therefore encouraged.

**Limit saturated fat and moderate total fat intake**

Lean meats and poultry and low-fat cooking methods are recommended. Australian red meat cuts are generally much leaner than their equivalents from countries such as the United States.

**Care for your child’s food: prepare and store it safely**

Illness caused by food-borne bacteria is a public health concern. All foods are potential vectors of pathogens. In Australia the risk of food-borne illness in primary food industries is managed across the food chain, with industry, government and consumers sharing responsibility for the delivery of microbiologically safe products. Nevertheless, some foods from the meat, fish
3.3 Include lean meat, fish, poultry and/or alternatives

and poultry group have been implicated in outbreaks of food-borne disease\textsuperscript{92,93}, and constant vigilance is required.

**Conclusion**

Inclusion of lean meats, fish, poultry and alternatives in the daily diet will help to ensure adequate iron, zinc and vitamin 12 intake as well as providing a valuable source of protein. Lean red meats are a particularly valuable source of iron, zinc and B\textsubscript{12} and fish is a particularly good source of omega-3 fats. Whilst well planned vegetarian diets can provide both iron and zinc in adequate amounts, care needs to be taken to ensure intake of adequate iron and zinc from the less bioavailable plant sources and particular attention has to be paid to alternative vitamin B\textsubscript{12} sources.

**Evidence**

The scientific rationale for this guideline is based on a variety of evidence sources, among them the following:

- two well-designed randomised controlled trials (Level III evidence) relating to iron supplementation and cognition (references 8, 8)
- a meta-analysis of case-control and cohort studies (Level III evidence) assessing the effects of red meat on cancer (reference 59); of iron deficiency on cognition (reference 6); of vitamin B\textsubscript{12} on cognition (reference ); of red meat consumption on cardiovascular disease risk factors (reference 74); of nut consumption on cardiovascular disease (references 83 and 85-87); of various foods, drinks or nutrients on iron or zinc bioavailability and absorption (references 28, 31–34, 37, 39); and of diet on homocysteine status (references 43 to 45).

Evidence was also obtained from a number of cross-sectional population studies, as well as human experimentation relating to bioavailability and nutrient requirements and intakes, and expert reviews of selected issues.

**References**


3.3 Include lean meat, fish, poultry and/or alternatives


23. UN Food and Agriculture Organization. *Apparent consumption data: iron in western diets*. Rome: FAO.


3.3 Include lean meat, fish, poultry and/or alternatives


3.3 Include lean meat, fish, poultry and/or alternatives


3.3 Include lean meat, fish, poultry and/or alternatives


3.4 **INCLUDE MILKS, YOGHURTS, CHEESES AND/OR ALTERNATIVES**

- **Reduced-fat varieties should be chosen where possible**
- **Reduced-fat milks are not suitable for young children under 2 years, because of their high energy needs, but reduced-fat varieties should be encouraged for older children and adolescents.**

**Katrine Baghurst**

**TERMINOLOGY**

**Mills, yoghurts and cheeses**

The term *milks, yoghurts and cheeses*, as used in this guideline, generally refers to cow’s milk and the yoghurt and cheese produced from it but can also include milks, yoghurts and cheeses from goat and sheep milks. Goat and sheep milks have overall nutrient profiles that are similar to that of cow’s milk, although goat’s milk is slightly more ‘watery’ (less nutrient dense), whereas sheep’s milk is almost twice as concentrated as cow’s milk, containing more calcium per unit weight but also more fat and energy. In addition, goat and sheep milks are generally not pasteurised and can constitute a health risk. Milks, and products made from them, are good sources of a number of nutrients—for example, protein, riboflavin and vitamin B₁₂—but notably calcium.

**Alternatives**

Inclusion in the ‘alternative’ category is based primarily on calcium content, although most of the alternatives also provide substantial amounts of protein. *Alternatives* includes milk-based custards, ice-creams and evaporated milks, as well as fortified soy milk and derivatives. Sardines and other fish whose bones are eaten, and certain nuts (such as almonds), also contain moderate to good amounts of calcium and protein and in this respect can be considered occasional ‘alternatives’. Table 3.4.1 shows the calcium content and the content of other key nutrients for a selection of milks, yoghurts, cheeses and alternatives.

**Milk foods**

For the purposes of this guideline, where *milk foods* is used it generally refers to cow’s milk (fresh, long-life, reconstituted dried and evaporated) and products made from it, such as yoghurts, ice-creams, cheeses and milk-based custards.
which are good sources of calcium as well as a range of other nutrients. The
‘milk foods’ category is a major source of saturated fat in children’s and
adolescents’ diets, so—with the exception of children aged less than 2 years—
reduced-fat varieties are encouraged. In the 1995 National Nutrition Survey, a
category called ‘milk products and dishes’ was used; this category included the
foods listed here as ‘milk foods’ as well as cream and soy alternatives such as
soy milks and cheeses.

**Reduced-fat products**

Reduced-fat milks, yoghurts and cheeses generally contain 75 per cent (or less)
of the fat in the equivalent full-fat product. It is important to note that soft
cheeses such as cottage cheese and ricotta, whilst low in fat, contain very little
calcium.

Reduced-fat milks are not suitable for children aged less than 2 years: milk is a
major energy source in these children, who are in a period of rapid growth.
Reduced-fat milks are, however, recommended for older children and
adolescents when the diet has diversified.

**Osteoporosis**

Osteoporosis, a condition of low bone mass, can lead to bone fragility and
increased risk of fractures. Most fractures in older adults are related to
osteoporosis; in young adults, trauma is the primary cause of fractures.\(^1\)
Clinically, osteoporosis is measured in terms of bone mineral density that is
below the age-adjusted reference range. Individuals are considered osteoporotic
if their bone mineral density is 2.5 SD or more below the young adult mean.\(^2\)
This criterion identifies about 30 per cent of all post-menopausal women as
having osteoporosis and, of these, more than 50 per cent will have suffered a
previous fracture.\(^2\)

Clinical expression of osteoporosis is not generally seen in childhood or
adolescence, but inadequate development of peak bone mass during this period
is a primary risk factor.

**Background**

Milk foods are a major source of nutrients in the Australian diet. Milk itself is one
of the most complete of all foods, containing nearly all the constituents of
nutritional importance to humans. Milk foods are a key source of protein,
calcium, vitamin A, riboflavin, vitamin B12 and zinc. They do, however, also
provide about one-third of the saturated fat in the diet of children and
adolescents\(^3\); milk itself provides about 20 per cent of the saturated fat in
children and 14 per cent in adolescents, and cheeses provide a further 6–7 per
cent in both children and adolescents. For this reason—and with the exception
of children under 2 years of age—reduced-fat varieties are recommended.
### Table 3.4.1 Nutrient content per 100 grams: milk, yoghurts, cheeses and calcium-rich alternatives

<table>
<thead>
<tr>
<th>Food</th>
<th>Energy (kJ)</th>
<th>Protein (g)</th>
<th>Fat (g)</th>
<th>Sat. fat (g)</th>
<th>Calcium (mg)</th>
<th>Sodium (mg)</th>
<th>Vitamin B₂ (mg)</th>
<th>Vitamin B₁₂ (µg)</th>
<th>Vitamin A (equiv (µg))</th>
<th>Zinc (mg)</th>
<th>Iron (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk: fluid, whole</td>
<td>272</td>
<td>3.3</td>
<td>3.8</td>
<td>2.5</td>
<td>114</td>
<td>51</td>
<td>0.2</td>
<td>0.3</td>
<td>48</td>
<td>0.4</td>
<td>0.1</td>
</tr>
<tr>
<td>Milk: fluid, reduced-fat (fat 1–2%)</td>
<td>203</td>
<td>3.9</td>
<td>1.4</td>
<td>0.9</td>
<td>137</td>
<td>58</td>
<td>0.2</td>
<td>0.3</td>
<td>14</td>
<td>0.4</td>
<td>0.1</td>
</tr>
<tr>
<td>Milk: fluid, low-fat (fat &lt;1.1%)</td>
<td>190</td>
<td>4.6</td>
<td>0.2</td>
<td>0.1</td>
<td>160</td>
<td>66</td>
<td>0.3</td>
<td>0.3</td>
<td>5</td>
<td>0.5</td>
<td>0.1</td>
</tr>
<tr>
<td>Milk: fluid, skim or non-fat (fat &lt;0.16%)</td>
<td>145</td>
<td>3.6</td>
<td>0.1</td>
<td>0.1</td>
<td>123</td>
<td>54</td>
<td>0.2</td>
<td>0.3</td>
<td>0</td>
<td>0.4</td>
<td>0.1</td>
</tr>
<tr>
<td>Yoghurt: regular fat, plain</td>
<td>304</td>
<td>4.7</td>
<td>3.4</td>
<td>2.2</td>
<td>171</td>
<td>77</td>
<td>0.3</td>
<td>0.3</td>
<td>39</td>
<td>0.5</td>
<td>0.1</td>
</tr>
<tr>
<td>Ice-cream: regular</td>
<td>766</td>
<td>3.5</td>
<td>10.6</td>
<td>6.9</td>
<td>119</td>
<td>86</td>
<td>0.3</td>
<td>0.4</td>
<td>140</td>
<td>0.3</td>
<td>0.1</td>
</tr>
<tr>
<td>Ice-cream: reduced-fat</td>
<td>607</td>
<td>4.5</td>
<td>6.0</td>
<td>3.9</td>
<td>130</td>
<td>95</td>
<td>0.3</td>
<td>0.4</td>
<td>80</td>
<td>0.4</td>
<td>0.1</td>
</tr>
<tr>
<td>Cheese: cheddar</td>
<td>1690</td>
<td>25.4</td>
<td>33.8</td>
<td>21.5</td>
<td>775</td>
<td>656</td>
<td>0.0</td>
<td>0.2</td>
<td>390</td>
<td>3.6</td>
<td>0.0</td>
</tr>
<tr>
<td>Soy beverage: fortified, unflavoured</td>
<td>260</td>
<td>3.5</td>
<td>3.5</td>
<td>0.4</td>
<td>116</td>
<td>59</td>
<td>0.2</td>
<td>0.5</td>
<td>39</td>
<td>0.2</td>
<td>0.5</td>
</tr>
<tr>
<td>Soy beverage: low-fat, fortified with calcium</td>
<td>175</td>
<td>3.5</td>
<td>0.5</td>
<td>0.1</td>
<td>110</td>
<td>40</td>
<td>0.2</td>
<td>0.3</td>
<td>39</td>
<td>0.2</td>
<td>0.5</td>
</tr>
<tr>
<td>Tofu: cooked, fat not added in cooking</td>
<td>304</td>
<td>8.1</td>
<td>4.2</td>
<td>0.6</td>
<td>330</td>
<td>7</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>0.7</td>
<td>1.2</td>
</tr>
<tr>
<td>Sardine: canned in oil, drained</td>
<td>952</td>
<td>21.8</td>
<td>15.7</td>
<td>5.1</td>
<td>380</td>
<td>608</td>
<td>0.3</td>
<td>28.0</td>
<td>65</td>
<td>1.8</td>
<td>2.7</td>
</tr>
<tr>
<td>Sardine: canned in water, drained</td>
<td>767</td>
<td>21.8</td>
<td>10.7</td>
<td>2.8</td>
<td>380</td>
<td>608</td>
<td>0.3</td>
<td>28.0</td>
<td>65</td>
<td>1.8</td>
<td>2.7</td>
</tr>
<tr>
<td>Almond: raw</td>
<td>2455</td>
<td>20.0</td>
<td>55.3</td>
<td>3.6</td>
<td>235</td>
<td>6</td>
<td>1.2</td>
<td>0.0</td>
<td>2</td>
<td>3.6</td>
<td>3.5</td>
</tr>
<tr>
<td>Almond: roasted</td>
<td>2618</td>
<td>18.6</td>
<td>60.5</td>
<td>4.2</td>
<td>218</td>
<td>6</td>
<td>1.0</td>
<td>0.0</td>
<td>1</td>
<td>3.3</td>
<td>3.3</td>
</tr>
</tbody>
</table>

### Examples of milk-based and soy foods with limited calcium content

<table>
<thead>
<tr>
<th>Food</th>
<th>Energy (kJ)</th>
<th>Protein (g)</th>
<th>Fat (g)</th>
<th>Sat. fat (g)</th>
<th>Calcium (mg)</th>
<th>Sodium (mg)</th>
<th>Vitamin B₂ (mg)</th>
<th>Vitamin B₁₂ (µg)</th>
<th>Vitamin A (equiv (µg))</th>
<th>Zinc (mg)</th>
<th>Iron (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cheese: cottage</td>
<td>512</td>
<td>15.3</td>
<td>5.8</td>
<td>3.8</td>
<td>73</td>
<td>200</td>
<td>–</td>
<td>0.2</td>
<td>65</td>
<td>0.5</td>
<td>0.0</td>
</tr>
<tr>
<td>Cream: pure (fat &gt;35%)</td>
<td>1660</td>
<td>1.9</td>
<td>42.8</td>
<td>28.3</td>
<td>60</td>
<td>27</td>
<td>0.2</td>
<td>0.1</td>
<td>580</td>
<td>0.3</td>
<td>0.1</td>
</tr>
<tr>
<td>Soy beverage: unfortified, unflavoured</td>
<td>164</td>
<td>2.5</td>
<td>2.1</td>
<td>0.3</td>
<td>13</td>
<td>59</td>
<td>–</td>
<td>1.5</td>
<td>–</td>
<td>0.3</td>
<td>0.4</td>
</tr>
<tr>
<td>Soy beverage: low-fat, unfortified</td>
<td>110</td>
<td>2.5</td>
<td>0.3</td>
<td>0.0</td>
<td>12</td>
<td>40</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>0.3</td>
<td>0.4</td>
</tr>
</tbody>
</table>

Note: The milk analysis is for cow’s milk.

Source: AUSTRNUT food composition tables (FSANZ, 1999) for all nutrients except salt (Nuttab '95) and vitamin B₁₂ (British food tables—McCance & Widdowson).
In particular, milk foods are the richest source of calcium in the Australian diet; few other foods provide such a readily absorbable and convenient source of this nutrient. Calcium is required for the normal development and maintenance of the skeleton. It is stored in the teeth and bones, where it provides structure and strength. In western cultures low intakes of calcium have been associated with osteoporosis, which often results in bone fracture and is one of the main causes of morbidity among older Australians, particularly women. It is worth noting, however, that osteoporosis has its origins in childhood and adolescence.

In the light of the ageing of Australia’s population, in 1986, it was estimated that by 2011 hospital admissions for osteoporotic fractures would increase by 84 per cent. The Dubbo Osteoporosis Epidemiology Study found that, after the age of 60 years, about 60 per cent of women and 30 per cent of men suffer osteoporotic fractures. The most common fracture sites related to the condition are the hip, vertebrae and wrist; hip fractures have the greatest overall public health impact. Considerable morbidity and mortality are associated with hip fractures, and they lead to a substantial decline in physical function. In 2001 it was estimated that the cost of osteoporosis in Australia was $1.9 billion in direct health care costs and a further $5.6 billion in indirect costs associated with loss of earnings, volunteer carers, modifications and equipment.

**Current intake of milk and milk foods**

The 1995 National Nutrition Survey used a 24-hour recall technique supplemented by a qualitative food-frequency questionnaire. The survey had a category of consumption called ‘milk products and dishes’, which includes items such as milks, yoghurts, cheese, cream, ice-cream and milk-based custards, as well as milk substitutes such as soy milks and soy cheeses. On the day of the survey, about 30 per cent of participating children and adolescents aged 2 to 18 years consumed less than one serve of milk products and dishes (where a serve is equivalent to one cup of milk, 35 grams of cheese, 200 grams of yoghurt, or the calcium equivalent). A further 51 per cent consumed between one and three serves, and 20 per cent consumed three or more serves. Intakes were particularly low in 16–18 year old girls, where some 44 per cent consumed less than one serve on the day of the survey and only 12 per cent consumed three serves or more. The *Australian Guide to Healthy Eating*—which is based on the NHMRC core food groups analysis—recommends two to three serves a day for children aged 4–11 years and three to five for adolescents, depending on their preferred eating patterns.

**Scientific basis**

Although milk foods are valuable sources of a number of nutrients, including protein, retinol, riboflavin, vitamin B₁₂ and zinc, the primary rationale for including this food group in the dietary guidelines lies in its role as a rich source of calcium.
The scientific basis for this guideline thus centres on the role of the milk foods as a key source of readily absorbable dietary calcium and the role of calcium (in conjunction with a number of other factors) in attaining peak bone mass and in preventing osteoporosis in later life.

The role of human milk, cow’s milk and milk substitutes in infant nutrition is covered in the Infant Feeding Guidelines for Health Workers, so is not discussed here.

The importance of peak bone mass

The skeleton is in a phase of rapid growth throughout childhood and adolescence. Between birth and puberty it increases in mass about seven-fold and a further three-fold during adolescence.\textsuperscript{12} Studies of factors influencing the accumulation of bone mass in childhood and adolescence have been summarised in a recent review by Zhu et al.\textsuperscript{13}; among these factors are racial and genetic inheritance, body weight, physical activity, nutritional intake (including calcium) and endocrine factors.

The best protection against age-related bone loss and consequent fracture risk is the attainment of a high peak bone mass at skeletal maturity, between 19 and 30 years of age, after which bone mass gradually declines, at a rate that varies from person to person. Calcium seems to be the pre-eminent nutritive factor determining peak bone mass in young adults.\textsuperscript{4,12}

Because approximately 60 per cent of the weight of mature bone is mineral (mainly in the form of calcium phosphate), and because mineralisation occurs as bone matrix is laid down, a continuous supply of calcium in amounts appropriate to the changing needs of growth is essential for healthy bone development during childhood and adolescence.\textsuperscript{12}

It is important to achieve a high peak bone mass: the greater the mass before age-related loss begins the less likely it is that the mass will decrease to levels where fractures may occur.\textsuperscript{1,4} During the adolescent growth spurt, the required calcium retention is two to three times greater than the average level required for the development of peak bone mass.\textsuperscript{14} It is particularly important therefore that an adequate diet is consumed during this period Restricted food intakes at this age are therefore of particular concern, and young girls with very heavy exercise regimes and who restrict their total food intake are at heightened risk of developing an inadequate peak bone mass. During the period that peak bone mass is developing, it is necessary to ingest sufficient calcium to maintain positive balance. This quantity will vary from person to person, depending on individual efficiency of intestinal calcium absorption. Once peak bone mass is achieved, it is maintained without much change for 10 to 20 years.
Calcium balance and bone mass

On balance, evidence suggests that calcium intake in childhood can have long lasting effects on bone mass but also suggest that adequate intakes must be maintained throughout the period of peak bone mass accretion.

Intervention trials in which children were randomised to different calcium intakes have shown short-term changes in bone mineral content. In one trial, in twins averaging 7 years of age, a significant increase in bone mineral density was seen in the radius and lumbar spine after three years of treatment. The controls ingested approximately 900 milligrams a day on average and their twins ingested 1600 milligrams. This higher level was, however, not sustained when they returned to their previous diets. Lee found a similar result in 7-year-old Chinese children receiving a 300-milligram calcium supplement as opposed to a placebo. In this case, there was a significant increase in bone mineral content at mid-shaft radius after 18 months of treatment, but the gain disappeared after an 18-month follow-up period without supplementation. Similar improvements with supplementation have been reported in pre-pubertal children. There is, however, mounting evidence from randomised clinical trials that the bone mass gained in childhood and adolescence through calcium or milk supplementation is not retained after such intervention and that optimal calcium intakes need to be retained throughout the period of attainment of peak bone mass.

Several retrospective studies do suggest that higher calcium intakes throughout childhood are associated with greater bone mass in adulthood.

Most cross-sectional studies of children and adolescents have also shown a positive correlation between dietary calcium and bone mass density, but some have found little or no relationship. It has been proposed that these discrepancies may relate to a threshold below which calcium intake will influence accumulation of bone mass and above which it will not. It has been claimed that for children aged 9–17 years this threshold might be around 1500 milligrams a day.

Studies in adults also confirm the link between calcium and bone mass. A meta-analysis of 27 cross-sectional, two longitudinal and four intervention studies assessing the effect of calcium intake on bone mass in young and middle-aged females and males concluded that overall there was evidence that calcium intakes were positively associated with bone mass in pre-menopausal women, although calcium intake alone accounted for only a small part of the variance in bone mass.

Consequences of low bone density

The consequences of low bone density are mostly expressed at older ages. However, in a 1998 study in New Zealand, Goulding et al. showed that low bone density was more common throughout the skeleton in girls with forearm...
fractures than in those who had never broken a bone; this supports the view that low bone density may also contribute to the risk of fracture in childhood.

Low bone density in adults is associated with an increased risk of fracture: the lower the bone density, the greater the risk. There is evidence that a high calcium intake at older ages slows the rate of bone loss and may reduce the risk of fracture. A number of randomised controlled trials have shown that calcium supplements are effective in slowing bone loss in older women45–48 but a meta-analysis of nine randomised controlled trials of the effect of calcium supplementation on bone density in post-menopausal women49 concluded that, whilst the rate of bone loss was less in supplemented women in the first year of treatment, in the second year it was not. Only a limited number of randomised controlled trials of calcium supplementation have used fracture end-points50–53; these studies have, however, consistently shown a reduction in risk, albeit ranging from 26 to 70 per cent. A systematic review of 14 studies—randomised and non-randomised controlled trials, case-control studies and cohort studies—also concluded that calcium supplements and dietary calcium probably reduce the risk of osteoporotic fractures in women.54

**Milk consumption in childhood and adolescence and adult bone mass density**

A number of retrospective studies have shown that milk consumption in early life has positive effects on adult bone mass density25,55–59, although a study by Ulrich et al. showed no effect.60 A study by Du et al.61, in Chinese girls aged 12–14 years, showed that the intake of milk and milk products was a determinant of bone mineral content—independent of protein, calcium or vitamin D intake—but the significance of this finding in the Australian context is unclear.

**Some factors affecting calcium needs**

**Bioavailability**

For food sources of calcium, content is of greater importance than bioavailability. Calcium absorption efficiency is similar from most foods, but it may be poor from foods rich in oxalic acid (for example, spinach, rhubarb and beans) and phytic acid (seeds, nuts, grains, raw beans and soy isolates). Soybeans have large amounts of phytate but absorption of calcium is still quite high.62 Compared with milk, calcium absorption from dried beans is about half; from spinach it is about one-tenth. Bioavailability from non-food sources such as supplements depends on the dose and whether taken with a meal. In standardised studies of 250-milligram calcium supplements given with a breakfast meal, calcium citrate malate gave a fractional absorption rate of 35 per cent, calcium carbonate 27 per cent, and tricalcium phosphate 25 per cent; this compares with a rate of 29 per cent for calcium from milk.63–66 Efficiency of absorption of calcium from supplements is greatest at doses of 500 milligrams.67,68
Physical activity

It is generally accepted that weight-bearing exercise determines the strength, shape and mass of bone\(^69\), although the mechanisms are still not clear. It is also unclear whether calcium intake influences the benefit gained from exercise. With complete immobilisation, rapid bone loss occurs despite a high calcium intake.\(^70\) In an intervention study in children, calcium and exercise both affected bone mineralisation but the effects appeared to be independent.\(^71\) A review of 16 studies in adults, mostly women, concluded that high calcium intakes (over 1000 milligrams) enhanced the bone mineral density benefits of exercise to different degrees in various parts of the skeleton.\(^72\) The review of calcium requirements undertaken for development of the US dietary reference values\(^73\) concluded there was insufficient evidence to justify different calcium requirements for people with different activity levels.

Sodium

Sodium and calcium excretion are linked in the kidney tubules. A high salt intake increases urinary sodium, resulting in increased obligatory loss of urinary calcium. In post-menopausal women, 500 milligrams of excreted sodium draws 10 milligrams of calcium into the urine.\(^74\) In children and adolescents, urinary sodium is an important determinant of urinary calcium excretion\(^75,76\), but no association has been shown between salt intake or excretion and skeletal development in children. One longitudinal study in post-menopausal women did, however, show a link between high urinary sodium and increased hip bone loss.\(^77\) No study has yet shown a direct link between sodium intake and bone loss or fracture rates. The US dietary reference intakes committee examining calcium requirements\(^73\) concluded that, despite the relatively high salt intake in the United States, the available evidence did not warrant the setting of different calcium requirements for people with different sodium intakes.

Protein

Protein increases urinary calcium excretion but its effect on calcium retention is unclear. Walker and Linkswiler\(^78\) found that urinary calcium increased by about 0.5 milligrams for each gram of dietary protein over about 47 grams a day; the data for children are limited. The US review of calcium requirements\(^73\) concluded that evidence of the effect of protein intake on calcium requirement was not sufficient to recommend different calcium intakes for different intakes of protein.

Requirements and recommended intakes for calcium

Calcium requirements are largely determined by skeletal needs, which increase during periods of rapid growth (such as childhood and adolescence), during pregnancy and lactation, and in later life. Needs can be assessed in a number of ways, among them balance studies, a factorial estimate approach, and changes in bone mineral density or content.\(^79\)
In Australia the calcium requirement has been used to estimate the recommended dietary intake, which is traditionally set to meet the requirements of the majority of the population.\textsuperscript{80} The NHMRC’s current recommended intake of dietary calcium, which was set over a decade ago, in 1991, increases from 700 milligrams a day in 1–3 year old boys, to 800mg/day in boys aged 4–11 years, 1200mg/day in boys aged 12–15 years and 1000mg/day in boys aged 16–18 years. For girls, the recommended intakes are set at 700mg/day at 1–3 years of age, 800mg/day at 4–7 years, 900mg/day at 8–11 years, 1000mg/day at 12–15 years and 800mg/day at 16–18 years.

The continuing revision of the US recommended dietary allowances, or RDAs, is being undertaken by a group of committees under the auspices of the Institute of Medicine.\textsuperscript{73} A new multi-stage form of expression for the recommendations is being used, similar to that first used in the United Kingdom in the early 1990s.\textsuperscript{81} This includes an evidence-based determination of an ‘estimated average requirement’, or EAR, for individuals, the mean and variance of which is used to derive the more familiar recommended dietary allowance for individuals (RDA = EAR + 2SDEAR).

The committee assessing calcium concluded that there was insufficient evidence to establish an evidence-based estimated average requirement for calcium, for any age or gender group. As a result, it did not produce recommended dietary allowances for calcium but instead estimated what it called an ‘adequate intake’ (AI) figure for each age and gender group. An AI for a nutrient is set as an alternative to the RDA where the data are considered insufficient (or not certain enough) to develop a reliable variance estimate for the population. The AI is believed to cover the needs of most people in the population, although the percentage of the population covered by this recommended intake level cannot be specified with confidence.

The AI for calcium for infants aged to 6 months was set at 210 milligrams a day; for infants aged 7–12 months it was set at 270mg/day, for children aged 1–3 years it was 500mg/day, and for children aged 4–8 years it was 800mg/day. For both boys and girls aged 9–18 years the AI was set at 1300mg/day, a figure considerably higher than the current Australian recommended dietary intake, set in 1991.

One group in Australia that may need to pay particular attention to calcium requirements is recent migrants from countries where the background diet is traditionally lower in protein and salt than in Australia and where everyday physical activity may be greater—for example, some Asian countries. If these migrants and their children adopt Australian dietary and lifestyle patterns, their calcium requirement will increase. This group may be at particular risk of developing osteoporosis in the future.
Current intakes of calcium and other nutrients

The National Nutrition Survey found that the mean daily intake of calcium in 2–3 year olds was 834 milligrams; from this, the intake fell to 769mg at age 4–7 years, then rose to 868mg at age 8–11 years, 943mg at 12–15 years and 1047mg at 16–18 years. There was, however, a large differential in the intakes of boys and girls, particularly in adolescence, when girls' intake was about two-thirds that of boys. Milk products and dishes provided two-thirds of the calcium intake of children and adolescents; milk itself provided about 43 per cent of the intake in 2–11 year olds and 35 per cent in adolescents.

In addition, the National Nutrition Survey found that, apart from their role as a source of calcium, milk products and dishes provided some 18 per cent of dietary energy in children aged 2–11 years and 15 per cent in adolescents, 25 per cent of protein in children and 19 per cent in adolescents, 28 per cent of vitamin A in children and 21 per cent in adolescents, 41 per cent of riboflavin (vitamin B₂) in children and 35 per cent in adolescents, 52 per cent of vitamin B₁₂ in children and 45 per cent in adolescents and 24 per cent of zinc in children and 18 per cent in adolescents.

The importance of protein, zinc and vitamin B₁₂ in the diet is discussed in more detail in relation to Section 3.3. Retinol is the preformed form of vitamin A; it is found only in foods of animal origin, although beta-carotene from plant sources can be converted in the body to retinol. It is essential for maintaining epithelial integrity: deficiency can lead to a variety of eye conditions, ranging from inability to see in dim light to conditions causing blindness. Riboflavin is a B vitamin that is important in cell respiration. Deficiency can lead to oedema of the pharynx and oral mucosa, cheliosis, glossitis, angular stomatitis, conjunctivitis, corneal vascularisation and some forms of anaemia. Deficiency has been documented in both industrialised and developing nations and across varying demographic groups.

The National Nutrition Survey found that on the day of the survey the ‘milk products and dishes’ category accounted for 26 per cent of total fat in children’s diets and 22 per cent in adolescents, as well as 38 per cent of saturated fat in children and 33 per cent in adolescents, emphasising the need to promote the low- or reduced-fat varieties. Dairy milk itself provided some 14 per cent of total fat for children and 21 per cent of their saturated fat; for adolescents it provided 9 per cent of total fat and 14 per cent of saturated fat. Cheeses provided 5 per cent of total fat and 6–7 per cent of saturated fat in both children and adolescents. Section 3.6 provides more information on dietary fats and their health effects.
Special groups

Adolescent girls

Because of the importance of attaining a good peak bone mass, it is essential that intakes of calcium in adolescence are maintained. As already noted, however, data from the 1995 National Nutrition Survey show that substantial numbers of adolescent girls consumed less than one serving of calcium on the day of the survey; this compares with a recommendation of three to five servings for adolescents.

Vegetarians

Vegetarian children and adolescents who do not drink milk or consume calcium-fortified soy products should seek advice about whether they need to take calcium supplements. Adherence to a vegetarian diet can influence calcium needs because of the diet’s relatively high oxalate and phytate content. Recent short-term studies have, however, indicated that isoflavone-rich soy protein may have a beneficial effect in terms of bone loss. More research is needed in this area to establish whether there are in fact any long-term benefits for bone health in humans. On balance, lacto-ovo-vegetarians appear to have calcium intakes similar to those of omnivores and similar urinary excretion. One five-year study in post-menopausal lacto-ovo-vegetarians and omnivores with similar calcium intakes showed that these groups lost radius bone mineral density at similar rates. Data on the bone health of strict vegetarians are not available.

Children and adolescents with lactose intolerance

Lactose intolerance is high in Asian communities (at 80–90 per cent) but relatively low in Caucasians (at 10–20 per cent). A 1994 review found limited data available on the extent of lactose intolerance in Australians. At that time, most studies of adult Caucasians showed a rate of 17–20 per cent for lactose malabsorption, with one study showing a rate of only 4 per cent. Data for Aboriginal adults showed rates of 80 per cent or more; for Asian-Australian adults the figure was 80–90 per cent. For children, figures of 3–9 per cent were obtained for Caucasians, 50–90 per cent for various studies in Aboriginal children, and about 50 per cent for children of Mediterranean background. Study numbers for both adults and children were, however, generally very limited.

Small amounts of milk or dairy foods can often be tolerated by people with lactose intolerance, but lactose-free dairy products are available now. Lactose-intolerant people often avoid milk products, although this may not be necessary. Fortified soy milks can also be used for people with lactose intolerance.

Adolescent girls with amenorrhea

Amenorrhea resulting from anorexia is associated with lowered calcium absorption, higher urinary calcium excretion, and a lower rate of bone formation. Exercise-induced amenorrhea results in reduced calcium retention and lower bone mass.
3.4 Include milks, yoghurts, cheeses and/or alternatives

Practical aspects of this guideline

As noted, although milk foods are rich in calcium, they are also high in saturated fat, so it is recommended that reduced-fat varieties and reduced-fat alternatives be encouraged for older children and adolescents. In the case of children aged less than 2 years, reduced- or low-fat milk is not recommended: milk usually forms a much higher proportion of their diet and is a major energy source during this period of rapid growth. As the child grows older and relies less heavily on milk as a source of energy and nutrients, reduced-fat varieties can be introduced, as appropriate.

A variety of calcium-enriched milks that are low in fat are readily available. Low- and reduced-fat yoghurts and cheeses are also available, but low-fat soft cheeses such as cottage cheese and ricotta have very little calcium and cannot be counted as a ‘serving’, even though they may add variety to a low-fat diet.

Low-lactose milks and milk products are now available for people with lactose intolerance. However, children and adolescents who are lactose intolerant can usually consume a sufficient amount of milk, yoghurt and cheese products without developing significant symptoms. If children and adolescents do not want to, or cannot, eat milk foods, the following are examples of what can be substituted in terms of calcium equivalents:

- a cup of calcium- (and vitamin B₁₂-) fortified soy beverage containing 100 milligrams of calcium per 100 millilitres—non-fortified soy beverages do not provide sufficient calcium
- a cup of almonds—although not suitable for young children because of the risk of choking
- five sardines or half a cup of pink salmon (with bones)
- a cup of calcium-fortified breakfast cereal.

Among other ways of encouraging calcium consumption are using milk or calcium-fortified alternatives on breakfast cereals; offering milk-based desserts (puddings, custards or yoghurts), adding skim-milk powder to mashed potatoes and other vegetables; adding milk-based sauces to casseroles and pasta dishes; sprinkling grated cheese on mashed potato, cauliflower, and other vegetables; and substituting cheese spread or plain fromage frais for other fat spreads in sandwiches and on dry biscuits, savoury muffins and toast.

Relationship to other guidelines

In the earlier dietary guidelines—for adults, children and older Australians—there was one guideline dealing with variety in food choice and others encouraging consumption of calcium-rich and iron-rich foods.
For this revision of the dietary guidelines, it was felt that the previous ‘variety’ guideline should be more closely linked to the *Australian Guide to Healthy Eating*, which recommends daily consumption of a variety of foods from five basic food groups:

- vegetables and legumes
- fruit
- breads, cereals and grain
- milk, yoghurt, cheese and alternatives
- meats, fish, poultry and alternatives.

Guidelines on consumption of vegetables (including legumes) and fruit and of breads, cereals and grains were included in earlier guidelines. In this revision, guidelines are included for milks, yoghurts, cheeses and alternatives and for meats, fish, poultry and alternatives. It was also felt that a food-based—rather than a nutrient-based—approach to the guidelines would be more consistent with international trends in the setting of dietary guidelines. As a consequence, calcium-rich foods are included in the milks, yoghurts, cheeses and alternatives guideline and iron-rich foods are included in the meat, fish, poultry and alternatives guideline.

**Physical activity is important for all children and adolescents**

Regular weight-bearing exercise is an important factor in bone mineralisation. Participation in regular physical activity from early childhood will contribute not only to a healthy body weight but also to the attainment of peak bone mass.

**Enjoy a wide variety of nutritious foods**

Milks, yoghurts, cheeses and alternatives are recommended as part of a varied diet to achieve the balance of nutrients required for optimal health. The NHMRC’s core food group analysis\(^9\) confirms a central role for these foods in the Australian diet in this context. As noted, the *Australian Guide to Healthy Eating* includes the milk group as one of its five core food groups.\(^9\)

**Limit saturated fat and moderate total fat intake**

The 1995 National Nutrition Survey\(^3\) found that milk products and dishes contributed some 17 per cent of total fat and 27 per cent of saturated fat to the diet. But these foods are valuable sources of other nutrients, so it is appropriate to choose low- or reduced-fat varieties rather than reducing overall intake in order to limit fat intake. Serves of full-fat cheeses should be limited to three or four times a week. Children under 2 years of age should not be given reduced- or low-fat milks.
3.4 Include milks, yoghurts, cheeses and/or alternatives

**Choose foods low in salt**

There is evidence that high intakes of sodium increase urinary calcium loss. Conservation of calcium is thus an additional reason for following the salt guideline. This is more important for older people, whose ability to absorb dietary calcium may be impaired.

**Conclusion**

The health costs associated with hospital admissions for osteoporotic fractures are high in Australia. An adequate intake of calcium during childhood and adolescence will help attain peak bone mass and delay bone loss and the onset of osteoporosis, consequently reducing the number of related fractures in older people. Milk, yoghurt and cheeses are the most reliable sources of calcium and are readily available and convenient to use. They are also valuable sources of protein, riboflavin, vitamin A, vitamin B₁₂ and zinc. If foods that are high in calcium are part of children’s and adolescents’ daily diet, the physiological, financial and social costs associated with a low-calcium diet will be reduced.

**Evidence**

The scientific rationale for this guideline is based on a variety of evidence sources, among them the following:

- meta-analyses of randomised controlled trials (Level I evidence) relating calcium supplementation to bone density (reference 46)
- well-designed, individual randomised controlled trials (Level II evidence) relating calcium supplementation to bone loss and bone density or fracture (references 34 to 40, 42 to 45 and 48 to 50)
- Level III evidence—a meta-analysis of case-control and cohort studies relating calcium intake to bone mass (reference 41) and a longitudinal study relating sodium and calcium and bone density (reference 75).

Evidence was also obtained from a number of cross-sectional and population studies, as well as human experimentation relating to bioavailability and nutrient requirements and intakes.

**References**

3.4 Include milks, yoghurts, cheeses and/or alternatives


Dietary Guidelines for Children and Adolescents in Australia

3.4 Include milks, yoghurts, cheeses and/or alternatives


3.4 Include milks, yoghurts, cheeses and/or alternatives


3.4 Include milks, yoghurts, cheeses and/or alternatives


3.5 **CHOOSE WATER AS A DRINK**

*Alcohol is not recommended for children*

*Kirsti McVay and Sue Jeffreson*

**BACKGROUND**

Water is an essential nutrient for life. All biochemical reactions occur in it. It fills the spaces in and between cells and helps form structures of large molecules such as protein and glycogen. Water is also required for digestion, absorption and transportation and as a solvent for nutrients, and for elimination of waste products and thermoregulation.

Fluid requirements depend on body size. In the Australian climate very young children (and older adults) are at particular risk of dehydration. Solid foods contribute some water; an additional amount comes from the water produced by the body’s metabolism (water of oxidation). The remainder needs to come from free water or other fluids, or both.

A balance between fluid intake and output is essential for effective body function and for the maintenance of good health. In the Australian climate, children—particularly young children—are often at risk of dehydration. A child’s fluid needs are best met by water and milk, although fruit juice in limited quantities is good and can provide valuable nutrients. Excessive consumption of fruit juice and soft drinks should be discouraged: these liquids have a high sugar and energy content, which may displace other nutrients in the diet and contribute to dental caries.

**Beverage consumption among Australian children and adolescents**

The 1995 National Nutrition Survey, which used a 24-hour recall method, collected information about food and beverage consumption from 13,858 respondents aged over 2 years. Table 3.5.1 shows the results for consumption of beverages (excluding fluids consumed as ingredients of other foods) among children and adolescents.

In all age groups from 2 to 18 years, mineral waters and water (mainly consumed as plain drinking water) made the greatest contribution to fluid intake and contributed at least 50 per cent to the mean daily intake of non-alcoholic beverages. Consumption of other beverages varied by age. Milk consumption was greatest in the 2–3 years age group, whereas soft drink consumption was greatest in the 16–18 years group.
Relatively high amounts of fruit and vegetable juices were consumed in all age groups. Tea and coffee were not consumed in large amounts, although coffee consumption increased markedly in the 16–18 years age group, as did alcohol consumption.

Of the beverages consumed by Australian children and adolescents, milk made the greatest contribution to energy intake—about 10 per cent on average in children aged 2–11 years and 6–7 per cent in adolescents (see Table 3.5.2). Fruit and vegetable juices contributed 4–6 per cent to energy intake, as did soft drinks and mineral water for adolescents. Alcoholic beverages made a very small contribution to energy intake in adolescents.

Table 3.5.1 Mean daily beverage intake (grams/person) of Australian children and adolescents, 1995

<table>
<thead>
<tr>
<th>Beverage</th>
<th>2–3 (n=383)</th>
<th>4–7 (n=799)</th>
<th>8–11 (n=739)</th>
<th>12–16 (n=653)</th>
<th>16–18 (n=433)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk products</td>
<td>416.7</td>
<td>301.0</td>
<td>307.1</td>
<td>320.2</td>
<td>327.8</td>
</tr>
<tr>
<td>Dairy milk</td>
<td>388.0</td>
<td>277.7</td>
<td>283.3</td>
<td>293.3</td>
<td>288.9</td>
</tr>
<tr>
<td>Milk substitutes</td>
<td>16.5</td>
<td>3.7</td>
<td>4.3</td>
<td>1.5</td>
<td>–</td>
</tr>
<tr>
<td>Flavoured milk</td>
<td>12.2</td>
<td>19.6</td>
<td>19.5</td>
<td>25.4</td>
<td>38.9</td>
</tr>
<tr>
<td>Non-alcoholic beverages</td>
<td>808.5</td>
<td>976.9</td>
<td>1168.8</td>
<td>1457.9</td>
<td>1817.8</td>
</tr>
<tr>
<td>Tea</td>
<td>9.9</td>
<td>11.8</td>
<td>22.7</td>
<td>33.3</td>
<td>48.0</td>
</tr>
<tr>
<td>Coffee and coffee substitutes</td>
<td>–</td>
<td>3.0</td>
<td>4.8</td>
<td>16.4</td>
<td>113.3</td>
</tr>
<tr>
<td>Fruit and veg. juices/drinks</td>
<td>285.8</td>
<td>312.8</td>
<td>278.0</td>
<td>298.6</td>
<td>278.0</td>
</tr>
<tr>
<td>Mineral waters and water</td>
<td>453.8</td>
<td>540.6</td>
<td>687.9</td>
<td>845.2</td>
<td>959.7</td>
</tr>
<tr>
<td>Soft drinks, flavoured mineral water and electrolyte drinks</td>
<td>58.3</td>
<td>108.4</td>
<td>174.7</td>
<td>264.1</td>
<td>417.5</td>
</tr>
<tr>
<td>Alcoholic beverages</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>115.5</td>
</tr>
<tr>
<td>Beers</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>83.5</td>
</tr>
<tr>
<td>Wines</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>14.6</td>
</tr>
<tr>
<td>Spirits</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>3.5</td>
</tr>
<tr>
<td>Other</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>13.9</td>
</tr>
</tbody>
</table>

– Zero.
### Table 3.5.2  Contribution of beverages to energy intake and intake of selected nutrients in Australian children and adolescents, 1995

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>2–11 years</th>
<th>12–18 years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Males %</td>
<td>Females %</td>
</tr>
<tr>
<td>Energy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dairy milk</td>
<td>10.3</td>
<td>9.7</td>
</tr>
<tr>
<td>Fruit and vegetable juices/drinks</td>
<td>6.2</td>
<td>6.8</td>
</tr>
<tr>
<td>Soft drinks(^a)</td>
<td>2.6</td>
<td>2.2</td>
</tr>
<tr>
<td>Alcoholic beverages</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Beers</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Wines</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Protein</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dairy milk</td>
<td>16.1</td>
<td>15.4</td>
</tr>
<tr>
<td>Fat</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dairy milk</td>
<td>14.9</td>
<td>13.9</td>
</tr>
<tr>
<td>Total sugars</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dairy milk</td>
<td>11.4</td>
<td>10.7</td>
</tr>
<tr>
<td>Fruit and vegetable juices/drinks</td>
<td>22.2</td>
<td>23.9</td>
</tr>
<tr>
<td>Soft drink</td>
<td>9.8</td>
<td>8.1</td>
</tr>
<tr>
<td>Calcium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dairy milk</td>
<td>44.1</td>
<td>42.5</td>
</tr>
<tr>
<td>Vitamin C</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruit and vegetable juices/drinks</td>
<td>48.8</td>
<td>47.1</td>
</tr>
<tr>
<td>Vitamin A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dairy milk</td>
<td>17.0</td>
<td>15.0</td>
</tr>
</tbody>
</table>

\(^a\) Includes flavoured mineral water and electrolyte drinks.

Note: Only average contributions greater than 10% are listed for nutrients other than energy.

**Scientific basis**

Water is an essential nutrient for life. All biochemical reactions occur in it, and it fills the spaces in and between cells and helps form the structures of large molecules such as proteins and glycogen. Water is also required for digestion, absorption and transportation and as a solvent for nutrients, elimination of waste products and thermo-regulation.\(^3\)

About 60 per cent of the adult human body is made up of water, and about 2.5 litres of water are needed each day to replace water lost from the body.
3.5 Choose water as a drink

Beverages are the main source of this water, although water is also obtained from a range of other foods, such as fruit and vegetables.²

Water lost from the lungs and skin is responsible for half of the total water turnover; the remainder is lost in urine and faeces. The normal daily turnover of water is about 4 per cent of body weight in adults and 15 per cent in infants. Dehydration is defined as a 1 to 2 per cent loss of body weight caused by fluid losses. Among the factors contributing to dehydration are a poor thirst mechanism, dissatisfaction with the taste of water, and increased fluid losses as a result of alcohol and caffeine consumption, exercise, and environmental conditions such as high altitude and low humidity.³

Infants are especially susceptible to dehydration because of the high proportion of their body weight that is water, the high rate of turnover, their relatively large surface area, and their poor thirst mechanism.³ Dehydration can occur in formula-fed infants, particularly when over-concentrated formula has been used. In breastfed infants, however, dehydration is rare—even in very hot weather—provided that the infant has free access to breastfeeding.⁴

Children who are very physically active are more prone to dehydration than adults because they have a relatively low circulating blood volume and a poor thirst mechanism. Any fluids lost through perspiration should be promptly replaced.⁵

Dehydration has been shown to link to a number of health outcomes such as increased risk of kidney stones, increased risk of urinary tract and colon cancer, diminished physical and mental performance as well as increased risk of childhood obesity. Details of these studies are given in the accompanying Dietary Guidelines for Australian Adults.

Practical aspects of this guideline

Different beverage types and their importance for the nutritional health of children and adolescents

Water

Sports Medicine Australia⁶ has recommended that children consume 150–200 millilitres (and adolescents 300–400ml) of fluid 45 minutes before exercise and 75–100ml (and adolescents 150–200ml) each 20 minutes whilst exercising.

Although plain water is considered the most economical source of fluid, flavoured drinks or sports drinks may be more palatable and facilitate fluid replacement. A study by Meyer et al.⁷ found that sufficient fluid intake to offset sweat losses in children aged 9 to 13 years occurred only when flavoured drinks were ingested. The children in the study preferred grape- and orange-flavoured drinks over apple flavour. The management of diarrhoeal disease—which is still
Choose water as a drink

a common cause of mortality and morbidity in children—has been revolutionised by the use of oral rehydration fluids containing both water and electrolytes.

Guidelines have been developed to cover the safety and quality of drinking water in Australia. The water must meet microbiological, physical, chemical and radiological standards to ensure that it satisfies public health requirements.8

Milk

Milk is an excellent source of many nutrients, particularly calcium, protein, riboflavin and vitamin B12.9 Calcium-fortified soy beverages can be used as alternatives to dairy milk. Dietary calcium is important for skeletal growth and in the attainment of peak bone mass in adolescence.10 Attainment of a high peak bone mass at skeletal maturity is considered the best protection against age-related bone loss and fracture. Section 3.4 provides detailed information about current intakes of dairy foods, calcium and other key nutrients in dairy foods and about the importance of dietary calcium.

During the first year of life in non-breastfed infants, infant formula should be given as the main source of milk. Cow’s milk is not recommended for infants. Skim milk and reduced-fat milk should not be used for children aged less than 2 years because these children have higher energy requirements from fat. Between the ages of 2 and 5 years, there is a gradual reduction in the energy requirement from fat, so reduced-fat milks are suitable; skim milk should, however, not be given (see Chapter 2 and Section 3.6). Section 3.6 discusses recommended fat intakes during infancy, childhood and adolescence.

The Australian Guide to Healthy Eating9 recommends that children and adolescents consume two to three servings daily from the dairy group. One glass of milk (250ml) represents one serving.

Soft drinks

Soft drinks have minimal nutritional value and contain large amounts of sugar and energy.11 They come within the ‘extra foods’ category, as defined in the Australian Guide to Healthy Eating.9 ‘Extra foods’ should be consumed only sometimes or in small amounts.

Trends in beverage consumption among children and adolescents over the past few decades suggest that the consumption of soft drinks is increasing and may be replacing more nutritious beverages such as milk and possibly fruit juices.12 In the United States, 12–19 year old females have doubled, and males have tripled, their consumption of soft drinks and have reduced their consumption of milk by more than 40 per cent.

Consumption of cola beverages, in particular, has been associated with bone fractures in physically active girls attending a US high school (mean age 15 years); this may be because of the high phosphoric acid content in cola drinks.13 In addition, caffeine increases the rate of elimination of calcium from the body.14
A low ratio of calcium to phosphorus in the diet may adversely affect calcium balance and increase the risk of bone fractures and osteoporosis in later life.\textsuperscript{15}

A study by Harnack et al.\textsuperscript{12} found that energy intake was positively associated with consumption of non-diet soft drinks in children and adolescents. This has implications for childhood obesity. The authors also suggested that soft drinks displace milk and fruit juice and the nutrients concentrated in these beverages. The intake of some nutrients in milk (calcium, riboflavin, vitamin A and phosphorus) and fruit juices (folate and vitamin C) tended to be lower among adolescents in the highest category of soft drink consumption compared with those in the lower categories.

Obesity rates have risen in conjunction with the increase in soft drink consumption.\textsuperscript{11} A two-year prospective study of 548 school children (mean age 11.7 years) of diverse ethnic background suggested a positive relationship between increased soft drink consumption and obesity. It is possible that the additional energy obtained from drinks does not displace energy obtained from solid foods at subsequent meals. The authors also showed that consumption of diet soft drinks was inversely associated with obesity.\textsuperscript{16}

**Fruit juice**

Fruit juice is an important part of the diet of young children.\textsuperscript{17} It is a good source of vitamins such as vitamin C and folate and also provides carbohydrates, particularly natural sugars. Some varieties of fruit juice contribute small amounts of fibre.\textsuperscript{9} If fruit juice is consumed in excess, however, it can detract from a well-balanced diet and/or lead to problems such as obesity\textsuperscript{18}, failure to thrive\textsuperscript{19}, dental erosion\textsuperscript{20} and dental caries.\textsuperscript{21}

Malabsorption of carbohydrate from juice can contribute to chronic non-specific diarrhoea in children.\textsuperscript{22} The main carbohydrates present in fruit juice are fructose, glucose and sorbitol. A higher ratio of fructose to glucose and the presence of sorbitol in juice—compared with juices that lack sorbitol and contain equal amounts of fructose and glucose—have been implicated in decreased carbohydrate absorption. Apple juice contains less sorbitol and is better absorbed than grape juice, despite a similar fructose–glucose relationship, suggesting that sorbitol may be the most important component associated with malabsorption.\textsuperscript{17}

Excess fruit juice consumption can lead to several outcomes depending on whether the fruit juice displaces other foods or is consumed in addition to an adequate diet. Excess fruit juice consumption has been associated with poor appetite, poor weight gain and loose stools (the ‘squash-drinking syndrome’)\textsuperscript{22} and with failure to thrive in early childhood.\textsuperscript{19} The latter study (1994) suggests that large intakes of apple juice—12–30 ounces a day (about 350–850ml)—may displace foods that are more energy and nutrient dense and/or contribute to malabsorption of carbohydrates or sugars. Both these factors could adversely affect growth, contributing to the development of decreased weight or height, or both. However, a more recent study did not find a higher prevalence of obesity or stunted stature in children consuming 12 ounces or more of fruit juice daily.\textsuperscript{23}
In another study, excessive fruit juice consumption has been linked to obesity in toddlers: 2-year-olds consuming excessive amounts of fruit juice (more than 350ml/day) were shown to have a higher energy intake, which was associated with excessive weight gain.18

The *Australian Guide to Healthy Eating*9 recommends that children and adolescents consume approximately two serves daily from the fruit group. Half a cup of juice supplies one serve from this group. It is important to note, however, that, because of their lower fibre content and their added sugars, fruit juices should not be used as a substitute for fresh fruit.

**Caffeine**

Caffeine is a naturally occurring substance found in many plant species. It is known to stimulate the central nervous system and at high doses can cause nervousness, irritability, anxiety, and disturbances of heart rate and rhythm. Effects on blood pressure, coronary circulation, urine production and secretion of gastric acids have also been documented.24

Caffeine is found in beverages and foods such as tea, coffee, chocolate, cola-type soft drinks and ‘energy drinks’. Coffee contains about three or four times as much caffeine as an equal volume of cola soft drink. The main dietary source of caffeine in Australian children aged 2–12 years is cola-type soft drinks; in adolescents it is coffee. Cola soft drinks may contain added caffeine up to 145 milligrams per kilogram, or 54 milligrams per 375-millilitre can.24

A review of caffeine consumption found that mean daily caffeine consumption among Australian children aged 10–15 years was 1.3 milligrams per kilogram of body weight per day, of which 0.8mg was obtained from soft drinks. This is well within the level of 95mg (3mg/kg/day) at which behavioural changes such as decreased reaction times, increased motor activity and increased restlessness have been observed in children aged 5–12 years. More recent studies have, however, indicated that the earlier studies suffered from methodological problems and used dose levels that were far greater than doses of caffeine consumed by children. Overall, the evidence to suggest that caffeine has adverse behavioural effects on children at current intake levels is inconclusive.24

**Energy drinks**

The term *energy drinks* refers to a group of non-alcoholic water-based beverages characterised by the addition of ‘energy-enhancing’ ingredients. Among these ingredients are a number of water-soluble B vitamins, amino acids and other substances, and caffeine. Most energy drinks contain caffeine levels of up to 80mg/250ml, the equivalent of a strong cup of coffee.25

Energy drinks are a relatively new product in the marketplace in Australia, although they are well established in Europe and the United States. Their marketing is not directed specifically at children, but there is evidence that younger consumers are becoming aware of the product and are attracted to it by the image portrayed.25
Current data on the consumption of energy drinks in Australia are limited. One Australian survey assessed the prevalence of consumption during a two-week period in 1999 but it did not record the quantities consumed or the frequency of consumption.\(^{26}\) The survey found as follows:

- Of the sample of 141 males and females aged 8–12 years, 27 per cent of males and 12 per cent of females had consumed energy drinks.
- Of the sample of 240 males and females aged 12–18 years, 24 per cent of males and 20 per cent of females had consumed energy drinks.

Energy drinks are not considered suitable for children, primarily because of their high caffeine content. At high consumption levels, caffeine and other biologically active substances may exceed known safety levels in children.\(^{25}\)

**Drinks and dental health**

Dental caries, or tooth decay, is the result of repeated acid attacks by bacteria in dental plaque. Fermentable carbohydrates in food and drinks provide the necessary substrate for acid production by bacteria. Acidic drinks such as citrus-based and other juices, carbonated and uncarbonated drinks, sports drinks and herbal teas are likely to exacerbate dental erosion, particularly when associated with habits such as slow sipping and swishing and swilling before swallowing, which cause prolonged contact of acid with tooth surfaces.\(^{27,28}\) Drinking practices that minimise beverages’ contact with the teeth—such as using a straw or squeeze bottle and rapid ingestion—may be important in avoiding the potential erosive effects of these beverages.\(^{28}\)

Early childhood caries, a recognised problem in infants and toddlers, is characterised by extensive and rapid tooth decay. Prolonged sessions of bottle feeding in infants and toddlers are generally thought to provide the carbohydrate substrate that enables high acid production by bacteria. Liquids containing sucrose are the most cariogenic; the potential cariogenicity of milk and infant formula is unclear.\(^{29}\) Infants and toddlers should therefore not be allowed prolonged access, during the day or night, to a bottle containing anything other than water.\(^{30}\)

The relationship between optimal fluoride intake and improved dental health is well established.\(^{31}\) Recent Australian data indicate that exposure to fluoridated water during childhood confers significant benefits in preventing dental caries in both deciduous and permanent teeth. There is no evidence of adverse health effects caused by drinking fluoridated water at current optimal levels.\(^{32}\)

**Children and adolescents and alcohol**

Alcohol is a powerful drug and is not recommended for children. Excessive, long-term alcohol consumption is associated with a variety of adverse health effects. Alcohol consumption among adolescents has increased, and more adolescents are drinking at harmful levels. The National Alcohol Action Plan
1999–2002–03 identifies a range of strategies to help reduce alcohol-related harm in high-risk groups, including young people.

**The effect of alcohol on childhood and adolescent morbidity and mortality**

Alcohol is high in energy—at 29 kilojoules per gram—but is deficient in important nutrients such as vitamins and minerals. High alcohol consumption can depress the appetite, displace other foods from the diet, and interfere with digestion and absorption of nutrients, leading to nutritional deficiencies.

Long-term alcohol consumption is associated with a variety of adverse health consequences, among them cirrhosis of the liver, mental illness, cancer, obesity, and foetal growth retardation. The acute and chronic effects of excess alcohol consumption are described in Section 1.8 of the *Dietary Guidelines for Australian Adults*. Among the adverse social effects related to excess alcohol consumption are drink-driving injuries and fatalities, aggressive behaviour, family disruption and reduced productivity.

Children are more vulnerable to alcohol than adults for a variety of reasons. Because of their smaller physique they metabolise alcohol more slowly. They also lack experience of drinking alcohol and its effects and so have a lower tolerance. This, coupled with increased risk-taking behaviour, can considerably heighten the potential for harm associated with alcohol consumption in adolescents.

Young people, particularly females, are most likely to consume alcohol in a hazardous and harmful way. In 1998 two-thirds of young women aged less than 25 years who drank alcohol reported consuming, on average, more than two glasses a day. Regular and excessive alcohol consumption in the early months of pregnancy can cause foetal alcohol syndrome, which results in intellectual and physical irregularities in the foetus. If they are consuming alcohol, females should also be aware of the possibility of drinks being contaminated with other substances for the purpose of inducing stupor and should ensure that they are not put at risk in social situations.

Alcohol consumption at all levels in younger age groups is associated with increased mortality, predominantly through violence and accidental injury. It has been estimated that, in people aged 15 to 34 years, 47 per cent of alcohol-related deaths were the result of road injuries.

Alcohol consumption is often associated with drug use; in these situations the effects of the alcohol or other drug(s) can be exaggerated or moderated. Adolescents have reported that alcohol removes their inhibitions and alters their judgment, increasing their likelihood of experimenting with other drugs. In 1998, 47 per cent of 14–19 year old recent drinkers also smoked marijuana; this was the highest proportion across all age groups.
Young Australians’ alcohol consumption

Alcohol plays a fundamental role in adolescent culture and features strongly in most social and recreational activities. Although levels of alcohol consumption among Australian adults have decreased in the last 10 years, more young people are drinking alcohol, drinking at an earlier age, and drinking at higher levels.\(^{35}\)

The 1998 National Drug Strategy Household Survey found that over two-thirds of adolescents aged 14–19 years were recent drinkers (that is, had consumed alcohol in the past 12 months). Of these, 30 per cent were regular drinkers (consumed alcohol at least once a week) and 41 per cent were occasional drinkers (consumed alcohol less than weekly). More adolescent males (33 per cent) than females (27 per cent) were regular drinkers.\(^{38}\)

Adolescents do not necessarily view drunkenness as harmful and are the group most likely to consume alcohol in a hazardous or harmful way or to deliberately drink to the point of intoxication. Binge drinking is common among under-age drinkers.\(^{37}\) In 1998 one in 10 teenagers who were regular drinkers drank more than 12 standard drinks in a typical day, and this was more common among males (14 per cent) than females (6 per cent).\(^{38}\)

The type of alcohol consumed varies between males and females. In 1998, among adolescent males the most popular alcoholic beverage was regular beer (67 per cent), whilst bottled spirits were the beverage of choice for females (63 per cent); low-alcohol beer was the least favoured beverage (9 per cent).\(^{38}\)

Influences on alcohol consumption

Peer-group norms are an important influence on the use of alcohol in adolescence.\(^{37}\) Under-age adolescent drinkers are most commonly introduced to their first alcoholic drink by a friend or acquaintance.\(^{38}\) Other factors contributing to alcohol consumption during adolescence are the perceived benefits, such as alcohol’s relaxant qualities, enjoyment, to gain confidence, to bond with a peer or social group, to experiment, to lose control, and to get drunk.\(^{37}\)

Family life in early childhood is believed to be an influential factor in the establishment of alcohol misuse in later life. Among the risk factors are parents’ substance abuse, ineffective parenting, inconsistent or harsh discipline, lack of support, and lack of mutual attachments and nurturing.\(^{34}\) Exposure to alcohol before the age of 6 years and lax parental attitudes to alcohol may also increase vulnerability to frequent heavy drinking in adolescence.\(^{39}\)

Research has shown that, in cultures where alcohol is introduced to young people in a supportive family setting, alcohol-related problems tend not to arise in adolescence; this contrasts with countries where alcohol is officially not available.\(^{35}\)

Public health strategies

The National Alcohol Action Plan 1999–2000 to 2002–03 identifies key strategy areas for helping to reduce alcohol-related harm.
Young people are seen as one of a number of groups in the Australian community who are at higher risk of harm caused by alcohol consumption. As a result, young people drinking is the focus of a number of harm-minimisation educational initiatives, such as the National Alcohol Campaign. The campaign was developed through qualitative and quantitative research, involving detailed examination of prevailing attitudes, perceptions and behaviours among adolescents. Other National Alcohol Action Plan strategies that are directed at young people are alcohol education programs in schools and tertiary institutions, drink-driving campaigns, and the development of guidelines for ‘responsible’ drinking behaviour. The National Health and Medical Research Council has recently reviewed the 1992 Responsible Drinking Guidelines to provide population groups with up-to-date guidance on safe levels of alcohol consumption.

Among the action plan’s other strategies for reducing alcohol-related harm in adolescents are the use of identity cards providing proof of age; controlling the price, availability and advertising of alcohol; labelling alcoholic beverages with alcohol-content information; and devotion of resources to discouraging drink-driving.

**Relationship to other guidelines**

**Children and adolescents need sufficient nutritious foods to grow and develop normally**

A balance of nutrients and energy is important for appropriate growth in children and adolescents. Excessive consumption of soft drinks and fruit juice can contribute significantly to energy intake and detract from a well-balanced diet, leading to an increased risk of obesity or underweight.

**Enjoy a wide variety of nutritious foods**

Food contains water. A varied diet contributes to meeting water requirements in children and adolescents.

**Eat plenty of vegetables, legumes and fruits**

Fruit juice should not be consumed as a substitute for fresh fruit. Fresh fruit is a good source of dietary fibre and is of higher nutritional value than fruit juice.

**Include milks, yoghurts, cheese and/or alternatives**

Dairy foods and their alternatives (such as calcium-fortified soy drinks) are a rich source of calcium, protein, riboflavin and vitamin B12. Calcium is important in the attainment of peak bone mass during adolescence and in the prevention of osteoporosis. Reduced-fat milks are not suitable for children aged less than 2 years.
Limit saturated fat and moderate total fat intake

Cow’s milk is unsuitable for children aged less than 12 months. Skim milk and reduced-fat milk should not be given to children aged less than 2 years; over that age, reduced-fat milks are appropriate.

Consume only moderate amounts of sugars and foods containing added sugars

Excessive consumption of sugar-sweetened beverages can contribute to obesity and dental caries in children. Prolonged sucking from a bottle containing carbohydrate-rich fluids is a possible risk factor for caries in infants and toddlers. Flavoured carbohydrate drinks such as sports drinks may be more palatable and promote higher fluid intakes in exercising children.

Conclusion

Adequate fluid consumption is an integral component of a healthy diet. Water is a good source of fluids as it can hydrate without adding additional energy to the diet. Nevertheless other drinks such as milks, fruit juices, low energy soft drinks beverages can add variety and in some cases (eg milks and juices) can add valuable nutrients to the diet. Intakes of fluids containing substantial amounts of added sugars should be moderated. Alcohol is not suitable for children.

Evidence

There is Level III evidence of the effect of hydration on thirst and on drink preference (reference 7); of the effect of carbonated beverages on bone fracture in adolescence (references 13 and 15); of a link between sugar-sweetened drinks and childhood obesity (reference 16); and of excessive fruit juice consumption in preschoolers compromising stature and obesity (reference 18) and causing failure to thrive (references 19 and 22), although one recent study (reference 23) showed no relationship to childhood growth.

Some of the other consequences of low fluid intakes have been studied primarily in adults; the evidence for this is discussed in the Dietary Guidelines for Australian Adults and the Dietary Guidelines for Older Australians. Evidence relating to health effects of alcohol is discussed in the Dietary Guidelines for Australian Adults.

References

3.5 Choose water as a drink


3.5 Choose water as a drink


32. Ahokas JT, Demos L, Donohue DC, Killalea S, McNeil J, Rix CJ. *Review of water fluoridation and fluoride intake from discretionary fluoride supplements: report to NHMRC*. Melbourne: Key Centre for Applied and Nutritional Toxicology & Department of Applied Chemistry, RMIT, & Department of Epidemiology and Preventive Medicine, Monash University, 1999.


3.5 Choose water as a drink


3.6 LIMIT SATURATED FAT AND MODERATE TOTAL FAT INTAKE

Low-fat diets are not suitable for infants

Geoffrey Davidson

Terminology

Fats
Chemically, most of the fats in foods are triglycerides, made up of a unit of glycerol (glycerine) combined with three fatty acids, which may be the same or different. The differences between one fat and another are largely a consequence of the fatty acids they contain, which together make up 90 per cent of the weight of the molecule. Fats in the diet can be ‘visible’ or ‘invisible’. Among the visible fats are butter, margarine, cooking oils, and the fat on meat. Invisible fats occur in foods such as cheese, sauces, mayonnaise, biscuits, cakes, pastries and nuts. In most diets, about half the fats are visible and half invisible.

Fats are the most concentrated form of energy—37 kilojoules per gram. They are the chemical form in which most of the energy reserve of animals and some seeds is stored.

Saturated fats
In saturated fats the majority of the fatty acids, in chemical terms, contain no double bond; that is, they are fully saturated with hydrogen. Saturated fats are usually solid at room temperature. They are the main type of fat in milk, cream, butter and cheese, in some meats (most of the land animal fats), and in palm oil and coconut oil. Most predominantly saturated fats contain one or more of the fatty acids palmitic (16:0), myristic (14:0) and lauric (12:0). When these predominate in dietary fat, they tend to raise plasma cholesterol.

Mono-unsaturated fats
In mono-unsaturated fats the main fatty acid is oleic acid (18:1), which has one (mono) double (unsaturated) bond. Olive, canola and peanut oils are rich in oleic acid.
Polyunsaturated fats

In polyunsaturated fats the main fatty acid contains two or more (poly) double (unsaturated) bonds. These fats are liquid at room temperature; that is, they are oils. The most common polyunsaturated fatty acid is linoleic acid (18:2); its double bonds are in the n-6 position, and it occurs in seed oils—for example, sunflower oil, safflower oil and corn oil. Smaller amounts of polyunsaturated fatty acids with double bonds in the n-3 position also occur in the diet; best known are those in fatty fish, their names abbreviated to EPA (20:5 eicosapentaenoic) and DHA (22:6 docosahexaenoic). Another n-3 polyunsaturated fatty acid, ALA (18:3 alpha linolenic), occurs in small amounts in leafy vegetables; there is more of it in canola oil and most in flaxseed oil.

BACKGROUND

Fat is the nutrient that provides the most concentrated source of energy and is an essential source of fat-soluble vitamins and essential fatty acids. The guideline on fat intake for the adult population is not suitable for young children, particularly children to the age of 2 years. Restriction of the fat intake of children aged up to 2 years may interfere with optimal energy intake and reduce the supply of essential fatty acids needed by developing nervous tissue, thus adversely affecting growth and development.

Neurological development is particularly rapid in the first two years of life. Growth and tissue replacement require 30 per cent of energy intake in infants, compared with only 5 per cent in adults. Thus even a small energy deficit during this period of rapid growth may affect growth.1

As children grow older, however, another problem emerges—the increasing prevalence of overweight and obesity in our community. There is evidence of a significant increase in overweight and obesity in the 2–6 year age group.2 A high-fat diet is very energy dense, contributing to an excess energy intake and the development of obesity. Even at a young age, a diet high in saturated fats may predispose to the development of cardiovascular disease later in life.

A 1997 Finnish randomised prospective clinical trial showed that in the under 2 age group a fat intake of less than 30 per cent of total calories did not compromise nutrient intake or lead to an increased sucrose intake.3 The study also suggests that current recommendations for fat intake in the first two years of life are an overstatement. The total fat intake data were similar to those for Australian children.3 These new guidelines do not recommend a change for the under 2 age group, but in the 2–5 year age group a lower fat intake is recommended.

Another important factor in recommending change concerns the educational process. Optimal dietary habits should be inculcated early in life. A 1995 Australian study found no difference in the relative amount of fat in the diet of children aged 3 months to 8 years.4 Evidence from the Finnish study that a
targeted dietary intervention program can bring about a change in children’s intake of saturated fat suggests that a health-oriented dietary intervention program for children, with a particular emphasis on fat, should be supported.

**Current fat intake and sources of fat in the diet**

About 50 per cent of the energy in breastmilk is fat. In older infants and children, milk becomes a less important source of fat, being replaced by the fat content of solid foods. The 1995 National Nutrition Survey found that in children and adolescents aged 2 to 18 years fat contributed about 33 per cent of energy intake (see Table 3.6.1). This is very similar to the total fat intake recorded in the 1985 National Dietary Survey. The previous edition of the Dietary Guidelines for Children and Adolescents recommended for children aged 2–5 years a fat intake of 35–40 per cent of total energy intake; the current data put the intake at 33 per cent of total fat intake. Similarly, for children aged 5–14 years the recommendation was a fat intake providing 35 per cent of total calories, which has already been achieved. The recommendation for adolescents was 30 per cent of total calories from fat; this level has not yet been achieved.

Table 3.6.1 also shows the contributions of saturated, mono-unsaturated and polyunsaturated fatty acids to the diet in children and adolescents; at all ages saturated fats account for the highest proportion of fat intake. The figures are similar to those obtained from dietary surveys of children in Adelaide and Western Australia.

| Table 3.6.1 Percentage contribution of fatty acids and total fat to energy intake: 1995 National Nutrition Survey, by age and gender |
|---|---|---|---|---|---|
| Category | Age (years) | 2–3 | 4–7 | 8–11 | 12–15 | 16–18 |
| Males | Saturated fatty acids | % | % | % | % | % |
| | Mono-unsaturated fatty acids | 10.7 | 11.3 | 11.4 | 11.6 | 12.1 |
| | Polyunsaturated fatty acids | 3.8 | 4.1 | 4.3 | 4.2 | 4.4 |
| | Total fat | 33.2 | 32.9 | 33.2 | 33.6 | 33.2 |
| Females | Saturated fatty acids | % | % | % | % | % |
| | Mono-unsaturated fatty acids | 16.1 | 14.4 | 14.7 | 13.8 | 13.2 |
| | Polyunsaturated fatty acids | 10.9 | 11.1 | 11.8 | 11.5 | 10.9 |
| | Total fat | 3.7 | 4.0 | 4.3 | 4.3 | 4.0 |
| | Total fat | 34.1 | 32.4 | 34.2 | 33.2 | 31.9 |

Note: Saturated, mono-unsaturated and saturated fatty acids together account for about 90 per cent of total fat.
### Table 3.6.2 Percentage of total fat contributed by selected food groups and foods: 1995 National Nutrition Survey, by age and gender

| Food group or food                              | 2–11 years |   | 12–18 years |   |
|------------------------------------------------|------------|------------------|------------------|
|                                                | Males %    | Females %        | Males %          | Females %        |
| Cereals and cereal products                    | 6.1        | 5.8              | 5.7              | 5.9              |
| Regular breads and rolls                       | 3.3        | 3.0              | 2.9              | 3.3              |
| Cereal-based products and dishes               | 19.3       | 18.1             | 20.0             | 20.0             |
| Sweet biscuits                                 | 3.4        | 3.3              | 2.2              | 2.1              |
| Vegetable products and dishes                  | 8.2        | 8.6              | 11.8             | 9.8              |
| Potatoes                                       | 7.5        | 7.7              | 10.5             | 7.8              |
| Milk products and dishes                       | 26.6       | 26.4             | 22.8             | 20.6             |
| Dairy milk                                     | 14.9       | 13.9             | 10.1             | 7.9              |
| Cheese                                         | 4.6        | 4.7              | 4.9              | 5.1              |
| Meat, poultry and game products and dishes     | 14.9       | 14.0             | 17.5             | 18.0             |
| Muscle meat                                    | 2.7        | 2.3              | 4.5              | 3.9              |
| Fish and seafood products and dishes           | 1.1        | 1.7              | 1.2              | 1.9              |
| Egg products and dishes                        | 1.3        | 1.6              | 1.4              | 1.0              |
| Snack foods                                    | 4.3        | 4.7              | 3.7              | 4.3              |
| Potato snacks                                  | 2.3        | 2.8              | 2.3              | 2.5              |
| Confectionery                                  | 3.6        | 4.2              | 3.6              | 4.8              |
| Chocolate and chocolate-based confectionery    | 2.4        | 3.2              | 3.1              | 4.3              |
| Seed and nut products and dishes               | 1.9        | 2.7              | 1.2              | 1.5              |
| Nuts and nut products                          | 1.9        | 2.7              | 1.1              | 1.5              |
| Fats and oils                                  | 9.8        | 9.6              | 8.6              | 8.3              |
| Dairy fats                                     | 1.6        | 1.8              | 1.4              | 1.8              |
| Margarine                                      | 7.8        | 7.4              | 6.8              | 5.8              |
3.6 Limit saturated fat and moderate total fat intake

Table 3.6.2 shows the proportion of total fat obtained from selected food groups by children and adolescents. The main sources of fat in both these age groups were milk products and dishes and cereals and cereal products. The intake of milk products and dishes decreased in adolescent girls. Particular foods’ contribution to fat intake varied according to the type of fat. For example, milk products accounted for about 30–40 per cent of saturated fat intake, and fats and oils accounted for about 5–10 per cent; in contrast, milk products accounted for about 5 per cent of polyunsaturated fat intake, whereas fats and oils accounted for about 20 per cent. Snack foods such as sweet biscuits, cakes, buns and pastries were moderate sources of fat intake at all ages but their contribution has increased since the 1985 dietary survey, now amounting to 18–20 per cent of total fat intake. This is most noticeable in the younger age group, where the 1985 survey showed a contribution of around 15 per cent for the under 10 age group.

Figure 3.6.1 shows that among children aged 2–11 years dairy milk was a major source of saturated fat. For adolescents, milk products provided 30–40 per cent of the saturated fat intake. This proportion decreased significantly in adults.
3.6 Limit saturated fat and moderate total fat intake

Scientific basis

Role of fat in the diet

Fat is an integral part of the diet. It provides a concentrated form of energy for growth and development and constitutes about 50 per cent of energy intake in early infancy. It also provides essential fatty acids, particularly the n-3 polyunsaturated fatty acids required by the body for cell structure, membrane function and the development of the central nervous system. Further, it is a source of precursors for eicosanoid synthesis—for example, prostaglandins, thromboxanes and leukotrienes—and a vehicle for transporting fat-soluble vitamins. In addition to these nutritional functions, fat contributes to the taste, texture and palatability of foods.10

There is some evidence that an adequate intake of cholesterol during the growth period is important for cholesterol metabolism later in life and for myelinisation of the nervous system, neurologic development in general, the formation of hormones essential for growth and sexual maturation, and the production of bile acids.11,12 However, this largely ignores the fact that the human body is capable of synthesising sufficient cholesterol for all its metabolic needs.13,14 It is also well established that the cholesterol-elevating effect of dietary cholesterol is rather less than that of saturated fats.15

Overweight and obesity in children and adolescents: prevalence and contributing factors

Excess body weight is the most common medical problem in Australia.2 It is also a major global public health concern.3,16

The most practical way of measuring obesity and overweight in clinical practice is to use the body mass index—weight (kilograms)/height (metres)². In childhood, BMI changes with age, so age-related reference charts are needed. This complicating factor has recently been addressed by the International Obesity Task Force, which has published BMI-for-age reference values setting the childhood percentile for overweight and obesity on the basis of adult BMI ranges.17 As a result, national data can now be analysed to determine point prevalence, identify secular trends, and allow meaningful international comparisons.

According to the most recent National Health and Nutrition Examination Survey in the United States, approximately 25 per cent of children in that country are overweight or obese.18 In Australia, there is evidence that the prevalence of obesity in children is increasing2,19,20, although current national prevalence figures are not available. Ethnicity21 and socio-economic status22 are important factors contributing to obesity in Australian children. In a recently published review of the prevalence of overweight and obesity in Australian children and adolescents, data from two national samples taken 10 years apart were reviewed and the new International Obesity Task Force definition applied.2 Depending on age, 13–26 per
cent of boys aged 2–18 years and 19–23 per cent of girls of that age are overweight or obese, the prevalence peaking at 12–15 years in boys and 7–11 years in girls. These rates, for both overweight and obesity, are higher than those for all the international reference populations and considerably higher than those in Australia in 1985.2

Overweight and obesity in childhood constitute a risk factor for a range of immediate and long-term problems, among them diabetes, high cholesterol levels, hypertension, sleep apnoea, musculoskeletal problems, liver disease23 and psychological problems (particularly in girls).24 Children who are overweight beyond the age of 7 years are at greater risk of obesity and cardiovascular disease in adulthood.25 The global epidemic of increasing overweight and obesity is attributed to changing lifestyle—decreasing activity26, increasing inactivity and increasing food energy intake.

Management of childhood obesity is difficult and relies heavily on the parents and a lifestyle change, particularly a change in the whole family’s eating habits, increased habitual physical activity, and decreased inactivity.27 A recent Adelaide study suggests that parents or guardians of overweight or obese children may not perceive the children as having a fat or obese body shape, and nor might the children themselves.28 This has implications in terms of families seeking advice about management of overweight or obese children.

Recommendations on children’s fat intakes

Although there is concern that limiting fat in the diet of young children may compromise growth and development—which seems unlikely29—the most controversial area in this regard concerns fat’s connection with the development of coronary heart disease in adulthood. There is, however, good evidence that overweight and obese children and adolescents are at greater risk of obesity in adulthood.30

A number of overseas organisations have recommended a general decrease in fat intake—to between 30 and 35 per cent of energy intake—for adults and for children over 2 years of age. Among those making this recommendation are the Canadian Paediatric Society31, the American Heart Association32, the American Health Foundation13, the National Cholesterol Education Program Expert Panel on Blood Cholesterol Levels in Children and Adolescents33 and the National Institutes of Health Consensus Development Panel.34 The basis for the recommendation can be summarised as follows:

- Compared with their counterparts in many other countries, US children and adolescents have higher blood cholesterol levels and higher intakes of saturated fatty acids and cholesterol, and adults have higher blood cholesterol levels and higher rates of morbidity and mortality from coronary heart disease.33,34
- Autopsy studies show that early coronary atherosclerosis or its precursors often begin in childhood and adolescence.13,33
3.6 LIMIT SATURATED FAT AND MODERATE TOTAL FAT INTAKE

- High serum total low-density lipoprotein and very low density lipoprotein cholesterol levels and low high-density lipoprotein cholesterol levels are correlated with the extent of early atherosclerotic lesions in adolescents and young adults.33
- Children and adolescents with elevated serum cholesterol, particularly LDL, often come from families in which there is a high incidence of coronary heart disease among adult members.33
- High blood cholesterol aggregates in families as a result of both shared environments and genetic factors.33
- Children and adolescents with high cholesterol levels are more likely than the general population to have high cholesterol levels as adults.13,33
- Dietary behaviour—the principal modifiable contributor to atherosclerosis—particularly an excessive intake of saturated fats, originates in childhood and probably has an impact, physiologically and behaviourally, early in life.13
- The importance of plasma cholesterol in coronary heart disease has been confirmed by many trials with cholesterol-lowering drugs, even in people with average US plasma cholesterol levels.35

On the other hand, a number of individuals and other organisations—such as the American Academy of Paediatrics Committee on Nutrition, the Dietitians Association of Australia, the Australian College of Paediatrics, and the UK Committee on Medical Aspects of Food Policy—advocate a more cautious approach in applying adult fat-intake guidelines to children and adolescents.11,36–39 Australian recommendations also support caution because many foods with a significant fat content are rich in nutrients and are important components of a healthy diet.40

The following views have been expressed about adoption of the diet recommended by the American Heart Association and other groups:

- Epidemiological studies are not of themselves sufficient to establish cause-and-effect relationships.11
- In diseases of multiple aetiology involving genetic factors, it is necessary to understand the extent to which dietary intervention and individual responses are related.11
- Successful implementation of a public health nutrition program requires the active support of the health-related professions.11
- The safety of diets that are designed to decrease consumption of fat and cholesterol has not been established for growing children.11–15
- It has not been demonstrated directly, by appropriately controlled studies, that dietary modification in children will alter the incidence of coronary heart disease in later life.34,36–38,41,42
- Children who have cholesterol levels in the high range will not necessarily have levels in the same range when they reach adulthood.42
On balance, however, the accumulating evidence of the increased incidence of overweight and obesity in our community, suggests that recommendations should now be made about taking care with children’s fat intakes. The evidence supports giving advice on fat intakes at an early age, and certainly under 5 years. There is also evidence that introducing healthy eating patterns in early childhood influences dietary patterns in later childhood. Previous discussions have targeted cholesterol and the potential hazards of cholesterol-lowering diets, but the aim of this guideline is to reduce total fat, particularly saturated fat, in the diet.

Implications of the recommendations on children’s fat intakes

Unsupervised restriction of infants’ and young children’s dietary fat intake can lead to growth failure and chronic non-specific diarrhoea. A high proportion of hypercholesterolaemic patients who were advised to eat a low-fat diet chose diets that would not sustain normal pubertal growth and weight gain; for example, they consumed too little milk, other dairy products, meat and eggs. Additionally, the diets often provided insufficient energy and inappropriate quantities of the vitamins and minerals that are essential for normal growth and development. The findings of these studies have been attributed to inadequate consumption of energy or inadvertent starvation of children by misinformed parents. The reports highlight the need to distinguish between two particular situations: a clinical need to reduce fat intake because of potential risk in a known disease state; and dietary recommendations for an otherwise healthy group of individuals who are overweight or obese.

In older children with a strong family history of cardiovascular disease or familial hypercholesterolaemia, where treatment is indicated the diet should aim to reduce total and saturated fat, substitute polyunsaturated and mono-unsaturated fats for saturated fat, and decrease dietary cholesterol. Carbohydrate can replace some of the energy from fat, but an experienced dietitian and a paediatrician must carefully monitor the children’s growth and development.

Low-fat diets and the need for supervision

When restricting fat in children’s diets, careful attention needs to be paid to educating parents about the importance of a well-balanced diet, taking account of the alterations needed for adequate intakes of nutrients. Children should be monitored to ensure that they are consuming a suitable diet.

Recommended targets for fat intakes during infancy, childhood and adolescence

The recommendations that follow propose a further drop in the total fat content of young children’s and adolescents’ diets. This can be justified on the basis of the increasing incidence of overweight and obesity and the role played by high-
fat foods. The Finnish study\(^3\) also showed that many children obtain less than 30 per cent of total calories from fat without detrimental effects.\(^4\)

The following guidelines cover the paediatric age periods of birth to 2 years, 2 to 5 years, 5 to 14 years, and adolescence.

**A. Birth to 2 years**

In the first six months of life fat is an important source of energy. In breastfed and formula-fed infants, fat intake should make up approximately 50 per cent of energy intake.

For non-breastfed infants, infant formula—not cow’s milk—should be the primary milk feed in the first year of life. This is because formula has a higher iron content and a complete nutrient profile (see Chapter 3 for further discussion). In the latter part of the first year of life and during the second year of life, the target should be approximately 40 per cent of energy as fat.

The fat content of milk becomes less important with age because other foods that contribute fats and oils are eaten. However, skim milk (less than 0.5 per cent fat) and reduced-fat milk (1.5–2.5 per cent fat) should not be used in children aged less than 2 years.

**B. Two to 5 years**

Between the ages of 2 and 5 years there will be a gradual increase in the proportion of energy derived from carbohydrate and a gradual reduction in the proportion of energy from fat. Children in this age group are already consuming a diet containing 33 per cent fat, so a target of 30 per cent is recommended—with no more than 10 per cent from saturated fat. Reduced-fat milks should be used but skim milk should not be used for children aged less than 5 years.\(^5\) This should not prevent its use, however, in family meals—for example, in custard and ice-cream.

**C. Five to 14 years**

For children between the ages of 5 and 14 years, approximately 30 per cent of energy intake as fat—with no more than 10 per cent coming from saturated fat—is appropriate. This will have no deleterious effects on nutrition or growth.\(^6\) The use of skim milk as a major dairy source is appropriate in this age group.

**D. Adolescence**

For adolescents, approximately 30 per cent of energy intake as fat—with no more than 10 per cent coming from saturated fat—is desirable. This should be accompanied by emphasis on physical activity and a balanced nutrient intake. Section 1.6 of the *Dietary Guidelines for Australian Adults* is relevant to adolescents.
3.6 Limit saturated fat and moderate total fat intake

Practical aspects of this guideline

For infants under the age of 6 months, breastmilk provides a suitable amount and type of fat.

When solid foods are introduced, the advice given in Chapters 2 and 3 here should be followed.

Reduced-fat milk may be used from the age of 2 years, when milk plays a less dominant role in the diet of the child.

Strategies for modifying the type and amount of fat consumed, as outlined in Section 1.6 of the Dietary Guidelines for Australian Adults, are important for older children and adolescents. Reid et al. offer a number of suggestions for fostering positive attitudes and practices in relation to moderating fat intake:

- Encourage children to be moderate in their use of high-fat sauces, salad dressings, and spreads such as butter and margarine.
- Trim visible fat from children’s meat.
- Limit the use of processed meats such as hot dogs, luncheon meats and sausages.
- Limit fried foods such as French fries and fried fish or chicken to very occasional use, and use polyunsaturated and mono-unsaturated cooking oils when preparing them.
- Choose lower fat foods when eating at fast-food restaurants—for example, milk instead of milkshakes, single meat patties and pasta instead of pizza.
- Provide fruit and vegetables or bread as snacks, rather than potato crisps, biscuits or pastries. Use crisps and pastries as ‘treat foods’ only.
- Use reduced-fat or low-fat dairy foods for all children over the age of 5 years.

Relationship to other guidelines

Children and adolescents need sufficient nutritious foods to grow and develop normally

- Growth should be checked regularly
- Physical activity is important for all children and adolescents

Activity has a positive effect on weight control, and obesity is often related to overeating, including overeating of high-fat foods.
Include milks, yoghurts, cheese and/or alternatives

Section 3.4 highlights the point that dairy foods are a major contributor of both total fat and saturated fat. But dairy foods are also a valuable source of other nutrients—particularly calcium—so it is important for older children and adolescents to choose low- or reduced-fat products where possible. Reduced-fat milks are not suitable for children aged less than 2 years.

Conclusion

In the first six months of life fat is an important source of energy. In breastfed and formula-fed infants, fat intake should make up approximately 50 per cent of energy intake. Between the ages of 2 and 5 years there will be a gradual increase in the proportion of energy derived from carbohydrate and a gradual reduction in the proportion of energy from fat. For children above the age of 5 yrs and for adolescents approximately 30 per cent of energy intake as fat—with no more than 10 per cent coming from saturated fat—is desirable.

Evidence

The evidence for chronic disease outcomes related to high intakes of saturated fat is discussed in Section 1.6 of the Dietary Guidelines for Australian Adults.

In addition, there is also Level III evidence that overweight or obesity in childhood increases the risk of obesity and cardiovascular disease in adulthood (references 25 and 30). There is Level IV evidence of a relationship between obesity and liver disease (reference 23) and psychological problems (reference 24) in children and Level IV evidence that growth failure can result from low-fat, low-cholesterol diets in young children (reference 12). Because of concerns about maintaining adequate growth and development in early childhood, it is not possible to conduct randomised trials dealing with intakes of fat and saturated fat in early childhood. There are, however, several Level III studies from Finland (references 3 and 29) showing no deleterious effects on growth or neurological development of limiting fat intake in children followed from age 7 months to 5 years.

References


3.7 CHOOSE FOODS LOW IN SALT

Malcolm Riley and Trevor Beard

Terminology

Salt and sodium

Dietary salt is an inorganic compound consisting of sodium and chloride ions. It is found naturally in many foods, but it is also added to many foods because of its preservative and flavouring characteristics. Research has shown that both the sodium and the chloride can be detrimental to health when consumed in excess. About 90 per cent of all the sodium added to food is sodium chloride, so dietary intake of sodium represents intake of sodium chloride for practical purposes. Sodium in the diet of Australian adults comes mostly from processed foods, although sodium added in cooking, at the table, in medications and naturally present in foods can contribute to the total dietary intake.

Recommended intake for sodium

The current National Health and Medical Research Council recommendations for sodium intakes among Australian children and adolescents are 140–280 milligrams a day for infants, 460–1730mg/day for 1–3 year olds, 600–2300mg/day for 4–7 year olds, and 920–2300mg/day for children aged 8 years and over and for adolescents. This last amount is the same as the recommendation for adults.

One thousand milligrams of sodium is contained in about 3 grams of common salt, or just over half a teaspoon.

Low-salt food

Food Standards Australia New Zealand defines a low-salt food as a food with a sodium concentration of up to 120 milligrams per 100 grams (Joint Australia and New Zealand Food Code, clause 17 of Standard 1.2.8).

The following are the conversion factors for the units used to express the sodium content of food:

- 1mmol = 23 milligrams
- 1 gram = 43mmol

One gram of sodium chloride (NaCl) contains 17mmol, or 391 milligrams, of sodium.
**BACKGROUND**

Cardiovascular disease is the largest cause of premature death and death overall in Australia; it accounted for 50,797 deaths, or 40 per cent of all deaths, in 1998. Most of these deaths are caused by coronary heart disease (55 per cent), followed by stroke (24 per cent). Each year about 40,000 Australians have a stroke; 70 per cent of these are first-ever strokes. Stroke is the cause of nearly 25 per cent of all chronic disability in Australia. Hypertension is the problem most frequently seen by general practitioners, accounting for 5.7 per cent of all problems they see. In 1995 an estimated 2.8 million Australians aged 18 years and over reported a recent and/or long-term cardiovascular condition. High blood pressure was the most common condition for both males and females.

Although male and female death rates from cardiovascular disease in Australia declined by about 3.6 per cent a year between 1985 and 1996, the number of people with the disease is expected to increase in the next few decades as the number of older people increases and life-sustaining treatments improve. The total direct costs to Australia of cardiovascular disease were estimated to be $3719 million in 1993–94, which represents 12 per cent of total health care costs for all diseases.

It is now well accepted that a reduction in dietary sodium intake will decrease the mean population blood pressure and reduce the prevalence of hypertension. It has not yet been conclusively demonstrated that a mean dietary sodium intake within the range recommended for Australian adults will result in lower morbidity and mortality rates than at present, but the balance of evidence suggests it will. Similarly, it has not been demonstrated that maintaining a mean dietary sodium intake within the range recommended for Australian adults will result in a lower incidence of hypertension—that is, prevent the occurrence of hypertension—but, again, the balance of evidence suggests it will. It has been said that ‘few measures in preventive medicine are as simple and economical and yet can achieve so much’. There is strong evidence that other components of the diet also influence blood pressure; this guideline focuses, however, on the independent influence of sodium.

The risk of stroke and ischaemic heart disease increases continuously with blood pressure, as shown by nine major prospective cohort studies. Within the range of diastolic blood pressure studied (about 70–110mmHg), there is no evidence of a threshold below which the relationship alters. If dietary salt were decreased by an average of 3 grams (50mmol sodium) a day, the average systolic blood pressure of people aged over 50 years of age would be expected to fall by about 5mmHg; diastolic blood pressure would be lowered by about half as much. The minority who are hypertensive would experience a greater average blood pressure fall, but the reduction in the number of new cases of cardiovascular disease would be greatest for the large proportion who are close to average blood pressure. It has been estimated that a reduction in dietary salt by an average of 3 grams a day in an entire western population would reduce age-
specific stroke mortality by about 22 per cent and ischaemic heart disease mortality by about 16 per cent.9,11

A recent review12 has pointed to a number of health conditions other than raised blood pressure that are associated with excess sodium intake. Among them are any condition exacerbated by water retention (including heart failure, cirrhosis, nephrotic syndrome, and idiopathic and cyclical oedema), stroke (independently of blood pressure), gastric cancer and left ventricular hypertrophy. Excess sodium intake also increases the rate of deterioration in kidney function in patients with renal disease, is associated with urinary stones, and may aggravate asthma13 and osteoporosis. Excretion of sodium is associated with an obligatory loss of calcium as a result of interference with the tubular reabsorption of calcium. Calcium is conserved on low salt intakes and wasted on high salt intakes. This has relevance to calcium stones of the urinary tract (the commonest variety of stone) and osteoporosis.

For infants, ingestion of foods high in sodium can lead to death because the kidneys are not fully developed until many months after birth. In July 1999 the press reported that a British coroner had heard, from two paediatricians at Sheffield Children’s Hospital, evidence that a 3-month-old baby boy had died of hypernatraemia after an attempt at weaning him onto solid foods containing too much salt. The parents found the recommended baby food too expensive, so used a standard (adult) breakfast cereal plus instant mashed potatoes and gravy. The gravy was made with ordinary commercial gravy granules, which are very high in sodium.

Weaning is not recommended until 6 months of age, and most makers of canned baby foods offer them for use from this age. The new Food Standards Code for Australia and New Zealand stipulates the total amount of sodium allowed in foods for infants (Standard 2.9.2). The maximum amount is 100 milligrams per 100 grams in flours, pasta and ready-to-eat foods, but the limitations of contemporary food technology are at present being accommodated by an allowance of 300mg/100g for biscuits and 350mg/100g for teething rusks. In comparison, the sodium content of breastmilk is 18mg/100g.

Little is known about current intakes of salt in Australian children and adolescents.

Scientific basis

It is uncommon for high blood pressure to express itself in children and adolescents, although the precursors of and risk factors for the condition can be identified from an early age. It is recommended that good eating practices be established at an early age, so as to avoid the development or expression of high blood pressure in later life.

Food preferences seem to emerge early in life, although the nature of the progression of these preferences to adulthood is not clear.15 Children’s food
preferences are influenced by food exposure, parents’ food preferences, parental role modelling, family approaches to food buying and cooking, media exposure, and parent–child interaction regarding food.\textsuperscript{15}

Breastmilk contains about 8mmol per litre of sodium\textsuperscript{14}, so breastfed infants receive about 7mmol of sodium each day. Infants’ immature kidneys have difficulty excreting an overload of salt, and their diet needs to comply with the adult dietary guideline to choose low-salt foods, which are defined in the Food Standards Code as foods with a sodium content up to 120 milligrams per 100 grams. Compliance with the adult guideline would also help prevent young children from becoming habituated to the taste of foods with a high salt content; this habituation develops within a few weeks of exposure.\textsuperscript{16}

Studies of the association between sodium intake and blood pressure are more common in adults than children, but at least one study suggests that early exposure to dietary sodium may have lasting effects. In a six-month randomised trial of almost 500 bottle-fed newborns, the group whose sodium intake was reduced by 50 per cent had a 2.1mmHg lower systolic blood pressure than the control group.\textsuperscript{17} Of the 35 per cent of subjects who could be traced 15 years later, those originally receiving the low-sodium formula had a blood pressure that was on average 3.6mmHg (systolic) and 2.2mmHg (diastolic) lower.\textsuperscript{18}

The evidence that dietary sodium is associated with blood pressure in children is, however, inconsistent. A cohort study\textsuperscript{19} of 233 children examined the association between sodium and potassium intakes and change in blood pressure. The subjects were followed for an average of seven years, each providing at least six annual, timed overnight urine collections. Urinary sodium was found to be unrelated to change in blood pressure over time; urinary potassium and the urinary sodium–potassium ratio were related to a rise in systolic blood pressure.

Adolescents are particularly prone to an increased sodium intake because their energy needs increase greatly, resulting in a commensurate increase in food intake, and their increased independence and disposable income encourage a greater intake of foods prepared outside the home, which may be more heavily salted than foods prepared at home.

Increased excretion of calcium in response to a higher intake of sodium may be more important in childhood and adolescence than in adulthood because of the need to develop the highest possible peak bone mass during adolescence. Peak bone mass is one of the determinants of the development of osteoporosis in later life.

The scientific literature relating dietary sodium intake to blood pressure is extensive and dates back more than 100 years.\textsuperscript{20} Here it is possible only to summarise the state of current knowledge, highlight important studies, and draw attention to important considerations. The literature provides evidence that different commentators can interpret similar scientific results quite differently, but there is general consensus on most issues.
It is generally agreed that the extent to which a reduction in dietary sodium intake reduces blood pressure depends on age and initial blood pressure; it is greater with age and at higher blood pressures. Law et al. found that the full effect of dietary sodium reduction on blood pressure is not seen for at least five weeks after the dietary change.

Among the major original studies are animal studies and human studies. Controlled experiments in chimpanzees have shown an important effect of dietary salt reduction on blood pressure, consistent with earlier experiments on rats. For chimpanzees that were allocated a high-sodium diet for only two years, up to six months of a return to their normal low-sodium diet was required before blood pressure lowering had reached its greatest extent.

In relation to human populations, three recent reviews are in agreement that dietary sodium reduction is associated with reduction in blood pressure. Kuller and Law have called for a public health approach to lowering salt in the diet—that is, for the average salt intake of the population to be lowered through reducing the amount of salt entering the food supply. Alderman, however, calls for randomised controlled studies of the long-term health benefits and safety of dietary sodium reduction and concludes, ‘Without knowledge of the sum of the multiple effects of a reduced sodium diet, no single universal prescription for sodium intake can be scientifically justified’. The mass addition of salt to the food supply depends on technology, however, and is a relatively recent phenomenon; further, it has never been scientifically justified. Societies without the necessary technology for mass addition of salt to the food supply still exist—and their members are all normotensive throughout life, with little, if any, increase in blood pressure with age.

**Meta-analyses of sodium and hypertension trials**

Law et al. took an approach that differs from a standard meta-analysis. They analysed cross-sectional data from 24 communities worldwide, involving more than 47 000 people, and derived relationships between dietary sodium intake and blood pressure that depended on age, centile in the blood pressure distribution, and the level of development of the community. They tested the relationships on 14 studies examining the association of blood pressure with sodium intake within populations—importantly, after adjusting for the large effect of regression dilution bias. They found that the within-population associations were consistent with the relationships estimated using between-population data. Finally, they examined how closely the results from 68 crossover trials and 10 randomised controlled trials conformed to the relationships they originally estimated from the between-population studies. They found that, for the 33 trials lasting five weeks or more, the observed reductions in blood pressure were similar to the predicted values (within a 95 per cent confidence interval for 30 of the trials). For trials lasting less than five weeks, they found that the predicted fall in blood pressure was less than the observed fall, which led them to conclude that dietary sodium reduction does not have its full effect on blood pressure until at least five weeks after
intervention begins. The consistency of results from different study types and in different populations has increased the investigators’ confidence in their estimates for the relationship between dietary sodium intake and blood pressure.9

Cutler et al.’s meta-analysis, published in 199728, updates an earlier meta-analysis conducted by Cutler and others.29 They included 32 trials in their analyses and concluded, ‘The blood pressure reduction that would result from a substantial lowering of dietary sodium in the US population could reduce cardiovascular morbidity and mortality’. Midgley et al.30 included a total of 56 trials in their analysis and concluded, ‘Dietary sodium restriction might be considered, but the evidence in the normotensive population does not support current recommendations for universal dietary sodium restriction’. Graudal et al.21 included 58 trials of hypertensive people and 56 trials of normotensive people in their analysis and concluded, ‘These results do not support a general recommendation to reduce sodium intake ... but ideally trials with hard end points such as morbidity and survival should end the controversy’. It is important to note that the mean duration of the studies in the Midgley et al. meta-analysis was only two weeks, and in the Graudal et al. analysis it was seven days. Table 3.7.1 summarises the results of the meta-analyses.

<table>
<thead>
<tr>
<th>Meta-analysis</th>
<th>Diastolic blood pressure (mmHg)</th>
<th>Systolic blood pressure (mmHg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midgley et al. 1996</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normotensive subjects</td>
<td>0.5</td>
<td>1.6</td>
</tr>
<tr>
<td>Hypertensive subjects</td>
<td>3.8</td>
<td>5.9</td>
</tr>
<tr>
<td>Hypertensive subjects</td>
<td>0.8</td>
<td>1.5</td>
</tr>
<tr>
<td>Hypertensive subjects</td>
<td>1.9</td>
<td>3.9</td>
</tr>
<tr>
<td>Normotensive subjects</td>
<td>0.3</td>
<td>1.2</td>
</tr>
<tr>
<td>Hypertensive subjects</td>
<td>1.9</td>
<td>3.9</td>
</tr>
</tbody>
</table>
The question is how to interpret the different conclusions between meta-analyses. The first point to be made is that the estimated effects are not greatly different from one another. The overall effects are lower than what might be expected with full dietary compliance because the inclusion of all randomised subjects (‘intention to treat’ analysis) dilutes the number of subjects actually complying with the intervention treatment. In determining the extent to which change in dietary sodium will change blood pressure, there are four effect-modifying factors: the magnitude of the change in sodium intake; the age of the subjects; the initial blood pressure of the subjects; and the duration of the intervention. Ideally, one would like to conduct meta-analyses at different levels of these factors, as has been done for normotension versus hypertension.

Many of the studies included in the meta-analyses were of short duration and conducted on young people. This would tend to decrease the effect observed. The studies involving larger reductions in dietary sodium also tended to be the shorter ones because of the current difficulty in maintaining a free-living population at a low sodium intake for a long period. In addition, technical factors—such as how to weight individual trials and how to construct a summary regression line—differed between meta-analyses. The choice of methodology alters the summary estimates considerably.

In effect, the meta-analyses indicate what might be expected from a dietary sodium reduction intervention undertaken in the current food environment, where avoiding dietary sodium is relatively difficult. Even under these circumstances, there is a fall in blood pressure for both hypertensive and relatively young normotensive subjects.

No randomised controlled trials have been conducted to test the effectiveness of dietary sodium reduction for primary prevention of hypertension. Furthermore, there is little information from randomised controlled trials about the effect of dietary sodium reduction on mortality or morbidity from cardiovascular disease.8

Two large randomised controlled trials whose results were published after the meta-analyses—the DASH-Sodium trial31 and the TONE study32—warrant discussion.

DASH-Sodium was a sequel to the first DASH (Dietary Approaches to Stop Hypertension) study.33 Both were multi-centre randomised controlled trials for a dietary period of 30 days. The first study held sodium constant at 130mmol/day and compared the standard American diet with an ‘ideal’ diet that emphasised fruits, vegetables, low-fat dairy foods, fish, legumes, nuts, and lean meat and poultry; DASH-Sodium repeated the experiment at three sodium levels—104mmol/day (approximately the US guideline) plus or minus 39mmol/day (that is, 143, 104 and 65mmol/day). The first DASH study observed a highly significant fall in blood pressure with the ‘ideal’ diet, indicating the benefits of a diet that decreased total and saturated fat and cholesterol and increased dietary potassium, calcium, magnesium, fibre and protein in relation to the standard American diet. The DASH-Sodium study demonstrated incremental further falls in
blood pressure at 104mmol/day and 65mmol/day of sodium, confirming that an otherwise ideal diet is more effective when it includes a sodium-reduction guideline. All the food was provided to the participants, thus enabling better control of the important confounding variable of dietary compliance; this is an important difference between DASH-Sodium and previous sodium studies.

The mean decrease in systolic blood pressure when changing from 143mmol/day on the control diet to 65mmol/day on the DASH diet was 7.1mmHg in normotensives and 11.5mmHg in hypertensives, the latter deriving as much benefit as they might expect from antihypertensive medication.\textsuperscript{34} While on the control diet only and changing from 143mmol/day to 65 mmol/day, the change in systolic blood pressure was 9.8mmHg for African-Americans with hypertension and 6.8mmHg for other racial groups with hypertension. The mean decrease in diastolic blood pressure between the high and low sodium intakes was \(-3.5\text{mmHg (95\%CI: \(-2.6 to \(-4.3\)) on the control diet and \(-1.6\text{mmHg (95\%CI: \(-0.8 to \(-2.5\)) on the DASH diet. The combined effects on blood pressure of low sodium intake and the DASH diet were greater than the effects of either intervention alone and were substantial.\textsuperscript{34,35}

The first DASH trial was widely misinterpreted as having negated the importance of other factors in hypertension such as overweight, alcohol and sodium intake\textsuperscript{31}, but the design of the first study deliberately omitted the well-established factors in order to test the other general dietary guidelines.\textsuperscript{34} Long-term health benefits of the DASH-Sodium diet remain to be demonstrated, but this large randomised controlled trial with high subject retention rates and excellent compliance with dietary protocols has provided compelling evidence that true reduction of dietary sodium has a substantial effect on blood pressure. The effect on normotensives was enough to justify it as a guideline for the whole population and to predict a substantial effect at the population level.\textsuperscript{34,35}

The TONE study was a randomised controlled trial of reduced sodium intake or weight loss in hypertensives aged 60 to 80 years.\textsuperscript{32} Of the 975 subjects, 585 were obese and 390 were not. Withdrawal of hypertensive medication was a goal for all subjects. Follow-up visits at nine, 12 and 30 months had attendance rates of 91, 86 and 86 per cent respectively.

The sodium-reduction group reduced their intake by a mean of only 46.6mmol/day at nine months, 49.3mmol/day at 18 months, and 39.5mmol/day at 30 months. The goal for sodium reduction was a total intake of 80mmol/day or less, and only about 38 per cent of the subjects met this target at each visit, compared with about 11 per cent in the control groups. This modest compliance rate resulted in about a 30 per cent decrease in the need for antihypertensive medication in the sodium-reduction group and a better result in subjects who combined weight loss with sodium reduction. The modest dietary sodium reduction of about 40mmol/day was well tolerated and sustained, and the subjects reported no adverse effects.\textsuperscript{32}
Special groups

Children of hypertensives

The children of a hypertensive person are at particular risk because of the genetic link and/or shared environment. From earliest childhood and throughout life they have a heightened need for low-salt foods that comply with the adult dietary guideline for salt. Such an eating pattern is easier to maintain when the whole family has the same diet.

Specific population groups

Mortality from cardiovascular disease is higher among Indigenous Australians, in rural areas and among socio-economically disadvantaged groups.7 Little information is available on the salt intake of Indigenous Australians. A survey of the food habits of adults living in Victoria36 found that Indigenous Australians—whether living in the city or in rural towns—were much more likely than European Australians to add salt to cooked food.

Practical aspects of this guideline

Relationship to the Australian Guide to Healthy Eating

The Australian Guide to Healthy Eating37 focuses on food and food selection. Individuals should avoid choosing higher salt foods and replace them with foods in the same group that are lower in salt. Much of the salt intake of Australians comes from recommended foods—such as bread, cereals and cheese—and other frequently consumed foods such as butter, margarine and snack foods. Although equivalent studies have not been conducted in Australia, it has become apparent that the source of most dietary sodium in western countries is not discretionary salt.38–42 In particular, cooking salt is a much less important source than was once thought. James et al.38 used lithium as a marker and found that only a quarter of cooking salt actually enters the consumed food: the rest is discarded with the cooking water. Table 3.7.2 shows the origin of dietary sodium as measured in the two studies.

Although it is important to advise people to consume less salt and to buy low-salt foods, the widespread use of salt in processed food and food prepared away from home is a major barrier to achieving any meaningful reduction in dietary sodium intake. If the important public health objective of reducing the mean intake of sodium for all people to at least the top end of the recommended dietary intake range42 is to be achieved, far-reaching action is necessary. Realistic medium-term policy objectives would include a gradual reduction in the amount of salt added to processed food and consumer-friendly labelling showing the sodium content of food.
3.7 Choose foods low in salt

### Table 3.7.2 Estimated percentages of sodium intake from different sources in two studies

<table>
<thead>
<tr>
<th>Sodium source</th>
<th>James et al.(^{38})</th>
<th>Edwards et al.(^{39})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural</td>
<td>10.0</td>
<td>18.5</td>
</tr>
<tr>
<td>Added in food manufacturing</td>
<td>75.0</td>
<td>65.0</td>
</tr>
<tr>
<td>Discretionary</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooking</td>
<td>9.0</td>
<td>9.0</td>
</tr>
<tr>
<td>At table</td>
<td>6.0</td>
<td>6.0</td>
</tr>
</tbody>
</table>

A recommendation that food manufacturers reduce the amount of salt added to their products is not without precedent. In 1982 the NHMRC Working Party on Sodium\(^{43}\) recommended that food manufacturers be asked to do this; foods such as bread, cheese, butter, margarine, processed meats and snack foods were named as items of critical importance. Food manufacturers responded to this call with the range of reduced- and low-salt alternatives now available. A 1995 survey of 63 brands of processed food sold in Australian supermarkets found an overall decrease in sodium concentration of 10 per cent compared with 15 years previously, the greatest change being evident in convenience foods, cheeses, potato crisps and breakfast cereals.\(^{44}\)

In 1993 the US National High Blood Pressure Education Program Working Group called for food processors to lower the sodium content of their products\(^{45}\), and there is at least some evidence that a modest reduction may have occurred.\(^{46}\) Information on sodium content is now included on food labels (in terms of density or standard serve), but it is easy to confuse salt and sodium and consumers may not be aware of the definition of a low-salt food. As with other nutrients, the sodium content usually needs to be considered in terms of the actual amount of the food consumed. It is particularly difficult for consumers to obtain compositional information on prepared food such as takeaway foods and restaurant meals.

When consumers reduce the amount of salt in their diet, the rated intensity of salt in a solid food increases and the concentration of salt in soup and crackers that previously produced maximum pleasantness decreases.\(^{47,48}\) The effects are observed within two months, although they may take many months to reach their full extent. In clinical trials, moderate sodium reduction was not associated with physical complaints or with impairment of quality of life.\(^{49,50}\)

### Sodium sensitivity

The sensitivity of people’s blood pressure response to dietary sodium varies\(^{50-52}\), and salt sensitivity may be related to mortality independently of blood pressure.\(^{53}\) Salt sensitivity appears to be a continuous phenomenon\(^{54}\), and its definition is
arbitrary; however, it appears to be reproducible in individuals. A clinically practical means of identifying salt sensitivity is yet to be found. It has been shown that the prevalence of sensitivity increases with age, raising doubts about the persistence of a determination of being ‘insensitive’ to dietary salt. Salt sensitivity is also associated with defective endothelial-dependent vasodilation in people with hypertension, although the reason for this is not understood. Salt sensitivity is an area of active research, and a better understanding of the mechanisms involved will probably improve our understanding of the health effects of dietary salt intake.

**Changes needed to current diet**

The recommended dietary intake for Australian adults for sodium is 40–100mmol/day (920–2300mg), with no extra recommendation for pregnancy or lactation. The following are the recommendations for children and adolescents:

- for children aged to 6 months, 6–12mmol (140–280mg) per day
- for children aged 7–12 months, 14–25mmol (320–580mg) per day
- for 1–3 year olds, 20–75mmol (460–1730mg) per day
- for 4–7 year olds, 26–100mmol (600–2300mg) per day
- for 8–18 year olds, 40–100mmol (920–2300mg) per day—the same as for adults.

To achieve this intake, children and adolescents should consume fresh food, foods normally processed without salt, and low-salt or no-added-salt groceries, and they should avoid adding salt to food. Among the substitutes for salt are acidic ingredients such as vinegar, lemon, lime, plum and other fruit juices; curry spices; garlic and onion; and herbs. These flavour substitutes may, however, be inappropriate for children who have never been habituated to salt: parents should take care not to rely on their own taste perception of salt when flavouring food for their children.

Sodium intake is poorly measured by many dietary survey methods that are used to measure other food components because foods of similar type vary widely in their sodium content (for example, breakfast cereals) and dietary addition can be discretionary but not easily quantifiable (for example, adding salt when cooking and at meals). Measuring sodium output in urine over a 24-hour period is an accurate way of estimating sodium intake: about 93 per cent of dietary sodium is recovered in the urine. Day-to-day variation in sodium intake is high, so intake for a single day generally does not accurately reflect a person’s usual long-term intake.

The sodium intake of Australian children and adolescents has not been measured in large population surveys. As a consequence, the extent to which this population group meets the recommended intake for each age is not known. But it is known that most adults overconsume salt by a large amount—as discussed in the Dietary Guidelines for Adult Australians—and it is likely that the same applies to children and adolescents.
People wanting to achieve a low sodium intake should choose low-salt foods—that is, with a sodium content up to 120 milligrams per 100 grams. Fresh foods such as fruit, vegetables, meat, milk and yoghurt are well under the sodium limit but most manufactured foods are well over it. Breads have a sodium content typically as high as 400–725 milligrams per 100 grams. ‘Salt-free’ bread can be difficult to find, but it (and other low-salt products) should be sought out. People used to a higher salt intake will at first miss the taste of salt when they begin a lower salt intake. But the palate adapts to lower sodium levels, and people will find that the intensity of salt in food increases and their ‘preferred saltiness’ of food reduces. Changes will be noticed within a week and taste change will continue for many months.

**Salt in relation to prevention of iodine deficiency**

Iodine deficiency disorders were once common in several Australian states, and a traditional control measure has been the sale of iodised salt. Only table salt is iodised, however, and its use has declined to the point where in a Hobart survey in 1995 over 50 per cent of both sexes stated that they neither cooked with salt nor used it at the table. Mild iodine deficiency is now regarded as an important cause of preventable mental retardation, and it is alarming that urinary excretion has revealed moderate to severe iodine deficiency, even in a survey of outpatients (including pregnant women) at a metropolitan hospital in Sydney. Adherence to the salt guideline reduces salt’s availability as a vehicle for iodine, and iodine fortification of one or more staple foods, such as bread, may need to be considered.

**Relationship to other guidelines**

The first edition of the *Dietary Guidelines for Children and Adolescents* contained the guideline ‘Choose low-salt foods’. This current review concurs that the most rational way of achieving a lower sodium intake is through choosing low-salt foods, but the wording of the guideline has been changed slightly to emphasise that many foods are naturally low in salt and that consumption of specially manufactured ‘low-salt’ foods is not the only way to limit one’s salt intake. Although discretionary use of salt is an important source of dietary sodium for many people, a single-focus, simple message is considered an important priority for this guideline.

This dietary guideline is consistent with each of the other guidelines presented here. Many manufactured foods have a large amount of salt added; these should be avoided while maintaining (or attaining) a healthy intake of breads and cereals and fruit and vegetables. A lower dietary sodium intake would be much more easily achieved if manufacturers in general were to decrease the amount of salt added to their products—following the lead that some manufacturers have set—and consumers were easily able to assess the sodium content of manufactured food.
Many diet-related factors are likely to be helpful in treating hypertension and limiting the risk of developing the condition. Among these are maintaining a healthy body weight, a moderate alcohol intake, and a relatively high potassium intake, and opting for a diet high in fruits and vegetables and low-fat dairy products (the DASH diet).

**Conclusion**

The past decade has seen the emergence of international consensus that a modest reduction in dietary sodium intake for people with normal and raised blood pressure has a sufficiently large effect on blood pressure (and therefore health) to justify a guideline advising restraint for the entire population. This consensus is strongly supported by a large and well-conducted randomised controlled trial in which subject retention was high and dietary compliance was optimised by providing all of the food throughout the trial period.

The proportion of the population who would benefit at older ages from a lower intake of dietary sodium is becoming increasingly large, yet salt in foods is difficult to avoid, mainly because of the large amount added by food manufacturers. A lifelong intake of dietary sodium within the recommended range would obviate the often-stated difficulty of reducing dietary sodium intake in later life. The Australian diet contains an unnecessarily large amount of salt, and a gradual reduction will certainly benefit the large numbers of people currently destined to develop hypertension; it would probably also benefit a substantial proportion of people who will otherwise develop disease—in particular, cardiovascular disease.

Primary prevention of hypertension poses one of the greatest challenges for public health in the 21st century, and reducing dietary salt is a leading population health strategy for achieving this goal.

**Evidence**

There is strong evidence that reducing dietary sodium reduces average blood pressure in groups of people whose blood pressure is raised. The evidence comes from well-conducted randomised controlled trials and is supported by meta-analyses of these—Level I evidence (references 21 and 28 to 30). The size of the effect is clinically important and is larger for older individuals and at higher blood pressures. The effect appears to be evident for ‘high-normal’ blood pressure; that is, when blood pressure is not high enough to be categorised ‘hypertensive’. The evidence is relevant even though randomised controlled trials have not been conducted to assess mortality or morbidity outcomes other than change in blood pressure.

There is also Level II evidence (references 9, 24, 31 to 33, 47 and 48), Level III evidence (references 10, 20 and 52) and Level IV evidence (reference 49) of the relationship between blood pressure and salt reduction. Further, there is Level II
Choose foods low in salt

evidence of a relationship between sodium intake and blood pressure in infants (references 17 and 18) and Level III evidence that urinary sodium–potassium ratios relate to rising blood pressure in children (reference 18).

The evidence that reducing dietary sodium levels to the recommended intake of 40–100mmol (920-2300 mg) a day causes adverse health effects is weak. Adverse health effects have not been observed in the randomised controlled trials conducted to date. Adverse health effects that become apparent over long periods seem unlikely, given the low dietary sodium intake observed in many populations without apparent specific ill-effect and the presumed low dietary sodium intake by humans—by analogy with other terrestrial mammals—over much of their history.

References


3.7 Choose foods low in salt


11. Law MR. Epidemiologic evidence on salt and blood pressure. *Am J Hypertens* 1997;10:428–45S.


3.8 **CONSUME ONLY MODERATE AMOUNTS OF SUGARS AND FOODS CONTAINING ADDED SUGARS**

*Colin Binns*

**Terminology**

**Carbohydrates**

Carbohydrates are polyhydroxy aldehydes, ketones, alcohols, acids, their simple derivatives, and their polymers having linkages of the acetal type. They can be classified according to their degree of polymerisation and can be divided initially into three principal groups—sugars, oligosaccharides and polysaccharides (see Table 3.8.1).

**Table 3.8.1 The major dietary carbohydrates**

<table>
<thead>
<tr>
<th>Class (DP)</th>
<th>Subgroup</th>
<th>Components</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugars (1–2)</td>
<td>Monosaccharides</td>
<td>Glucose, galactose, fructose</td>
</tr>
<tr>
<td></td>
<td>Disaccharides</td>
<td>Sucrose, lactose, trehalose</td>
</tr>
<tr>
<td></td>
<td>Polyols</td>
<td>Sorbitol, mannitol</td>
</tr>
<tr>
<td>Oligosaccharides (3–9)</td>
<td>Malto-oligosaccharides</td>
<td>Maltodextrins</td>
</tr>
<tr>
<td></td>
<td>Other oligosaccharides</td>
<td>Raffinose, stachyose, fructo-oligosaccharides</td>
</tr>
<tr>
<td>Polysaccharides (&gt;9)</td>
<td>Starch</td>
<td>Amylose, amylpectin, modified starches</td>
</tr>
<tr>
<td></td>
<td>Non-starch polysaccharides</td>
<td>Cellulose, hemicellulose, pectins, hydrocolloids</td>
</tr>
</tbody>
</table>

Note: DP = degree of polymerisation.

**Sugars**

The term *sugars* is conventionally used to describe monosaccharides and disaccharides such as sucrose, glucose and fructose. These can be found naturally in foods or can be added to foods in processing. *Sugars* is the term used in the analysis of the 1995 National Nutrition Survey; *sugar*, by contrast, is used to describe purified sucrose, as are the terms *refined sugar* and *added sugar*. 
**Intrinsic and extrinsic sugars**

*Intrinsic sugars* describes sugars occurring within the cell walls of plants—that is, naturally occurring sugars—while *extrinsic sugars* is used to describe sugars that are usually added to foods. However, the naturally occurring sugar in milk, lactose, is also an extrinsic sugar, so an additional phrase, *non-milk extrinsic sugars* is used in the literature. These terms have not gained wide acceptance, and there are no current plans to measure these sugars separately in the diet or to incorporate such data in food tables.1 The terms *refined, added* and *extrinsic* sugars are sometimes used to denote sucrose and glucose used in the food industry and in the home.

Physiologically, there is no difference between the sugars that occur naturally in food and the refined sugars that are added to the diet. Among foods rich in added sugars are confectionery, cakes, pastries, biscuits, fruit drinks, cordials and carbonated soft drinks. Foods with high added-sugar content often have a lower nutrient content but are energy dense. The term *no added sugar* means no sugars have been added during the manufacturing process; it does not mean that no sugar is present, since most foods contain sugars in some form.

**BACKGROUND**

Many of the foods found in the Australian diet contain naturally occurring sugars. In other foods, sugars (particularly sucrose) may be added during processing, to increase the food’s palatability and acceptability and sometimes to add bulk. Sugars provide a readily absorbed source of energy and have an important role as sweeteners and flavour enhancers. The presence of high amounts of sugar can, however, dilute the nutrient density of the diet, and diets high in added sugar have been associated with development of obesity and dental caries.

Because sugars are a significant source of energy in the Australian diet, all previous sets of dietary guidelines—for adults, children and adolescents, and older Australians—have included a guideline on sugar or sugars. Over the years the emphasis has changed, from a guideline aimed at reducing the amount eaten to one that emphasises care and moderation in the amount consumed. This reflects changing scientific knowledge and the relative stability of sugar consumption in Australia. The US year 2000 dietary guidelines include in the section on eating sensibly the guideline ‘Choose beverages and foods that limit your intake of sugars’.2 A review by Sheiham lists 23 countries that currently make dietary recommendations on sugars.3 The pros and cons of retaining an Australian dietary guideline on sugar have recently been debated in the literature by Stanton4, O’Dea and Mann5, and Williams.6

**Sugars in the Australian diet**

Australian adults derive about 45 per cent of their energy from carbohydrates and about half of this comes from sugars. The results of the 1995 National Nutrition Survey show that the percentage of energy from total sugars intake
3.8 CONSUME ONLY MODERATE AMOUNTS OF SUGARS AND FOODS CONTAINING ADDED SUGARS

declines from age 2–3 years to age 45–64 years; this is followed by a slight increase in intake in the 65 years and over age group (see Table 3.8.2). The percentage of energy from added sugars remains at a similar level from age 2–3 years to age 19–24 years but falls from age 25 years. Natural sugars as a percentage of energy were highest in very young children and adults over 65 years and lowest in the 19–44 year age group.

Table 3.8.2  Carbohydrates: mean percentage contribution to energy intake, by age, 1995

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>2–3</th>
<th>4–7</th>
<th>8–11</th>
<th>12–15</th>
<th>16–18</th>
<th>19–24</th>
<th>25–44</th>
<th>45–64</th>
<th>65+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbohydrate</td>
<td>52</td>
<td>52</td>
<td>50</td>
<td>52</td>
<td>49</td>
<td>46</td>
<td>45</td>
<td>44</td>
<td>45</td>
</tr>
<tr>
<td>Total sugars</td>
<td>29</td>
<td>28</td>
<td>25</td>
<td>26</td>
<td>25</td>
<td>22</td>
<td>19</td>
<td>19</td>
<td>21</td>
</tr>
<tr>
<td>Added sugars</td>
<td>14</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>13</td>
<td>10</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Natural sugars</td>
<td>16</td>
<td>13</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>9</td>
<td>9</td>
<td>11</td>
<td>12</td>
</tr>
</tbody>
</table>

Figure 3.8.1 shows the amounts (in grams per day) of sugars consumed, as recorded in the 1995 National Nutrition Survey.

Figure 3.8.2 shows the amount of sugars in the diet as a percentage of energy. Because of the higher energy consumption of adolescents and young adults, when consumption of sugars is expressed as a percentage of energy the peaks are much lower than for Figure 3.8.1. Male adolescents are the highest consumers of added sugars, both in absolute amounts and as a percentage of energy.

Figure 3.8.1 Consumption of sugars, by age: 1995 National Nutrition Survey
3.8 **Consume only moderate amounts of sugars and foods containing added sugars**

Figure 3.8.2 *Consumption of total and added sugars as a percentage of energy, by age: 1995 National Nutrition Survey*®

Figure 3.8.3 shows the sources of added sugars in the Australian diet, as recorded in the 1995 National Nutrition Survey, which used a 24-hour recall method.

Figure 3.8.3 *Sources of added sugars, by age: 1995 National Nutrition Survey*®

Note: Adults = people aged 19 years and over; children = people aged 2 to 18 years.
The most recent information on sugars (sucrose only) consumption comes from the Australian Bureau of Statistics *Apparent Consumption of Foodstuffs, 1997–98 and 1998–99*. Apparent consumption has fallen by about 15 per cent from pre-war levels, or by 23 per cent from the post–World War 2 peak reached in 1948 (see (kg 3.8.3)). The apparent consumption data do not represent actual consumption by individuals or population groups—some sugar is wasted and some is used for brewing and other purposes—but they do give an indication of trends. Baghurst et al. discuss the differences between apparent consumption of sugar and actual dietary consumption.

Apparent consumption data show that consumption of honey, which is a solution of sugars, has also declined in recent years and is now 0.5 kilograms per person.

### Table 3.8.3  
**Apparent annual consumption of sugar (kg per person), 1938–39 to 1998–99**

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Cane sugar as refined sugar</td>
<td>32.0</td>
<td>31.2</td>
<td>27.0</td>
<td>21.0</td>
<td>14.9</td>
<td>8.8</td>
<td>n.a.</td>
</tr>
<tr>
<td>Cane sugar in manufactured foods</td>
<td>16.3</td>
<td>23.1</td>
<td>23.6</td>
<td>27.7</td>
<td>34.6</td>
<td>33.9</td>
<td>n.a.</td>
</tr>
<tr>
<td>Total cane sugar</td>
<td>48.3</td>
<td>54.3</td>
<td>50.6</td>
<td>48.7</td>
<td>49.5</td>
<td>42.7</td>
<td>37.6</td>
</tr>
<tr>
<td>Total sugars</td>
<td>50.8</td>
<td>56.8</td>
<td>53.0</td>
<td>51.9</td>
<td>54.5</td>
<td>48.3</td>
<td>43.4</td>
</tr>
</tbody>
</table>

n.a. Not available.

In the 1930s, 60 per cent of sugar used in Australia was in the form of added sugar. Now the proportions are reversed: 73 per cent of sugar is used in food processing.

In remote Aboriginal communities, apparent consumption of sugar is much higher than the Australian average, as shown in Table 3.8.4. Lee et al.’s study shows that sugar consumption is high, whereas fruit and vegetable consumption is well below the Australian average. In the communities where apparent consumption was measured, refined sugars contributed approximately 30 per cent of total energy intake. Sixty per cent of the apparent high intake of sugars was derived from white sugar per se, which is in marked contrast to recent figures for the wider Australian community. No data are available for urban Indigenous communities.
Table 3.8.4  Apparent mean consumption of selected foods in Aboriginal communities (kg/head/year) compared with national data

<table>
<thead>
<tr>
<th>Food</th>
<th>Aboriginal communities</th>
<th>Australia</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Central Desert (n=3)</td>
<td>Northern coastal (n=3)</td>
</tr>
<tr>
<td>Flour (white)</td>
<td>37.6</td>
<td>44.4</td>
</tr>
<tr>
<td>Bread (all)</td>
<td>34.1</td>
<td>30.5</td>
</tr>
<tr>
<td>Beef and veal</td>
<td>51.6</td>
<td>25.8</td>
</tr>
<tr>
<td>Poultry</td>
<td>22.3</td>
<td>19.7</td>
</tr>
<tr>
<td>Lamb</td>
<td>22.8</td>
<td>3.3</td>
</tr>
<tr>
<td>Fish</td>
<td>–</td>
<td>4.8</td>
</tr>
<tr>
<td>Fruits</td>
<td>33.2</td>
<td>17.6</td>
</tr>
<tr>
<td>Vegetables</td>
<td>24.3</td>
<td>19.6</td>
</tr>
<tr>
<td>Sugar (refined)</td>
<td>54.1</td>
<td>50.3</td>
</tr>
<tr>
<td>Carbonated beverages</td>
<td>67.9</td>
<td>224.6</td>
</tr>
<tr>
<td>Fruit juice</td>
<td>48.3</td>
<td>12.8</td>
</tr>
</tbody>
</table>

– Zero.
n.a. Not available.
Note: ‘Bread’ includes flour used in bread-making.

A review of the nutrition of Indigenous Australians has suggested that a reduction in sugar consumption in this group would be an important strategy to improve their health and nutritional status.13

Intake of sugars in relation to the total diet

There are two important nutrition questions relating to consumption of sugar in the diet. The first concerns other nutrients that might be associated with sugars, and much has been written about a fat–sugar relationship. The second concerns nutrient density: if sugar (sucrose) provides around 10–15 per cent of energy in the diet, is the remainder of the diet sufficiently nutrient dense to provide all the necessary nutrients?

A number of authors have suggested that high consumption of extrinsic sugar is associated with high intakes of dietary fat.14 Studies from Europe and Australia suggest, however, that—although it is possible to identify some foods rich in both fat and sugars—in the context of the whole diet, foods that are the primary sources of sugars are only minor sources of fat and vice versa.15 Studies of the relationship between a low-fat diet and refined sugar intake often show an inverse relationship.15–19 One study, of 3290 people living in Victoria and South Australia, found that respondents who had the lowest relative intake of fat had high intakes of simple sugars, both natural and refined.20 In the 1995 National Nutrition Survey publications, only information on total sugars is available and this does not show a consistent relationship between sugars and fat intake.7 A
3.8 Consume only moderate amounts of sugars and foods containing added sugars

Further analysis of the survey data showed that those adults in the highest tertile of percentage of energy from total sugars had a significantly lower percentage of fat in their diet, but there was no difference in the percentage of fat intake between the lowest, middle and highest tertiles of percentage of energy from added sugars.

Some studies, particularly the larger studies from the United States, suggest that high intakes of sugar are linked to diet quality. Using food intake data from a representative sample of 15,011 people, Naimith et al. divided the sample into quartiles based on added sugar consumption. Many high consumers of sugar also overconsumed total energy. The intake of fruit in this group was lower than in other groups with similar energy intakes. The 41 per cent of sugar overconsumers who did not consume excessive energy compensated for the additional energy by reducing their intakes of other foods, including the fruit, vegetable, milk and grains groups. Similarly, an analysis of the third National Health and Nutrition Examination Survey (n=15,611, aged 20 years or over) showed that energy-dense, nutrient-poor foods tended to be consumed at the expense of foods that are nutrient dense. The former group included foods high in fat and/or sugar, such as soft drinks, confectionery, biscuits, cakes, desserts, pastries and processed savoury snacks. A recent review by Williams, summarising a number of studies from the United States and the United Kingdom, noted that in most cases energy and nutrient intakes were positively related to total sugar intake. At any given level of energy intake, however, as the proportion of sugars in the diet is increased the nutrient density will fall.

The report of the UK Committee on Medical Aspects of Food concluded:

- on average people with high total energy intakes eat more of all nutrients including sugar
- sugar intake is a weaker predictor of absolute micronutrient intake than total energy consumption.

The association between high refined-sugar intake and low micro-nutrient intake was investigated by re-examining data from three large-scale Australian population surveys of dietary intake in adults and from the CSIRO sugars analysis of the 1995 National Nutrition Survey. The results of this review did not show a consistent relationship between refined sugar consumption and micro-nutrient intake. A study of older South Africans showed that as sugar intake increased there was a significant decrease in the proportion of energy derived from fat. But a negative aspect of the increasing sugar intake was evidence of nutrient dilution: with the exception of folate and Vitamin B₁₂, more than one-fifth of the subjects failed to consume 67 per cent of the recommended daily allowance for several vitamins and minerals. This sub-optimal nutrient intake can be explained by the contribution of cakes, puddings, tarts, meat pies, snacks, soups, sauces and cool drinks to overall energy intake. (It should be noted, however, that this study was in older people: its relevance to younger adults and children and adolescents is not clear.) Results from several other studies vary depending on the classification of different sugars used, but in general moderate sugar consumers appear to have the most adequate diet.
The 1995 National Nutrition Survey shows that an increasing proportion of energy is obtained from meals and snacks eaten outside the home, and it is likely that these have a higher sugar and fat content than the rest of the diet. Summerbell et al. found that 25 per cent of adolescents’ and 20 per cent of adults’ daily energy intake was in the form of snacks and that the proportion of energy derived from total sugars in snacks was greater than that in meals. Most often this sugar was provided by plain biscuits and milk and sugar added to cups of tea and coffee.

If energy balance is to be maintained—or approximately maintained—foods of high energy content and lower nutrient density must be replacing other food groups. When more foods of low nutritional value (lower nutrient density) are consumed, either less of the foods that supply essential nutrients will be consumed or the total kilojoule intake will rise.

Foods prepared for infants should contain relatively low levels of sugar. The Australian Food Standards Code stipulates that if foods prepared for infants contain more than 4 grams per 100 grams of added sugar they must be labelled as ‘sweetened’.

In summary, then, it is likely that the results of surveys reported as averages of group consumption obscure the effects of consumers who are in the upper percentiles of sugar intake. It is important that care is taken with snack foods that are high in added sugars, since foods that are high in refined sugars (for example, soft drinks and confectionery) are energy dense but do not provide vital nutrients. Foods such as cakes, biscuits and confectionery are high in both sugar and fat and also energy dense; they provide few nutrients and are often eaten instead of more nutritious, necessary foods by both children and adults.

**Scientific Basis**

Carbohydrates constitute the largest source of energy in the diets of most people—on average around 45 per cent of the energy in the Australian diet. Dietary carbohydrates are usually associated in foods with important micronutrients and phytochemicals. Diets high in carbohydrate are not associated with the development of obesity independently of energy intake. People whose diets are high in carbohydrates usually have a lower prevalence of obesity, heart disease, type 2 diabetes, and some forms of cancer.

Among carbohydrates’ physiological functions are the following:
- provision of energy
- effects on satiety and gastric emptying
- effects on blood glucose and insulin metabolism
- protein glycosylation
- bile acid dehydroxylation
- fermentation—production of hydrogen and methane
• production of short-chain fatty acids
• control of colonic epithelial cell function
• bowel habit, laxation and motor activity
• effects on large bowel microflora.28

Epidemiological and clinical studies help to give us an understanding of the role of carbohydrates in the aetiology of disease. Few of these studies suggest a direct causal link between carbohydrate consumption and disease.

**Obesity**

The 1995 National Nutrition Survey results demonstrated that obesity is an increasing problem for all age groups in Australia.7 The World Health Organization describes this epidemic as part of an ‘escalating epidemic of overweight and obesity that is affecting many countries in the world’ and notes, ‘The principal causes of the accelerating obesity problem worldwide are sedentary lifestyles and high-fat, energy-dense diets’ <http://www.who.int/nut/obs.htm>.

The links between sugar intake and obesity are not clear: many studies show no links but others suggest there may be cause for concern. In Australia, obesity has been increasing during the past two decades. Lowered physical activity may, of course, be involved in the overall picture, but changes in diet may also be playing a role (see Chapter 2). The national dietary surveys of 1983 to 1985 and 1995 showed a small increase in energy intake in adults (3–4 per cent) and a larger increase in children aged 10–15 years (11–15 per cent). Carbohydrates were the macronutrient whose consumption increased most over this period.

It has been suggested that excess consumption of sugar contributes to an energy-dense diet that may lead to energy imbalance and obesity. In the CARMEN study30, a randomised controlled trial of diets and weight reduction, subjects were randomly placed in groups with diets that included reduced fat and high simple carbohydrate and reduced fat and high complex carbohydrate. The study found that a reduction in fat intake resulted in a modest, but significant, weight loss. Whether the carbohydrate was in simple or complex form made no difference to weight outcomes or to the subjects’ lipid profiles. The lack of a significant difference between complex and simple carbohydrates may, however, have been a consequence of insufficient sample size.4

It is nevertheless important to stress that excess energy in any form will promote the accumulation of excess body fat and that high-carbohydrate diets should be promoted only in accordance with an individual’s energy needs.28

In a two-year longitudinal study of 548 ethnically diverse school children in the United States (mean age 11.7 years), Ludwig et al.31 found that an increase in consumption of sweetened soft drink was linked to increasing body mass index and risk of obesity. On the other hand, a number of studies have concluded that intake of carbohydrate or even sucrose has no association with obesity or that the association may even be negative.32 The Ludwig study used a standardised...
food-frequency questionnaire to obtain dietary data. It was undertaken in adolescents and similar studies have not yet been reported in adults. It does, however, suggest that there may be cause for concern, and in such an important and growing area of concern it is essential that additional studies be done to assess the results’ relevance to the Australian situation.

In some studies, children and adults who ingest large amounts of carbohydrate or sucrose, or both, have been reported to be leaner than their peers. But the study participants’ high carbohydrate intake might reflect higher levels of physical activity. Another reason for the lack of relation between carbohydrate intake and adiposity, as just noted, might be inaccuracy in assessing intake and energy expenditure using traditional dietary methods. The ‘doubly labelled water method’ used for measuring energy expenditure in free-living individuals has recently cast doubt on the validity of self-reported food intake for adults, although dietary data do appear to be more valid for children. Yet another reason could be that very active children need and ingest more sugar.

If the study by Ludwig et al. is generalisable to the Australian situation, it suggests that the consumption of sugar-sweetened beverages could be an independent risk factor for development of obesity in children. This may be related to the reduced effect on satiety of sugar in a liquid medium. A meta-analysis has shown that compensation for energy in liquid form is less complete than that for energy in solid form. In this context it is of interest to note that the contribution of fluids (sweetened soft drinks and fruit juices and drinks) to sugar intake increased in Australian adults between 1983 and 1995 relative to non-fluid sources, particularly sugar products and fruit products (see Table 3.8.5). The increase mirrors the situation in the United States and elsewhere. This is against a background of little change in consumption of total sugars (see Table 3.8.6) and thus a lessening relative contribution from other solid food sources.

Table 3.8.5 Percentage intake of sugars from various food groups: children, 1983 and 1995

<table>
<thead>
<tr>
<th>Food group</th>
<th>Boys</th>
<th>Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1983&lt;sup&gt;a&lt;/sup&gt;%</td>
<td>1995&lt;sup&gt;b&lt;/sup&gt;%</td>
</tr>
<tr>
<td>Confectionery</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Sugar products and dishes</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td>Vegetable products</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Milk products</td>
<td>25</td>
<td>20</td>
</tr>
<tr>
<td>Fruit products</td>
<td>11</td>
<td>9</td>
</tr>
<tr>
<td>Cereals and cereal products</td>
<td>17</td>
<td>16</td>
</tr>
<tr>
<td>Non-alcoholic beverages (total)</td>
<td>23</td>
<td>34</td>
</tr>
<tr>
<td>Fruit and vegetable juices and drinks</td>
<td>9</td>
<td>20</td>
</tr>
<tr>
<td>Sweetened soft drinks</td>
<td>8</td>
<td>14</td>
</tr>
</tbody>
</table>

<sup>a</sup> 10–15 year olds assessed by one-day record.
<sup>b</sup> 8–15 year olds assessed by one-day recall.
Note: Figures are for 10–15 year olds.
In the Ludwig et al. study, the consumption of diet soft drinks was inversely associated with becoming obese. In Australia, consumption of beverages, most of which are sweetened with sugars, is increasing. Carbonated and aerated beverages have become the most popular beverages, and consumption of these beverages has continued to increase—from the late 1980s figure of 87.4 litres per person per year to 113.0 litres in 1998–99. This is an increase of 30 per cent in a decade and an increase of 3.7 per cent in the year prior to 1998–99. Figure 3.8.4 shows the trend in soft drink consumption. By the end of 2000, 19.3 per cent of soft drinks consumed in Australia were sweetened with non-nutritive sweeteners.

Sugar-sweetened drinks make up the major portion of the soft drink market. The 1995 National Nutrition Survey results showed that consumption of soft drinks in the 16–18 year and 19–24 year age groups was just over 400 grams a day (see Figure 3.8.5). About 7 per cent of the reported intake was of non-sugar containing drinks. The increasing consumption of sweetened drinks (fruit juices and soft drinks) as a component of increasing energy consumption (see Chapter 3) suggests that moderation of consumption of these products is advisable.

### Dental caries

Historically, the prevalence of dental caries has increased when the diet has changed to include more sugars and other refined foods. The relationship between sugar (sucrose) and dental caries was first documented in the scientific literature by Miller in 1883, and it has been confirmed in numerous studies since then. Dental caries remains a significant public health problem in Australia: it is estimated to be the most expensive diet-related health problem. There have, however, been dramatic declines in average levels of dental decay, as defined by the number of decayed, missing and filled teeth. In 12-year-old children, scores for this criterion fell from approximately 8 in 1965 to 1.01 in 1995. These improvements are obviously the starting point for improvements in oral health in later life, but even in adults the average number of missing teeth has fallen from 8.3 in 1973 to only 3.6 in 1995. The role of fluoridation in prevention of dental caries has been documented.

This improvement in the dental health of children does not, however, extend to Australian Aboriginal children or to Australian children from the lowest socio-economic groups. Historically, Aboriginal Australians have had substantially less
dental caries than non-Indigenous people, but more recently this trend appears to have been reversed: the oral health of non-Indigenous children has improved and that of Aboriginal children has deteriorated.45

Dental caries can be defined as a dietary carbohydrate and saliva–modified infectious disease. Its key microbiological feature is a dietary carbohydrate enrichment of the dental plaque microflora with bacteria such as *Streptococcus sobrinus* and *S. mutans*, which increase the acid-producing potential of dental plaque.46 Development of the disease is a dynamic process involving the metabolism of a carbohydrate substrate by oral bacteria to produce acid, with

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**Figure 3.8.4** Per capita consumption of soft drinks, 1990 to 2000

**Figure 3.8.5** Average daily consumption of fruit juice and soft drink: 1995 National Nutrition Survey

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saliva and host resistance offering protective elements.\(^{47}\) *Streptococcus mutans* can ferment sugars to lactic acid. Dietary sugars other than sucrose—for example, glucose and lactose—can also induce caries formation, although these sugars are less cariogenic than sucrose because, in addition to being converted to acid metabolites, sucrose is uniquely used for extracellular polysaccharide synthesis. Starch is less cariogenic than other dietary sugars because it does not readily diffuse into plaque and is less readily hydrolysed. *Streptococcus mutans*, dietary sugars and a susceptible tooth surface are the important factors in dental caries. If there is frequent exposure to sugars, the rate of demineralisation of the tooth will exceed the rate of remineralisation and dental caries will occur.\(^{48}\) The duration of exposure depends on the extent of retention of sugary foods in the mouth and the number of eating occasions; it can be difficult to describe and quantify.\(^{47}\)

Comparisons of international data indicate that low sugar consumption does not necessarily translate into less dental caries or that higher consumption inevitably leads to more.\(^{47}\) The relationship between the quantity and frequency of sugar consumption approximates a sigmoid curve. Thus, as the consumption of sucrose increases, dental caries incidence rises ever more steeply until the curve flattens out and the increase in dental caries is small with further increases in sucrose intake.\(^{49}\) A WHO study group\(^{49}\) noted that very little caries occurs in children when the national per capita sugar (sucrose) consumption is below 10 kilograms a year (about 30 grams a day) but that a steep increase may occur from 15 kilograms upwards. Studies have also shown that it is the frequency of eating sugar, rather than the amount of sugar per se, that is related to dental caries.\(^{50}\) The sugars contained in the cellular structure of foods (such as the intrinsic sugars of fresh fruits and vegetables) have been found to have little cariogenic potential; it is foods high in extrinsic sugars that are most damaging to the teeth.\(^{51}\) Petti et al. (cited in reference 47) found that good oral hygiene was three times more likely to predict low caries prevalence than a ‘low cariogenic’ diet. The principal diet and health association given for the retention of a sugar guideline in the US dietary guidelines continues to be dental caries.\(^{2}\) In severe cases, dental caries can cause loss of teeth and pain that may reduce dietary intake and compromise nutritional status.

On the basis of the scientific evidence, advice on sugar intake for the prevention of dental caries should include advice on the frequency of intakes, not just the amount. The FAO report\(^{1}\) summarises the evidence:

The incidence of dental caries is influenced by a number of factors. Foods containing sugars or starch may be easily broken down by 1-amylase and bacteria in the mouth and can produce acid which increases the risk of caries. Starches with a high glycaemic index produce more pronounced changes in plaque pH than low glycaemic index starch, especially when combined with sugars. However, the impact of these carbohydrates on caries is dependent on the type of food, frequency of consumption, degree of oral hygiene performed, availability of fluoride, salivary function, and genetic factors. Prevention programs to control and eliminate dental caries should focus on fluoridation and adequate oral hygiene, and not on sucrose intake alone.
The British Nutrition Foundation’s report concludes, ‘The evidence establishing sugars as an aetiological factor in dental caries is overwhelming. The foundation of this lies in the multiplicity of studies rather than the power of any one’.

While infants and young children are at risk of dental caries, as people age the risk increases again.

**Dental caries and infants**

Baby-bottle tooth decay, or nursing-bottle caries, is a recognised problem in infants who are pacified by giving them a bottle to suck on for long periods. Babies who are allowed to fall asleep while continuing to feed from their bottle can end up with a severe form of tooth decay. Whether the bottle contains infant formula, fruit juice or some other carbohydrate-containing food does not seem to matter. (See Chapter 3 for further discussion of fruit juices.)

**Carbohydrates and the prevention of dental caries**

Both xylitol and sorbitol have been shown to have a preventive effect on dental caries. Daily consumption of xylitol (5–10 grams a day) added to chewing gum and confectionery foods has been shown to prevent dental caries in children. Highly acidogenic snack foods should be consumed only at meal times to reduce the risk, and between-meal snacks should be either non-acidogenic (such as xylitol products) or hypo-acidogenic (such as sorbitol and HSH products). Cheeses are a natural product that may provide anti-cariogenic effects. A systematic review of published double-blind comparative trials showed that xylitol-containing chewing gums may provide superior efficacy in reducing caries rates in high-risk populations. One mechanism of the action of xylitol-containing gums is the stimulation of salivary flow.

**Type 2 diabetes**

The rapid cultural change experienced by many populations that previously consumed a traditional diet and the high incidence of centrally distributed abdominal obesity in these populations have coincided with high rates of type 2 diabetes. Some populations appear to have a stronger predisposition to the development of type 2 diabetes than others, suggesting the involvement of genetic factors. Family history, diet, and lifestyle conditions that are conducive to obesity will influence the risk of developing diabetes. Development of type 2 diabetes does not appear to be related to ingestion of sugar or other carbohydrates: it is predominantly influenced by genetics, body weight and lifestyle factors. Avoiding obesity and increasing intakes of a wide range of foods that are rich in non-starch polysaccharides and carbohydrates with a low glycaemic index offer the best means of reducing the rapidly increasing rates of type 2 diabetes in many countries. Dietary fibre may also have a beneficial effect on insulin metabolism.
Cardiovascular disease

Body mass index, abdominal obesity, hyperlipidaemia, homocysteinaemia, and genetic and lifestyle factors are all important in the aetiology of coronary heart disease. Early studies suggested that a reduction in dietary sucrose could lower elevated triglyceride levels, but it is likely that the effects seen were the result of a reduction in energy intake and body weight. Metabolic studies of lean and obese volunteers have shown that solid-food diets that are very low in fat and high in simple sugars markedly stimulate fatty acid synthesis from carbohydrate and that plasma triglycerides increase in proportion to the amount of fatty acid synthesis.

There is some evidence that antioxidants confer protection against the development of cardiovascular disease. Fruits and vegetables, which are sources of sugars and carbohydrates, are rich in antioxidants, and increasing the amount of these foods in the diet can assist in the reduction of saturated fat, which will provide further protection against cardiovascular disease. There is no evidence of a causal role for sugar in the development of cardiovascular disease. Ensuring that the diet contains adequate amounts of fruit, vegetables and carbohydrate-rich foods—at the expense of fat—and maintaining a healthy body weight are the basis of dietary advice aimed at reducing the risk of cardiovascular disease.

When the content of dietary carbohydrate is elevated above the usual level in our diets (more than 55 per cent of energy), blood concentrations of triglycerides rise. There is, however, a concurrent reduction in LDL cholesterol concentration, which makes it difficult to predict whether negative health consequences will result.

Cancer

In a case-control study of gastric cancer (382 cases and 561 controls), higher intakes of sugar were found to decrease the likelihood of developing this cancer. Other studies have suggested a link between sugar consumption and colorectal cancer. The World Cancer Research Fund reviewed the eight case-control studies available to it and concluded that there was a correlation between sugar intake and colorectal cancer. In contrast, when the National Health and Medical Research Council reviewed the risk factors for colorectal cancer, sugar was not included as a significant factor. The FAO–WHO Expert Consultation concluded, ‘There is little evidence of any significant correlation between intake of mono-, di- and oligosaccharides and cancer at any site that could not be explained by total energy intake’. Although it is widely recognised that diet influences the development of cancer, a consistent role for sugar has not been identified. Fruit, vegetables and cereal foods are considered to be protective against some forms of cancer, including colorectal cancer.
Gastrointestinal diseases other than cancer

Consumption of non-starch polysaccharides and resistant starch contributes to stool weight: increasing the intake of these foods can effectively prevent constipation, colon polyps, haemorrhoids and anal fissures.63,64

Attention deficit/hyperactivity disorder

Attention deficit/hyperactivity disorder is the most common neuro-behavioural disorder in children and among the most prevalent chronic conditions in school-aged children. There is no evidence that sugars or sugar-containing foods are involved in the aetiology of attention deficit/hyperactivity disorder.65

Summary

The evidence for sugar’s role in the aetiology of dental caries is strong. When energy intake exceeds energy expenditure over a sustained period, overweight or obesity will result. Excess dietary energy intake—from whatever source, including sugars—can thus contribute to weight gain, overweight and obesity. Inappropriately high levels of intake of sugars may also displace other nutrients from the diet. No other links to the causation of specific disease have been identified.

On the other hand, moderate use of sugars as sweeteners or to add flavour may actually improve the palatability of food and increase overall nutrient consumption. There is no evidence that, for most Australians, consumption of up to 15–20 per cent of energy as sugars is incompatible with a healthy diet. Consumption of greater amounts than this could lead to a decrease in nutrient density. A diet without any sugar would be impractical, hence this guideline: ‘Consume only moderate amounts of sugars and foods containing added sugars’.

Practical aspects of this guideline

Adding a small amount of refined sugar can increase the palatability of some highly nutritious foods and increase the overall nutrient intake. For example, adding a small amount of sugar or honey to porridge and spreading jam on bread or toast can greatly improve the taste and acceptability of these high-carbohydrate, nutrient-dense foods. But adding stewed fruit to porridge would offer equal palatability, with less sugar. A growing number of non-nutritive sweeteners are available and promoted as substitutes for sugars. Although there are still problems with heat stability, use of non-nutritive sweeteners in carbonated beverages could reduce the energy load in the highest-consuming age groups. Some studies on obesity control have shown mixed results, but at least one study of the use of an artificial sweetener has shown a long-term benefit for weight control.66
3.8 Consume only moderate amounts of sugars and foods containing added sugars

Relationship to other guidelines

Enjoy a wide variety of nutritious foods
It is important that a wide variety of foods is included in the diet and that consumption of foods high in added sugars is kept to moderate levels.

Eat plenty of vegetables, legume and fruits
Sugars are an important constituent of vegetables and fruit, contributing to their palatability. Adding a small amount of sugar to stewed fruits and some cooked vegetables can increase their palatability.

Eat plenty of cereals (including breads, rice, pasta and noodles), preferably wholegrain
Cereals, breads and pasta are an excellent source of energy and nutrients. Adding small amounts of sugar to cereals and breads can greatly increase their palatability.

Choose water as a drink
Adding sugar to hot beverages is a common practice; it should be regulated if a sizeable number of drinks are consumed each day. Artificial sweeteners can be useful in providing the sweetened flavour but reducing the amount of added sugar consumed.

Conclusion
The amount of sugar added to the diet of Australians should be moderate, to ensure that valuable nutrients are not diluted by foods high in added sugar and limited in nutrient density. On the other hand, adding small amounts of sugar to foods that are energy and nutrient dense can increase the palatability of these foods and promote their intake.

Evidence
Much of the evidence presented in this guideline relates to dispelling commonly held beliefs about sugar and disease. As a result, much of it is negative in that it provides evidence against a hypothesised relationship. There is Level I evidence of dental caries prevention with xylitol (reference 54) and Level III evidence for the role of carbohydrates in dental caries (references 39 and 50) and for a link between consumption of sugar-sweetened drinks and childhood obesity (reference 31).
In contrast, a number of studies have concluded that intake of carbohydrate, or even sucrose, has no relationship with obesity or that the relationship may be negative (see reference 32). Other evidence concerning sugar and dental caries comes from cross-population studies and observational studies within populations.

References


3.8 CONSUME ONLY MODERATE AMOUNTS OF SUGARS AND FOODS CONTAINING ADDED SUGARS


3.8 Consume only moderate amounts of sugars and foods containing added sugars


55. Bessesen D. The role of carbohydrates in insulin resistance. *J Nutr* 2001;131(suppl.): 2782S–2786S.


CARE FOR YOUR CHILD’S FOOD: PREPARE AND STORE IT SAFELY

Rochelle Finlay and Patricia Blenman

BACKGROUND

Despite having one of the world’s safest food-supply systems, Australia has seen an increase in the number of reported foodborne illnesses in the last 10 years. Foodborne illness can have very serious health consequences. Correct handling of food during all stages of its preparation and storage is essential in reducing the incidence of foodborne illness.

All population groups are susceptible to foodborne illnesses, but children and infants are particularly vulnerable because of their underdeveloped immune systems. They are totally dependent on others to provide food that has been prepared correctly and is suitable for their consumption. Attention to food safety for this age group is of great importance.

The incidence of foodborne illnesses

Reported data on foodborne illnesses consistently underestimate the true incidence of these illnesses, and full diagnostic testing is usually done only in more severe cases or when there are extensive common-source outbreaks.\(^1\,^2\) As a result of their apparently increasing incidence, in Australia and worldwide, foodborne diseases pose a significant public health problem.\(^3\) A number of factors are thought responsible for the increase in foodborne illness\(^4\,^5\):

- changes in human demographics, resulting in a greater proportion of the population with increased susceptibility to severe foodborne illness
- changes in food-production methods, including intensive farming practices and more extensive food-distribution systems. Food grown in one country can now be transported and consumed halfway across the world
- new and emerging pathogens. Three of the four most significant foodborne pathogens in the United States (campylobacter, listeria, and enterohaemorrhagic \textit{Escherichia coli}) were unrecognised as causes of foodborne illness 20 years ago
- consumer preferences, particularly with the increasing trend towards takeaway food and dining out.

An increase in notifications of foodborne illness has also occurred, for two main reasons:

- better reporting and identification of pathogens.\(^4\) Dramatic scientific and technological improvements in the detection of pathogens have
contributed to the reporting of increasing numbers of cases of foodborne disease that may have previously gone unreported

- increased awareness among consumers and health professionals.

In 1999 it was estimated that the annual cost to Australia of foodborne illness was $2.6 billion. A reduction in the incidence of such illness would benefit the Australian community through lower health care costs, less absenteeism, improved business productivity, increased competitiveness in world markets, and reduced levels of business failure and associated costs, including the cost of litigation.

In 1999 and 2000 the three most common notified foodborne diseases in Australia were infections with campylobacter, salmonella and hepatitis A (see Table 4.1).

### Table 4.1 Notifications of foodborne illness received by Australian health authorities: selected pathogens, 1991 to 2000

<table>
<thead>
<tr>
<th>Year</th>
<th>Campylobacter</th>
<th>Hepatitis A</th>
<th>Listeria</th>
<th>Salmonella</th>
<th>Yersinia</th>
</tr>
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<tr>
<td>1991</td>
<td>8 672</td>
<td>2 195</td>
<td>44</td>
<td>5 440</td>
<td>515</td>
</tr>
<tr>
<td>1992</td>
<td>9 136</td>
<td>2 109</td>
<td>38</td>
<td>4 614</td>
<td>567</td>
</tr>
<tr>
<td>1993</td>
<td>8 111</td>
<td>2 006</td>
<td>53</td>
<td>4 731</td>
<td>459</td>
</tr>
<tr>
<td>1994</td>
<td>10 117</td>
<td>1 901</td>
<td>34</td>
<td>5 327</td>
<td>414</td>
</tr>
<tr>
<td>1995</td>
<td>10 933</td>
<td>1 600</td>
<td>58</td>
<td>5 895</td>
<td>306</td>
</tr>
<tr>
<td>1996</td>
<td>12 158</td>
<td>2 150</td>
<td>70</td>
<td>5 819</td>
<td>268</td>
</tr>
<tr>
<td>1997</td>
<td>11 851</td>
<td>3 076</td>
<td>71</td>
<td>7 005</td>
<td>245</td>
</tr>
<tr>
<td>1998</td>
<td>13 449</td>
<td>2 503</td>
<td>58</td>
<td>7 700</td>
<td>207</td>
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<tr>
<td>1999</td>
<td>12 643</td>
<td>1 563</td>
<td>62</td>
<td>7 330</td>
<td>142</td>
</tr>
<tr>
<td>2000</td>
<td>13 455</td>
<td>824</td>
<td>66</td>
<td>6 017</td>
<td>71</td>
</tr>
</tbody>
</table>

Note: It is generally recognised that only a small proportion of cases are reported.

The general trend in the last 10 years in Australia is for gradual increases in notifications of foodborne illnesses associated with campylobacter, salmonella and listeria.
**Scientific Basis**

**Characteristics of foodborne illness**

The symptoms of foodborne illness are dependent on the pathogen responsible and the immune status of the affected person. Symptoms can range from being so mild as to be hardly noticeable to being so severe that hospitalisation is needed. Common symptoms are abdominal pain, nausea, vomiting, diarrhoea, bloody stools, fever and dehydration. People may also experience fatigue and muscle pain. In serious cases, and depending on the pathogen, foodborne illness may result in double vision, trouble with swallowing or breathing, paralysis, encephalopathy, kidney failure, or death. Some foodborne pathogens can also trigger longer term effects such as reactive arthritis and auto-immune disorders.

The time taken between infection by the pathogen and development of symptoms varies according to the pathogen involved. Symptoms of commonly acquired foodborne infections can present themselves within two to four hours or up to 10 days after infection. For some agents, such as *Listeria monocytogenes*, the average incubation period is three weeks.

Infection by *Escherichia coli* O157:H7 is of particular concern with children because it can cause kidney failure and death. The pathogen has been found particularly in undercooked ground beef and in unpasteurised apple juices. In children aged less than 5 years the infection can cause a complication called ‘haemolytic uraemic syndrome’, which results in kidney failure: 2–7 per cent of infections lead to this complication. In the United States, HUS is the principle cause of acute kidney failure in children, and most cases of the syndrome are caused by *E. coli* O157:H7. The death rate from HUS is 3–5 per cent. Another strain, *E. coli* O111, can also cause HUS. An outbreak of *E. coli* O111 in Australia in 1995, which caused the death of one child and the hospitalisation of 24 others, was traced to consumption of mettwurst produced in the Garibaldi smallgoods factory.

**Children and food safety**

Children are especially prone to foodborne illness and other infectious diseases.

Infants and young children are at particular risk because their immune systems are still developing and they cannot fight infection as well as adults can. As a result, they are more susceptible to all types of infection and are likely to suffer more severe consequences. In addition, children produce less acid in their stomachs than do adults, and low stomach acidity increases the likelihood of infection if foodborne pathogens are ingested.
Causes of foodborne illnesses

Foodborne illnesses can be caused by bacteria, viruses or bacterial toxins.\(^4\) Bacterial food poisoning occurs when pathogenic bacteria multiply to harmful levels as a result of incorrect handling of food, particularly if temperature control is inadequate. But not all foodborne pathogens need to multiply in food to cause illness. Viruses such as hepatitis A and Norwalk virus, and some strains of bacteria—such as *Escherichia coli* (for example, *E. coli* O157:H7 and *E. coli* O111), *Campylobacter jejuni* and *Shigella* spp.—can cause illness, even when present in low numbers. Food must be protected from contamination if these pathogens are to be excluded. If a ready-to-eat food is contaminated with these pathogens, illness may occur and, once the pathogens are present, keeping the food at a safe temperature will not have any effect.\(^15\)

A number of micro-organisms produce toxins when allowed to multiply to high levels in food, and eating food that contains such toxins can cause foodborne illness. For example, botulism is caused by ingestion of a toxin produced by *Clostridium botulinum* present in contaminated food; other micro-organisms linked with toxin production in food are *Staphylococcus aureus* (which causes staphylococcal food poisoning), *Bacillus cereus* and shigella. Toxin formation can be prevented if foods are kept at safe temperatures. Even re-heating food to high temperatures will not destroy toxins.\(^16\)

The following are the main causes of foodborne illness in Australia:
- inadequate cooking
- improper holding temperatures
- contaminated equipment
- unsafe food sources
- poor personal hygiene.\(^1\)

**Temperature**

Exposure to high temperatures, such as those used in cooking, should destroy the vegetative cells of bacteria. Some bacteria do, however, have heat-resistant spores and toxins that survive the cooking process; an example is *Bacillus cereus*. Cooling to low temperatures, such as refrigeration, will slow bacterial growth. With the exception of *Listeria monocytogenes* and *Yersinia enterocolitica*, pathogenic bacteria do not multiply at temperatures at or below 5°C. Foods that support the growth of foodborne bacteria should be stored at or below 5°C or at or above 60°C. Between 5°C and 60°C is considered to be the ‘danger zone’ for food safety: within this temperature range, bacterial replication can occur.

**Time**

The longer food is left in the temperature danger zone, the more time bacteria will have to multiply. Some bacteria can reach an infective dose in four to six hours at temperatures within the danger zone.\(^17,18\)
Food contamination

Microbiological food contamination can occur in a number of ways:

- The utensils used to prepare raw food—such as a chopping board used to cut raw meat and poultry—are then used on ready-to-eat food without having been cleaned, sanitised and dried.
- Raw foods are allowed to make direct contact with ready-to-eat foods.
- People preparing or serving food contaminate it by not washing their hands adequately, particularly after handling raw food and immediately after using the toilet.
- Food storage and preparation areas are themselves contaminated through inadequate cleaning and sanitising or are open to contamination by pests such as insects and rodents.

Potentially hazardous foods

The ability of micro-organisms to grow in a food depends on external factors (such as temperature) as well as the characteristics of the food itself (such as nutrient content, water content and pH). Bacteria need adequate nutrients for replication; among their most suitable media are high-protein, perishable foods such as dairy products, egg products, seafood, meat and poultry. These foods also have a relatively high moisture content: bacterial growth is limited in the absence of moisture. The acidity or alkalinity of a food also affects bacterial growth: bacteria are least active in very acidic foods (those with a pH less than 4.5). Often foods are preserved using vinegar to reduce bacterial growth, although moulds may still grow in these conditions.

The following are examples of foods that are normally considered potentially hazardous:

- raw and cooked meat or foods containing raw or cooked meat—for example, casseroles, curries and meat pies
- dairy products and foods containing dairy products—for example, milk, custard and dairy-based desserts
- seafood and foods containing seafood
- cooked rice and pasta
- processed fruits and vegetables such as salads
- processed foods containing eggs or other protein-rich food
- foods that contain any of the foods just listed—for example, sandwiches.

The foods most commonly implicated in food-borne illness in Australia are meat and seafood.

Some food-borne pathogens, such as viruses and enterohaemorrhagic strains of Escherichia coli, do not need to grow in foods to produce illness. Contamination of any ready-to-eat food with such a pathogen can result in food-borne illness.
Foreign matter in foods

Physical hazards—foreign objects and other extraneous material (that is, any physical matter not normally found in food)—can cause illness, including psychological trauma, or injury. The danger is especially great for young children, who are more likely to choke and, if they are very young, cannot tell their parent or carer that a foreign object is present.

Practical aspects of this guideline

To optimise food safety, care should be taken at all stages of the consumer ‘food chain’—purchasing, transport, storage, preparation, cooking, serving and cleaning. Children are susceptible to infection, so it is vital that their food is handled safely.

Purchasing

It is important to make appropriate food purchases for young children. The following foods should not be fed to young children because of their potential to cause serious foodborne illness in this age group:

- uncooked fermented meats, such as salami. Check the label: ‘heat treated’ or ‘cooked’ products are safe. Do not feed young children ‘not heat treated’ products
- unpasteurised fruit juices. Shelf-stable juices are pasteurised, but some packaged refrigerated juices may be unpasteurised. Check the label or contact the manufacturer. All freshly squeezed juices are unpasteurised
- unpasteurised milk and products made from unpasteurised milk—such as raw-milk cheese
- raw or undercooked meat (particularly minced meat), poultry, fish and shellfish
- honey, which should not be fed to children aged less than 1 year because it may be contaminated with Clostridium botulinum and lead to infantile botulism\(^{19}\)
- raw sprouts—such as alfalfa, clover and radish.\(^{20}\)

Storage

The various food types need to be stored properly to retain their nutrient value, freshness, aroma and texture, and to keep them safe.\(^{17–21,22}\) Always read the label for storage instructions. Ensure that storage areas such as cupboards and pantries are clean and that foods are stored in food-grade containers away from chemicals. Store raw foods separately from ready-to-eat foods to prevent cross-contamination.\(^{15}\)
Refrigeration

Refrigeration retards the growth of bacteria and the rate of chemical change in food. The refrigerator temperature should be 5°C or less—this can be checked using a suitable thermometer—and care should be taken to ensure that the temperature is maintained. All cooked foods should be covered and stored on a shelf above uncooked foods. Leftovers and ready-to-eat meals should be used the next day or stored in the freezer. Raw meats should be wrapped or placed in a container and stored near the bottom of the refrigerator, so that the juices do not drip onto other foods. Any spills should be cleaned up immediately, and fridge and freezer shelves and doors should be cleaned regularly. Ready-to-eat chilled foods are becoming widely available; they should be stored in the coldest part of the fridge and used before the ‘use by’ or ‘best before’ date or as soon as possible after purchase.

Frozen foods

Care should be taken to ensure that frozen food is kept hard frozen. It should be stored in packages that are free of air and fully sealed, to prevent ‘freezer burn’. Freezer burn is dehydration or drying that occurs on the surface of a product if it is improperly wrapped; the product is safe to eat but of poorer quality.

Canned and other hermetically sealed foods

Canned and other hermetically sealed foods—such as foods sealed in glass jars—should be stored in a cool place. Read the labels carefully for any storage instructions. Once opened, canned foods should be stored in the refrigerator, preferably not in the can. Swollen or leaking cans indicate faulty processing: their contents should not be eaten. In addition, throw out the contents of any can if there is an unusual odour. When opening vacuum-sealed jars, listen for a popping sound, which shows that the jar’s seal was intact. This is particularly important with commercial baby foods: if the jar fails to ‘pop’ when opened, do not use the food.

Vacuum-packed and modified–atmosphere packed foods

Vacuum packing extends the shelf life of food by removing air from the packages. Modified-atmosphere packaging extends shelf life by replacing the oxygen in a packaged food with other gases that slow bacterial growth; the method is often used with meat and poultry products. An increasing number of blister packs of foods such as fresh pasta, lunch meat, bacon and olives are now available. Vacuum-packed and modified–atmosphere packed foods should be stored according to the instructions on the package.

Dehydrated and dried foods

Dehydration inhibits the growth of micro-organisms by removing water, but it does not make the food sterile: a high level of micro-organisms can remain, only to become active again when the food is rehydrated. Rehydrated foods should be treated as perishables and be stored in the refrigerator. Dried food
should be stored in a sealed container and in a cool, dry place away from direct
heat or sunlight. It should be regularly inspected for insect infestation. Opened
packages of dried food can be stored in the refrigerator to maintain quality for
longer.

Date-marked packaged foods

The ‘best before’ date on packaged food signifies the end of the period during
which the intact package of food—if stored in accordance with any stated
storage conditions—will retain all of its quality attributes, such as colour, taste,
texture and flavour. Foods that are date-marked in this way can continue to be
sold after that date provided the food is not damaged or has not deteriorated or
perished. Check foods that have passed their ‘best before’ date for signs of
spoilage.

The ‘use by’ date on packaged food signifies the end of the estimated period—if
the food is stored in accordance with any stated storage conditions—after which
the intact package of food should not be consumed for health and safety
reasons. Foods marked with a ‘use by’ date are prohibited from being sold after
this date because the food might then pose a health risk.

Food spoilage

Food spoilage occurs when food-spoiling bacteria multiply and cause the food to
deteriorate and develop unpleasant odours, tastes and textures. The bacteria
spoil the food so that it becomes inedible, but they do not themselves cause
foodborne illness. On the other hand, food in which pathogenic micro-organisms
have grown to high levels may appear and taste normal. Food handling measures
used to optimise food safety, such as proper storage and temperature controls,
also help prevent premature spoilage.

Food preparation

Handwashing and hygiene

Before starting to prepare food, people should thoroughly wash and dry their
hands. This is particularly important after:

• handling raw foods—such as raw meat
• touching animals
• using the toilet
• assisting others with toilet use
• blowing noses
• changing children’s nappies.

Hands should be lathered and held under running water to ensure that any
micro-organisms are washed away. Particular attention should be paid to
washing between fingers and under fingernails. After washing, hands should be
dried using either a clean towel or a paper towel. Food should not be prepared by anyone who might be suffering from a foodborne illness or who has a foodborne disease.\textsuperscript{15}

**Preventing cross-contamination**

A number of measures should be taken to help prevent cross-contamination of food with potentially harmful micro-organisms:

- Special care should be taken with cleaning after cutting up raw meat and before dicing vegetables, particularly if the vegetables are to be eaten raw or with minimal cooking.
- Use a different chopping board and utensils when preparing foods to be eaten raw and foods for cooking.
- Never place cooked food on plates that have held raw meat, poultry or seafood.
- Never use a tea towel as a hand towel or for cleaning surfaces.
- During food preparation, do not taste, or allow children to taste, the food with the utensil used for stirring.\textsuperscript{18,25,26}

**Thawing foods**

The method chosen for thawing food should be the one that minimises the time the food is at a temperature that supports the growth of micro-organisms—for example, room temperature. Ready-to-eat frozen foods should be thawed in the refrigerator or under cold water in an airtight plastic wrapper or bag, the water being changed every 30 minutes.\textsuperscript{27,28} Foods can also be thawed in a microwave oven, using the defrost setting.

When thawing raw meat, it is important that fluids produced during the thawing process do not contaminate other foods or containers and other utensils that might be used for other foods. Make sure that larger portions of raw meat, such as chickens and turkeys, are thawed completely before cooking. This might call for some forward planning, to allow sufficient time for thawing these meats before they are required; for example, if a turkey is thawed in the fridge it might take several days, depending on the bird’s size.

Follow the manufacturer’s instructions for re-heating packaged ready-to-eat frozen foods (such as TV dinners). And be sure to check the information on pre-packaged foods to determine whether they need to be cooked or simply re-heated before being eaten.

**Preparing fruits and vegetables**

Fruits and vegetables should be washed thoroughly under running water before peeling and cutting. Special care should be taken with produce such as parsley and lettuce: they are harder to clean than smooth-skinned produce.
4. Care for your child’s food: prepare and store it safely

Marinating

Marinate raw foods in the refrigerator. The marinade can be used during cooking, but do not add it to the cooked dish or use it as a dressing if raw meat has been in it.

Cooking

Not all meat needs to be cooked thoroughly: steaks, whole fillet, chops and whole pieces of roast meat can be eaten rare. In contrast, rolled and/or stuffed meats, poultry, pork, sausages and mince should always be cooked all the way through, until the juices run clear when the meat is pierced.15

When using a microwave to cook, rotate and stir the food so that it cooks evenly. Cover it with a lid or plastic wrap so that the steam can aid thorough cooking. Food finishes cooking during standing time, and it is important to wait until the standing time has elapsed before checking that cooking is complete.29

Never partially cook products then finish cooking them later.29 Meat, fish and poultry must be cooked thoroughly; they can then be refrigerated and reheated later.

Cooling

Cooking of itself does not guarantee safety: some bacterial spores can survive several hours of cooking and later grow in the food if there is poor temperature control. Foods such as stews and other meat and poultry dishes that will be eaten later should be cooled as quickly as possible to prevent spores from germinating and bacteria from multiplying.

Foods that have just been cooked and are still very hot can be cooled at room temperature until the temperature of the food drops to 60°C. The food should then be cooled to 5°C as quickly as possible. To cool a large portion of food more quickly, divide it into smaller quantities or place it in shallow containers (5 centimetres deep) in the refrigerator.15 All leftovers should be placed in the refrigerator to cool as soon as possible and should be used within two or three days.29

Reheating

When reheating food, heat it until it is ‘steaming hot’ throughout: this should destroy any vegetative cells of foodborne pathogens that may be present, but it will not destroy toxins. Bring soups, sauces and gravies to a rolling boil. Do not reheat food more than once.29 When heating pre-prepared frozen or refrigerated dinners, follow the instructions on the packet.
Serving

It is essential to serve food safely: foodborne illness can result if food is not safely handled and served as soon as possible after it is cooked. Hands should be washed with soap and water and dried thoroughly using a clean towel or a paper towel, and the food should be served on clean plates. Never put cooked food on a plate that has held raw food or re-use utensils used during food preparation. Unless foods are to be served immediately, they should be covered until ready to be eaten.

Freshly cooked food that is eaten straight away is safest; if foods cannot be consumed immediately, keep them cold (at 5°C or below) or hot (at 60°C or above). For buffets, food can be kept hot by using chafing dishes and warming trays. Cold food should be kept cold by keeping it in the refrigerator or in a cooler with ice until served; for buffets, it can be kept on ice. When feeding babies, only feed directly from the baby food jar if the child is to eat all of the food or the uneaten portion is to be discarded; otherwise, use a clean plate or bowl.

Cleaning

All work surfaces, crockery, cutlery, cooking utensils and other equipment should be thoroughly cleaned to remove any food or other residue. This can usually be done by using warm water with detergent. After cleaning, utensils and work surfaces can be sanitised using hot water or chemical sanitisers (such as a mixture of bleach and water) if necessary. Utensils and other equipment should be thoroughly dry before they are re-used.

Foodborne bacteria readily persist in kitchen towels, sponges and cloths: wash and dry them often, and replace sponges regularly. Using paper towels can reduce the risk of cross-contamination because they are disposable and so cannot harbour and spread bacteria.

For added protection, keep appliances such as microwave ovens, toasters, can openers, and blender and mixer blades free of food particles. After thorough cleaning, use a bleach solution to sanitise chopping blades and hard-to-clean areas. Keep benches, shelves and work surfaces free of food particles. When making baby food at home, use a brush to clean around areas of the blender blades or food processor parts. Old food particles can harbour bacteria that may contaminate other foods.

Food handling for infants and children

In addition to the general precautions just discussed, other factors should be taken into consideration for infants and babies being fed infant formula or milk and for children taking packed lunches to schools, day-care centres or creches.
Infant formula

Infant formulas are available in ready-to-use or powder form. Powdered formula is prepared by adding the powder to cooled boiled water. Fresh formula should be prepared daily; it can be stored in the refrigerator for a maximum of 24 hours.\textsuperscript{19}

Outbreaks of foodborne illness have been associated with consumption of contaminated powdered infant formula.\textsuperscript{31} Among the pathogens found to be the cause of these outbreaks are salmonella (various strains) and \textit{Enterobacter sakazakii}. In infants, particularly premature newborns, colonisation by \textit{E. sakazakii} has been linked with the use of contaminated spoons and blenders and with keeping ready-made milk warm in bottle heaters.

With infant formula, there is a greater risk of infection resulting from sub-standard sterilisation techniques. The risk of contamination can be reduced if bottles, teats and spoons are boiled or otherwise sterilised. Further, baby bottles containing formula or milk should not be left sitting at room temperature.\textsuperscript{12} Ready-made milk should be stored in the fridge and warmed up immediately before use by placing the bottle of milk in hot water. Microwave ovens should not be used to heat the milk; this can cause variations in temperature throughout the milk. The temperature of the milk should be tested before feeding the baby. Any partially consumed milk or formula should be discarded.

If travelling, take formula powder in a bottle and add warm water just prior to feeding.

Breastmilk

Breastfeeding offers the best way of avoiding foodborne illness. There is a low risk of bacterial contamination, and the risk of infectious diseases such as gastroenteritis is reduced because maternal antibodies are passed to the infant.\textsuperscript{32,33}

Breastmilk can be expressed and placed in a sterile container with a lid.\textsuperscript{19} The expressed milk can be stored in a refrigerator for up to five days. Frozen breastmilk can be stored in a deep freeze for up to six months, in a separate-door fridge/freezer for three to four months, and in the box freezer of a refrigerator for up to two months. Each time breastmilk is expressed it should be stored in a different container, rather than being added to already frozen breastmilk. Addition of warm breastmilk to pre-frozen milk can cause the frozen milk to partially thaw, increasing the risk of bacterial growth in the milk.\textsuperscript{19}

Frozen breastmilk should be allowed to thaw in the refrigerator or be placed in its container in warm water until thawed. Breastmilk should be heated gradually by placing the bottle or other container of milk in hot water. Microwave ovens should not be used to heat breastmilk: they can destroy some of the immunological components\textsuperscript{34} and can cause variations in temperature throughout the milk. The temperature of the milk should be tested before feeding the baby.
Sterilising bottles and equipment

Equipment used in preparation and feeding—including bottles or cups used to feed expressed breastmilk—must be sterilised before use, particularly in the first three months of the baby’s life. Sterilising equipment and tablets for making sterilising solution are widely available and effective, provided the manufacturers’ instructions are followed carefully. Sterilising solutions can be used for 24 hours before being changed. Equipment can also be sterilised by boiling it in water for five minutes. All pieces of breast pumps should be washed with warm water and a mild detergent. If the pump has clear plastic tubing connected to an electric motor, check the manufacturer’s guidelines for washing and sterilising the tubing. Most such tubing needs to be washed and sterilised only if breastmilk has accidentally been drawn up into it. The outside of the tubing should be wiped with a clean, moist cloth then dried with a towel or allowed to air dry.

Food safety in day-care centres and creches

Outbreaks of foodborne illness in day-care centres and creches are often associated with children’s poor hygiene and poor hygiene associated with nappy changing. Hands should be washed thoroughly after changing nappies. Many day-care centres and creches provide a midday meal or snack for children; however, when children are required to bring their own food from home, it must be prepared in such a way as to ensure that it is safe. The day-care centre or creche should advise parents that if leftovers are to be sent with the child they should be stored in the refrigerator overnight, then refrigerated immediately upon arrival at the centre. Foods prepared fresh and sent with the child should also be refrigerated immediately upon arrival at the centre. Any leftovers sent home with the child should not be eaten later by the child; nor should they be sent to the centre the next day. Lunches should be clearly labelled with the child’s name, the date and the type of food and should be stored at the correct temperature until eaten. One child’s food should not be fed to another child.

If a child is being fed infant formula or expressed breastmilk, the formula or milk should be poured into containers labelled with the child’s name, then capped and refrigerated. Containers should be placed in a fridge immediately upon arrival at the centre. Any unused expressed breastmilk or formula should be sent home with the child that day or discarded.

Food safety and packed school lunches

School lunches can safely be made ahead of time (the previous night), provided they are then kept in the fridge or freezer. To help prevent illness, ensure that food preparation surfaces, hands and utensils are clean when preparing and packing the lunch and that all fruits and vegetables are washed thoroughly. If possible, lunches should be carried in an insulated lunch box. Something cold,
such as a frozen juice box or a freezer gel, should be packed with the lunch. Pack perishable foods such as cold meats or egg sandwiches between the cold items. Children should (if possible) keep their lunches away from heat sources such as direct sunlight or room radiators.

When hot foods are taken to school, they should be kept in an insulated bottle or flask. To ensure that the food is kept hot (and safe), the flask should be pre-heated by adding hot water, letting it stand for a few minutes, then emptying it and filling it with hot food. The flask should not be opened until lunchtime.

If lunches are not finished, the leftovers should be thrown out.

Children should be warned against sharing drink bottles because of the risk of meningococcal disease. A high proportion of cases of meningitis occur in children aged less than 5 years.

**What to do if it is thought that a child is suffering the effects of food poisoning**

A child with suspected food poisoning should be fed liquids to prevent dehydration. Seek medical care immediately if symptoms persist or are severe—for example, bloody diarrhoea, excessive nausea and vomiting or a high temperature.

If the suspect food was served at a large gathering, by a restaurant or at some other food-service facility, or if it is a commercially produced product, contact your local health department.

If possible, preserve the evidence. Wrap the remaining portion of the food securely, label it ‘DANGER’ and freeze it. Save all the packaging materials and any identical unopened products. Record details of when the food was consumed and when the onset of symptoms occurred.

The last meal eaten is often blamed for causing illness, whereas it is often a food that has been eaten the previous day. It is useful to recall and write down the foods eaten in the last 48 hours.

**Relationship to other guidelines**

**Eat plenty of vegetables, legumes and fruits**

This guideline closely relates to food hygiene and the purchase, transport, storage, preparation and cooking of vegetables and fruits. When these foods are stored correctly, their nutritional quality and storage life are maximised. Buy fresh vegetables and fruits that are ‘firm’, and make sure that canned and frozen varieties have complete, undamaged packaging.
Eat plenty of cereals (including breads, rice, pastas, noodles), preferably wholegrain

Include milks, yoghurts, cheeses and/or alternatives …

Limit saturated fat and moderate total fat intake …

Correct storage will maximise the storage life and prevent spoilage of breads, cereals and pastas—as well as dairy products and fats (including cooking oils). It is important to make sure that packaging is complete and undamaged.

Include lean meat, fish, poultry and/or alternatives

Illness caused by foodborne pathogenic bacteria is a serious public health problem, and all foods are potential vectors of pathogens. In Australia the risk of foodborne illness from primary food industries is managed across the food chain, with industry, government and consumers sharing responsibility for the delivery of microbiologically safe products. Nevertheless, some foods from the meat, fish, poultry and alternatives food group have been implicated in outbreaks of foodborne disease, and constant vigilance is required.

Children and adolescents need sufficient nutritious foods to grow and develop normally

- Growth should be checked regularly for young children
- Physical activity is important for all children and adolescents

Research has shown that immune cells are responsive to the effects of acute exercise, in terms of both number and function. Regular physical activity can be beneficial for older people’s immune system function and can enhance the body’s ability to defend itself against foodborne illnesses.

Conclusion

It is essential to educate all food handlers, health care providers and the general public if we are to reduce the incidence of foodborne illness. Although most foodborne illnesses can be avoided if safe food-handling procedures are followed, risk reduction is very important at every step of the way, from food purchase to meal serving.

Evidence

Because of the nature of this guideline, there is no evidence of the kind required for rating according to the National Health and Medical Research Council’s levels of evidence. It is not possible to conduct trials or case-control, cohort or
experimental studies of the microbiological safety of foods. Information about
safe practice comes from a basic understanding of food microbiology and human
physiology and is based on a wide variety of evidence from laboratory studies
and ‘opportunistic’ evidence from outbreaks of food poisoning.

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Special considerations
The idea that nutrition early in life can influence growth and health in later life is not new, but it is only in the past decade that the hypothesis has become more widely accepted. In a paper published 15 years ago, Barker noted a correlation between high neonatal mortality and deaths from coronary heart disease 40 to 50 years later. He hypothesised that neonatal mortality could be a surrogate indicator for early nutrition. Since that time Barker's group has published more than 60 papers on the subject and there have been hundreds more papers by other researchers.

In its original form, the hypothesis related weight at birth to subsequent disease patterns. In the last decade, however, the hypothesis has been further developed and refined to include not only birthweight but also body leanness at birth and growth during childhood.

The original studies on which Barker based his hypothesis involved a cohort of men and women born in Hertfordshire between 1911 and 1920. The maternal and child health nurses in the county had kept excellent records, which had been preserved and were available for research. Follow-up of the cohort about 50 years later showed that those who had a low birthweight were more likely to die of coronary heart disease (see Table A.1) or to develop metabolic syndrome.

<table>
<thead>
<tr>
<th>Birthweight (pounds)</th>
<th>Standardised mortality ratio</th>
<th>Deaths (number)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;5.5</td>
<td>100</td>
<td>57</td>
</tr>
<tr>
<td>5.6–6.5</td>
<td>81</td>
<td>137</td>
</tr>
<tr>
<td>6.6–7.5</td>
<td>80</td>
<td>298</td>
</tr>
<tr>
<td>7.6–8.5</td>
<td>74</td>
<td>289</td>
</tr>
<tr>
<td>8.6–9.5</td>
<td>55</td>
<td>103</td>
</tr>
<tr>
<td>&gt;9.5</td>
<td>65</td>
<td>57</td>
</tr>
<tr>
<td>All</td>
<td>74</td>
<td>941</td>
</tr>
</tbody>
</table>

Barker's original studies were subject to criticisms—that there may have been confounding by social class or that the relatively low follow-up rate may have resulted in biased results. Since that time, however, the results of other studies...
that have been published have overcome these objections. Most notable are the studies from Scandinavia, particularly Helsinki, where a comprehensive database and excellent follow-up have allowed for more detailed work.\textsuperscript{5,7,8} The Finnish studies added to our knowledge of how growth during infancy and childhood modifies health outcomes. The path of growth during childhood modifies the risk of disease associated with small body size at birth. The highest death rates from coronary heart disease were found in men who were thin at birth but who had accelerated growth rates, so that by the age of 1 year they had above average-body mass. Other confirmatory studies for the hypothesis have come from continuing analysis of the results of the famine that occurred in Holland during World War 2.\textsuperscript{9}

The hypothesis has become more complex because it is apparent that, in addition to birthweight, other dimensions of body shape at birth and subsequent growth from childhood into adulthood must be considered.\textsuperscript{10} As Barker puts it, the current version of the foetal origins hypothesis applies to people who had low birthweight or were thin or short at birth or failed to grow in infancy.

As adults, children in these categories develop increased rates of coronary heart disease, stroke, type 2 diabetes and hypertension.

Death rates from coronary heart disease increase in those with poor prenatal or infant nutrition followed by improved postnatal nutrition. The patterns differ for those who later develop stroke, type 2 diabetes or hypertension. And there are slightly different patterns for each gender. Common to all, however, is a period of reduced early growth followed by a period of accelerated growth. People who were small at birth are more prone to developing type 2 diabetes or coronary heart disease if they become overweight as adults.

Detailed analysis of the Finnish cohort has shown that there are in fact two pathways whereby growth may lead to subsequent coronary heart disease. In one, thinness at birth is followed by rapid weight gain in childhood. In the other, failure of infant growth is followed by persisting thinness during childhood. Both are associated with short stature in childhood.\textsuperscript{8} Figure A.1 illustrates the combined influences of thinness at birth—a ponderal index of less than 26 (the ponderal index is weight/height\textsuperscript{3})—and subsequent growth rates. For example, a male who is thin at birth but who gains one standard deviation of body mass index by the age of 6 years has a hazard ratio of 1.2. This compares with a male born with a normal body shape and who also gains weight but whose subsequent risk of coronary heart disease remains below average.

An Australian contribution to the hypothesis has been documentation of the influence of low birthweight on the subsequent development of chronic renal disease through studies of Aboriginal Australians in the Northern Territory. The association might be mediated through impaired nephrogenesis caused by intra-uterine malnutrition. The current epidemic of renal disease in Aboriginal Australians may be at least in part a result of the higher incidence of low-birthweight babies and the improvements in life expectancy in this population.\textsuperscript{11}
A. THE FOETAL ORIGINS OF DISEASE HYPOTHESIS, OR BARKER HYPOTHESIS

Type 2 diabetes in adulthood is also related to body size in early life. Barker’s original studies in Hertfordshire showed that diabetes was related to low birthweight. However, in studies in Swedish males by Lithell thinness at birth was found to be a stronger predictor—see Figure A.2.

Hypertension is also included in the outcomes of the foetal origins hypothesis; an extensive literature review by Law documents numerous supporting studies. The relationship between low birthweight and hypertension holds good in both developed and developing countries. Several studies have also shown that blood pressure increases with placenta size. One explanation proposed for this is that a larger placenta is the result of an undernourished foetus attempting to extract additional nutrients from the mother. The physiological and biochemical

Figure A.1 Hazard ratios for coronary heart disease associated with a standard deviation increase in body mass index, ages 1 to 12 years

Note: Ponderal index = weight/height^3.

Figure A.2 Prevalence of type 2 diabetes, by ponderal index at birth

Note: Ponderal index is weight/height^3.
mechanisms involved are not yet fully documented. The foetal origins hypothesis proposes that these chronic diseases develop as a result of adaptations the foetus makes when it is undernourished. These adaptations can be cardiovascular, metabolic or endocrine, and they appear to permanently change the structure and function of the body. Among the specific adaptations proposed are diversion of oxygenated blood away from the trunk to the brain. There may also be alterations to the hormonal systems that regulate growth and maturation and alterations to body composition.

One mechanism for the association may be the way in which the hypothalamo–pituitary–adrenal axis is programmed. Programming of this axis is one hypothesis that can explain the link between the foetal environment and development and later disease. An excess of glucocorticoids may be associated with hypertension and glucose intolerance. Some animal data are available to support this hypothesis, and human studies have found that reduced size at birth was associated with higher fasting 9am plasma cortisol concentrations in adults. Raised plasma cortisol concentrations were, in turn, associated with higher blood pressure and inversely related to measures of glucose tolerance. The resultant long-term alterations in the set-point of several major hormonal axes would explain the increased prevalence of type 2 diabetes in low-birthweight infants.

These adaptations permanently ‘re-program’ the physiology of the body. Influences on foetal programming include the mother’s body composition before, during and after pregnancy; diet during pregnancy; and postnatal nutrition and growth.

Although the evidence supporting the foetal origins hypothesis is strong, there are numerous gaps and some findings are hard to explain. For example, one would expect that the intra-uterine nutritional stress on twins would make them good examples for the hypothesis. Yet a study in New Zealand shows that twins have lower blood pressures than singletons, not the higher blood pressure that would be expected. Similarly, if the hypothesis holds, it would be expected that the twins would have a higher death rate from cardiovascular disease, but this is not the case, although in this study the shorter of the pairs of twins did have a higher death rate, confirming that nutrition in early life is important. It seems likely that some additional protective mechanism operates in the case of multiple births. Whatever the reason, further research into multiple births may help us understand the foetal origins hypothesis.

In reviewing the evidence for the foetal origins hypothesis, Terry and Susser acknowledge the momentum gathered by the hypothesis and pose three central challenges:

- refining the measure of early experience
- tracing the causal pathway that connects early experience with later health
- ruling out confounding by social class.
The challenge now must be to discover more about the cellular and molecular mechanisms giving rise to these associations. But, even before the mechanism is fully understood, it is not too early to begin to apply the findings to public health interventions. Evaluation of appropriate interventions could actually expand our knowledge of the mechanisms involved.

One interesting aspect of the foetal origins hypothesis is its ability to explain differences in the prevalence and timing of chronic disease epidemics in different countries. For some time epidemiologists have been puzzled by the ‘French paradox’, whereby mortality from ischaemic heart disease in France is about a quarter of that in Britain but the major risk factors are similar. It is thought that under-certification of ischaemic heart disease in France could account for about 20 per cent of the difference and that the high consumption of alcohol in France—and of red wine in particular—could explain a small amount of the difference. However, Barker has reviewed the development of maternal nutrition programs in the two countries and suggests that the earlier concern of the French with improving nutrition has protected them from this chronic disease epidemic.

**Implications for Public Health**

Because of the unproven nature of the foetal origins hypothesis, any intervention should be conservative and not present a potential risk to the community. Nevertheless, there are at least two areas where public health nutrition interventions could be considered:

- prenatal care—nutrition and health care programs to minimise the number of low-birthweight babies and thin babies (ponderal index <26)
- postnatal growth—programs to avoid under-nutrition or the development of overweight or obesity during childhood. This would be an extension of present growth monitoring at child health clinics to ensure universal care.

In Australia, low birthweight is observed more often in the babies of younger or older mothers, first-time mothers, single mothers and Indigenous mothers. Cigarette smoking, alcohol consumption and the nutritional status of pregnant women are also factors.

The overall proportion of low-birthweight infants in Australia is relatively low by international standards (see Table A.2), but there are sections of Australian society in which the proportion is significantly higher.
Table A.2  Low-birthweight infants in Australia

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<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>16,272</td>
<td>16,489</td>
<td>16,374</td>
<td>16,387</td>
<td>16,571</td>
<td>16,525</td>
<td>16,800</td>
<td>16,854</td>
</tr>
<tr>
<td>Per cent of all births</td>
<td>6.3</td>
<td>6.3</td>
<td>6.3</td>
<td>6.3</td>
<td>6.4</td>
<td>6.4</td>
<td>6.6</td>
<td>6.6</td>
</tr>
</tbody>
</table>

Among Aboriginal Australians, 11.8 per cent of infants were below 2500 grams at birth—almost double the national average. In the Northern Territory the rate for Aboriginal babies was 13 per cent. It is interesting to note that in the United States the prevalence of low birthweight in black Americans is about the same as that for Australian Aboriginal people.

Programs to reduce the prevalence of low birthweight should be a high priority. Maternal nutrition is particularly important—not just during pregnancy but also prior to conception. The nutrition of girls is obviously very important, so that they enter adulthood in a state of nutrition that prepares them for pregnancy.

Postnatal growth and breastfeeding

Breastfeeding is an extremely important factor in maintaining appropriate growth in infants. Infants who are breastfed have slightly lower rates of growth at 6 months of age when compared with infants being fed artificial formula. They also have lower rates of childhood obesity—and probably lower rates of obesity later in life. Studies have shown that exclusive breastfeeding seems to have a protective effect against some risk factors for cardiovascular disease in later life, including lipoprotein and glucose levels. This suggests that the most practical intervention is the promotion of exclusive breastfeeding until the age of 6 months. More studies are needed before the most appropriate interventions for infants who are born with a low birthweight can be determined.

Conclusion

The foetal origins of disease hypothesis explains many facets of the current epidemic of chronic disease occurring around the world, but many aspects of the hypothesis need further research and substantiation before its wider acceptance. Acceptance of the hypothesis would suggest that further programs for maternal, prenatal and child nutrition should be implemented. Programs designed to achieve the goals of improved maternal and child nutrition can be justified on many grounds, have no downside, and should therefore be promoted without waiting for further evidence.
REFERENCES


Weight gain and an increase in body size are integral parts of normal growth and development during childhood and adolescence. At this life stage the focus is on maintaining a rate of physical growth that is consistent with the expected norms for age, sex and stage of physiological maturity. Physical growth is best assessed by the conventional measures of weight, length or height, and head circumference. Maintenance of a positive energy and nutrient balance is critical in achieving and sustaining normal growth and development. During periods of rapid growth, any intentional restriction of weight gain—through dieting, for example—is usually inappropriate.

In recent years there has been increasing awareness of the importance of perinatal nutrition in relation to the development of disease in adulthood; this is known as the *foetal origins of disease hypothesis* or *Barker hypothesis*—see part A of this ‘Special considerations’ section. In addition, there is increasing evidence of the importance of growth and nutrition in relation to cognitive development. Growth during infancy also influences future bone mass.

**Definitions**

**Growth**

*Growth* refers to the acquisition of tissue and increase in body size.

**Development**

*Development* refers to the increased ability of the body to function physically and intellectually. Physical and intellectual development proceed at different rates in different individuals.

**Growth**

Between birth and 18 years of age, a person’s body weight increases about twenty-fold. During early childhood, the rate of increase in weight and length is essentially linear: the rate of increase in weight generally keeps pace with the rate at which length increases. During infancy and adolescence, however, the rate of growth changes rapidly over time; for example, it decelerates rapidly during the first year of life, while during adolescence it first accelerates over a period of one to three years and then decelerates rapidly until growth in height...
ceases at about 16 years of age in girls and 18 years in boys. Secular changes in growth and maturation have been well documented in many countries and Australia is no exception. Loesch et al.\(^6\) compared the data on height and body weight obtained in 1992 to 1993 from 1804 Melbourne school students aged 5 to 17 years with historical data collected from white Australians during the last 100 years. Australians have been getting taller every decade and, although the increase in height has significantly slowed down during the last two decades, the increase in body weight is continuing and is more pronounced in females. This is resulting in a continuing increase in the proportion of people who are overweight and obese—in all age groups.

**Growth references**

The term *growth reference* refers to the data set used to compile a growth chart. In Australia, the international growth reference developed by the World Health Organization, which was originally based on data from the US National Center for Health Statistics\(^7\), was recommended by the National Health and Medical Research Council in 1984.\(^8\) This growth reference has been used throughout Australia since that time and is used in most countries of the world. This is despite the fact that it has minor anomalies around the age of 2 years; these arose when two separate data sets were blended.

Many studies have shown that nutritional and health status is more important than ethnicity in determining growth rates, allowing the use of this single WHO reference. Decision points (or ‘cut-off’ points) may, however, be defined differently for different purposes and perhaps for some ethnic groups. The growth reference currently in use is derived from a mix of infants who were breastfed and infants fed on infant formula. Exclusively breastfed babies may grow at a slightly lower rate than the reference.

In Australia the US National Center for Health Statistics growth charts\(^7\) are recommended for this purpose for all ethnic groups. The charts are included in the personal health records produced by various organisations for use by parents and health workers as a continuing record of a child’s health. The NCHS has since been incorporated in the Centers for Disease Control and Prevention, which has revised the growth reference to eliminate the minor anomalies around 2 years of age.\(^9\) In particular, the data used for infants have been updated and the calculation of some percentiles has been revised.

Previously, the term *growth standard* was used, implying that there was a particular growth pathway every child should follow. A *growth reference* implies that the chart will be used to monitor the individual child and not to make a prescriptive comparison. The difficulty of developing a ‘standard’ would be compounded by the secular trend just discussed and the current epidemic of obesity. This means that the selection of any reference is somewhat arbitrary in the absence of defined outcomes—that is, which growth channel would maximise longevity and minimise morbidity. Evidence is now accumulating from
the various ‘Barker hypothesis’ studies to suggest that the present reference is about right.

The suitability of the WHO–NCHS reference values for use as an international standard has been debated because many of the children on whom the values were based were not breastfed. In an international study, which included Australian children, the growth of breastfed infants was slightly below the WHO–NCHS reference. In 1993 the World Health Organization set up a working group to develop new internationally applicable standards based on the growth of infants who were breastfed according to the WHO protocol. A number of problems were identified with the growth references developed by the National Center for Health Statistics and supported by the World Health Organization:

- the predominance of formula-fed babies
- lack of representativeness and excessive homogeneity in the data for ages 0–2 years
- lack of monthly measurements during early infancy—the infants and children were only measured every three months
- small sample sizes and lack of repeated measurements on the same children
- outdated curve-fitting procedures
- a length–height disjunction at 24 months. This has been eliminated in the latest version from the Centers for Disease Control and Prevention.

These concerns resulted in the WHO recommendation to replace the WHO–NCHS reference data and the establishment of the WHO working group. Data collection for a new international growth reference began in 1998, and it is anticipated that the new reference will be available in 2005. The new reference will be prescriptive—in contrast with the existing descriptive reference—since it will include infants who are healthy and who have been fed in accordance with the WHO recommendations. Preliminary studies for the new reference suggest that, at age 12 months, infants who were exclusively breastfed to 6 months were 600–650 grams lighter than artificially fed infants. This is the equivalent of a Z score of –0.6 (at 12 months). This difference is the same as that found between male and female infants at 12 months. Since it is more important to monitor velocity of growth, it is uncertain whether this change will be noticeable in growth monitoring.

Dewey has also shown that the height of 12-month-old infants who were exclusively breastfed to age 6 months is identical to that of artificially fed infants. This is important because cognitive development in infants is related more to height than to weight, and it reflects the protective effect of breastfeeding against obesity (see Chapter 1). Thus, at the age of 12 months, infants who were exclusively breastfed to 6 months will be the same height as artificially fed infants but will weigh slightly less.

* Z scores are standard deviations above or below the mean.
In Australia, the growth of Aboriginal infants who are exclusively breastfed follows the WHO–NCHS reference until 6 months of age then begins to fall away.\textsuperscript{14,15} By the age of 12 months, the weight increase in Aboriginal infants is around 0.5 \( Z \) scores below the reference.

**Assessment of body size and growth rate**

The most practical measures of nutritional status in childhood are comparisons with reference growth charts that show the normal ranges for weight for age, height for age and weight for height, by sex. When only a single measurement of weight and height is available, the traditional method has been to establish the percentile of the growth reference. In some situations it is more appropriate to use the \( Z \) scores, and growth reference charts are available in both formats or a calculator is available on the internet.\textsuperscript{16,17} If weight and height are measured on several occasions, the measurements are most usefully interpreted by plotting them on reference growth charts. Weight is a better indicator of acute developments, while height reflects long-term nutrition.

Generally, if a child is growing normally the lines connecting the plotted values will proceed along or parallel to one of the percentile lines on the charts. If the plotted values show a markedly irregular pattern, this could signify a problem, although some of the measurements might have been inaccurate or the data might have been plotted incorrectly. This possibility should always be checked at the first opportunity. The extent to which serial data for a child can deviate from a given percentile range before concern is warranted depends on the age of the child, the child's position in the percentile range, the length of time for which the rate of growth deviates from the norm, and the coexistence of any medical condition. In general, the more pronounced the change in the growth rate, the younger the child and the more extreme the percentile, the greater is the concern.

Skinfold measurement—a measure of the amount of fat in the subcutaneous compartment—is another index of under- or over-nutrition, although generation of reliable measurements depends to a large extent on the use of trained operators and calibrated instruments, and not all are reliable. DEXA (dual energy X-ray absorptiometry) and ultrasound provide the most accurate measurements, but cost limits their application to experimental use and to clinical settings where more accurate diagnosis is required for management. Measurement and recording of weight and height at regular intervals remain the best way of monitoring growth.

**Use of a growth reference in primary health care**

An accurate record of growth is one of the most useful assessment tools for both well children and children suffering from disease.

The commonly used growth charts are prepared with a number of percentiles marked, usually ranging from the 3rd percentile to the 97th percentile. Growth
charts using $Z$ scores are also available but are more often used in research studies and surveys. The 95th and 5th percentiles are approximately plus and minus 1.65 standard deviations respectively ($Z$ scores of +1.65 and −1.65). The value of a growth record is dependent not so much on the percentiles on the chart but more on accurate measurement and plotting, followed by correct interpretation of the information and, in particular, the trends.

Scales used for weighing children must be accurate and reliable. All scales need to be continually readjusted to zero and constantly checked for any objects that are obstructing an accurate measurement. If a towel or nappy is to be placed on the scales, do this before the scales are set to zero. When reading the scales, always position yourself at right angles to them, to avoid parallax errors. Ideally, infants and young children should be weighed without clothing. If clothing has to be worn, the scales should first be set to zero with an identical set of clothing, which is then removed from the scale; alternatively, a set of clothing can subsequently be weighed and subtracted from the clothed weight. Subtraction of an arbitrary standard weight for clothing leads to inaccuracies.

The accuracy of all scales must be checked at least daily, using a standard weight. Electronic scales are just as susceptible as mechanical ones to damage and other causes of inaccuracy and must be cared for to ensure their continued accuracy. If an obviously inaccurate reading is made—for example, as a result of movement or excess clothing—it should not be recorded.

Children less than 2 years old are usually measured while they are lying down. Between 2 and 3 years of age practices vary, and a note should be made to indicate if the child was measured lying or standing. Two adults are always required to accurately measure the length of an infant: the infant must lie straight, and quietly, on the measuring board, with feet at a right angle, head straight, and eyes looking straight upwards. A child or infant being measured should wear only minimal clothing, so that the correct position can be easily seen. Children should be measured in a standing position only when they are able to ‘stand up straight and stand still’ long enough to be accurately measured.

Anthropometric data are of little use unless they are plotted on a growth chart for comparison with earlier measurements from the same child or, if sequential measurements are unavailable, for comparison with the growth reference. Serial measurements are of far more value than a ‘one-off’ measurement, and an accurately measured and correctly plotted growth chart can be of considerable assistance in diagnosis and management. Data must be plotted for the correct gender. Make a note on the chart of any potential source of error; for example, the child was a struggler or was weighed in clothing. Check that the chart that is being used is based on the WHO or CDC growth reference.

A child’s percentile obviously gives an indication of the position of the child relative to the reference population. Parental size influences a child’s measurements, and where this is thought to be a significant factor charts or tables adjusted for the average height of both parents are available. In the case of premature infants, allowance for their small size at birth can be made by
subtracting the number of weeks of prematurity from the infant’s age before plotting on the growth chart. After 12 months of age it is no longer necessary to allow for prematurity.

Growth trends reveal more about a child’s nutrition or health than the position of one measurement on the chart. A child who is on approximately the same percentile for height and weight and who is growing at a rate parallel to the next percentile line is very unlikely to have a serious nutrition or chronic health problem. If a child’s growth percentile is changing—and particularly when it is near or crossing the upper or lower extremes, the 10th and 90th percentiles—a reason should be sought. For example, a child with a body mass index greater than the 85th percentile should be evaluated for risk factors associated with excess adiposity and referred for weight management if appropriate. Similarly, a trend towards weight loss over a month or more should prompt efforts to establish a nutritional cause or the existence of an underlying problem.

Whenever a major discrepancy from the previous measurement is found, the accuracy of the measurement and recording should first be checked. In addition, it is important to note any difference between the weight and height percentiles. In acute nutritional problems, the weight percentile is likely to be substantially lower than the percentile for height. Where there are endocrine deficiencies or other long-term diseases, both weight and height will be substantially depressed.

More than half of the children who are diagnosed in primary care or a community clinic as ‘failing to thrive’ have a relatively simple nutrition problem—just not getting enough food to meet their needs. For example, a child might be thought to have an allergy and be placed on a very restrictive diet, or if the adults in the family have been placed on a low-fat diet the child might also be eating the same diet. Many chronic diseases cause growth retardation; among them are undiagnosed renal, cardiac or metabolic problems. In the absence of other symptoms or signs, however, it is usually appropriate to embark on a trial of improved nutrition rather than proceeding immediately to further investigation. Referral to a specialist clinic for investigation of growth hormone deficiency is only necessary if a child is consistently below the third percentile and no other disease is present.

**Classification of Overweight and Obesity in Children and Adolescents**

Overweight and obesity are serious health problems in Australia and other western countries: obesity, defined as a condition in which excess fat has accumulated to the extent that health may be impaired, accounted for over 4 per cent of the total burden of disease in Australia in 1996. Overweight and obesity are delineated at arbitrary points along a continuum of increasing risk of adverse health outcomes with increasing levels of fatness. A recent report found that 19–23 per cent of Australian children are either overweight or obese.
Among adults, body mass index—weight (kilograms / height (metres))²—is widely accepted as a means of categorising an individual’s weight. A person with a BMI greater than 25kg/m² is considered overweight, while a BMI greater than 30kg/m² is indicative of obesity. These cut-off points are related to the points at which the risks of adverse health outcomes rise steeply. Table B.1 shows the BMI cut-off points widely accepted for use among adults in Australia.

**Table B.1** Body mass index categories for adults in Australia

<table>
<thead>
<tr>
<th>Category</th>
<th>BMI range (kg/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal weight</td>
<td>20–24.9</td>
</tr>
<tr>
<td>Overweight</td>
<td>25–30</td>
</tr>
<tr>
<td>Obese</td>
<td>&gt;30</td>
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Children and adolescents who are overweight or obese can suffer a range of psychological and physical problems. Among them are social isolation and metabolic and orthopaedic problems in the short term and type 2 diabetes and cardiovascular disease in the long term. Unlike adults, however, there is insufficient evidence to determine a level of excess adiposity that equates to health risk. As a result, choosing cut-off points for classifying a young person as overweight or obese is somewhat arbitrary.

### Defining overweight and obesity for research and monitoring

In 1999 an expert committee, on behalf of the International Obesity Task Force, recommended that BMI be used to assess adiposity in children and adolescents and that the adult cut-off points be used as a reference. Normal BMI among children and adolescents changes with age, so choosing a single cut-off number is not possible. Although not as accurate as more direct measures of adiposity (such as magnetic resonance imaging or dual energy X-ray absorptiometry), BMI measurement is a low-cost, simple method that has been validated against more direct measures of adiposity.

Following on from the recommendations of the International Obesity Task Force, Cole et al. developed tables for categorising overweight and obesity based on the adult cut-off points of 25kg/m² and 30kg/m². The tables were developed by pooling data on BMI from almost 200 000 children from six large, nationally representative growth studies in Brazil, Great Britain, Hong Kong, the Netherlands, Singapore and the United States. Designed for epidemiological use, the tables will allow international comparison of the prevalence of overweight and obesity, as well as assessment of trends within populations.

The Table B.2 shows the international BMI cut-off points for overweight and obesity for males and females aged 2 to 18 years.
### Table B.2: International BMI cut-off points for overweight and obesity: males and females aged 2–18 years\(^{26}\)

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Males</th>
<th>Females</th>
<th>Males</th>
<th>Females</th>
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<td>15.5</td>
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</tr>
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<td>16</td>
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<td>25.00</td>
<td>25.00</td>
<td>30.00</td>
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</tr>
</tbody>
</table>
Defining overweight and obesity in individuals

Cole et al. also developed a method of categorising overweight and obesity in population and clinical research, but it is not suitable for use in clinical practice. For clinical practice, the use of a BMI-for-age chart is more suitable since an individual can be described in terms of a percentile—for example, above the 85th percentile—and their progress plotted on a chart that forms part of the clinical record. An individual with a BMI above the 85th percentile is considered overweight, while a BMI above the 95th percentile is indicative of obesity.

Nevertheless, although they are useful in clinical practice, BMI-for-age charts do have some weaknesses. First, the choice of cut-off points to classify overweight and obesity is arbitrary, without evidence of an association with adverse health outcomes. Second, the charts must be derived from a reference population. Australia does not at present have growth reference charts derived from the local population, so a reference from another population must be used. The choice of a suitable reference population is also somewhat arbitrary. Importantly, BMI-for-age reference charts should be derived from the same population as that used for other widely used growth references such as weight-for-age and head-circumference charts. The new Centers for Disease Control and Prevention BMI-for-age charts, developed in the United States, would meet these criteria.

Ideally, child and adolescent overweight and obesity would be defined in terms of the risks of adverse health outcomes. Those data are not currently available, and further research to identify the appropriate cut-off points should be a priority.

Further considerations

Abdominal obesity

Another important factor is the distribution of body fat. Evidence is emerging that children with excess abdominal fat may be at increased risk of a constellation of risk factors such as hyperlipidaemia, hypertension and hyperinsulinaemia, known collectively as metabolic syndrome.

Abdominal fat is measured most accurately using magnetic resonance imaging or DEXA, but both of these techniques are expensive and available only in tertiary referral centres. The most practical measure is waist circumference, which has been validated against more direct techniques. At present there are no accepted waist-circumference cut-off points with which to characterise an individual’s risk of health problems associated with excess abdominal fat. It is, however, a useful measurement, in addition to BMI, as part of serial measurements to monitor progress in an individual.
**Ethnicity**

Among adults there are ethnic variations in the level of excess adiposity that prompts an increase in health risk. For example, an Asian person may have a greater proportion of fat than a Caucasian person with the same BMI. The International Obesity Task Force has suggested that $27.5\,\text{kg/m}^2$ might be a suitable cut-off point for obesity in Asian populations. Further research is needed to determine whether these differences also apply to young people.

**Conclusion**

Body mass index is the most practical method of assessing adiposity in children and adolescents, with waist circumference providing a measure of abdominal fat. For population and clinical research, the table developed by Cole et al. should be used to categorise young people as normal weight, overweight or obese. In clinical practice and non–health care settings, BMI-for-age charts such as those developed by the Centers for Disease Control and Prevention should be used to describe an individual in terms of a percentile. Although the cut-off points are arbitrary, a person with a BMI above the 85th percentile would be considered overweight, while an individual with a BMI above the 95th percentile would be considered obese. When determining a young person’s weight status, ethnicity should be taken into consideration and further assessment recommended as appropriate.

**References**


B. Growth, growth references and obesity cut-off points


CURRENT HEALTH AND NUTRITIONAL STATUS

Aboriginal and Torres Strait Islander peoples continue to suffer a much greater burden of ill-health—particularly nutrition-related chronic disease—compared with other Australians.1–3 In 1998 death rates among Indigenous Australians were at least three times greater than those for the total Australian population, and Indigenous people’s life expectancy was around 20 years less.2 Much of this poor health can be attributed to poor nutrition.1

The prevalence of many nutrition-related conditions—such as type 2 diabetes, cardiovascular disease, renal disease, poor dental health, iron deficiency anaemia, and some forms of cancer—is disproportionately high among Indigenous Australians. Overweight and obesity tend to underpin the development of many of these conditions4,5, which are discussed in detail in Nutrition in Aboriginal and Torres Strait Islander Peoples: an information paper1 (pp. 25–34 and 143–79) and The Health and Welfare of Australia’s Aboriginal and Torres Strait Islander Peoples.2

The potential intergenerational effects of poor health and nutritional status have been well described.6–9 Low birthweight, failure to thrive and inappropriate child growth are serious concerns in Indigenous Australian communities.1,10–12 Diabetes in pregnancy also has potential intergenerational effects13,14 and is an additional concern.

Good maternal nutrition and healthy infant and childhood growth are fundamental to the achievement and maintenance of health throughout the life cycle.12 Factors associated with maternal and infant health and childhood growth and nutrition are well documented in Nutrition in Aboriginal and Torres Strait Islander Peoples1 (pp. 83–140).

High Indigenous infant mortality rates have been reported throughout Australia.1,2 Several studies have indicated that infection—especially of the gastrointestinal and respiratory tracts—associated with malnutrition and growth retardation was, and continues to be, the most common cause of death in children, particularly before the age of two.1

Low Aboriginal birthweights have been documented, ranging from a prevalence of less than 7 per cent in Victoria to over 20 per cent in parts of northern Australia.1 Several causal factors are implicated: maternal ill-health and malnutrition are significant determinants.15 Although the birthweight distribution for Aboriginal and Torres Strait Islander infants is similar to that for non-Indigenous infants, the infant mortality rate is 2.5 times higher.16
Growth retardation among Aboriginal infants after the age of four to six months has consistently been noted. Relatively poor growth has also been shown to persist in older children, although overweight and obesity are becoming increasing concerns, particularly among Torres Strait Islanders.

National breastfeeding data for Indigenous Australians are limited. The 1995 National Health Survey found that Indigenous mothers breastfed for longer than non-Indigenous mothers. The 1994 National Aboriginal and Torres Strait Islander Survey confirmed that Indigenous mothers of higher socio-economic status were more likely to breastfeed and to do so for longer than Indigenous mothers from lower socio-economic groups, but that Indigenous babies in rural areas were more likely to be breastfed for longer than six months compared with those in urban areas. One small study in Melbourne found that, although 98 per cent of Indigenous mothers initiated breastfeeding, only 50 per cent and 32 per cent were still breastfeeding at three and six months respectively.

The nutritional and immunological effects of prolonged breastfeeding are particularly important in communities with a high prevalence of infectious diseases. However, introduction of appropriate solids at around six months is essential to ensure appropriate growth and development.

Vitamin and mineral status has been measured infrequently in Indigenous populations, but there have been some studies in a variety of groups and environments. Samples have generally been small and have often been selected from vulnerable groups in the community—infants and pregnant and breastfeeding women. Quantitative comparison of the prevalence of vitamin deficiencies may be misleading since varying methods and ‘normal’ ranges have been used in these studies. Multiple deficiencies have frequently been described in the same subject, suggesting the generally poor nutritional status of such individuals, rather than a specific micro-nutrient problem. In particular, vitamin status (in relation to ascorbic acid, folate and beta-carotene) consistent with the very low contemporary dietary intakes of fruit and vegetables have often been described.

Social determinants of Indigenous Australians’ health

A range of social determinants underpin the poor nutritional health status of Indigenous Australians. Among them are poverty; disrupted family and community cohesion; social marginalisation; stress; lower levels of education; unemployment; lack of control over circumstances; inadequate and overcrowded housing; inadequate sanitation, water supplies and hygiene; limited access to transport; and discrimination. The broader social environment affecting Indigenous Australians and their health status is well documented in the draft of the National Aboriginal and Torres Strait Islander Health Strategy.

Cultural factors can have both positive and negative influences on health and nutritional status. The relationship between social environment and poor health operates in both directions: poor health can increase the risks of deprivation through stigma and reduced earning capacity.
Indigenous Australians now make up 2.1 per cent of Australia’s population.\(^2\) Compared with the Australian population as a whole, Indigenous Australians are younger (a median age of 20.1 years compared with 34.0 years), live mainly in south-eastern Australia, are less likely to have post-school education (11 per cent compared with 31 per cent), have higher unemployment rates (23 per cent compared with 9 per cent), have a lower financial income (for men, an average weekly income of $189 compared with $415; for women, $190 compared with $224), and are less likely to own homes (31 per cent compared with 71 per cent).\(^2,28\) In addition, Aboriginal and Torres Strait Islander Australians are more likely to live outside metropolitan areas than other Australians: 32 per cent of Indigenous Australians live in rural areas containing less than 1000 people, whereas only 15 per cent of non-Indigenous Australians do.\(^20\) All Australians living in non-metropolitan areas experience higher mortality rates than those in metropolitan areas—15 per cent higher for men and 9 per cent higher for women in 1996.\(^30\) The higher morbidity and mortality rates observed for rural areas are probably related more to limited occupational and educational opportunities, and the effect of this on income, than any special attributes of the physical environment. Poor access to medical services and limited lifestyle options are additional factors.\(^22\)

Many other social, economic, geographical, environmental and infrastructural issues and factors influence food choices and nutrition in Indigenous groups; these are discussed in detail in *Nutrition in Aboriginal and Torres Strait Islander Peoples*\(^1\) (pp. 51–66). Examples are inadequate housing and food storage and preparation facilities.

In particular, people in rural and remote areas pay up to 50 per cent more for basic healthy foods than people living in urban and metropolitan areas.\(^31–35\) A recent Queensland study has assessed this disparity in terms of remoteness and accessibility, as measured by the Accessibility/Remoteness Index of Australia.\(^36\) In contrast to expectations, the price of fruit and vegetables was less affected by remoteness/accessibility than other food groups; the prices of meat and meat alternatives and dairy foods were the most affected.\(^37\) The cost of tobacco and takeaway food items was less affected by remoteness/accessibility than other items. Basic food items were less available in the more remote stores, as were fresh vegetables and fruits and better nutritional choices.\(^37\)

Among the factors contributing to the higher costs of foods in rural and remote areas are increased transport costs, high store overheads (including capital costs of building and maintaining long-term storage facilities and high accountancy costs) and greater wastage of stock.\(^38\) Commitment and partnership across a range of sectors are necessary if the factors contributing to the high costs and limited supply of nutritious foods in rural and remote regions are to be tackled.\(^1,37\)
HEALTH ASPECTS OF TRADITIONAL DIETS AND LIFESTYLES

All the available evidence suggests that, traditionally, Indigenous Australian were fit and healthy.\textsuperscript{20,35,39–42}

Traditional dietary intakes and associated lifestyles have been reviewed in detail recently and are summarised in the following paragraphs. Additional information about food collection, preparation, storage and distribution is also available in \textit{Nutrition in Aboriginal and Torres Strait Islander Peoples}.\textsuperscript{1}

The available information suggests that the traditional diet was generally low in energy density but high in nutrient density—high in protein, low in sugars, high in complex carbohydrate of low glycaemic index, and high in micro-nutrients. Even though the traditional Aboriginal diet contained a high proportion of animal foods, it would have been low in total fat, extremely low in saturated fat, and relatively high in polyunsaturated fatty acids (including the long-chain highly polyunsaturated fatty acids of the omega-3 and omega-6 families) and hence protective against cardiovascular disease and related conditions.

The composition of most traditional vegetable foods is typical of that of uncultivated plants worldwide—high in fibre and relatively high in protein, with a generally low energy density.\textsuperscript{43} The carbohydrate in most traditional plant foods is of low glycaemic index, producing lower glucose and insulin levels than similar western foods, and may be protective against diabetes.\textsuperscript{44}

Although some animal foods—such as witchetty grubs (\textit{Cossidae} spp.) and green ants (\textit{Oecophylla smaragdina})—have a relatively high fat content, most native land animals are very lean.\textsuperscript{43} Traditional meat foods have a much lower carcass fat content and intramuscular lipid content than meat from domesticated animals such as cattle and sheep.\textsuperscript{40} Most carcass fat is stored in discrete ‘depots’ within the abdomen; these fat depots tend to be small and were traditionally shared by many people. However, marine animals such as turtle and dugong tend to be high in fat.\textsuperscript{43,45} Chewing the bones of land and marine animals\textsuperscript{1} would have provided calcium.

Energy expenditure was high. Several accounts highlight the labour-intensive nature of collecting and preparing traditional foods.\textsuperscript{46–48} Food procurement and preparation by Aboriginal hunter–gatherers were energy-intensive processes that could involve sustained physical activity for many hours—for example, walking long distances; digging for tubers, reptiles, eggs, honey ants and witchetty grubs; chopping with a stone axe; winnowing and grinding seeds; digging pits for cooking large animals; and gathering wood for fires.\textsuperscript{20,41}
Children were traditionally breastfed until they were about 3 years old, the age of weaning depending on the arrival of another sibling. Solids were not introduced until teeth erupted. Responsibility for feeding tended to rest with the child, who was expected to express a desire for food and was fed on demand; older children had priority over the feeding of infants.

**Traditional Aboriginal diet and food preferences**

Until European occupation, Aboriginal people successfully pursued a hunter–gatherer lifestyle across widely different geographical and climatic conditions. Survival depended on an intimate knowledge of the land, sources of water, and the seasonal cycle’s effects on plant foods and game.

The traditional diet was characterised by diversity, and most early observers describe a varied and ample range of both animal and plant foods, even in dry regions. On a day-to-day basis, both the quantity and the quality of the food intake varied greatly; the usual pattern of subsistence was supplemented by ‘feasts’ when large game animals had been successfully hunted.

The most prized components of the Aboriginal hunter–gatherer diet were the relatively few energy-dense foods, such as depot fat and organ meats. Among other favoured foods were those with a high fat content—for example, witchetty grubs and marine mammals. Traditional diets were generally low in sugars, although sweetness was highly valued and provided by honey ants (*Melophorus inflatus*), the honey of the native bee, blossoms (for example, *Grevillea* spp.), lerp (a secretion from the insect *Psylla*, which lives on the leaves of eucalypts) and gums.

**Traditional Torres Strait Islander diet and food preferences**

Torres Strait Islanders were marine hunters, but they cultivated garden foods and gathered wild foods to varying degrees, depending on the local habitat. Some garden foods were stored and preserved. Turtle and dugong occupied a particular place in Torres Strait Islanders’ cultural life; the fat content of these animals was considered a principal indicator of meat quality, and the fat itself was particularly prized.

**Contemporary diet**

The process of acculturation from a traditional to a contemporary diet and lifestyle—including the effects of social, political and environmental factors—has been described in detail. With the transition from a traditional hunter–gatherer lifestyle to a settled westernised existence, Aboriginal and Torres Strait Islander people’s diet has generally changed from a varied, nutrient-dense diet to an energy-dense diet that is high in fat and refined sugars (see Table C.1).
The limited data available support the notion that contemporary Indigenous diets tend to reflect the dietary intake of wider Australia, both during the depression years of the 1930s and during colonial times, when food supply, transport, storage and costs were matters of general concern. The available dietary studies were recently reviewed in Chapter 3 of *Nutrition in Aboriginal and Torres Strait Islander Peoples*.1

### Table C.1 Characteristics of hunter–gatherer and western lifestyles20,41

<table>
<thead>
<tr>
<th>Criterion</th>
<th>Hunter–gatherer lifestyle</th>
<th>Western lifestyle</th>
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</thead>
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<tr>
<td><strong>Physical activity level</strong></td>
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<td>Low</td>
</tr>
<tr>
<td><strong>Principle characteristics of diet</strong></td>
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<td></td>
</tr>
<tr>
<td>Energy density</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Energy intake</td>
<td>Usually adequate</td>
<td>Excessive</td>
</tr>
<tr>
<td>Nutrient density</td>
<td>High</td>
<td>Low</td>
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<tr>
<td><strong>Nutrient composition of diet</strong></td>
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</tr>
<tr>
<td>Protein</td>
<td>High</td>
<td>Low–moderate</td>
</tr>
<tr>
<td>Animal</td>
<td>High</td>
<td>Moderate</td>
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<tr>
<td>Vegetable</td>
<td>Low–moderate</td>
<td>Low</td>
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<tr>
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<td>High (rapidly digested)</td>
</tr>
<tr>
<td>Complex carbohydrate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Simple carbohydrate</td>
<td>Usually low (honey)</td>
<td>High (sucrose)</td>
</tr>
<tr>
<td>Dietary fibre</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Fat</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Alcohol</td>
<td>Not available</td>
<td>Available</td>
</tr>
<tr>
<td>Sodium:potassium ratio</td>
<td>Low</td>
<td>High</td>
</tr>
</tbody>
</table>

**Urban Aboriginal communities**

Only limited quantitative dietary data are available pertaining to Aboriginal Australians’ diet in the urban setting. Because of methodological difficulties, individual dietary studies have tended to focus on qualitative and semi-quantitative assessment of the diet and to reflect dietary patterns and preferences, rather than actual, habitual intake. A comparison of the food habits of Aboriginal and non-Indigenous Australians in a city and a country town showed that in both localities Aboriginal groups consumed takeaway meals and added salt more often than their non-Indigenous counterparts. Twenty-four-hour dietary recall data from a small number of individuals suggested little difference between the dietary intakes of Aboriginal and non-Indigenous Australians in a country town, but the data have not been validated and highlight some methodological shortcomings.
Remote Aboriginal communities

A study using the ‘store-turnover’ method in remote Aboriginal communities in the Northern Territory showed that sugar, flour, bread and meat provided more than half the apparent total energy intake. Fatty meats contributed nearly 40 per cent of the total fat intake in northern coastal communities and over 60 per cent in central desert communities. In both regions, white sugar per se contributed approximately 60 per cent of all sugars consumed. Compared with national data on apparent consumption in Australia, intakes of sugar, white flour and sweetened carbonated beverages were much higher in Aboriginal communities in the Northern Territory and intakes of wholemeal bread, fruit and vegetables were much lower (see Table C.2).

Table C.2 Apparent mean consumption of selected foods in Aboriginal communities compared with national data

<table>
<thead>
<tr>
<th>Food</th>
<th>Central desert (n = 3)</th>
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<th>Australian data</th>
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</thead>
<tbody>
<tr>
<td>Flour (white)</td>
<td>37.6</td>
<td>44.4</td>
<td>n.a.</td>
</tr>
<tr>
<td>Bread (all)</td>
<td>34.1</td>
<td>30.5</td>
<td>45.5</td>
</tr>
<tr>
<td>Beef and veal</td>
<td>51.6</td>
<td>25.8</td>
<td>41.4</td>
</tr>
<tr>
<td>Poultry</td>
<td>22.3</td>
<td>19.7</td>
<td>23.0</td>
</tr>
<tr>
<td>Lamb</td>
<td>22.8</td>
<td>3.3</td>
<td>16.8</td>
</tr>
<tr>
<td>Fish</td>
<td>–</td>
<td>4.8</td>
<td>4.0</td>
</tr>
<tr>
<td>Fruits</td>
<td>33.2</td>
<td>17.6</td>
<td>106.9</td>
</tr>
<tr>
<td>Vegetables</td>
<td>24.3</td>
<td>19.6</td>
<td>136.2</td>
</tr>
<tr>
<td>Sugar</td>
<td>54.1</td>
<td>50.3</td>
<td>8.2</td>
</tr>
<tr>
<td>Carbonated beverages</td>
<td>67.9</td>
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<td>673</td>
</tr>
<tr>
<td>Fruit juice</td>
<td>48.3</td>
<td>12.8</td>
<td>n.a.</td>
</tr>
<tr>
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<td>10.1</td>
<td>n.a.</td>
</tr>
<tr>
<td>Pie/pasty</td>
<td>9.6</td>
<td>15.1</td>
<td>n.a.</td>
</tr>
<tr>
<td>Snack foods</td>
<td>1.8</td>
<td>2.7</td>
<td>n.a.</td>
</tr>
</tbody>
</table>

– Zero.
n.a. Not available.

Note: ‘Bread’ includes flour used in bread-making.

Nutritional analysis revealed the average diet of Aboriginal Australians in remote areas was high in energy and sugar (more than three times the Australian recommended dietary intake), moderately high in fat (particularly saturated fat), and relatively low in complex carbohydrate, dietary fibre and nutrient density; these results support qualitative and semi-quantitative dietary assessment.
Intakes of calcium and zinc and of some vitamins (vitamin B₂, vitamin E, beta-carotene and folic acid) appear low\textsuperscript{64}; these results have been confirmed by subsequent studies in different communities.\textsuperscript{65–67}

In contrast, very low energy intakes were described in one anthropological study in remote Aboriginal outstation communities in north-east Arnhem Land.\textsuperscript{68} The energy intake of all subjects was approximately 50 per cent of the Australian recommended dietary intake, and the vitamin C, magnesium and calcium intakes were low, as was retinol activity. Where traditional bushfoods (predominantly of animal origin) were consumed, zinc and iron intakes were higher and iron intake was equal to or above the recommended intake. Low intakes of fruit and vegetables were also described in this study.\textsuperscript{68}

Dietary intake has been shown to vary in close association with the income cycle in remote Aboriginal communities.\textsuperscript{62} Meat and vegetables (mainly as stew) and fruits were included in the diet after pay day but were usually absent for at least several days before the next pay day. A staple diet of bread or damper has often been described.\textsuperscript{62,69}

Even in remote traditionally oriented outstations, foods bought at the store accounted for most of the energy intake, while traditional bush foods provided the greatest proportion of protein intake.\textsuperscript{48,70,71} All the available studies show that flour, sugar, sweets and fats provided much of the energy intake from store-bought foods. Animal foods—particularly those high in fat, such as lizard—provided most of the energy from the bush. In general, dietary patterns in these small outstation communities are meat-oriented.

**Torres Strait communities**

In Torres Strait communities—and also in a few other island communities, such as the Tiwi community—marine foods continue to make substantial contributions to the diet. Men, women and children are involved in different aspects of gleaning, fishing and hunting. Torres Strait Islanders living on three outer islands were estimated to consume between 191 and 450 grams per person per day of seafood (including turtle and dugong), which is considerably more than the Japanese seafood intake (102 grams per person per day).\textsuperscript{45} Concerns have, however, been raised about the heavy metal content in the organ meat of dugong, and particularly turtle, and the potentially negative effects of this on health.\textsuperscript{72} Production of traditional garden staples continues to be important for some ceremonial purposes.\textsuperscript{31}

A study using the store-turnover method\textsuperscript{59} was undertaken in a small island community in Torres Strait. More than half the energy in the diet was found to come from white flour, white rice, tinned meat and vegetable oil. The amount of fruit and vegetables available through the store was low: the fruit available per person was about one-sixth of the recommended amount and vegetables about one-third. People who depended on store foods would thus not be able to meet their needs for vitamins A, C and E and folic acid.\textsuperscript{31}
Contemporary use of traditional foods

It had been suggested that in the short term, after establishment of ‘new’ settlements or outstations, there may be an increase in yields of traditional foods due to high initial availability and the use of western technology. In some areas introduced feral animals such as rabbits and buffalo have also been popular. But the longer term effect appears to be a reduction in the availability of traditional foods for several reasons, among them the following:

- environmental degradation caused by stock and feral animals
- introduction of exotic plant species
- the increasing incidence of hot, destructive bush fires as result of poor land-management practices
- restricted access to some areas of land
- depletion of resources and population pressure around permanent settlements
- high costs associated with the acquisition and maintenance of equipment, firearms, vehicles and fuel
- changing demographic patterns
- cultural loss from generation to generation

Contrary to some expectations, except for during some seasons in very remote areas the actual dietary intake of traditional foods has been found to be relatively low where it has been measured on mainland Australia. Bush foods contribute only a small proportion of nutrients in many areas. A study of a northern coastal Aboriginal community found that an average of less than 15 per cent of the population sought traditional foods on at least three days a fortnight throughout the year. It was estimated that the proportion of total energy intake derived from bush foods averaged over the population would be less than 8 per cent during the dry season and less than half this during the peak of the wet season.

In the 1994 National Aboriginal and Torres Strait Islander Survey 10 per cent of respondents aged over 14 years reported spending more than one hour a week hunting or foraging for traditional foods and, of these, more than half reported spending more than five hours a week doing so. The rate of return for this effort is, however, unknown. Even though the actual intake of traditional foods is low, traditional foods are still popular and culturally important for Aboriginal and Torres Strait Islander peoples.

The National Aboriginal and Torres Strait Islander Nutrition Strategy and Action Plan

The National Aboriginal and Torres Strait Islander Nutrition Strategy and Action Plan, NATSINSAP, provides a framework for national action to bring about an improvement in the nutritional status of Aboriginal and Torres Strait Islander Peoples.
peoples. It was developed following wide-ranging consultations by a working group (with broad Indigenous representation) as a key component of *Eat Well Australia*. The seven primary action areas in the plan are:

- food supply in remote and rural communities
- food security and socio-economic status
- family-focused nutrition promotion, involving resourcing programs, communicating and disseminating ‘good practice’
- nutrition in urban areas
- the environment and household infrastructure
- the Aboriginal and Torres Strait Islander nutrition workforce
- national food and nutrition information systems.

**Dietary Guidelines for Australia’s Indigenous peoples**

The Dietary Guidelines for Australian Adults; the Dietary Guidelines for Children and Adolescents in Australia, incorporating the Infant Feeding Guidelines for Health Workers; and the Dietary Guidelines for Older Australians are pertinent to Indigenous Australians. Two other recommendations are, however, also important:

- Choose store foods that are most like traditional bush foods.
- Enjoy traditional bush foods whenever possible.

**Rationale**

Indigenous people can select nutritious food by choosing those store foods that are most like traditional bush foods—for example, fresh plant foods, wholegrain cereal foods, seafoods, and lean meat and poultry. With the exception of the dairy food group, this approach is consistent with the general Australian dietary guidelines. All the available evidence suggests that, in terms of health and wellbeing, Indigenous Australians would benefit from closer adherence to the general Australian dietary guidelines. In particular, increased consumption of vegetables and fruits could be expected to improve the health and nutritional status of this population group. Lactose intolerance after the age of 3 to 5 years may, however, be problematic in some areas or individuals and may affect consumption of lactose-containing dairy foods. Alternative calcium sources such as low-lactose dairy foods (matured cheese, yoghurt), chewing meat and fish bones, and consumption of small, soft fish bones (for example, in tinned salmon) are recommended in these cases.

Consumption of traditional bush foods should also be supported wherever possible, although this may be a nutritional issue where high-fat marine animal foods are hunted in large numbers using modern procurement and distribution methods. In addition, there may be a problem with high levels of heavy metals.
in the organ meat of turtle and dugong. Several other environmental factors might also need to be considered within the framework of sustainability.

It is particularly important to encourage and support breastfeeding, to ensure that children and adolescents receive sufficient nutritious food to grow and develop normally, and to ensure that the growth of young children is checked regularly.

Where non-Indigenous Australians have sufficient understanding of the traditional Indigenous food supply, the additional Indigenous guidelines may also be useful in a wider context.

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SOCIAL STATUS, NUTRITION AND THE COST OF HEALTHY EATING

Katrine Baghurst

SOCIAL STATUS AND NUTRITION

There is no doubt that a social gradient exists for many diet-related chronic disease conditions in Australia, but—with the exception of extreme poverty conditions—it is unclear to what extent dietary differences across social groups affect chronic disease outcome or nutrition status.

The 1995 National Nutrition Survey\textsuperscript{1,2} showed few systematic differences in food and nutrient intake across quintiles of social disadvantage, as defined by SEIFA (socio-economic indexes for areas), based on the 1991 census. SEIFA assesses the relative social disadvantage of respondents on the basis of their area of residence; relative social disadvantage is determined by economic resources, education and occupation patterns in that area. Table D.1 shows the intake of various food groups across SEIFA quintiles.

Table D.1  Mean daily intakes from various food groups: people aged 19 years and over, by SEIFA quintile\textsuperscript{2}

<table>
<thead>
<tr>
<th>Food group</th>
<th>First quintile</th>
<th>Second quintile</th>
<th>Third quintile</th>
<th>Fourth quintile</th>
<th>Fifth quintile</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(most</td>
<td></td>
<td></td>
<td></td>
<td>(least</td>
</tr>
<tr>
<td></td>
<td>disadvantaged)</td>
<td></td>
<td></td>
<td></td>
<td>disadvantaged)</td>
</tr>
<tr>
<td>Cereal &amp; cereal products</td>
<td>196</td>
<td>222</td>
<td>203</td>
<td>217</td>
<td>232</td>
</tr>
<tr>
<td>Cereal-based products &amp; dishes</td>
<td>113</td>
<td>115</td>
<td>130</td>
<td>135</td>
<td>136</td>
</tr>
<tr>
<td>Fruit products &amp; dishes</td>
<td>126</td>
<td>147</td>
<td>141</td>
<td>143</td>
<td>156</td>
</tr>
<tr>
<td>Vegetable products &amp; dishes</td>
<td>264</td>
<td>258</td>
<td>260</td>
<td>262</td>
<td>251</td>
</tr>
<tr>
<td>Legumes &amp; pulses</td>
<td>9.8</td>
<td>7.9</td>
<td>10.8</td>
<td>9.5</td>
<td>10.7</td>
</tr>
<tr>
<td>Milk products &amp; dishes</td>
<td>281</td>
<td>284</td>
<td>285</td>
<td>292</td>
<td>301</td>
</tr>
<tr>
<td>Meat, poultry, game</td>
<td>149</td>
<td>163</td>
<td>164</td>
<td>155</td>
<td>158</td>
</tr>
<tr>
<td>Fish &amp; seafood</td>
<td>22</td>
<td>24.5</td>
<td>26.3</td>
<td>25.8</td>
<td>28.8</td>
</tr>
<tr>
<td>Egg products &amp; dishes</td>
<td>16</td>
<td>15</td>
<td>16</td>
<td>13</td>
<td>19</td>
</tr>
<tr>
<td>Snack foods</td>
<td>3.2</td>
<td>3.0</td>
<td>4.2</td>
<td>3.3</td>
<td>3.9</td>
</tr>
<tr>
<td>Sugar products &amp; dishes</td>
<td>20</td>
<td>21</td>
<td>20</td>
<td>18</td>
<td>17</td>
</tr>
<tr>
<td>Confectionery</td>
<td>7.8</td>
<td>9.2</td>
<td>8.3</td>
<td>9.3</td>
<td>9.1</td>
</tr>
<tr>
<td>Seeds &amp; nuts</td>
<td>3.6</td>
<td>4.1</td>
<td>5.2</td>
<td>4.0</td>
<td>4.8</td>
</tr>
<tr>
<td>Fats &amp; oils</td>
<td>12</td>
<td>13</td>
<td>13</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>Soup</td>
<td>53</td>
<td>62</td>
<td>55</td>
<td>48</td>
<td>57</td>
</tr>
<tr>
<td>Savoury sauces &amp; condiments</td>
<td>30</td>
<td>30</td>
<td>28</td>
<td>30</td>
<td>29</td>
</tr>
<tr>
<td>Alcoholic beverages</td>
<td>239</td>
<td>254</td>
<td>273</td>
<td>270</td>
<td>234</td>
</tr>
</tbody>
</table>

Note: SEIFA = socio-economic indexes for areas.
The findings can be summarised thus for the major food groups:

- Consumption of cereals and cereal-based foods (for example, rice, pasta and breads) was somewhat lower in the most disadvantaged group and the middle group compared with all other groups. Consumption of cereal-based products and dishes (for example, cakes and biscuits) was about 20 per cent lower in the two most disadvantaged groups compared with the other three.

- Consumption of fruit and fruit products was lower (10–20 per cent) in the most disadvantaged group compared with the other four groups, but vegetable and legume consumption showed no consistent trend across the groups.

- Consumption of milk and milk products increased slightly with social advantage—about a 10 per cent increase across the groups.

- Consumption of meat, poultry and game was slightly higher in the middle quintiles; fish and seafood consumption gradually increased with social advantage.

An assessment of energy and nutrient intakes across the SEIFA quintiles (see Table D.2) showed that energy intake increased with social advantage, as did intakes of most nutrients. However, when correcting for energy differences across groups, few differences were apparent in dietary quality, defined as nutrient intake per unit energy. It is unclear from the published data whether other factors, such as the age profile, differed across the quintiles of disadvantage and how much variation in factors such as age (which are known to influence total food intake) might account for the differences that were apparent (for example, in total energy intake). Physical activity may also vary across quintiles.
### Table D.2  
Mean daily intakes of energy and nutrient densities: people aged 19 years and over, by SEIFA quintile

<table>
<thead>
<tr>
<th>Food group</th>
<th>First quintile (most disadvantaged)</th>
<th>Second quintile</th>
<th>Third quintile</th>
<th>Fourth quintile</th>
<th>Fifth quintile (least disadvantaged)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy (MJ)</td>
<td>8.82</td>
<td>9.18</td>
<td>9.37</td>
<td>9.31</td>
<td>9.45</td>
</tr>
<tr>
<td>Nutrient density (per 10MJ energy)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protein (g)</td>
<td>98.2</td>
<td>98.4</td>
<td>98.5</td>
<td>98.6</td>
<td>99.4</td>
</tr>
<tr>
<td>Fat (g)</td>
<td>89.8</td>
<td>90.7</td>
<td>91.1</td>
<td>88.9</td>
<td>88.8</td>
</tr>
<tr>
<td>Saturated (g)</td>
<td>35.7</td>
<td>35.5</td>
<td>36.0</td>
<td>35.2</td>
<td>35.0</td>
</tr>
<tr>
<td>Mono-unsaturated (g)</td>
<td>32.5</td>
<td>32.8</td>
<td>33.4</td>
<td>32.4</td>
<td>32.3</td>
</tr>
<tr>
<td>Polyunsaturated (g)</td>
<td>13.5</td>
<td>13.5</td>
<td>13.9</td>
<td>13.4</td>
<td>13.4</td>
</tr>
<tr>
<td>Cholesterol (mg)</td>
<td>332</td>
<td>331</td>
<td>332</td>
<td>319</td>
<td>305</td>
</tr>
<tr>
<td>Total carbohydrate (g)</td>
<td>276</td>
<td>277</td>
<td>272</td>
<td>276</td>
<td>277</td>
</tr>
<tr>
<td>Sugars (g)</td>
<td>128</td>
<td>125</td>
<td>123</td>
<td>124.</td>
<td>123</td>
</tr>
<tr>
<td>Starch (g)</td>
<td>147</td>
<td>150</td>
<td>148</td>
<td>151</td>
<td>152</td>
</tr>
<tr>
<td>Fibre (g)</td>
<td>24.4</td>
<td>24.4</td>
<td>24.9</td>
<td>25.2</td>
<td>25.6</td>
</tr>
<tr>
<td>Alcohol (g)</td>
<td>13.4</td>
<td>13.3</td>
<td>14.3</td>
<td>14.6</td>
<td>13.8</td>
</tr>
<tr>
<td>Vitamin A (µg)</td>
<td>1280</td>
<td>1299</td>
<td>1236</td>
<td>1218</td>
<td>1329</td>
</tr>
<tr>
<td>Thiamin (mg)</td>
<td>1.81</td>
<td>1.74</td>
<td>1.81</td>
<td>1.83</td>
<td>1.80</td>
</tr>
<tr>
<td>Riboflavin (mg)</td>
<td>2.27</td>
<td>2.18</td>
<td>2.24</td>
<td>2.25</td>
<td>2.22</td>
</tr>
<tr>
<td>Niacin (mg)</td>
<td>45.8</td>
<td>45.9</td>
<td>45.6</td>
<td>45.5</td>
<td>45.9</td>
</tr>
<tr>
<td>Folate (µg)</td>
<td>289</td>
<td>286</td>
<td>299</td>
<td>272</td>
<td>292</td>
</tr>
<tr>
<td>Vitamin C (mg)</td>
<td>132</td>
<td>131</td>
<td>130</td>
<td>135</td>
<td>142</td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>907</td>
<td>888</td>
<td>900</td>
<td>926</td>
<td>945</td>
</tr>
<tr>
<td>Phosphorus (mg)</td>
<td>1626</td>
<td>1631</td>
<td>1630</td>
<td>1654</td>
<td>1673</td>
</tr>
<tr>
<td>Magnesium (mg)</td>
<td>353</td>
<td>356</td>
<td>354</td>
<td>361</td>
<td>366</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>15.1</td>
<td>15.0</td>
<td>15.3</td>
<td>15.4</td>
<td>15.6</td>
</tr>
<tr>
<td>Zinc (mg)</td>
<td>12.9</td>
<td>13.07</td>
<td>12.8</td>
<td>13.0</td>
<td>13.3</td>
</tr>
<tr>
<td>Potassium (mg)</td>
<td>3541</td>
<td>3495</td>
<td>3507</td>
<td>3528</td>
<td>3551</td>
</tr>
</tbody>
</table>

Neither is it clear whether these relatively small differences in nutrient profiles could explain a significant proportion of the variation in the health profiles across the groups. In interpreting the data set, however, it should be borne in mind that a relatively crude, area-based measure of social disadvantage was used; it is also possible that many of the most disadvantaged individuals in the community did not take part in the survey.
THE COST OF HEALTHY EATING

In recent years most countries in the western world have developed dietary guidelines and recommendations similar to those outlined in this Australian document. The aim is to improve health and nutritional status and help prevent chronic diseases such as coronary heart disease, certain cancers, hypertension and diabetes. If, however, the changes encouraged by these guidelines are financially costly, there will be groups, including some low-income families, in the community that are unable or unwilling to make these adjustments.

Although there is widespread speculation about the expense of healthy, or 'healthful', eating, few cost analyses of healthful diets have been reported. One study, in the United Kingdom, compared the cost of one-day diets that did and did not conform to the British dietary guidelines and found that following the guidelines was in fact potentially more expensive. In Australia, Santich looked at the eating patterns recommended in various federal government nutrition education publications and concluded that the changes recommended may not be financially realistic for low-income families. However, this conclusion was based on an analysis of specific recipes given in the pamphlets and on the substitution models for healthful eating used in the education materials—for example, using lean minced beef instead of fattier versions and using wholegrain breads instead of white bread. Using a qualitative sociological analysis, Crowley has also suggested that the 'cost' of a diet that follows the dietary guidelines is potentially higher compared with the cost of the average Australian diet. His analysis included factors outside the direct financial cost of food as purchased, such as access and transportation.

In the early 1990s McAllister et al. undertook an analysis, based on Australian data, to determine whether it was necessarily more directly financially costly to follow a healthful diet in Australia (see Table D.3). Three different approaches were used: a substitution approach; a relative costing of individual diets that are in line with the dietary guidelines; and an analysis of the cost of eating according to a healthy eating plan, the 12345+ Nutrition Plan developed by the CSIRO. This healthy eating plan was highly flexible; it was designed to produce diets conforming to both the existing Australian dietary guidelines and the recommended dietary intakes for people with varying energy needs and/or special nutrient needs (for example, during pregnancy, lactation and adolescence) and from a variety of cultural backgrounds.

The cost of 229 foods and drinks used in the analysis was determined by assessing prices in four major supermarkets and other food outlets such as takeaway stores when necessary. The food outlets used for pricing were located in a suburban area of Adelaide where there is a large concentration of low-income families. In each supermarket, for each food or drink the cheapest branded item (that is, bearing the manufacturer's brand name) was recorded, together with the price of the equivalent generic item (that is, without the manufacturer's brand name but commonly associated with a particular retailer).
An analysis of the potential cost of direct substitution of healthful food choices for less healthful ones (for example, product-by-product substitution through the use of fat, fibre or salt-modified alternatives) showed that this approach would result in a more costly diet while providing limited nutritional improvement at the population level. Pricing of self-selected diets of people who currently comply with the dietary guidelines and targets for healthful eating showed that these people are paying more per megajoule. In contrast, costing of diets that conformed to a new healthful eating plan—designed to produce eating patterns that meet both the dietary goals set for components of the food supply (such as dietary fat, refined sugars and fibre) and the recommended daily intakes for energy, protein, vitamins and minerals—showed that healthful eating need not be more expensive and, indeed, for most people would bring cost savings.

In summary, this study showed that healthful eating is not necessarily more expensive but that restructuring the diet, rather than using a direct-substitution approach, is the more cost effective strategy. Education programs that stress this restructuring approach and its cost advantages are therefore more likely to be successful in promoting an affordable and effective healthful alternative for people with limited financial means.

Unfortunately, it is generally easier for people to understand and adopt a substitution approach rather than to basically restructure their diets. They also receive encouragement to adopt the substitution approach—not only from food manufacturers, who, understandably, wish to promote specific healthful products, but also from much of the educational literature produced by health professionals.

The study just described was designed to look only at the potential financial costs of healthful eating. It showed that the theoretical cost savings associated with healthier diets would be similar across all social groups in Australia. But there are obviously other factors that could make a healthful diet more difficult to achieve—such as the ready availability of healthful foods, skills, facilities, time, taste factors and motivation. And these factors might vary across social, educational and income groups. This has been discussed by Santich and Crowley, but the data available are limited and further investigation would be valuable, especially with respect to low-income groups in the community. These issues do, however, need to be dealt with in implementing the dietary guidelines in socially disadvantaged groups and will be addressed in the implementation plan for the dietary guidelines.

Table D.3 summarises the financial costs of healthy eating, as determined in the 1989 Australian Bureau of Statistics Household Expenditure Survey, the 1990 Victorian and South Australian surveys, and the CSIRO’s 12345+ Nutrition Plan.
Table D.3  The financial costs of healthy eating

<table>
<thead>
<tr>
<th>Product type</th>
<th>Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Branded</td>
<td>4.92</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1989 Household Expenditure Survey</th>
<th>Branded</th>
<th>Generic</th>
<th>Current cost</th>
<th>Cost ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>4.58</td>
<td>4.99</td>
<td></td>
</tr>
<tr>
<td>1990 Victorian and South Australian surveys</td>
<td>Branded</td>
<td>Generic</td>
<td>4.60</td>
<td></td>
</tr>
<tr>
<td>Conformers to dietary guidelines</td>
<td>Branded</td>
<td>Generic</td>
<td>4.96</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Branded</td>
<td>4.96</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-conformers with equivalent energy intakes</td>
<td>Branded</td>
<td>Generic</td>
<td>4.33</td>
<td></td>
</tr>
<tr>
<td>Substitution of health choices (adjusted for energy content)</td>
<td>Branded</td>
<td>Generic</td>
<td>5.22</td>
<td></td>
</tr>
<tr>
<td>Healthy eating plan (CSIRO 12345+ Nutrition Plan)</td>
<td>Branded</td>
<td>Generic</td>
<td>5.54</td>
<td></td>
</tr>
<tr>
<td>Average woman</td>
<td>Branded</td>
<td>Generic</td>
<td>3.48</td>
<td></td>
</tr>
<tr>
<td>Average man</td>
<td>Branded</td>
<td>Generic</td>
<td>3.81</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Branded</td>
<td>4.09</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

References

E  DIETARY GUIDELINES AND THE SUSTAINABILITY OF FOOD SYSTEMS

Malcolm Riley

Sustainable development is relevant to dietary guidelines because the production and consumption of food is a fundamental human activity guided by what we choose to eat. Human activity has affected all the major planetary processes and cycles, and the earth’s human population continues to grow, as does its appetite for resources. The immediate problems facing the world concern not limits to those resources but the increasing disturbances to global and natural systems. Systemic changes have been recognised—climate change, ozone depletion, biodiversity loss, freshwater depletion and degraded food-producing systems. All of these have important implications for activities such as food production. Although sustainable development is a global concern, solutions also need to be sought at national and local levels. If we are to deal comprehensively with the problems that have been identified, we need integrated policies across many sectors; these policies must be adequately resourced and have an effective legislative and administrative base.

The World Commission on Environment and Development defined sustainable development as ‘the ability to meet the needs of the current generation without compromising future generations’ ability to meet their economic needs’. Common elements in more comprehensive definitions of sustainable agriculture and animal production are resource efficiency, profitability, productivity, environmental soundness, biodiversity, social viability, and other ethical aspects. Important prerequisites for sustainable production are appropriate governmental policies, awareness of our way of thinking, and a more communal world view.

The consensus on human impact is that every major planetary process—whether in the biosphere, the lithosphere, the hydrosphere or the atmosphere—is already dominated by our activity. The dominant species on earth (domesticated animals and plants) are heavily selected for specific traits, and this has reduced genetic heterogeneity and adaptability. Maintaining the desirable traits in adverse environments, and in the face of mounting disease and pathogen attacks (predicted results of global climate change), requires ever-increasing energy inputs and environmental modification.

It can be argued that the limits of sustainability have already been reached in the human population—with 6 billion humans alive today—since at least 20 per cent of the population suffers from hunger, our natural resources are overexploited, and biodiversity is threatened. Demographers now believe that the world population will reach a peak of 8 to 10 billion during the 21st century, before beginning to slowly decline as fertility rates drop below the level necessary for replacement. Problems relating to sustainable development will then be focused on managing for the peak world population, rather than for a continually rising
population. This task will be difficult enough in its own right, and ecological sustainability will necessarily move from being a side issue to being a central force in managing development, including the development of our food production and consumption systems.

Humans are highly successful in an evolutionary sense, as demonstrated by steady population increase, and this may be proof of our ability to modify ecosystems to our advantage. It has been argued that humankind can take care of environmental concerns when it can afford to and that environmental clean-up follows wealth creation. But it is now clear that this might be misleading: for example, the rate of increase in agricultural productivity is slowing and major food-production systems such as fisheries are approaching maximum capacity; it has been estimated that nearly half the world’s marine fish populations are fully exploited and another 22 per cent are overexploited.

Agricultural sustainability can be enhanced by a switch from linear solutions to circular approaches to food production—for example, closing water and nutrient loops to reduce reliance on external inputs and reducing outputs of waste from the system. These general strategies would help restore soil fertility and ultimately improve food security.7

In Australia the most pressing environmental problems are loss of biodiversity, land degradation, and disturbances to inland waterways.2 Effective solutions to these problems will require halting large-scale land clearing, measures to deal with dryland salinity, restoration of adequate environmental flows to our rivers, and major land use changes, including the retirement of large areas of land from grazing and similar uses.2

In the last 30 years there have been substantial changes to eating habits in Australia, with the result that both apparent consumption and the level of waste (packaging and food wastes) have increased. Between 1970 and 1990 annual food consumption in Sydney increased from 0.52 tonnes per person to 1.00 tonnes per person—a 92 per cent increase. The increase in consumption is attributable to changes in food processing, retailing and lifestyle, rather than an increase in food intake by each individual.8

Australians are the highest per capita users of water in the world, using 2.3 times the global average. Domestic water use accounts for only 12 per cent of this; agricultural use accounts for 79 per cent and industrial use for 9 per cent.

Published guidelines to help people consume food in a manner more consistent with sustainable development focus on matters such as avoiding overconsumption, eating less processed food, and eating food produced locally and in season.9,10 Suggestions for ways that dietitians can contribute to protection of the environment have also been the subject of recent discussion.11

It is apparent that a move towards more sustainable food-production methods will require policy development and change in many different sectors. If successful, we can expect that this will result in substantial changes to the way we eat. While these Dietary Guidelines for Children and Adolescents are
consistent with sustainable food production and consumption, dietary guidelines of the future will probably become more and more focused on sustainability as the problems caused by non-sustainable systems become more starkly obvious.

**References**

Infant Feeding Guidelines for Health Workers

Colin Binns and Geoff Davidson
SUMMARY

Breastmilk is a living tissue that includes many species-specific compounds. Exclusive breastfeeding is recommended to six months of age, before additional fluids and solids need to be introduced. Breastfeeding is the normal way to feed infants. Exclusive breastfeeding confers on them protection against infection and some chronic diseases, and it leads to improved cognitive development.

In Australia, it is recommended that as many infants as possible be exclusively breastfed until 6 months of age. It is further recommended that mothers then continue breastfeeding until 12 months of age—and beyond if both mother and infant wish. This document provides information that will help health professionals promote these objectives.

Almost all mothers are capable of breastfeeding their infants. Outcomes are much improved where the mother has the support and encouragement of the infant’s father, other family members, the hospital, and the community. Many mothers—perhaps the majority—encounter some difficulties with breastfeeding but, with support and encouragement from health professionals and community organisations, they can nearly always continue to breastfeed. Further, most mothers can continue breastfeeding if they choose to return to work. It is important, though, to follow the correct procedures when expressing and storing breastmilk.

Similarly, in the event that an infant is not breastfed, it is important that correct methods be used for the preparation and storage of feeds. The WHO International Code of Marketing of Breast-milk Substitutes and the Marketing in Australia of Infant Formulas: Manufacturers and Importers Agreement provide the basis for control of the marketing of infant formula in Australia.

All health workers have an obligation to promote breastfeeding in the community and to ensure that best practice in breastfeeding is followed.

In comparison with many other countries, Australia’s breastfeeding record is good, but it is important for the health of the nation’s mothers and infants that initiation rates and the duration of breastfeeding be increased.

The main management precepts are briefly described in the remainder of this summary.
Breastfeeding

Breastfeeding is the normal way to feed all infants. Breastfeeding is very important in the first six months; breastfeeding and its substantial benefits may continue for two years and beyond.

RECOMMENDATION

- Encourage, support and promote exclusive breastfeeding for the first six months of life. An initiation rate in excess of 90 per cent and 80 per cent of infants being breastfed at the age of 6 months are objectives for Australia.

The active promotion and support of breastfeeding by community health, primary health care services, hospitals, and workplaces will increase initiation rates and the duration of breastfeeding.

RECOMMENDATIONS

- Provide antenatal information and counselling about the benefits and practical aspects of breastfeeding (and the risks of not breastfeeding) to all potential mothers and fathers.
- Promote the principles of the Baby Friendly Hospitals initiative.
- Pay particular attention to the importance of correct attachment and positioning when breastfeeding. Effective, rapid management of any breastfeeding difficulties is important to extend the duration of breastfeeding.
- Encourage community-based programs supporting breastfeeding families: such programs are of increasing importance as the length of hospital stays decreases.
- Encourage support in the community and workplace for flexible work schedules, ‘part-time’ breastfeeding, and the use of expressed breastmilk.
- Continue to implement the WHO International Code of Marketing of Breast-milk Substitutes and the Marketing in Australia of Infant Formulas: Manufacturers and Importers Agreement and ensure that all health professionals understand their obligations.

There are very few contra-indications for breastfeeding. Smoking and environmental contaminants are not reasons for stopping breastfeeding. Moderate, infrequent use of alcohol, most prescription and over-the-counter
drugs, and most maternal diseases are not indications for stopping breastfeeding. Use of a pacifier (dummy) can, however, interfere with breastfeeding.

**RECOMMENDATIONS**

- Encourage mothers who smoke to stop or reduce smoking and to avoid exposing their infant to tobacco smoke. Even if a mother persists with smoking, breastfeeding remains the best choice.
- Encourage mothers to limit their intake of alcohol and to avoid illicit drugs.
- Most prescription drugs are compatible with breastfeeding, but each case should be specifically assessed.
- At present, breastfeeding is contra-indicated when a mother is known to be HIV positive. (Research into the possible benefits of antiretroviral drugs is continuing.)
- If a pacifier (dummy) is used, it should be introduced after one to two months and be used infrequently.

**When an infant is not receiving breastmilk**

If an infant is not breastfed or is partially breastfed, the commercial infant formulas are the most acceptable alternative to breastmilk until 12 months of age.

**RECOMMENDATIONS**

- Parents should be informed of the benefits of breastfeeding and of the risks of not breastfeeding when a change from breastfeeding is being considered.
- If complementary feeding is considered in hospital, the mother’s informed consent should be obtained.
- Use cow’s milk–based formulas until 12 months of age. (All infant formulas available in Australia are iron-fortified.) Use soy-based or other special formulas only for infants who cannot take dairy-based products or because of specific medical, cultural or religious reasons.
- Specialty formulas are indicated only for infants with detected or suspected pathology; the advice of a health care professional should be sought.
- When an infant formula is used, the instructions for preparation must be followed exactly.
It is not appropriate to use nutritionally incomplete alternate milks as the sole source of nutrition for infants. Pasteurised whole cow’s milk is, however, an important component of a mixed diet for a child older than about 12 months.

**RECOMMENDATIONS**

- Pasteurised whole cow’s milk may be introduced to a child’s diet at around 12 months of age and be continued throughout the second year of life—and, of course, beyond. It is an excellent source of protein, calcium and other nutrients.

- Reduced-fat milks (skim milk and milk with 1 or 2 per cent fat) are not recommended in the first two years of life.

- Soy (except soy formula where specifically indicated), rice and other vegetarian beverages—whether or not they are fortified—are inappropriate alternatives to breastmilk, formula or pasteurised whole cow’s milk in the first two years of life.

**Other fluids in infant feeding**

Tapwater that meets the Australian water standards and commercially bottled water—but not mineral, carbonated or flavoured water—are generally suitable for infants and children. Limit the use of fruit juices, to avoid interfering with the intake of nutrient-containing foods and fluids. Herbal teas and other beverages are of no known benefit to an infant and could possibly be harmful.

**RECOMMENDATIONS**

- Boil all water that is to be fed to an infant.

- Limit an infant’s fruit juice intake, to avoid interfering with their intake of breastmilk or infant formula.

- Do not use herbal teas, soft drinks or other beverages.

**The transition to solid foods**

At the age of 6 months, infants are physiologically and developmentally ready for new foods, textures and modes of feeding, and they need more nutrients than can be provided by breastmilk or formula. By 12 months of age, ingestion of a variety of foods from the different food groups, as described in the *Australian Guide to Healthy Eating*, is recommended.
**RECOMMENDATIONS**

- Introduce solid foods at around 6 months, to meet the infant's increasing nutritional and developmental needs.

- Start with low-allergenic foods such as single-grain baby cereals; follow this with vegetables and fruits and then meats. Add only one food at a time and wait several (ideally five to 10) days before introducing a new food. To prevent iron deficiency, iron-containing foods such as iron-fortified cereals are recommended as the first foods, followed later by foods containing meats and other protein-rich foods.

**Caring for infants’ food**

Foods provided to an infant must be free of pathogens and of suitable size and texture; they must also provide the necessary nutrients and be fed to the infant in a safe way.

**RECOMMENDATIONS**

- Store foods safely and prepare them hygienically.

- To prevent botulism, do not feed unpasteurised honey to infants.

- To prevent salmonella poisoning, cook all eggs well and do not use products containing raw eggs.

- Hard, small and round, smooth and sticky solid foods are not recommended because they can cause choking and aspiration.

- Ensure that infants and toddlers are always supervised during feeding.

- Avoid feeding an infant using a ‘propped’ bottle.

**Nutrition in the second year of life**

Healthy eating is important in the second year of life. It provides the energy and nutrients needed for growth and development; it develops a sense of taste and an acceptance and enjoyment of different foods; and it instils attitudes and practices that can form the basis for lifelong health-promoting eating patterns.
RECOMMENDATION

• Small, frequent, nutritious and energy-dense feedings of a variety of foods from the different food groups are important to meet nutrient and energy needs during the second year of life. The regular family diet (see the Australian Guide to Healthy Eating) should be the basis of the child’s meals.

Other aspects of infant nutrition

Food allergies

Whenever possible, food allergies should be minimised.

RECOMMENDATION

• Encourage exclusive breastfeeding for six months to decrease the risk of allergy in infants with a positive family history. If there is a strong family history of allergy, delay introducing some or all of the highly allergenic foods during the first year; among these foods are cow’s milk and other dairy products, soy, eggs, nuts, peanuts and fish. It is best to continue avoiding eggs, nuts and shellfish until the age of 3 years.

Treatment of proven food allergies involves avoidance of foods known to cause symptoms.

RECOMMENDATION

• When food choices are restricted, the advice of a dietitian should be sought to ensure that the dietary intake continues to meet nutrient and energy needs.

Colic

Changes in diets and restrictions on individual foods have had very limited success in the treatment of colic.

RECOMMENDATION

• Ensure that any dietary modification or pharmacological intervention is safe and does not result in nutritional deficiencies.
**Constipation**

In infancy, true constipation is infrequent.

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**Recommendation**

- To avoid unnecessary intervention, parents need to be educated about the wide variation in normal bowel function in infants (particularly those who are breastfed) and toddlers.

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**Dietary fat**

Dietary fat is an important source of energy and the primary source of essential fatty acids. It also promotes the absorption of essential fat-soluble vitamins.

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**Recommendation**

- Restriction of dietary fat is not recommended during the first two years of life because it may compromise the intake of energy and essential fatty acids and adversely affect growth, development, and the myelination of the central nervous system.

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**Dental caries**

The prevalence of dental caries is lower where infants and children have access to fluoridated water and when long-term exposure of teeth to nutrient-containing liquids is avoided. Excessive fluoride intake can, however, cause dental fluorosis.

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**Recommendations**

- Fluoride supplementation is not recommended for infants aged less than 6 months.
- For children between the ages of 6 months and 2 years who are living in areas where the household water supply is not fluoridated, daily supplementation with 0.25 milligrams of fluoride may be recommended.
- Avoid leaving a bottle with a sleeping infant or using one as a pacifier. Avoid night-time and long-term use of baby bottles containing liquids other than water.
- Do not dip pacifiers or bottle teats in sugar or honey.
**Diarrhoeal disease**

Mild to moderate dehydration associated with gastroenteritis should be managed with oral rehydration therapy on the advice of a health professional.

**Recommendations**

- Manage mild to moderate dehydration with an oral electrolyte solution and early refeeding.
- For breastfed infants, continue breastfeeding while supplementing their fluid intake with an oral electrolyte solution as necessary.

**Iron deficiency anaemia**

Iron deficiency is common, but it is preventable if suitable feeding choices are made. Exclusive breastfeeding to the age of 6 months will ensure that breastmilk is not replaced by foods of lower nutrient density and will minimise the risk of iron deficiency.

**Recommendations**

- Continue exclusive breastfeeding for about six months.
- Introduce complementary foods containing iron at about 6 months of age.
- Choose iron-containing formula for infants who are not breastfed and for infants receiving formula as well as breastmilk.
- Delay the introduction of whole cow’s milk until 12 months of age.
- Continue to offer iron-fortified and meat-containing foods beyond 12 months of age.
**Vegetarian diets**

Nutritional needs can be met by a well-planned vegetarian diet. The advice of a dietitian may be needed in particular situations.

**Recommendations**

- Vegetarian mothers should be advised to breastfeed their infants for as long as possible—two years or more. For vegan infants who are not breastfed or are partially breastfed, use of a commercial soy-based infant formula during the first two years of life is recommended.

- After dietary assessment, infants on vegan diets may require nutritional supplements.

**Low-birthweight infants**

Breastmilk is the best food for low-birthweight infants, although special supplements may be required. Low-birthweight infants are often iron deficient and supplementation is required.
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DEFINITIONS

[Unless otherwise noted, the following definitions are taken from reference 1 at the end of this list. Where ‘WHO Code’ is inserted in brackets, this refers to the WHO International Code of Marketing of Breast-milk Substitutes. All the definitions given here are consistent with the WHO definitions—see reference 2 at the end of the list.]

Breastfeeding duration The total length of time during which an infant receives any breastmilk at all—from initiation until breastfeeding has ceased.

Breastmilk substitute Any food being marketed or otherwise represented as a partial or total replacement for breastmilk, whether or not it is suitable for that purpose [WHO Code]. In Australia, this term is considered inappropriate because it implies an equivalence to breastmilk. The term infant formula is used throughout this document, although it is acknowledged that other foods and fluids are used in place of breastmilk. Infant formula is the term used in Australia New Zealand Food Standards Code, volume 2.

Complementary food Any food—manufactured or locally prepared—suitable as a complement to breastmilk or infant formula, when either becomes insufficient to satisfy the nutritional requirements of the infant. Such food is also commonly called weaning food or breastmilk supplement [WHO Code]. In this document the following working definition is used: any nutrient-containing foods or liquids (other than breastmilk) given to infants who are breastfeeding.

Complementary feeding The infant or child is receiving both breastmilk and nutrient-containing foods, which includes any food or liquid containing non-human milk.

Container Any form of packaging of products for sale as a normal retail unit, including wrappers [WHO Code].
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<td><strong>Distributor</strong></td>
<td>A person, corporation or other entity in the public or private sector engaged, directly or indirectly, in the business of marketing at the wholesale or retail level a product within the scope of the WHO Code. A ‘primary distributor’ is a manufacturer’s sales agent, representative, national distributor or broker [WHO Code].</td>
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<tr>
<td><strong>Ever breastfed</strong></td>
<td>Infants who have been put to the breast, if only once. Also includes infants who have received expressed breastmilk but have never been put to the breast.</td>
</tr>
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<td><strong>Exclusive breastfeeding</strong></td>
<td>An infant receives only breastmilk from his or her mother or a wet nurse, or in the form of expressed breastmilk, and no other liquids or solids apart from drops or syrups containing vitamins, mineral supplements or medicines.</td>
</tr>
<tr>
<td><strong>Fully breastfed</strong></td>
<td>This term embraces the WHO indicators of ‘exclusive’ breastfeeding and ‘predominant’ breastfeeding. It refers to infants who are receiving almost all of their nutrients from breastmilk but take some other liquids such as water, water-based drinks, oral rehydration solutions, ritual fluids, and drops or syrups. It excludes any food-based fluids.</td>
</tr>
<tr>
<td><strong>Health care system</strong></td>
<td>Government, non-government and private institutions or organisations engaged, directly or indirectly, in providing health care for mothers, infants and pregnant women. Also includes nurseries and child care facilities, plus health workers in private practice. For the purposes of the WHO Code, the term does not include pharmacies or other established sales outlets.</td>
</tr>
<tr>
<td><strong>Health worker</strong></td>
<td>A professional or non-professional person working in a component of a health care system; includes voluntary unpaid workers [WHO Code].</td>
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<td><strong>Infant</strong></td>
<td>A child aged less than 12 months.</td>
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<td><strong>Infant formula</strong></td>
<td>An infant formula product represented as a breastmilk substitute for infants and which satisfies the nutritional requirements of infants aged up to 4 to 6 months. (Aust New Zealand Food Standards (volume 2) See also Breastmilk substitute.</td>
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**Infant formula product**

Means a product based on milk or other edible food constituents of animal or plant origin which is nutritionally adequate to serve as the principal liquid source of nourishment for infants. (Australia New Zealand Food Standards (volume 2).

**Initiation of breastfeeding**

An infant’s first intake of breastmilk.

**Label**

Any tag, brand, mark, pictorial or other descriptive matter written, printed, stencilled, marked, embossed or impressed on, or attached to, a container of any product within the scope of the WHO Code.

**Manufacturer**

A corporation or other entity in the public or private sector engaged in the business or function—whether directly, through an agent, or through an entity controlled by or under contract with it—of manufacturing a product within the scope of the WHO Code.

**Marketing**

Product promotion, distribution, selling and advertising; product public relations; and product information services [WHO Code].

**Marketing personnel**

Any people whose functions involve the marketing of a product or products coming within the scope of the WHO Code.

**Nursing staff**

The terms used for nursing staff associated with infant care change from time to time and in different localities. In this document the term encompasses all involved in infant and maternal care, regardless of their current or former titles.

**Predominant breastfeeding**

An infant’s predominant source of nourishment is breastmilk but he or she may also receive water and water-based drinks (sweetened and flavoured water, teas, infusions, and so on); fruit juice; oral rehydration solution; drop and syrup forms of vitamins, minerals and medicines; and ritual fluids (in limited quantities). All other food-based fluids are excluded—in particular, non-human milk. (In everyday use, this term is sometimes used to include infants who are occasionally fed non-human milk, but the ‘official’ use of the term precludes this.)
DEFINITIONS

Samples Single or small quantities of a product provided without cost [WHO Code]. For the purposes of this document, and having regard to the Australian context, free or subsidised samples or supplies of infant formula are those given by manufacturers to health care facilities at no cost or at a cost that is substantially less than the normal retail or wholesale cost.

Supplies Quantities of a product provided for use over an extended period, free or at a low price, for social purposes, including those provided to families in need [WHO Code].

Solid foods Any nutrient-containing foods (semi-solid or solid)—for example, dilute infant cereals. Excludes breastmilk and breastmilk substitutes, fruit and vegetable juices, sugar water, and so on.

Supplementary feed Fluids or foods dissolved in fluids given to completely replace a breastfeed. The distinction between complementary feeds and supplementary feeds is important: there seems to be a great deal of confusion among health professionals.

Toddler A child aged from 1 to 2 years.

Weaning The period during which an infant is introduced to breastmilk substitutes or solid foods, or both, with the intention of ceasing breastfeeding. (This term should be used with care: in the literature, weaning, weaning foods and weaned are used in different ways.)

Weaned The infant or child no longer receives any breastmilk.

Young child A child aged less than 5 years.

REFERENCES


INTRODUCTION: BREASTFEEDING IN AUSTRALIA

[The introduction of solid foods is covered in detail in the Dietary Guidelines for Children and Adolescents in Australia.]

Breastfeeding is the normal way to feed infants. The purpose of this document is to encourage health workers to continue promoting breastfeeding as the norm and to help mothers overcome any difficulties they might encounter. All health workers have an obligation to promote breastfeeding and to ensure that best practice in breastfeeding is followed. With modern obstetric care, mothers spend so little time in hospital that breastfeeding may not be fully established before they are discharged; the result is that many mothers who are breastfeeding consult community health professionals.

Provision of breastfeeding education prior to, or in the early stages of, pregnancy is important. The earlier in the pregnancy a mother makes the decision to breastfeed, the more likely is she to initiate breastfeeding and continue to breastfeed.1,2 The support of the baby’s father and the encouragement of society play important roles in the success of breastfeeding3—see Chapter 1 of the Dietary Guidelines for Children and Adolescents and Section II here for a more detailed discussion.

When, for some reason, substitutes for breastmilk are used, health workers should provide the relevant information and do their utmost to ensure that best practice is followed. Once the use of infant formula is established, the appropriate public health response is to ensure best practice, minimise the risks associated with formula feeding, and avoid inducing guilt in the mother.

Exclusive breastfeeding to the age of about 6 months gives the best nutritional start to infants and is recommended by a number of authorities.4–8 The WHO reviewed the literature on breastfeeding duration and more than 3000 references were identified. The WHO Expert Consultation recommended exclusive breastfeeding for six months, with the introduction of complementary foods and continued breastfeeding thereafter; the 2001 World Health Assembly adopted a resolution supporting this change in policy.7 The WHO also recommends that breastfeeding continue for up to two years and beyond. Breastmilk can continue to provide half or more of an infant’s nutrients during the second half of the first year of life and up to one-third during the second year of life <www.who.int>.

For Australia, it is recommended that as many infants as possible be exclusively breastfed until 6 months of age. It is further recommended that mothers then continue breastfeeding until 12 months of age—and beyond if both mother and infant wish. Although the greatest benefits from breastfeeding are to be gained in
the early months, especially from exclusive breastfeeding for at least six months, there is no doubt that breastfeeding provides benefits that continue beyond this time. After six months, continued breastfeeding along with complementary foods for at least 12 months will bring continuing benefits.9–14

Infants’ needs differ, and a small number may benefit from the introduction of solids before the age of 6 months, but not before 4 months.15 Growth monitoring on a regular basis, using an accurate scale, a suitable methodology and a growth reference, offers the most objective way of determining whether there is a need for supplementation. This should, however, be considered in association with a number of factors, among them examination, the infant’s history, the parents’ size, and the infant’s current feeding patterns. If an infant’s growth is faltering, efforts should be made to increase the milk supply: the assistance of a lactation consultant is often beneficial. Infants who are exclusively breastfed until the age of 6 months are likely to have better iron status than those who have been given other foods. This is because of the high bioavailability of the iron (lactoferrin) in breastmilk. However, delaying the introduction of solid foods much beyond 6 months can compromise iron status. Iron deficiency at this age is known to cause delayed growth and problems with cognitive development16,17—see Chapter 3 of the Dietary Guidelines for Children and Adolescents for further information.

Australia includes breastfeeding in its national health goals and targets, and all the states have also accorded high priority to maximising initiation rates and the duration of breastfeeding. Following a decline in breastfeeding around the middle of the 20th century, in the 1970s there was increasing recognition of the harm being done by departing from the norm of breastfeeding. Rates began to increase again, in Australia and in comparable overseas countries, beginning in the higher socio-economic groups. By 1983 both the prevalence and the duration of breastfeeding in Australia were among the highest in the western world, with 85 per cent of mothers breastfeeding at discharge from hospital and 54–55 per cent three months later.18 Breastfeeding rates have remained around this level since then. In comparison, breastfeeding initiation rates in the United States were around 20 per cent in the 1970s and increased to 62 per cent in 198219; they then declined in the 1990s but rose again, to 68.2 per cent, in 2000.8 Promotion of breastfeeding in the Australian dietary guidelines may have been an important factor in preventing the decline in breastfeeding seen in the 1990s in other countries.

In 1992–93 in Western Australia and 1995–96 in Queensland a survey was carried out by Scott et al.1,20; the results suggested a continuing trend to increasing breastfeeding rates and durations in those states. In the years preceding the survey the hospitals had a breastfeeding discharge rate of 82 per cent, and by six months 46 per cent of mothers were still breastfeeding (note that the Scott et al. and the Palmer18 data are not significantly different). Women who were born in Australia or New Zealand were almost twice as likely to be breastfeeding at discharge than women born in other countries.
INTRODUCTION: breastfeeding in Australia

Donath and Amir analysed data from the 1995 National Nutrition Survey and found that breastfeeding rates were 81.8 per cent on discharge from hospital and 57.1 per cent fully breastfed at age 3 months. At age 6 months it is estimated that 18.6 per cent of babies are fully breastfed and 46.2 per cent partially breastfed; at 1 year of age 21.2 per cent of infants are receiving some breastmilk. Thus, in Australia at present fewer than 20 per cent of infants are achieving the goal of being exclusively breastfed to 6 months of age and continuing with breastfeeding thereafter. It is important to note, however, that, while the objective is to promote exclusive breastfeeding to the age of 6 months, any amount of breastfeeding is to be encouraged. Mothers should always be encouraged to continue breastfeeding, even if their circumstances do not allow exclusive breastfeeding.

Mothers who are less likely to breastfeed are those from lower socio-economic groups and certain ethnic groups. Mothers born in Asia are among the earliest of the ethnic groups to stop breastfeeding; they are followed by mothers from lower socio-economic groups.

Although the Australian figures are better than those for most other developed countries, by the age of 6 months about half of the infants in Australia are no longer breastfed. This decline in breastfeeding rates after the first few months means a loss of important health benefits for these infants, and hence for Australia.

The current situation and the challenge facing Australia can be put in the following terms. Initiation rates are relatively high, at around 82 per cent or more, but experience in countries such as Sweden and Norway suggests that an initiation rate of 98 per cent is achievable. A target of 50 per cent exclusive breastfeeding for the first six months is realistic in the next few years; this target would still be sub-optimal, and it should be raised as soon after that as practicable. Within a decade a target of 80 per cent fully breastfed for around six months should be set and the necessary parental education and community support initiated.

The socio-cultural environment has an important influence on parents’ choice to breastfeed their infant. Antenatal exposure to the advertising of infant formula increases the rate of early termination of breastfeeding and shortens the overall duration among women with uncertain breastfeeding goals or goals of 12 weeks of less. For these reasons, the promotion of infant formula in Australia is controlled by voluntary codes based on the World Health Organization’s policies.

The WHO International Code of Marketing of Breast-milk Substitutes

During the 1960s and 1970s infant formulas were inappropriately marketed in many countries, contributing to a decline in breastfeeding and consequent increases in infant morbidity and mortality. In response to this situation, UNICEF, the WHO and a number of other organisations proposed a code to limit the inappropriate promotion of infant formulas. The World Health Assembly adopted...
the International Code of Marketing of Breast-milk Substitutes on 21 May 1981, with 118 votes in favour, one against, and three abstentions.

The recommendation to develop a marketing code came out of the 1979 UNICEF–WHO ‘Meeting on Infant and Young Child Feeding’. The meeting was attended by representatives of governments, UN agencies, non-government organisations and the infant-food industry, and experts from related disciplines. The WHO Code aims to protect the nutritional wellbeing of all infants in two separate but closely related ways: through protecting and promoting breastfeeding; and the appropriate use and marketing of breastmilk substitutes, bottles and teats when these are necessary.24

Since 1981 the World Health Assembly has adopted a number of resolutions that relate to the WHO Code and clarify some of its provisions. Among the most significant of these is Resolution 39.28 (1986), which deals with the issue of free supplies, the promotion of early introduction of and use of complementary foods, and the use of follow-up milks. The Assembly’s Resolution 47.5 (1994) adds important guidance on the issue of free supplies and proper complementary feeding at the age of about 6 months. Resolution 49.15, adopted in 1996, urges member states to ensure that complementary foods are not marketed in ways that undermine exclusive and sustained breastfeeding. The same resolution addresses the question of financial support for health professionals and warns about the danger of conflicts of interest. In response to the WHO Code, in Australia a self-regulatory model was adopted (see ‘Implementation of the WHO Code in Australia’, at the end of this introduction). To mark the 20th anniversary of the Code, Young reviewed some of the violations still being encountered.25

Since the WHO Code was adopted a number of other initiatives designed to improve the health of infants through promoting and supporting breastfeeding have been developed. One is the joint WHO–UNICEF Baby Friendly Hospital initiative, announced in 1991, which seeks to eliminate hospital practices that may interfere with successful initiation and maintenance of breastfeeding. Although mothers are now in hospital for only a short period after delivery, hospitals can still have a positive influence on breastfeeding. If hospitals are not supportive of breastfeeding the negative effects can be marked. A Cochrane systematic review has shown that that negative hospital practices, such as the distribution of commercial sample packs, can have a very negative effect on breastfeeding. The distribution of these packs (with or without formula) to mothers while in hospital reduces the number of women who exclusively breastfeed.26

Hospitals are encouraged to adopt the Baby Friendly Hospital initiative and the ‘Ten steps to successful breastfeeding’ (see the box below). All steps in this program have been shown to positively influence breastfeeding outcomes.27 The benefits of this policy have been demonstrated by the Boston Medical Centre, where breastfeeding initiation rates rose from 58 per cent in 1995 to 86.5 per cent in 200028; the recent PROBIT study in Belarus has also shown increased initiation rates.12
A further important statement on breastfeeding is the Innocenti Declaration, which was adopted in April 1990 by participants in the WHO–UNICEF policy makers’ meeting ‘Breastfeeding in the 1990s: a global initiative’.30

**The Baby Friendly Hospitals initiative in Australia**

In Australia the Baby Friendly Hospitals initiative is administered by the Australian College of Midwives Incorporated. As of mid-2001, there were 24 hospitals across Australia that had achieved ‘Baby–Feeding Friendly Hospital status’ <www.UNICEF.org>.

**Promotion of breastfeeding in Australia**

The Commonwealth Government is committed to protecting, promoting and supporting exclusive breastfeeding for the first six months of life and continued breastfeeding thereafter. Australia is one of the few developed countries in the world to include a guideline on breastfeeding in its Dietary Guidelines for Adults; the guideline is included in recognition of the role the whole community plays in encouraging and supporting breastfeeding. In the Dietary Guidelines for Children and Adolescents the breastfeeding guideline is placed first, to emphasise its importance to the health of this age group.

A systematic review of the promotion of breastfeeding has been undertaken by the Health Technology Assessment Group of the National Health Service.31 A total of 59 studies were identified as eligible for inclusion, including 14 randomised controlled trials. Three types of intervention have been found to be effective in developed countries when delivered as stand-alone interventions, or as part of an integrated package:

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**Ten steps to successful breastfeeding**

Every facility providing maternity services and care for newborn infants should:

1. Have a written breastfeeding policy that is routinely communicated to all health care staff.
2. Train all health care staff in skills necessary to implement this policy.
3. Inform all pregnant women about the benefits and management of breastfeeding.
4. Help mothers initiate breastfeeding within half an hour of birth.
5. Show mothers how to breastfeed, and how to maintain lactation even if they are separated from their infants.
6. Give newborn infants no food or drink other than breastmilk, unless medically indicated.
7. Practise rooming-in (allow mothers and infants to remain together), 24 hours a day.
8. Encourage breastfeeding on demand.
9. Give no artificial teats or pacifiers (also called dummies or soothers) to breastfeeding infants.
10. Foster the establishment of breastfeeding support groups and refer mothers to them on discharge from the hospital or clinic.
• small group health education delivered during the antenatal period
• one-to-one health education can be effective in increasing initiation rates in low income mothers
• peer-support programs in the antenatal and postnatal periods have been shown to be effective in increasing breastfeeding initiation and duration.\(^\text{31}\)

**Breastfeeding programs**

The National Breastfeeding Strategy was initiated in 1996 and has funded a number of projects (see [www.health.gov.au/pubhlth/strateg/bbreed/index.htm](http://www.health.gov.au/pubhlth/strateg/bbreed/index.htm) for details). The National Child Nutrition Program, with funding of $15 million, will support community-level projects designed to improve the diet and eating habits of children from the prenatal stage to the primary school years. In addition, the state and territory governments support the promotion of breastfeeding and have additional programs and resources available. Appendix I lists some of the resources relating to breastfeeding and infant feeding that are provided by the Commonwealth and the states and territories.

The National Breastfeeding Strategy has promoted the following actions:

- National Health and Medical Research Council guidelines
  - development and dissemination of the *Infant Feeding Guidelines for Health Workers* (1996), with the aim of helping health workers to promote and support breastfeeding in a consistent way
  - development and dissemination of the *Dietary Guidelines for Australians* (1991), which encourage breastfeeding because of its importance to all Australians in terms of nutritional, health, social and economic benefits to the community
  - development and dissemination of the *Dietary Guidelines for Children and Adolescents*\(^\text{32}\), in which the breastfeeding message is the most important guideline

- the International Code of Marketing of Breast-milk Substitutes
  - facilitation of a self-regulatory model for implementation of the WHO Code in the 1990s. The resulting voluntary agreement is the 1992 Marketing in Australia of Infant Formulas: Manufacturers and Importers Agreement, which deals solely with the marketing of infant formula by manufacturers

- the Australian Breastfeeding Association
  - funding of $50 000 a year for the three years, beginning in 1998–99, allocated to the Australian Breastfeeding Association (formerly the Nursing Mothers Association of Australia) to assist its ongoing work of supporting breastfeeding in the community

- Indigenous health services
  - an audit of current training in breastfeeding support and infant nutrition and a review of current interventions and best practice. The
resultant reports—covering current training in breastfeeding support and infant nutrition, current interventions and identification of best practice, and stories and ideas from around Australia—were produced for use in the development of a national public health nutrition strategy and disseminated by the Office for Aboriginal and Torres Strait Islander Health

- **Naturally: the facts about breastfeeding**
  - a companion to the NHMRC’s *Infant Feeding Guidelines for Health Workers*, this document contains fact sheets for health workers and was distributed to health workers and GPs across Australia

- national accreditation standards for maternal and child health services
  - national care standards for services, such as hospitals and community health services, that support the maintenance of breastfeeding. The standards are set out in the *Maternal and Infant Care Services Module* and the *Guidelines for Maternal and Infant Care Services*

- family education
  - resources called ‘tip cards’ targeting a variety of ethnic, cultural and socio-economically disadvantaged groups in Australia; disseminated in 1998. A variety of resources were produced: five series of tip cards, each with seven hints; a series of tip cards in Vietnamese, Chinese, Arabic, Turkish and Spanish; *You can Breastfeed Your Baby*, a booklet for those with lower literacy; *Let’s give our Baby the Best*, a comic booklet aimed at young parents; and two posters captioned ‘Mother’s milk—perfect anytime, anywhere’

- employer support
  - insert developed for the Department of Workplace Relations and Small Business newsletter *Work and Family* on workplace initiatives to support breastfeeding women (targeted at employers). Disseminated nationally to employers

- health professionals’ education
  - education kit targeting community health workers and members of professional colleges. Distributed to practising GPs and paediatricians, baby health clinics and pharmacies. A variety of resources were produced: a best-practice guide to the management of common breastfeeding problems; a lactation resource guide; a breastfeeding module (a continuing education program for GPs); a continuing pharmacy education module on breastfeeding; and similar modules for child health nurses and pharmacy assistants

- antenatal education breastfeeding package
  - an education package, distributed to 3000 antenatal educators and obstetricians, consisting of an *Educators Manual*, providing strategies, tools and lesson plans, including for use with people of non–English speaking background; a video promoting the importance of the social,
emotional and relationship aspects of breastfeeding; and a poster to accompany the video and for display in waiting rooms

- workplace support
  - resources to be developed and strategies implemented that facilitate women breastfeeding whilst in employment. Fifty thousand kits have been distributed to medium and large businesses across Australia. The resources produced are a booklet, aimed at employers and employees, on ways of continuing breastfeeding; a poster for display in workplaces as a general awareness-raising tool; a flier featuring key aspects of combining breastfeeding and paid work; and the same flier translated into Turkish, Vietnamese, Chinese, Arabic and Spanish.

The National Breastfeeding Monitoring Program will provide consistent and accurate monitoring of breastfeeding prevalence nationally as part of the National Nutrition Monitoring and Surveillance Project.

The documents prepared as a part of the National Breastfeeding Program are available from the Commonwealth Department of Health and Ageing <www.health.gov.au/pubhlth/strateg/brfeed/index.htm>. Australia is also fortunate in having a number of voluntary organisations active in the promotion of breastfeeding. The largest—and the one most accessible to mothers, through its many branches—is the Australian Breastfeeding Association <www.breastfeeding.asn.au>.

**Implementation of the WHO code in Australia**

In Australia the WHO International Code of Marketing of Breast-milk Substitutes is implemented in a number of ways. A voluntary agreement, the Marketing in Australia of Infant Formulas: Manufacturers and Importers Agreement (the MAIF Agreement), was signed in 1992 (see Appendix J). Under this agreement a monitoring mechanism, in the form of the Advisory Panel on the Marketing in Australia of Infant Formula, was established, funded jointly by industry and government. The panel comprises an independent chairperson, a public health nutritionist and industry and consumer nominees; the Department of Health and Ageing provides secretariat support. (The panel's annual reports are available at <www.health.gov.au>.) The working of the panel and the implementation of the agreement itself has recently been reviewed.34

Australia’s health workers also need information about their responsibilities under the WHO Code, to ensure the continuing emphasis on breastfeeding. Approximately one-third of the WHO Code is directly addressed to health workers, and Section X of these guidelines is devoted to interpreting the Code. Health workers must always ensure that they encourage the initiation and maintenance of breastfeeding and avoid any role in the promotion of breastmilk substitutes.33
These guidelines—prepared after extensive consultation—are a revision of those originally developed by the National Health and Medical Research Council in 1984; they provide for health workers information on ways of encouraging and supporting breastfeeding. Health workers are committed to promoting optimal health and development for all infants. When interpreting these guidelines, however, health workers should be mindful that mothers who do not breastfeed need information about infant formula and instruction about its use and preparation; this is covered in Section VIII. All mothers are entitled to support and advice, so that they can feed their infants well.

**Scope of the WHO Code**

The WHO Code applies to the marketing (and practices related to the marketing) of breastmilk substitutes—including infant formula, other milk products, foods and beverages. It also applies to bottle-fed complementary foods when these are marketed or otherwise represented as suitable, with or without modification, as a partial or total replacement for breastmilk. In addition, the Code deals with the quality and availability of feeding bottles and teats and provides information about their use.

The following box summarises the provisions of the WHO Code, as interpreted and implemented in Australia.
**Interpretation and implementation of the WHO Code in Australia**

The WHO Code has been implemented in Australia through the MAIF Agreement and the NHMRC’s *Interpretation of the WHO Code for Health Workers in Australia*. Following is a summary of the main points covered by these documents.

- The restrictions in the Code apply to infant formula and other products marketed or represented as breastfeeding substitutes and to feeding bottles and teats. Responsibilities are outlined for companies that manufacture, market or distribute these products, as well as for health workers and the health care system.

- Educational materials produced by companies for parents should be unbiased and consistent; they should include all the facts, describe all the hazards, and avoid reference to a specific product. Distribution of materials should be only through the health care system, not through retail outlets.

- Companies are not permitted to promote their products to the general public, either directly or through retail outlets. Companies may not give samples or gifts to parents. Health workers may not give samples to parents.

- Health workers should consider the message about infant feeding that their actions and their health care facility gives to mothers. There should be no display or distribution of products or of company materials that refer to a product or encourage artificial feeding.

- Marketing personnel—even if they are health professionals—should have no contact with parents and should not perform any educational or health care functions.

- Companies may provide scientific and factual information about their products directly to health workers through meetings or materials.

- Companies may not offer, and health workers may not accept, gifts or other inducements that might influence a health worker’s product recommendations to parents or their health care facility. Study grants may be accepted in some circumstances, but they must be disclosed.

- All products within the scope of the Code must conform to standards for quality, composition and labelling.

- Independently of measures taken to implement the Code, companies and health workers should take steps to conform to the principles and aim of the Code and to monitor their own practices.

In Australia, concerns about or breaches of the WHO Code should be reported to the Advisory Panel on the Marketing in Australia of Infant Formula:

APMAIF Secretariat  
Department of Health and Ageing  
PO Box 7186  
Canberra BC ACT 2610


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**References**


ENCOURAGING AND SUPPORTING BREASTFEEDING IN THE AUSTRALIAN COMMUNITY

[The breastfeeding guideline in the Dietary Guidelines for Children and Adolescents contains additional material on factors that are important in promoting breastfeeding initiation and duration.]

A partner who is supportive is important for both the initiation and the duration of breastfeeding. Education of fathers during the antenatal period is a priority as a public health intervention.

Partner support

In my view breastfeeding is like holding down a full time job—only more physically demanding than most! If your partner is working while you are at home with a baby, sometimes it is difficult for them to understand why the dinner is not on the table when they get home, the house is a tip and no shirt is ironed ready for the next day’s work. A supportive partner is able to roll up their sleeves and lend a hand when they are at home. They also bring the baby to you in the middle of the night and don’t complain when you feed the baby lying down in bed because you are too tired to sit upright. It is the small things that help to make it work.

——A senior nutritionist, writing about her own experience

BREASTFEEDING AS THE PHYSIOLOGICAL NORM

Numerous studies have demonstrated the importance of breastfeeding for mothers and infants. The epidemiological evidence confirms the protective effects of breastfeeding, in both developed and less-developed countries.1–3 Breastfeeding has positive effects on the nutritional, health and psychological make-up of the infant and brings health and fertility-control benefits for the mother. It also offers economic benefits to both the family and society.

Benefits to the infant

Nutrition

It is now clear that the composition of breastmilk is uniquely suited to the neonate, at a time when growth and development are occurring at very high rates yet when many of the infant’s systems—such as the digestive, hepatic,
neural, renal, vascular and immune systems—are functionally immature. Many of
the nutrients contained in breastmilk are in readily absorbed and bioavailable
forms.4

Breastmilk is not only a high-quality food; it also contains many components—for
example, bile salt–stimulated lipase, glutamate, certain polyunsaturated long-
chain fatty acids, low sodium, lysozyme, immunoglobulin A, growth factors and
numerous other bioactive factors—that facilitate optimal function of the infant's
immature systems. The living cells found in breastmilk are also important
functionally.

Furthermore, the young of various mammals are born at very different stages of
maturity, and it is not easy to modify the milk of one species so that it optimises
the metabolism of the young of another species.

Health

Studies have shown that breastfeeding reduces the risk or severity of a number
of disease states, among them the following:
• physiological reflux5
• pyloric stenosis6
• respiratory illness, particularly in households where both parents smoke7
• asthma8,9
• obesity10,11
• gastrointestinal tract disease12,13
• inflammatory bowel disease14
• some childhood cancers15,16
• coeliac disease—reduced incidence17 or delayed onset17–20
• otitis media21,22,3
• urinary tract infections23,24
• bacteraemia-meningitis25,26
• SIDS—sudden infant death syndrome27–29
• necrotising enterocolitis in premature infants—reduced incidence.30

A detailed review of the scientific and epidemiological evidence in support of the
World Health Organization’s and UNICEF’s Global Strategy for Infant and Young
Child Feeding provides detailed summaries and assessments of the most relevant
studies. (León-Cava, Lutter et al. 2002)

The mechanism whereby middle ear pressure changes during bottle-feeding and
predisposes to ear infection has recently been described.31

In children who were breast-fed for at least three months, a longitudinal study in
Australian children has shown an improvement in bone mass in eight-year-old
children.32

The association between breastfeeding dose and illnesses in the first six months of
life was analysed by reviewing illness episodes in 7092 infants from the National
I. ENCOURAGING AND SUPPORTING BREASTFEEDING IN THE AUSTRALIAN COMMUNITY

Maternal and Infant Health Survey. Full breastfeeding was associated with the lowest illness rates, while minimal breastfeeding was not protective. Breastfeeding conferred health benefits on infants from all socio-economic groups.

Colic and/or excessive crying in their infants is often a complaint of mothers. Whether colic exists as a separate entity or as symptom of a maternal problem is often debated. However, in a study of 3345 infants aged 1 to 6 months (96 per cent response rate), the prevalence of colic was twice as high among infants of smoking mothers but significantly less among breastfed infants. Maternal smoking as a potential risk factor for infantile crying needs further study. A meta-analysis identified 27 controlled trials of a number of interventions for colic; the authors concluded that for non-breastfed infants ‘infantile colic should preferably be treated by advising carers to reduce stimulation and with a one week trial of a hypoallergenic formula milk’.

Studies on colic are fraught with definitional problems, and many of the studies identified were of short duration. For breastfed infants, simple strategies such as changing to a more upright position should be tried. Letting the baby ‘finish the first side first’ can also be helpful. In the management of colic, discussion with the mother followed by environmental changes should be the first response; changing to an expensive formula should be a last resort, and then only for babies not being breastfed.

Diabetes

Using data from the Oxford Record Linkage Study, Jones and colleagues were able to demonstrate a significant 33% increased risk of diabetes among infants who were not breastfed at discharge. The development of insulin-dependent diabetes mellitus (type 1 diabetes) is linked to the age at which cow’s milk is introduced to an infant’s food intake. Breastmilk contains factors that protect the infant against developing this disease.

Leukaemia

In a case-control study of children under the age of 14 years with leukaemia, 2200 cases and 2419 controls were studied. Ever having breastfed was found to be associated with a 21 per cent reduction in risk of childhood acute leukaemias (odds ratio for all types combined = 0.79; 95%CI: 0.70–0.91). A further nine case-control studies have suggested that children who have never been breastfed or were breastfed in the short-term only have a higher risk than those breastfed for six months or more of developing Hodgkin’s disease. Further studies are needed to confirm the strength of these relationships.

Specific immune factors

Immunoglobulin A (IgA) is the most abundant antibody in breastmilk. It is manufactured in and excreted by the breast in response to specific bacteria and viruses to which the mother is exposed. This provides protection against
I. Encouraging and Supporting Breastfeeding in the Australian Community

pathogens the infant is most likely to encounter in his or her local environment.\textsuperscript{42} IgG and IgM antibodies offer further protection against specific pathogens.\textsuperscript{43} Donnet-Hughes et al. have reviewed all the specific and non-specific factors present in breastmilk\textsuperscript{44} and Oddy has reviewed current knowledge of immune factors in breastmilk.\textsuperscript{45}

Non-specific protective factors\textsuperscript{46}

- Lactoferrin has a high binding affinity with iron, making it unavailable to micro-organisms such as \textit{E. coli} and \textit{Candida albicans}, which require iron for growth. Further, a peptide with bactericidal properties is released from lactoferrin, and it is possible that this peptide is responsible for much of the antibacterial action attributed to lactoferrin.\textsuperscript{47,48} Similarly, vitamin B\textsubscript{12}-binding proteins make vitamin B\textsubscript{12} unavailable to micro-organisms.
- Lysozyme is bactericidal against certain gram-negative rods and gram-positive bacteria.
- Prolactin enhances the development of B- and T-lymphocytes and affects differentiation of intestinal lymphoid tissue. Cortisol, thyroxine, insulin and growth factors promote maturation of the newborn’s intestine and the development of intestinal host defences.
- The functions of cellular components such as macrophages and monocytes, neutrophils and B- and T-lymphocytes are not yet fully understood but do include the inhibition and/or destruction of micro-organisms such as bacteria and viruses.\textsuperscript{43} The concentration of these cellular components is especially high in colostrum, but they are present in all breastmilk.
- Oligosaccharides form the third most abundant class of compounds in breastmilk (12–24 grams per litre). Over 130 different oligosaccharides have been isolated from human milk\textsuperscript{49}, and most are resistant to digestion in the small intestine. They provide specific growth factors for the desirable bifidus bacteria of the large intestine. They also inhibit the attachment of pathogenic bacteria to the mucosal surfaces of the intestinal and urinary tracts and may provide important precursors for the development of the brain in early infancy.
- Fatty acids are released from milk fat by the hydrolytic action between milk and infant lipases. Some of these free fatty acids have antimicrobial actions.\textsuperscript{50}

The concentration of most of these protective factors is highest in colostrum; it decreases as lactation is established and increases again during slow weaning. Although breastfeeding is of particular value while the infant’s immune system is immature, it continues to offer some protection throughout the entire course of lactation.\textsuperscript{45,51}
Breastfeeding and allergy

Breastfeeding offers at least some protection against allergy. In the general population and in atopic families, it can protect against allergic rhinitis, wheezing, asthma and atopy in children. A prospective study of 2187 Western Australian children showed that breastfed infants had lower rates of asthma and atopic disease. After adjusting for confounding factors, the introduction of milk other than breastmilk, led to increased rates of asthma at 6 years of age (OR 1.25, 1.02-1.52) and of atopic disease (1.30, 1.04-1.61). The results of some studies are confounded by the failure to control for the introduction of cow’s milk formula in hospital in the newborn period. The mother’s own feeding history and intake of dietary allergens may also be significant. Among the reasons breastfed babies have fewer occurrences of atopic disease are:

- reduced exposure to the food proteins present in formulas and other foods
- improved maturation of the intestinal barrier, which reduces the absorption of large molecules
- reduced frequency of infection, which can act as an adjuvant
- the presence of anti-inflammatory factors and antibodies in human breastmilk.

Cytokine, growth factors, hormones and other bioactive components in human milk may play an important role in modulating the development of asthma.

Allergy is often a concern for parents and health workers. Current preventive strategies are limited, and many children still develop allergies despite efforts at prevention. If through family history an infant is identified as being at high risk of developing an allergy, the practical tips in Box I.1 may be of assistance.
I. ENCOURAGING AND SUPPORTING BREASTFEEDING IN THE AUSTRALIAN COMMUNITY

Box I.1 Minimising the risk of allergy in high-risk infants

- Do not smoke during pregnancy, and provide a smoke-free environment for your child after birth.
- Dietary restrictions in pregnancy are not recommended.
- Exclusively breastfeed your child for at least six months, and preferably longer.
- If breastfeeding is discontinued for any reason, seek professional advice. A hydrolysed protein formula may be recommended.
- Soy milk and goat’s milk formulas do not reduce allergies, and should not be used as an alternative to cow’s milk formulas.
- Solid foods should not be introduced until about 6 months of age.
- Start with low-allergenic foods such as single-grain baby cereals, followed by vegetables and fruits, then meats.
- Add only one food at a time. Wait several days (ideally five to 10 days) before introducing a new food.
- If there is a strong history of allergy in the family, delay introducing some or all of the highly allergenic foods during the first year—including cow’s milk and other dairy products, soy products, eggs, nuts and fish. It is best to continue to avoid nuts and shellfish until the age of 3 years.
- The foods most commonly associated with allergies are eggs, nuts, dairy products, soya and shellfish. If breastfeeding, the mother should avoid these foods.
- Simple measures designed to reduce the amount of house dust in the child’s bedroom and play areas—for example, using barrier encasing for the mattress and pillow and removing carpets—may help prevent the development of allergy.
- The role of pets in the development of allergy is controversial. It is currently recommended that household pets be kept outside and away from the child’s bedroom and play areas.

Benefits later in life

Breastfeeding confers health advantages that persist into later life. Obviously, this is a difficult area to study because of time lags and differences in definitions. In a study of 625 adults aged about 50 years in Holland, information on infant feeding methods was available. Exclusive breastfeeding seems to have a protective effect against some risk factors for cardiovascular disease in later life, including lipoprotein and glucose levels. Part A of the ‘Special considerations’ section in the Dietary Guidelines for Children and Adolescents provides further information about these benefits.

Psychological benefits

Breastfeeding can be an important factor in the bonding between mother and infant. The interdependence between the breastfeeding mother and infant, the regular close interaction, and the skin-to-skin contact during breastfeeds encourage mutual responsiveness and attachment.

Several studies have shown that the method of feeding in early life affects cognitive development. Children who were breastfed are reported to gain higher
scores on tests of intelligence and language development than those who were bottle-fed. This beneficial effect becomes more pronounced with increasing duration of breastfeeding. Pre-term infants given breastmilk for at least one month had enhanced cognitive development (approximately 7 IQ units) at 7 to 8 years of age compared with formula-fed pre-term infants. This research has been extended to term infants, with similar results for both cognitive and visual development. These responses may be related to the higher concentration of a particular polyunsaturated long-chain fatty acid (docosahexaenoic acid, or DHA) in breastmilk.

**Benefits to the mother**

**Health**

Breastfeeding shows some protection against premenopausal breast cancer, ovarian cancer and osteoporosis.

The Collaborative Group on Hormonal Factors in Breast Cancer has brought together worldwide data from epidemiological studies in 30 countries that included information on breastfeeding patterns and other aspects of childbearing. Their meta-analysis showed a relative risk of breast cancer reduction of 4.3% (95% CI 2.9–5.8; p<0.0001) for every 12 months of breastfeeding in addition to a decrease of 7.0% (5.0–9.0; p<0.0001) for each birth.

Breastfeeding hastens uterine involution after birth and helps the mother regain her pre-pregnancy body weight (providing that breastfeeding continues for more than seven months).

**Contraceptive effect**

Although breastfeeding is not regarded as a reliable method of contraception for individual women in Australia, it does provide useful benefits on a population-wide basis. If all women in the world stopped breastfeeding, it is estimated that 30 to 50 per cent more children would be born in the following 12 months. The risk of pregnancy during periods of lactational amenorrhoea is as low as 1.7 per cent in the first six months, and even in developed countries that compares favourably with barrier methods of contraception, as long as the woman remains amenorrhoeic. For example, amenorrhoea is increased by exclusive and more frequent nursing, especially at night.

**References**

I. ENCOURAGING AND SUPPORTING BREASTFEEDING IN THE AUSTRALIAN COMMUNITY


I. ENCOURAGING AND SUPPORTING BREASTFEEDING IN THE AUSTRALIAN COMMUNITY


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II INITIATING, ESTABLISHING AND MAINTAINING BREASTFEEDING

Health professionals and voluntary health workers can provide invaluable help for mothers initiating breastfeeding. Offering factual information and sympathetic support, demonstrating practical skills, and discussing strategies for problem solving all work to create a positive environment for breastfeeding. Nevertheless, it is important to view this role as one of encouragement and support between mother and worker, always having regard for the mother’s suggestions, concerns and cultural background.

BREASTFEEDING EDUCATION FOR PARENTS

All women should be informed of the benefits of breastfeeding and the risks of not breastfeeding. Health professionals should also discuss the management of breastfeeding with them, and they should be encouraged to use the services available for antenatal education. The antenatal education should cover the importance of exclusive breastfeeding for the first six months (including the nutritional and protective benefits), basic breastfeeding management, and coping with minor problems. Mothers should also be encouraged to become familiar and comfortable with handling their breasts. Virtually every mother can breastfeed, but for some it is not so easy and learning and patience are necessary.¹

In many cultures the support of grandmothers and other female relatives is very important and changes in family structures in Australian society now mean that the father’s role has assumed greater importance. Education programs should involve fathers and help them understand the advantages of breastfeeding and the role they can play in supporting the breastfeeding mother.²⁵

Since breastfeeding should be regarded as ‘best practice’, mothers wishing to initiate formula feeding in a health care institution should sign a form indicating their informed consent. A policy using standard informed-consent procedures should be considered; this is required by the Baby Friendly Hospital initiative. The Baby Friendly Hospital initiative should be implemented in all maternity facilities in Australia, and a 10-year plan for achieving this should be prepared.

A range of useful, easy-to-read, publications dealing with pregnancy and breastfeeding is available through antenatal programs, outpatient services, early childhood centres, community health centres, and medical practitioners. Hospitals and other agencies should offer information about the Australian Breastfeeding Association and contact details for local support groups. A resource list is provided in Appendix I. The ABA’s (Australian Breastfeeding
II. Initiating, Establishing and Maintaining Breastfeeding

Association) Lactation Resource Centre has breastfeeding information available in a variety of media. Many of these resources are also available from local ABA groups.

In hospital during the postnatal period, midwives give support, help and advice as mothers begin breastfeeding. A lactation consultant is generally available if someone experiences difficulties and needs specialist advice. Women whose babies are in special care should be encouraged—using both practical demonstration and written information—to initiate and maintain an adequate milk supply. When expression of breastmilk is required, mothers sometimes have particular difficulty in the immediate post-partum period and may require extra support.

Following discharge from hospital, support, particularly from home-support midwives and lactation consultants, should still be available. Mothers are also encouraged to seek assistance from other people, such as maternal and child health nurses and ABA counsellors. General practitioners need to be familiar with breastfeeding or at least with points of referral for assistance.

Antenatal Advice

The initial antenatal interview between a woman and her doctor or midwife should include a careful assessment of a woman’s (and her partner’s) attitudes, beliefs, expectations, knowledge and experience in relation to infant feeding. Nursing and medical practitioners often leave discussion of breastfeeding until later in the pregnancy, but research shows that the earlier in the pregnancy a decision to breastfeed is made the more likely the breastfeeding will be successful.4

During antenatal examination the following breast characteristics should be noted:

- scars indicating previous surgery
- extra-large breasts, which may sometimes cause initial difficulties with attachment
- nipple or areola eczema or dermatitis
- minimal or absent development of the mammary tissue—very rare
- any other breast pathology.

Physical problems that interfere with breastfeeding are extremely rare, and in most societies breastfeeding has been universal.5,6 Antenatal treatment of inverted or non-protractile nipples is not recommended: it has been found to be ineffective and associated with a negative impact on breastfeeding.7 Various practices for antenatal nipple preparation—including some form of nipple friction, applications of cream, and antenatal expression of colostrum—have
been evaluated by a number of researchers, but no evidence has been found to support these practices. Nor is there evidence to support the commonly held belief that fair-skinned women are more likely to experience nipple problems.

**Physiology of Breastmilk and Breastfeeding**

**Breastmilk production**

The alveoli of the breast mature during pregnancy under the control of the hormones of pregnancy. Progesterone, prolactin and human placental lactogen are essential for the final stages of mammary growth and differentiation. Lactogenesis Stage One is complete by mid-pregnancy; the breast is then able to secrete and lactose is found in blood and urine. During the first three to four days post-partum, copious milk secretion occurs; this is Lactogenesis Stage Two, and it involves preparation of the mammary epithelium, progesterone withdrawal, maintained prolactin levels, and removal of milk from the breast.

**Control of the initiation of lactation after birth**

Late in pregnancy, copious milk production is inhibited by the high concentrations of blood progesterone. In the presence of permissive hormones (prolactin, cortisol and insulin), the withdrawal of progesterone following the delivery of the placenta triggers a rapid increase in milk production approximately 30 to 40 hours after birth.

The withdrawal of progesterone and the changes in milk composition following delivery by Caesarean section are similar to those following normal delivery. Where possible, management of breastfeeding after a Caesarean birth should be similar to that after a normal birth. Initiation of lactation is delayed a further 24 hours in women who have type 1 diabetes and may be inhibited if there is a retained placental fragment.

Milk ‘comes in’ about 48 to 72 hours after birth and is perceived by the mother as the start of lactation. However, milk ‘coming in’ does not mean a sudden increase in the infant’s milk intake, and the aetiology of associated engorgement is poorly understood.

Four secretory processes are involved in the production of milk by the mammary gland:

- exocytosis
- fat synthesis and secretion
- secretion of ions and water
- transcytosis of immunoglobulins and other substances, from the interstitial space and the paracellular pathway.
II. INITIATING, ESTABLISHING AND MAINTAINING BREASTFEEDING

Regulation of milk production

It has long been known that one of the most important factors in successful lactation is removing milk from the breasts. Recent research shows that the lactating mammary gland exercises a local feedback inhibitory control over milk synthesis, referred to as autocrine control. It is important to emphasise the following simple equation:

\[ \text{SUPPLY} = \text{DEMAND} \]

The rate of milk production is regulated to match the amount of milk removed from each breast at each breastfeed. If milk withdrawal has not started within three days post-partum, the changes in milk composition with lactogenesis are reversed and the likelihood of the establishment of successful breastfeeding declines.

Prolactin is secreted by the anterior pituitary gland in response to sucking and the consequent stimulation of the nerve endings in the nipple and areola. The secretion is greatest in early lactation and declines to only a small response six months after birth. There does not appear to be any relationship between the release of prolactin and milk yield: it is thought that hormonal influences regulate the maximum potential for milk production in women and that autocrine control ‘downregulates’ milk synthesis to match the mother’s supply of milk to the infant’s appetite. In contrast with fat, the concentration of prolactin is high in the ‘fore milk’ but low in the ‘hind milk’. However, the physiological significance of these changes is unknown.

A meta-analysis of the milk volumes of exclusively breastfeeding women shows that milk production is fairly constant across studies from a number of different countries, at about 800 millilitres a day (820ml; SD 110ml).

Milk ejection

Within seconds of a baby stimulating the sensory nerve endings around the nipple by sucking, a pulse of oxytocin is released from the posterior pituitary gland. Oxytocin stimulates the contraction of myoepithelial cells surrounding the alveoli, and milk is forced into the ducts and milk sinuses towards the nipple. This process is known as milk ejection or milk let-down. Multiple releases of oxytocin can occur during a breastfeed (or during breast expression). Milk ejection can be blocked by stress, but it rarely seems to be a problem in breastfeeding mothers; on the other hand, eliciting milk ejection can at times be a problem for mothers expressing breastmilk.

Breastmilk composition

Human breastmilk is a very complex secretion, consisting of thousands of compounds and cellular components. Furthermore, the composition of milk varies greatly between different species, and mature human milk tends to fall at
II. INITIATING, ESTABLISHING AND MAINTAINING BREASTFEEDING

one extreme (see Tables II.1 and II.2), having very low concentrations of protein and sodium chloride and high concentrations of lactose and oligosaccharides. Appendix G provides a detailed table of composition. Human milk has a characteristic very pale whitish-blue appearance. One important component is, of course, water: this meets all the infant’s requirements, and for at least six months no additional fluids are required when breastfeeding.

Breastmilk’s whiteness is a result of its fat content, so hind milk, which usually has a higher fat content than fore milk, has a whiter appearance. It is misleading to describe breastmilk as ‘thin’ or ‘watery’: it contains the same energy and total solids content as cow’s milk. Precipitation of the casein curd from milk produces whey that contains soluble proteins, lactose and many water-soluble minor components.

Table II.1 Composition of mature human milk and cow’s milk and composition of infant formula

<table>
<thead>
<tr>
<th>Component</th>
<th>Mean value for mature human milk</th>
<th>Cow’s milk</th>
<th>Infant formulaa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy (kJ)</td>
<td>280</td>
<td>276</td>
<td>273–285</td>
</tr>
<tr>
<td>Energy (kcal)</td>
<td>67</td>
<td>66</td>
<td>65–68</td>
</tr>
<tr>
<td>Protein (g)</td>
<td>1.3b</td>
<td>3.2</td>
<td>1.5–1.7</td>
</tr>
<tr>
<td>Fat (g)</td>
<td>4.2</td>
<td>3.9</td>
<td>3.6–3.9</td>
</tr>
<tr>
<td>Lactose (g)</td>
<td>7</td>
<td>4.6</td>
<td>7.0–7.6</td>
</tr>
<tr>
<td>Sodium (mg)</td>
<td>15</td>
<td>55</td>
<td>14–17</td>
</tr>
<tr>
<td>Chloride (mg)</td>
<td>43</td>
<td>97</td>
<td></td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>35</td>
<td>120</td>
<td>42–55</td>
</tr>
<tr>
<td>Phosphorus (mg)</td>
<td>15</td>
<td>92</td>
<td>21–32</td>
</tr>
<tr>
<td>Iron (µg)</td>
<td>76c</td>
<td>60</td>
<td>700–800</td>
</tr>
<tr>
<td>Vitamin A (µg)</td>
<td>60</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Vitamin C (mg)</td>
<td>3.8</td>
<td>1.8</td>
<td>5.4–7.1</td>
</tr>
<tr>
<td>Vitamin D (µg)</td>
<td>0.01</td>
<td>0.08</td>
<td></td>
</tr>
<tr>
<td>Linoleic acid (mg)</td>
<td>–</td>
<td>–</td>
<td>Minimum 190mg</td>
</tr>
<tr>
<td>Potassium (mg)</td>
<td>60–70</td>
<td>–</td>
<td>56–59</td>
</tr>
<tr>
<td>Magnesium (mg)</td>
<td>3.0–3.5</td>
<td>–</td>
<td>4.5–5.3</td>
</tr>
<tr>
<td>Renal solute load</td>
<td>–</td>
<td>–</td>
<td>Average 290</td>
</tr>
</tbody>
</table>

– Zero.

a. Ranges for infant formula products (from birth, cow’s milk–based, whey:casein ratio of 60:40). 

b. True protein = 0.85g per 100ml, excluding non-protein nitrogen, although a proportion of the non-protein nitrogen is used for the maintenance and growth of infants.

c. Iron in breastmilk is highly bioavailable, with absorption of 50–70 per cent.

d. Iron in infant formula is poorly bioavailable, with only about 10 per cent absorption.

Sources: Reference 23; data for the average composition of infant formula supplied by the Infant Formula Manufacturers Association of Australia Inc. (2001).
Table II.2  Composition of milk from selected species: a comparison

<table>
<thead>
<tr>
<th>Species</th>
<th>Lactose</th>
<th>Protein</th>
<th>Fat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human</td>
<td>70</td>
<td>8</td>
<td>41</td>
</tr>
<tr>
<td>Horse</td>
<td>62</td>
<td>19</td>
<td>13</td>
</tr>
<tr>
<td>Pig</td>
<td>55</td>
<td>56</td>
<td>83</td>
</tr>
<tr>
<td>Cow</td>
<td>48</td>
<td>32</td>
<td>37</td>
</tr>
<tr>
<td>Goat</td>
<td>41</td>
<td>29</td>
<td>38</td>
</tr>
<tr>
<td>Rabbit</td>
<td>22</td>
<td>103</td>
<td>151</td>
</tr>
<tr>
<td>Harp seal</td>
<td>1</td>
<td>87</td>
<td>422</td>
</tr>
</tbody>
</table>

The increase in the fat content as milk is withdrawn from the breast is a feature of mammalian lactation. Much emphasis has been given to the significance of this change for an infant’s energy intake, but the physiology of milk synthesis, secretion and removal is not fully understood. There are only two ways a breastfed baby can obtain a higher energy intake over a 24-hour period: if the mother produces more milk; or if the mother produces the same volume of milk with a higher fat content. Since animal studies demonstrate that it is indeed very difficult to alter the average daily composition of milk, it is not surprising that research has shown that variations in the intervals between breastfeeds and in the amount of milk withdrawn during a breastfeed explain only a small proportion (20 per cent) of the variation in the fat content of breastmilk. (Daly, S. E. J., A. Di Rosso, et al. (1993). Degree of breast emptying explains changes in the fat content, but not fatty acid composition, of human milk. *Experimental Physiology* 78: 741–55.)

One factor that does determine the fat content of breastmilk is the fullness of the breast. The first milk withdrawn from a full breast has a low fat content, and the fat content begins to rise more rapidly after the removal of about 40 per cent of the breast’s storage capacity. Depending on both the fullness and the storage capacity of the mother’s breasts, the fat content at the end of one breastfeed (the hind milk) may be either lower or higher than that at the beginning (the fore milk) of a subsequent breastfeed. 24

Colostrum, which is produced in the breast during late pregnancy and for the first 30 to 40 hours after birth, is yellowish and thicker than mature milk, and it contains a high concentration of immunoglobulins.

Individual variation

Mothers and babies vary considerably in a range of aspects of breastfeeding. 25 The anatomy of the breast varies greatly between women. Some women can store up to six times more milk than other women. 26 As a result, women with large storage capacity have great flexibility in their frequency of breastfeeding, while women with a smaller storage capacity need to feed more frequently to
maintain similar levels of milk production. This latter group should spread breastfeeds fairly evenly over the 24-hour day. This highlights the importance of infant-led feeding—allowing the infant to regulate intake according to need. It also shows the value of letting the infant ‘finish’ the feed in their own time, not according to the clock.

Apart from storage capacity, there is considerable variability in the rate of milk flow, the nature of mouth–breast positioning, and the changes in milk composition during a feed. Advice should be tailored to each mother and her infant’s circumstances, rather than arbitrary rules on timing and positioning being imposed.27

Maternal nutrition and lactation

Good nutrition is very important for the health and wellbeing of all women and particularly for lactating women, who have additional nutritional requirements.28 The additional nutrient requirements are documented in the recommended dietary intakes.29 While milk intakes of infants are quite variable, average intakes of exclusively breastfed infants (defined as those who receive no other foods or fluids) range from 710 grams per day at 0–2 months of age to 900 grams/day at 9–11 months of age. For partially breastfed infants (defined as those who receive breast milk plus other foods or fluids), average intake decreases from 640–687 grams/day at 0–5 months of age to 436–448 grams/day after 9 months of age.30 The amount of additional energy that is required to produce these amounts of milk is shown in Table II.3.

Table II.3 Summary of additional energy needs during lactation30

<table>
<thead>
<tr>
<th>Breastfeeding (months)</th>
<th>Milk volume (ml/day)</th>
<th>Energy cost of milk (kcal/day)a</th>
<th>Energy cost of milk synthesis (kcal/day)b</th>
<th>Full costs (kcal/day)</th>
<th>Allowing for fat loss (kcal/day)c</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exclusively</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0–2</td>
<td>710</td>
<td>476</td>
<td>119</td>
<td>595</td>
<td>440</td>
</tr>
<tr>
<td>3–8</td>
<td>800</td>
<td>536</td>
<td>134</td>
<td>670</td>
<td>515</td>
</tr>
<tr>
<td>Partially</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0–5</td>
<td>660</td>
<td>442</td>
<td>111</td>
<td>553</td>
<td>398</td>
</tr>
<tr>
<td>6–8</td>
<td>590</td>
<td>395</td>
<td>99</td>
<td>494</td>
<td>339</td>
</tr>
<tr>
<td>9+</td>
<td>440</td>
<td>295</td>
<td>74</td>
<td>369</td>
<td>369</td>
</tr>
</tbody>
</table>

a. Using 0.67 kcal/g.

b. Assuming 80% efficiency.

c. Assuming about 500 g/month (16.7 g/day) up to 8 months (none thereafter) at 9.3 kcal/g.

Diet can influence the chemical constituents of breastmilk, as studies on vitamin A and lipids have shown.31–33 The principles of the *Australian Guide to Healthy Eating* remain the basis of an appropriate diet. Mothers who are on very restrictive diets—vegans, for example—will need specific assessment to ensure that they are not deficient in nutrients such as vitamin B12.
II. Initiating, Establishing and Maintaining Breastfeeding

Attaching and positioning at the breast: the key to successful breastfeeding

An infant’s ‘milking’ of the breast is dependent on two things: ‘latching onto’ sufficient breast tissue containing the lactiferous sinuses or milk glands; and the correct sucking or milking action with the tongue. Correct positioning at the breast and correct latching-on and milking action are vital for the efficient removal of milk from the breast without nipple pain or trauma.

- The mother should be seated comfortably in an upright position, so that her breasts fall naturally. She should have good support for her back, arms and feet. The infant should be unwrapped to allow easy handling and avoid overheating.

- If the nipple is erect, support the outer area of the breast with a ‘C’ hold, being careful not to alter the breast position. If the nipple is flat or inverted, move the ‘C’ hold under the breast and shape the breast between the thumb and index finger, well back from the areola.

- The infant should be supported behind the shoulders and facing the mother, with his or her body flexed around the mother’s body. The position must be a comfortable drinking position for the infant.

- The infant’s top lip should be level with the mother’s nipple, and a wide gape should be encouraged by teasing the infant’s mouth with the nipple.

- When the infant gapes widely, bring him or her quickly onto the breast. So that the infant will take a good mouthful of breast, it is always advisable to bring the infant to the breast, not the breast to the infant.

- The chin should be tucked well into the breast, and the infant’s mouth should be wide open, with the bottom lip curled back. More areola will be evident above the infant’s top lip than below the bottom lip. When positioning is correct it is not necessary to hold the breast away from the infant’s nose.

- After an initial short burst of sucking, the rhythm will be slow and even, with deep jaw movements that should not cause the mother any discomfort. Pauses are a normal part of the feed and they become more frequent as the feed continues.

- If the cheeks are being sucked in or there is audible ‘clicking’, the infant is not latched on correctly.

- The infant should stop feeding of his or her own accord by coming off the breast spontaneously. The nipple will appear slightly elongated but there should be no evidence of trauma.

Women normally experience heightened nipple sensitivity and tenderness in the first few days after birth but this subsides as breastfeeding becomes established. If nipples are already sore or cracked—and even if positioning and attaching errors are corrected—they may continue to be tender at the start and end of feeds for some time. The mother should be reassured that the discomfort will diminish as the nipples heal and feeding continues.

If the baby is correctly positioned and attached and is sucking correctly there should be no nipple pain.
II. INITIATING, ESTABLISHING AND MAINTAINING BREASTFEEDING

Signs of a functioning let-down reflex

Although some mothers report no noticeable signs of the let-down reflex, many mothers do notice one or more of the following signs:

- tingling or prickling—‘pins and needles’, which may take several weeks to develop
- a sudden feeling of fullness
- an increase in skin temperature
- a feeling of wellbeing or relaxation
- for some mothers, pain or nausea
- dripping, leaking or spurting from the unsucked breast
- for some mothers, an intense thirst
- uterine contractions accompanied by a gush of lochia in the immediate postpartum period—more common in multiparas.

There may also be noticeable changes in the infant’s sucking and swallowing pattern. This sign is more consistent than any of the others, but it may take the mother several days of observation after her the milk ‘comes in’ to recognise the changes. There are two types of sucking: non-nutritive and nutritive.

Non-nutritive sucking occurs in short, sharp bursts at a rate of up to two per second. Nutritive sucking occurs at a slower rate—about one per second. Once the milk has started to flow the sucking continues at a regular rate. As the feed progresses sucking becomes fragmented into bursts, usually separated by pauses of longer duration than are seen in the non-nutritive phase. At the start of each burst there may be two to three fast sucks typical of non-nutritive sucking—termed restart sucking.

At all times the aim of the health professional should be to help the mother achieve independence in breastfeeding and caring for her infant. If mothers are managing well—particularly mothers who have previously breastfed successfully—advice from midwives and others may be inappropriate if it is not asked for.

THE FIRST BREASTFEED

Baby Friendly training will inform all staff of what is required to promote and support breastfeeding. There is evidence that starting to breastfeed within the first hour or so of birth is good for both mother and infant and for continued breastfeeding. A successful first breastfeed has a number of positive effects:

- It builds the mother’s confidence in her ability to breastfeed.
- The infant starts to receive the immunological benefits of colostrum.
- The infant’s digestion and bowel function are stimulated.
- Correct sucking at the breast at this stage may avert later sucking difficulties.
- The bonding and attachment between mother and infant are enhanced.
Ideally, uninterrupted skin-to-skin contact should be maintained following birth. Common practices such as early weighing, bathing the infant, or passing him or her around should be delayed until later. Good antenatal education will help with parents’ expectations in this regard.

When the infant indicates an interest in sucking, the midwife can guide the mother into a comfortable position that will enable the infant to latch on correctly.

Unless there is a medical reason (such as prematurity) mother and infant should remain together, so that breastfeeding begins and proceeds according to the infant’s needs—without restriction on the number or length of feeds. It should also be emphasised, however, that, although early contact between mother and infant is the ideal, when this is not possible it does not preclude successful breastfeeding. In many cultures, the mother may not have contact with her infant for many hours, yet successful breastfeeding is almost universal.

References

II. INITIATING, ESTABLISHING AND MAINTAINING BREASTFEEDING


III  BREASTFEEDING: EARLY DAYS

Breastfeeding

No-one ever warned me just how hard it is to get breastfeeding established. In my mind I knew that this was the best food for my new baby and certainly the only option as far as convenience was concerned, however I found it quite frustrating (and painful) to learn this new skill at first. It was an eye-opener when I realised that the 2–3 hours between feeds included the time that you took feeding, which meant that sometimes there was a break of less than one hour between feeds to get anything else done. I relied a lot on the support and encouragement that I received from community nurses.

——A senior nutritionist, writing about her own experience

[See also ‘Ten steps to successful breastfeeding’, in the Introduction.]

THE NATURAL PATTERNS OF BREASTFEEDING

Unrestricted feeding, both day and night, is an important factor in successfully establishing breastfeeding and results in optimum milk production. An infant will vary the feeds according to his or her needs and the rate of milk transfer. The mother should be encouraged to allow the infant to finish the first breast before offering the second one. Both breasts should be offered at each feed. The infant may or may not feed from the second breast, depending on his or her appetite.

With correct positioning and unrestricted feeding, breast engorgement is unlikely to occur or will occur only briefly.

THE SLEEPY INFANT

After the initial alert period following birth, some infants become very sleepy for the next 24 hours or so. This may be a consequence of the birth experience or of maternal analgesia during labour, or both.

If an infant has fed well at least once in the first day since birth there is no cause for concern. During the daytime if the infant does not ‘ask’ for a feed after about five hours, he or she can be roused and put to the breast. If the infant has not been to the breast at least once, every effort should be made to encourage him or her to breastfeed.
Strategies for sleepy infants

A number of strategies can be used to rouse sleepy infants and encourage them to breastfeed:

- Changing the nappy often wakes an infant.
- Expressing a little colostrum and giving it by teaspoon, syringe or cup can give the infant the ‘taste’ and he or she will then start seeking the breast.
- Unwrapping the infant, talking to him or her, and gently stroking the legs and abdomen may stimulate him/her to wake and start seeking the breast.
- Sometimes getting the infant to suck on a finger will stimulate the sucking reflex; stroking the lip and cheek will stimulate the rooting reflex.
- The mother can cuddle her infant as often as she likes, and holding the infant against her breast may stimulate seeking.
- If the infant does not take the breast in spite of all efforts and is otherwise well, it is essential to express the colostrum and feed it by teaspoon, syringe or cup.

Most infants soon recover from the initial sleepy period and begin to seek feeds frequently. This can be very tiring for the mother, but the midwife can prepare her for this and reassure her about the benefits of early frequent feeding. This gives the infant colostrum, stimulates full milk production, and reduces the chance of breast engorgement (see Section IV).

Persistent sleepiness

Occasionally sleepiness persists beyond the first day. The infant may be one of the few who do not wake for feeds and so fail to thrive as well as expected. It is important that any medical causes are excluded before the infant is regarded as a ‘sleepy’ baby. This will be apparent after several days. If all other causes are excluded—particularly incorrect attaching to and sucking at the breast—the mother must make sure she feeds the infant at least six times every 24 hours. (Six feeds would be a minimum: mothers should expect that they may be feeding their newborn babies eight to 10 times in a 24-hour period, sometimes more often.)

These infants usually start feeding more frequently as they grow bigger and older. Before going home, the mother should be alerted to the possible need to offer more frequent feeds for some time to come.

The unsettled infant

Most infants have unsettled periods, which can be distressing for parents even though the causes (when they can be found) are usually minor. The midwife and mother may need to evaluate the feeding progress and develop strategies for settling the infant. Health professionals and parents should be aware that the use
of bottles and dummies is usually inappropriate at this early stage of breastfeeding.

Unsettled periods may occur before the mother’s milk ‘comes in’. It is common for infants to want to feed frequently before the milk comes in, particularly in the second 24 hours. The mother may need to be reassured that this is normal and that frequent feeds help stimulate the milk supply and reduce the likelihood of engorgement. Frequent feeds can, however, present a problem for tired mothers during the night. In many cultures it is common for mothers to sleep with their infants. The safest way of co-sleeping is for the infant to have a bassinet next to the mother’s bed. If a mother does choose to sleep with an infant, ‘safe sleeping’ should be emphasised; this includes avoiding hyperthermia, not using soft pillows or bed coverings, avoiding smoking, and avoiding drugs that cause drowsiness (such as alcohol). Sometimes it is appropriate for the midwife to offer the mother time away from the infant, the midwife caring for the infant between feeds while the mother sleeps or rests.

After the milk comes in the following factors should be assessed:

- Is the infant attached properly and getting the milk?
- Is the mother leaving the infant on the breast until he or she comes off naturally?
- Is the infant sucking properly?

Some infants take several days to establish a good sucking technique. Until that happens, the breastmilk may need to be expressed and given to the infant after the breastfeed, by spoon, cup or syringe.

Unrealistic expectations

Because of entrenched social attitudes about sleeping and eating schedules, many people think infants sleep three to four hours in regular patterns around the clock. Infants’ individuality and variations in their appetites should be carefully explained to new mothers.

Is the infant needing attention other than for breastfeeding?

Infants need contact for comfort in addition to food. The mother and the health professional should together consider strategies and options for helping restless or crying infants (see ‘The crying infant’ in Section IV).

Exclusive breastfeeding

Exclusive breastfeeding—that is, no use of breastmilk substitutes—ensures that an infant receives the full nutritional and protective benefits of colostrum and breastmilk.
Detrimental effects of bottle and dummy use

Early use of bottles and dummies (pacifiers), especially before the first breastfeed, can interfere with the natural processes of breastfeeding, reducing the infant’s sucking capacity and the stimulation of the mother’s breasts. The likely result is delayed or poor establishment of lactation.¹ The most important risks associated with use of a pacifier and the non-nutritive sucking habit it promotes are failure of breastfeeding, dental deformities, recurrent acute otitis media, and the risk of accidents. Latex allergy, tooth decay, oral ulcers and sleep disorders are other possible problems; the WHO has published a review of evidence supporting this statement.² A longitudinal study in New Zealand found the use of dummies to be very widespread, at around 80 per cent.³ The authors followed 351 mothers and their infants for 12 months to assess the impact of the use of pacifiers on the duration of breastfeeding; they showed that breastfeeding duration was decreased by pacifier use.

The detrimental effects of giving breastmilk substitutes

Offering complementary feeds—water, glucose or milk formula—when there is no medical reason has been shown to adversely affect the establishment and maintenance of successful breastfeeding.⁴⁻⁷

Complementary feeds

If an infant is unable to take all the feeds directly at the breast, expressed breastmilk should be the preferred method of feeding the infant (see Section V).

Midwifery staff should seek the informed consent of the mother before complementing or supplementing infant feeding with fluids other than breastmilk. Sample consent forms for complementary feeds are shown in Appendix H.

If lactation is not fully established, the mother should be helped to understand the processes of lactation and breastfeeding techniques. She should also be encouraged to call on support people or groups when in need; these can include home care, home midwifery services, lactation consultants, and early childhood nurses. The Australian Breastfeeding Association offers counselling and mother-to-mother support seven days a week.

Breastfeeding of premature infants is occasionally complemented by formula feeding (usually a special product for low-birthweight infants) while in hospital. If these feeds are to be continued after discharge, the mother’s competence in formula preparation and bottle feeding should be ensured and follow-up care organised. In particular, the mother will benefit from information about how she can establish full breastfeeding by:

- gradually increasing her milk supply by expressing after feeds
- increasing the number of breastfeeds per day

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or

- gradually reducing the amount of bottle complements—by putting slightly less in the bottle each time or by cutting down the complement one feed at a time, daily or on alternate days, or more slowly if appropriate.

Even if the mother does need to continue giving complementary feeds indefinitely, it should not be suggested that the infant be totally formula fed. The mother should be encouraged to continue breastfeeding before offering the complementary feed.

**Rooming-in**

Rooming-in 24 hours a day is the usual practice in most hospitals. This means the infant is with the mother from birth. The practice:

- facilitates unrestricted breastfeeding
- promotes mother–infant bonding
- helps prevent cross-infection
- allows both mother and infant contact with the father and other family members
- helps the mother learn about her infant’s patterns of behaviour and feeding, so she learns sooner to manage and care for the infant.

After delivery the infant should remain with the mother, so that they are transferred to the postnatal ward together. The infant’s cot remains beside the mother’s bed. Contrary to popular opinion, mothers who have their infants with them at night lose no more sleep than mothers whose infants are in a nursery.8

Occasional use of the nursery or staff care during the day or night is an option for the mother. If she does choose to place her infant with staff at night, the infant should be taken to her for breastfeeds or the mother should be encouraged and helped to express breastmilk.

After delivery by Caesarean section an infant is sometimes placed in the nursery. When the mother returns to the postnatal ward, though, the infant should be in her room. Initially, rooming-in after Caesarean section calls for extra support from the midwife.

**Monitoring an infant’s progress**

To ensure that an infant is well and to allay any concerns the mother might have, it is important that both mother and health professional have a means of assessing the infant’s progress. Observing the infant and his or her behaviour and documenting his/her feeding and output contribute to this assessment.

A healthy infant is alert and responsive when awake and has bright eyes and firm skin with good elasticity. The adequacy of breastfeeding (with no breastmilk
substitutes) can be assessed by observing the infant’s behaviour, feeding patterns, urine output and bowel actions, and by checking the infant’s weight and using growth reference charts.

**Infants’ behaviour**

Infants are generally content after feeds, although most have one period each day when they want to feed frequently and will not settle (see ‘The crying infant’ in Section IV). This often happens in the evening, and it should not be interpreted as ‘running out of milk at the end of the day’: milk production is continuous over a 24-hour period, although the rate of production varies according to the fullness of the breast.

**Feeding patterns**

Infants usually breastfeed eight to 10 times, or even 12 times, during a 24-hour period. Some mothers expect their infant to feed on a regular four-hourly pattern, but they should be reassured that this is not a common pattern of feeding. The length of each feed is very variable, and during the early neonatal period feeds can take about an hour. If an infant is spending long periods on the first breast, however, there is a good chance there is a feeding problem: perhaps he or she is not attached properly and cannot milk the lactiferous sinuses effectively. The positioning and attachment of an infant should be carefully monitored in the early days.

**Urine output**

Until the mother’s milk comes in an infant will not pass urine often; provided he or she voids once or more every 24 hours there is no cause for concern. As the milk volume increases, the infant’s urine output will increase, and a cloth nappy will be soaked with pale or colourless urine six or more times every 24 hours. Disposable nappies tend to mask wetness and may need close inspection to determine whether the infant has urinated. If an infant’s urine becomes scanty and strongly yellow in colour—suggesting the development of dehydration—feeding frequency and milk transfer should be evaluated.

**Bowel actions**

An infant’s first bowel actions consist of meconium, which is greenish-black. After 24 to 48 hours the meconium changes—first to brownish ‘transitional’ stools and then, by the third or fourth day, to typical breastfed infants’ stools, which are loose and mustard-yellow (sometimes with milk curds), although occasionally they are green or orange. None of these changes is significant in a healthy breastfed infant. Frequent, runny stools do not mean a breastfed infant has diarrhoea or lactose intolerance: they should simply be viewed as evidence of sufficient milk. Diarrhoea entails very frequent watery stools.
The number of bowel motions of breastfed infants tends to decrease between 6 weeks and 3 months of age. Intervals of several days or more between stools are common. If the infant is receiving breastmilk only and no other food or fluid, there is no cause for concern. Infants who are having formula for most of their feeds tend to pass fewer motions than breastfed infants—once a day or every second day, often khaki-coloured and with a Plasticine-like consistency. Mothers need to be aware of the potential change in their infant’s motions when they are weaning.

**Constipation** refers to the hard, dry consistency of the stools, not the frequency of bowel motions. It has been observed that hard, dry bowel motions are more likely to occur after formula or solids have been introduced. Exclusively breastfed infants are rarely constipated. Many breastfed infants show signs of discomfort or distress before passing a motion: this is a normal response to body sensations they are not used to; it does not indicate pain or constipation.

**Infants’ weight**

A newborn infant adapts to the small amounts of colostrum available. With the passage of meconium and loss of water by evaporation, an initial weight loss of 5–10 per cent of the birthweight is normal. Between 4 and 6 days of age the infant starts to regain weight and by 2 weeks of age should have returned to their birthweight. If the infant appears contented and healthy there should be no immediate cause for concern about minor fluctuations in weight—which can result from factors as simple as passing a stool, urinating, or a recent feed. Static weight or suspected weight loss over several days should, however, be carefully examined. Further investigation to exclude disease should include evaluating feeding frequency and milk transfer.

It is recommended that an appropriate growth chart be used. In general, weight gain should be assessed on a four-week average. The rate of growth is the most important factor, although if growth is above the 95th percentile or below the 5th, or crosses these percentiles, further investigation is required. A growth reference chart should always be used, but the following is a rough guide:

- **birth to age 3 months**—a gain of 150–200 grams a week
- **age 3 to 6 months**—a gain of 100–150 grams a week
- **age 6 to 12 months**—a gain of 70–90 grams a week.

**Percentile growth reference charts**

Percentile charts are used to assess growth. While the international growth reference used in Australia was originally derived from US data, it is applicable to Australia. The charts should be used as a reference for monitoring, not as an absolute standard. The body size of infants and their growth rates are determined mainly by nutritional status, and the weights of individual infants often cross percentiles in the first few months after birth. Birthweight is influenced more by nutritional conditions in utero and maternal health—for example, mothers who
smoke or have pregnancy-induced hypertension have smaller babies—than by
genetic considerations. 10

The weight percentiles for breastfed infants differ only slightly from those for
bottle-fed infants. In general, breastfed infants tend to grow rapidly in the first
two to three months of life but then at a slightly slower rate than the current
percentile charts. At 8–11 months of age, infants who have been exclusively
breastfed for six months will have a weight-for-age Z score of around −0.5 to −
0.6.11 Height for age is generally less affected. Studies have confirmed minimal
differences between ethnic groups.12,13 Part B of the ‘Special considerations’
section in the Dietary Guidelines for Children and Adolescents discuses growth
and growth references in detail.

In Australia, the growth rate of Aboriginal infants who are exclusively breastfed
follows the WHO–NCHS reference until about 6 months of age, when it begins to
fall away.14,15 This suggests that the differences between breastfed infants and the
CDC–WHO reference are not very significant for Australia, particularly if the
reference charts are used for monitoring growth and not as a standard.

Whitehead and Paul16 reviewed the use of doubly labelled water techniques to
study energy dynamics in breastfed infants. This approach indicated that
460 kilojoules (110 kilocalories) per kilogram per day at age 1 month and 397kJ
and 355kJ (95kcal and 85kcal) per kilogram per day at 3 and 6 months
respectively would provide sufficient nutrients, given the high bioavailability of
the nutrients in breastmilk. This means that a breastmilk intake of 850 millilitres
a day would cover the dietary energy needs of the average infant growing along
the 50th percentile until at least age 4 months, but after that there may be some
decline in the growth percentile of currently used references.

The extent to which serial data for an infant can deviate from a given percentile
range before concern is warranted depends on the infant’s age, their position in
the percentile range, and the length of time for which the rate of growth deviates
from the norm. Because of the slightly slower growth velocity of breastfed
infants, they may appear to be faltering after two to three months when they are
plotted on current growth charts, even when they are healthy and thriving.17
Health professionals may mistakenly believe that the mother’s milk production is
inadequate and suggest starting complementary formula.

In general, the more pronounced the change in growth rate, the younger the
infant and the more extreme the percentile, the greater the cause for concern. As
noted, some slowing in the infant’s rate of growth is expected after 3 months of
age. In addition, many normal infants cross percentiles to reach their genetic and
nutritional potential, so percentile charts should be used as a guide only. As a
general rule, however, any infant whose weight is static for two weeks, who
loses weight over a five to seven–day period, or who crosses the 10th or 90th
percentiles should be clinically examined.
III. BREASTFEEDING: EARLY DAYS

Not enough breastmilk?

Most mothers at some stage are concerned that they are not producing enough breastmilk. Here are some tips:

- Is your baby losing weight or gaining weight and growing in length? Most babies lose weight in the days following birth. Within a week or two, they start to gain weight, at the rate of around 600 grams a month, or 150 grams a week. Plotting weights on a growth chart and explaining these patterns can be very reassuring. A baby who is gaining weight is getting enough breastmilk and does not have any significant chronic disease problem.

- Does your baby have six to eight wet nappies a day? This is the typical amount for a breastfed baby. Bowel movements are often infrequent in breastfed babies: this isn’t constipation; it’s just that breastmilk is so good there’s nothing to waste!

- Are you eating a nutritious diet, drinking plenty of water, and getting as much rest as possible? Taking care of yourself will enable you to take care of your baby. Make sure you eat good food and drink plenty of fluid; drink a glass of water every time you breastfeed. Weight-loss diets are not recommended for breastfeeding mothers.

- Is your baby’s urge to suck being met in other ways? Breasts respond to frequent stimulation by producing more milk. If your baby is sucking on a dummy (pacifier) or a bottle, he or she won’t nurse as much and your milk supply will decrease. Complementary bottles should be completely avoided.

- Your baby can’t tell the time yet. In the first months of life babies don’t always become hungry at the same time each day. Don’t feed on a schedule: feed ‘according to need’, whenever your baby shows signs of hunger or fussiness. Your baby will be happier and your milk supply greater.

- Breast size has no relationship to milk production.

YOUNG MOTHERS

The results of many observational studies, and two intervention studies, show that adolescent mothers breastfeed less often than older mothers. Teenage mothers’ breastmilk is comparable in composition to that of adults.

A study of breastfeeding by Aboriginal mothers in Kalgoorlie found that among older women breastfeeding was almost universal, but the rates among young mothers were often much lower. Young mothers, Indigenous mothers and mothers from lower socio-economic groups generally require more support if they are to maintain satisfactory breastfeeding levels.

REFERENCES


Much of the advice in this section of the first edition of the Infant Feeding Guidelines was based on Promoting Breastfeeding, the breastfeeding guidelines produced by the Victorian Department of Health and Community Services. It has been modified here to give guidance to health workers who have contact with infants and families after discharge from hospital.

At an institutional level, many lactation problems are iatrogenic and will respond to changes in the routine care of mothers and newborns, such as those outlined in the Baby Friendly Hospital initiative.¹ The early days of breastfeeding are critical times for education and assistance to ensure correct positioning and attachment, which will prevent many subsequent difficulties.² Early follow-up visits and support at home or in community or outpatient clinics are important to answer mothers’ breastfeeding concerns.³ In Australia, additional community resources are available from the Australian Breastfeeding Association and lactation consultants.

Most women experience some difficulties when breastfeeding, particularly in the early days. But they are usually only minor and can be readily overcome with advice, assistance and support.⁴ Adequate support in the community and in general practice—particularly through the use of lactation consultants and other trained health professionals—is of considerable value in minimising the impact of problems on breastfeeding outcomes.⁵ Table IV.1 provides an indication of the prevalence of the difficulties encountered during breastfeeding.
Table IV.1 Prevalence of difficulties during breastfeeding

<table>
<thead>
<tr>
<th>Difficulty</th>
<th>0 (in hospital)</th>
<th>2</th>
<th>6</th>
<th>10</th>
<th>14</th>
<th>18</th>
<th>24</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sore nipples</td>
<td>46.8</td>
<td>15.8</td>
<td>5.0</td>
<td>2.3</td>
<td>2.2</td>
<td>0.8</td>
<td>0.9</td>
</tr>
<tr>
<td>Engorged breasts</td>
<td>22.3</td>
<td>2.3</td>
<td>1.2</td>
<td>0.3</td>
<td>0.0</td>
<td>0.0</td>
<td>0.9</td>
</tr>
<tr>
<td>‘Milk too fast’</td>
<td>19.2</td>
<td>1.3</td>
<td>1.5</td>
<td>0.3</td>
<td>0.7</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Sucking difficulty</td>
<td>7.0</td>
<td>3.6</td>
<td>0.3</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.5</td>
</tr>
<tr>
<td>Mastitis</td>
<td>–</td>
<td>2.1</td>
<td>5.0</td>
<td>3.2</td>
<td>1.1</td>
<td>1.2</td>
<td>1.2</td>
</tr>
<tr>
<td>Not gaining weight</td>
<td>2.7</td>
<td>0.5</td>
<td>0.3</td>
<td>0.3</td>
<td>1.1</td>
<td>0.0</td>
<td>0.5</td>
</tr>
</tbody>
</table>

– Zero.
Note: n=556 in hospital, declining to 218 at 24 weeks.

**Hygiene**

Good basic hygiene is important when caring for infants. Mothers should be advised to carefully wash their hands with soap and water after changing a nappy and before handling their breasts and preparing expressed breastmilk or infant formula.

**Nipple pain and trauma**

Although nipple sensitivity and some initial discomfort in the early days after birth are to be expected, nipple pain is not normal and could be a sign that something is wrong. Nipple pain is the second most common reason given for abandoning breastfeeding. (Perceived milk insufficiency is the most common reason.) The nipple is constantly subject to trauma and to exposure to the bacterial flora in the infant’s mouth. There are a number of causes of nipple pain:

- incorrect positioning and attachment
- engorgement
- infant causes
  – incorrect sucking action
  – mouth or palatal abnormalities
- nipple variations such as flatness or inversion
- thrush
- eczema or dermatitis.

Correct positioning and attachment are important. Incorrect positioning and attachment are the most common causes of nipple pain and trauma. They can lead to the vicious cycle of engorgement and more difficulty in attachment, causing further nipple trauma and possibly premature weaning.
Nipple care
• Avoid using shampoos and soaps on the nipples.
• Air dry the nipples after breastfeeding.
• Applying hind milk or colostrum to the nipples after a feed may be helpful.
• If nursing pads are used, replace damp pads frequently.
• Generally avoid applying ointments, sprays, tinctures and powders—apart from purified lanolin, which may be useful.\textsuperscript{11-13}
• For severe cases, a controlled trial has shown that treatment with purified lanolin and breast shells is more effective than using moist dressings.\textsuperscript{10}

Management
• Correct positioning and attachment are essential.
• Treat any underlying cause.
• Continue breastfeeding unless the pain is intolerable or, in spite of every effort, the trauma worsens.
• Except in rare circumstances, an infant who has been removed from the breast should be fed on expressed breastmilk and returned to the breast as soon as possible. Skilled support is usually required.

Although I found early breastfeeding painful with my son, the discomfort really wasn’t necessary. I’d recommend future mothers to do what I did this time round—make it easy on yourself with correct positioning from the start. Contact your local breastfeeding group before the birth to learn and practise the technique. I’m delighted to say that since my daughter was born eight weeks ago breastfeeding has not caused so much as a twinge.


Nipple variations
Most women’s nipples are perfectly adequate for breastfeeding, in spite of variations in shape and size, and there is no scientific evidence of the benefit of nipple preparation during the antenatal period. For a small number of women, however, nipple variations such as non-protractile or inverted nipples can present difficulties when initiating breastfeeding. Previous breast or nipple surgery, or nipple piercing, can also cause difficulties, but each case should be individually assessed.

If some degree of flatness or retraction is present the following will assist:
• The ideal is to begin breastfeeding early, preferably within an hour of birth, when the infant is alert and eager to suckle. Teaching correct attachment and encouraging correct suckling action at this time may reduce the likelihood of subsequent problems.
IV. BREASTFEEDING: COMMON PROBLEMS AND THEIR MANAGEMENT

- Express milk until successful attachment is achieved. If the infant cannot latch onto the breast, the colostrum needs to be expressed and given to him or her. Expression should be frequent and thorough to keep the breasts well drained and to stimulate the milk supply.

- Avoid ‘nipple confusion’: the sucking action used by an infant on the breast appears to be different from that used on teats and dummies. The theory of nipple confusion refers to an infant who has difficulties breastfeeding because he or she has first learnt to ‘bottle suck’ on teats or dummies in the early postnatal period. It has been suggested that bottle teats and dummies should be avoided in the early postnatal period, and if an alternative to breastfeeding is required consideration should be given to feeding the infant expressed breastmilk with a cup, spoon or syringe or to gavage.

NIPPLE SHIELDS

Using nipple shields may be associated with a decreasing milk supply. Their use should be limited to situations where all other avenues of treatment have failed. If a nipple shield is needed, the woman should be referred to a qualified person, such as a lactation consultant, midwife, maternal and child health nurse, or Australian Breastfeeding Association counsellor.

OTHER NIPPLE PROBLEMS

Candida

A lactating mother suffering from candida (thrush) infection of the nipples or breast, or both, may experience breast pain, nipple pain or nipple rash.

Breast pain is often described as ‘shooting, burning’ pain, like ‘red-hot needles’, that radiates from the nipple into the breast. The pain can occur both during and between breastfeeding. Similarly, the nipples may be painful during and between breastfeeding. In the case of nipple rash, the nipples may look normal, be a brighter pink than usual, or be covered with an erythematous rash and possibly itchy. In association with these maternal symptoms, the infant may have oral and perianal thrush.

Treatment

Miconazole or nystatin is a suitable antifungal agent for topical application to the nipples while simultaneously treating the infant with an oral preparation. Treatment should continue until mother and infant have been symptom-free for several days. If pacifiers (dummies) are used during an episode of monilial infection they could be a source of re-infection: they should be boiled several times each day and be replaced after a week.
Eczema and dermatitis

Eczema and dermatitis are generalised skin conditions that can affect the nipples and breasts of breastfeeding women. There are three main types:

- atopic eczema, where the nipples are affected by more widespread skin disease
- irritant contact dermatitis, occurring in response to an agent being applied to the nipples
- allergic contact dermatitis, which is a delayed hypersensitivity reaction to an allergen in contact with the nipple—for example, in nipple cream or even food in the baby's mouth.

Management

- Avoid using soap and nipple creams—except for the treatment of candida.
- If a nipple cream being used for the management of thrush is suspected, change to another antifungal agent.
- Breastfeed before offering solids to the infant and/or rinse the infant's mouth with water to avoid food allergens in the mouth.
- To reduce the infant's exposure, topical corticosteroids should be used only as a last resort. When one is necessary, use the minimum effective preparation strength for the shortest period and apply it sparingly to the nipples after a feed.

'Too much milk'

When an infant is not removing the milk effectively, there might be a perceived 'oversupply' of milk (see also 'Engorgement', later in this section).

Some women find they initially have so much milk that it causes temporary difficulties. This is more common in the early days of breastfeeding because the breasts have the potential to feed more than one infant. But as an infant continues to feed, local autocrine control of milk production helps to balance the amount of milk produced with the amount he or she is taking.

Management

- Provide reassurance that it is usually a temporary problem and will resolve with time.
- Try temporarily feeding on one breast only at each feeding time. The infant is put back on the first breast instead of being offered the second breast.
- Provide symptomatic relief—ice packs, analgesia (paracetamol) and breast support.
- Expression of milk at the beginning or end of feeds will also help to ease discomfort. It may prolong the excess production somewhat but it can be a
more comfortable approach while the milk supply is settling down. The expressed milk can be saved and stored for future use (see Section V).

There is no evidence that posture feeding assists, so it is not recommended.

‘Too little milk’

It is important to distinguish between actual low milk supply and perceived low milk supply. Although most problems of undersupply can be resolved by improving the management of breastfeeding, a very small proportion of women do not have the metabolic capacity to produce enough breastmilk for their infants. Perceived low milk supply is a cause of much anguish to mothers and the most common reason for stopping breastfeeding early. Underlying endocrine and/or metabolic defects, while uncommon, do occur; among them are another pregnancy, oral contraceptives or diuretics, and thyroid disease.

The mother’s milk supply is sufficient if:

- The infant is fully breastfed—that is, receiving no other fluids or solids—and producing six to eight very wet nappies of pale, inoffensive-smelling urine in a 24-hour period.
- When young, the infant has some greenish-gold bowel motions daily, changing to less frequent soft, pasty or curdy yellow bowel as he or she becomes older.
- The infant is alert, with bright eyes, moist lips and good skin tone.
- The infant is reasonably content for some time between some feeds.
- The infant has appropriate weight gain when averaged out over a four-week period, remembering that infants often lose 5 to 10 per cent of their birthweight during the first week.
- The infant is fed according to need rather than schedule, although some sleepy infants may have to be reminded.

There are a number of reasons mothers (and those around them) believe they have insufficient milk:

- The infant keeps turning his or her head and opening the mouth, as if wanting to suck. This is the ‘rooting reflex’, present from birth to 3 or 4 months of age; infants do it when they are awake and alert and something touches their cheek, whether or not they are hungry.
- The mother experiences no sensation of let-down or the sensation fades or disappears as the infant grows older.
- The infant is unsettled. The reasons infants cry a lot and have trouble sleeping are complex and varied: when an infant is taking the breast well, gaining weight and developing normally, it is unlikely that the unsettled behaviour has anything to do with breastfeeding.
• The translucent appearance of breastmilk makes the mother (or others) think breastmilk is weaker than formula or cow’s milk and therefore not as nourishing.

• The mother may be unable to express much milk. It must be remembered that the ability to express is not a reflection of how much milk the infant takes.

• The infant starts to suck her fists all the time: between 8 and 12 weeks of age her hands are almost never out of her mouth. This is a normal part of sensory and motor development and not a sign of hunger.

• Between six and 12 weeks after the birth the mother’s breasts stop leaking and become softer and smaller. This is normal and not a sign of insufficient milk.

• The infant’s bowel motions become less frequent at about 6 to 12 weeks of age.

• The feeds become shorter.

• The mother receives well-meaning advice from an assortment of sources, suggesting that her milk supply is not ‘satisfying the baby’. This plants doubts in the mother’s mind about the quantity and quality of her milk supply. Similar suggestions—the baby would be more content and sleep for longer if the milk was satisfying’, ‘you’ll have greater peace of mind if you can see how much the baby is getting’, and so on—contribute to the mother’s misperceptions about her milk supply.

Actual insufficiency of breastmilk has a number of possible causes:

• Positioning or attachment is incorrect.

• The infant is not feeding frequently enough or not being given enough time to feed, or the milk is not being removed from the breast. After several days the milk supply will start to diminish.

• The use of dummies, which reduce sucking time at the breast, can eventually lead to reduced milk supply.26

• Reduction mammaplasty (breast reduction surgery) and other breast surgery, while not precluding breastfeeding, can hinder full lactation. Some areas of the glandular tissue that are no longer connected to the nipple ducts will become hard when the milk comes in, but this is temporary because these sections of the breast will gradually cease to make milk in response to local autocrine control.

• Very rarely, insufficient glandular tissue can be a problem, particularly if a mother has undergone augmentation surgery for a congenital lack of mammary tissue. It must be borne in mind, though, that breastmilk production is not related to breast size.

• Retained placenta can cause reduced milk supply.
Management

A low supply of breastmilk is usually a temporary difficulty; only occasionally does it become a continuing problem that requires supplementation of the breastmilk supply. It is important that health care professionals recognise the signs and symptoms of insufficient milk—among them can be infant lethargy and/or irritability, jaundice, infrequent stools, and scant urine production or infrequent urinating. Any failure to gain weight or excessive weight loss (7–10 per cent of birth weight) over a period should be assessed. Intervention is vital if an infant's health might be jeopardised; it should include a full assessment of lactation and a plan that preserves breastfeeding.\(^{27}\) A number of strategies may be helpful:

- Check positioning and attachment.
- Feed more frequently.
  - Offer the breast between the usual feeds.
  - Offer the breast as a comforter instead of a dummy.
  - Wake the infant and offer an extra feed before going to bed.
- Allow the infant to finish the first breast before offering the second breast.
- Always feed from each breast more than once each feed.
- Express milk between feeds.
- Encourage good maternal nutrition and rest.
  - Recommend a healthy, well-balanced diet.
  - Discourage excessive exercise and weight-loss diets.
  - Ensure adequate fluid intake by encouraging the mother to drink when thirsty.
  - Encourage rest and relaxation.
- Metoclopramide, a dopamine antagonist, induces the release of prolactin and has been shown to increase milk supply.\(^{28-32}\) It has been used in mothers with lactation failure caused by stress.\(^{33}\)
- If the infant requires supplementation, this can best be achieved by using a supply line or supplementary nursing system available from the Australian Breastfeeding Association. A supply line consists of a plastic container of expressed breastmilk or formula hung around the mother's neck; a fine tube leading from it is taped to the mother's nipple, and as the infant sucks on the breast he or she gets both milk from the breast and expressed milk or formula from the supply line. The 'nursing supplemener' is a similar product available from pharmacies.

The supply line obviates the possibility of 'nipple confusion', which can result if a bottle and teat are used, and encourages milk production by continued stimulation of the breast.\(^{34}\) Mothers using a supply line when discharged from hospital need specific follow-up and referral to a health professional. Careful sterilisation of supply lines is essential.
The most important factor to remember is:

SUPPLY = DEMAND

A good milk supply is dependent on continued stimulation of the breast.

**Engorgement**

Engorgement is a problem that occurs primarily in the early days of lactation. It is usually preventable and always manageable.

If breastmilk is not removed effectively, engorgement will result. Feeding other fluids can decrease an infant’s demand for breastmilk. Over-distension of the alveoli with milk can also restrict blood flow, leading to further distension and discomfort. Early engorgement can be reduced by correct positioning and attachment and unrestricted access to the breast.\(^\text{35}\) Engorgement can also result from prolonged separation of mother and infant and from weaning too rapidly.

**Management**

- Unrestricted sucking is the best response to engorgement. Dummies and complementary feeds should not be used.
- Correct positioning and attachment are vital; expressing a small amount of milk first may provide relief and help with attachment.
- Relief of the discomfort associated with engorgement can be found in simple analgesia (for example, paracetamol), cold packs between feeds, and support of the breast, although the bra should not be too tight. Some women find it more comfortable not to wear a bra; others prefer light support—perhaps a T-shirt tied under the breasts or a crop top.
- Feeding twice on the first breast can be tried as a temporary strategy.
- It can be helpful to remove the bra during feeding and allow the milk from the second breast to flow freely into a towel or cloth.
- If engorgement persists for more than a day or two—especially in the early days of lactation—the cycle can be broken by completely draining both breasts with an electric pump after a feed, but this is a ‘one-off’ strategy that brings relief and makes it easier for the baby to attach to the breast at the next feed.

Young infants often feed eight to 12 times in 24 hours, including several times during the night. If a mother is separated from her infant, complete expression (usually as often as the infant would breastfeed) is necessary.

Untreated engorgement can progress to complications such as suppression of lactation, blocked ducts, mastitis, and even breast abscess.
INFLAMMATORY CONDITIONS OF THE BREAST

Non-infective mastitis

Non-infective mastitis can result from a blocked milk duct. Usually one segment of a breast becomes tender, reddish and hardened. The inflammation occurs because milk in the blocked duct cannot be removed and banks up, causing localised distension. If the blockage is not cleared rapidly, milk is forced into the surrounding breast tissue, causing inflammation. A blocked milk duct will not initially be accompanied by systemic symptoms such as fever and aches and pains, but as the breast becomes more inflamed flu-like symptoms may develop. Blockage of ducts frequently recurs, and mothers need to be advised of this possibility and informed about preventive measures.

A variety of factors can lead to a blocked duct:
- poor drainage of the breast as a result of poor positioning and attachment or incorrect sucking
- sudden engorgement caused by a missed feed, perhaps because the infant has changed his or her feeding pattern—for example, by sleeping through the night. It can also happen if the mother is absent for a feed and cannot express milk while away.
- a tight or ill-fitting bra or other clothing putting pressure on one particular segment of the breast, inhibiting drainage
- consistently lying on one side or in one position during sleep, placing pressure on the breast
- pressure on one spot if the mother holds the breast too tightly, particularly close to the nipple, during feeding.

Treatment
- Check positioning and attachment.
- Vary the feeding positions of the infant.
- Feed the infant frequently, starting with the affected side and pointing the infant’s chin towards the blocked duct.
- A warm cloth can be applied before and during a feed to assist the let-down.
- The affected area can be gently massaged, towards the nipple, while feeding or expressing.
- Cold packs can be applied for comfort after feeding.
- Paracetamol can be taken as needed—simple analgesia, four-hourly.

When treated promptly, a blocked duct should clear in 24 to 48 hours. If the pooling of the milk continues, the inflammation will intensify and provide an ideal environment for bacterial growth, leading to infective mastitis.
Infective mastitis

Infective mastitis generally results from either an immense overgrowth of pathogenic bacteria or conditions that give bacteria access to breast tissue while at the same time preventing the body from destroying them. It can develop very rapidly.

There are several predisposing factors:
- nipple trauma
- poor physical health
- a blocked milk duct
- a sudden change in feeding pattern, such as abrupt weaning
- use of nipple creams.

The most common form of infective mastitis is cellulitis caused by infection with *Staphylococcus aureus* or, less commonly, a streptococcus.

The appearance of a breast harbouring infective mastitis differs from that of a breast with a blocked duct only in degree. The breast will usually be red, swollen, hot and painful. The skin may appear tight and shiny and be streaked with red. The mother will be feeling very unwell, with general myalgia (muscle pain) and a fever. A health professional should consider infective mastitis in any breastfeeding mother who complains of flu-like symptoms.

**Prevention**
- Ensure correct positioning of the infant on the breast to avoid nipple trauma and poor breast drainage.
- Avoid sudden long periods between feeds.
- Handle breasts gently to avoid bruising.
- Treat blocked milk ducts promptly.
- Wear loose, comfortable clothing.
- Avoid localised obstruction of the breast—such as a tight bra.
- Avoid nipple creams and ointments.
- Avoid prolonged use of nipple pads, especially plastic-backed ones.
- Maintain good health.

**Treatment**
- Early detection of infective mastitis is very important, and health workers need to be aware of the signs. A medical practitioner should be consulted without delay.
- Most importantly, breastfeeding should continue. This is not the time to wean because such an abrupt change can increase the risk of developing a breast abscess. The breast should be kept as well drained as possible.
- Breastfeed frequently.
- Express after feeds.
Feed from the affected breast first—but not all the time because as the other breast may become engorged.

Varying the feeding position may help to drain the affected area. For example, if the outer area is affected the underarm position may assist drainage of that area.

If after trying these measures the symptoms persist, antibiotics should be started early and continued for 10 days. As noted, *Staphylococcus aureus* is the most common cause, and suitable antibiotics are Cephalexin, Erythromycin and Flucloxacillin. On completion of a course of antibiotics, the mother may need to be reassessed by her GP to ensure that the mastitis has resolved completely.

Hospitalisation and intravenous antibiotics may be required if severe cellulitis has developed. Adequate analgesia should be provided, and bed rest and an adequate fluid intake encouraged.

**Breast abscess**

A breast abscess is a serious and painful condition. It is usually the result of untreated or inadequately treated mastitis, and it requires urgent medical attention. The abscess may be managed with needle aspiration or with surgical incision but, unless the position of the incision makes it impossible, breastfeeding should continue.

**Blood in the breastmilk**

Blood in the breastmilk occasionally occurs in late pregnancy or in the first few days after delivery. Its cause is unclear, although it is thought to be duct hyperplasia. When excess duct cells are dislodged during feeding or expressing, bleeding may result. Since only a small amount of blood is involved, it will not upset the baby and breastfeeding can continue as normal. If bleeding persists beyond a few days, however, medical referral is required to exclude the presence of a duct papilloma or other breast pathology.

If a baby vomits milk containing blood the most common cause is bleeding from traumatised nipples.

**Postnatal depression and mood disorders**

Knowledge about the use of drugs during pregnancy and lactation is advancing rapidly, so where specific medications are mentioned here the most recent advice should be sought. Medication that permits continued breastfeeding is nearly always available.

‘The blues’ is a mild, transient disorder occurring in the first week after delivery and peaking on the third to fifth day. It affects up to 70 per cent of mothers.
The symptoms are swings from tearfulness to elation and irritability or increased sensitivity. Empathy, support and encouragement are all that is necessary for treatment.

Post-partum psychosis is a severe psychiatric illness that begins acutely within the first three weeks of delivery. It affects two women per 1000 births or deliveries and is characterised by confusion and indecisiveness. The mother may have hallucinations or delusions, with a mixture of affective (manic, depressive or manic-depressive) or schizophrenic symptoms. Hospitalisation—ideally in a specialised mother–baby unit—and appropriate medication are necessary. Antipsychotics are often needed in the first few days of treatment; in this case, breastfeeding must be stopped temporarily. Health professionals can encourage mothers to maintain their milk supply by helping them express by hand or with a breast pump, discarding the milk.

Postnatal depression is an episode of major depression that arises within the first three to six months after delivery. It is important to distinguish between postnatal depression and the common mood changes experienced by many postnatal women who are sleep-deprived and struggling to come to terms with their new role. These common mood changes are probably better termed an ‘adjustment disorder with depressed (or anxious) mood’; women experiencing this need counselling, encouragement and support from their families and health professionals.

Depression as an illness is distinguished from an adjustment disorder by the persistence of the depressed mood and the presence of other symptoms, especially disturbed sleep, loss of appetite, loss of self-esteem, lethargy, and poor concentration. Anxiety and irritability are also common. Australian studies have shown prevalence rates for birth-induced depression ranging from 9 per cent at six weeks after birth to 14 per cent at four months and 15.4 per cent at eight months.

It is generally accepted that the aetiology of postnatal depression is multifactorial, involving psychological factors, hormonal changes and social variables. Australian studies have shown that the condition was associated with lack of support (being single, divorced or separated), not breastfeeding, having a Caesarean or forceps delivery, feeling dissatisfied with various aspects of maternity care, and being a non–English speaking immigrant. In some states and territories the Edinburgh Postnatal Depression Scale has been used to screen women as part of their postnatal care. The questionnaire has been validated for use in Australia.

If symptoms are marked—especially loss of appetite, insomnia, constantly lowered mood and feelings of worthlessness—medication and sometimes hospitalisation may be required. Antidepressant medication is not always necessary, but where it is appropriate women find that it quickly reduces their anxiety and helps with sleeping problems. It is often not until two to three weeks after the full dosage is reached that the full antidepressant effect occurs. Breastfeeding can continue while a mother is on tricyclic antidepressants and
most other drugs; for other classes of antidepressants specific advice on breastfeeding must be sought. Enabling a mother experiencing postnatal depression to continue breastfeeding may help her feel more positive about her mothering ability. Counselling or psychotherapy from a skilled health professional is essential for both the mother and her partner. Referral to a support group can also be valuable.

Among the mood-stabilising medications that have been the subject of at least limited studies in breastfeeding women are tricyclic antidepressants, selective serotonin reuptake inhibitors, benzodiazepines, and the mood stabilisers lithium, carbamazepine and divalproex. Tricyclic antidepressants such as dothiepin and amitriptyline are considered safe for the breastfeeding infant. The risk of recurrence of post-partum psychosis with subsequent deliveries is high, and lithium prophylaxis has proved beneficial, although it should be used only under close supervision. A Cochrane Review concluded that mothers with postnatal depression can be effectively treated with fluoxetine and that this was effective as a course of cognitive-behavioural counselling in the short term. The reviewers also commented that postnatal depression is a neglected area, despite its large public health impact.

**Breast refusal**

The causes of breast refusal are numerous; often no cause can be found.

Among the infant-related causes can be the following:

- infectious illness—for example, respiratory illness causing a blocked nose and/or sore ears. Clearing a blocked nose with saline drops may solve a feeding problem
- frequent regurgitation with acid reflux—oesophagitis rarely occurs under the age of 4 months
- allergy resulting in blockage of the Eustachian tube
- thrush
- distractions (10 weeks onwards)—some babies are easily distracted and need a quiet environment to feed. This is in fact a normal development in infants.

Among the mother-related causes can be the following:

- a change in perfume or talcum powder
- mastitis, which leads to salty-tasting milk
- unwell mother
- illness decreasing the milk supply or inhibiting let-down
- medication altering the taste of milk
- hormonal changes, which may affect both the taste and the supply of milk
- ovulation—three or four days before ovulation there appears to be a change in milk composition
• menstruation
• pregnancy.

Other causes can be low milk supply, a slow let-down response, and milk flow that is too fast.

Management

A number of management strategies might be helpful:

• reassurance—encouraging mothers to relax and not to perceive breast refusal as a personal rejection. They need to know this is usually a temporary situation. Support from their health professional or Australian Breastfeeding Association counsellor is extremely important
• stopping the feed when the infant cries and refuses the breast
• feeding the infant when he or she is drowsy, either when just awakening or just going to sleep
• encouraging the infant to suck on a finger and then slipping the nipple in
• calming the infant by singing, rocking or massaging him or her before feeding
• trying alternative feeding positions
• expressing milk into the infant’s mouth
• expressing milk and feeding the infant with a cup or bottle
• dealing with any underlying causes of an unwell baby.

The crying infant

Our society encourages the perception that infants who are loved, well cared for and well fed do not cry. So parents are bewildered when, in spite of all their efforts, their infant continues to cry. For this reason, they often seek a health professional’s advice during the first three months. Crying is an essential part of human development, but it is a complex subject and there are many different schools of thought about the management of a crying infant.

It is easy to respond to crying caused by hunger, heat, cold, noise, or a clearly defined medical problem. Less easy, but usually manageable, are causes such as over-tiredness or over-stimulation. Crying that persists after all these needs are met can cause deep distress and frustration—for the infant and especially the parents.

The age and times of day at which infants cry tend to fall into identifiable patterns. From birth to 3 weeks of age many infants sleep a lot. Their crying periods do not last long and are easy to resolve. From 3 weeks to 3 months the scene changes dramatically, with infants being more wakeful and active. Their crying, unsettled behaviour can be loosely classified into three types:
• Explained crying is ‘expected crying’. It has an obvious cause, and the infant can usually be calmed and settled by simple measures such as feeding, rocking or patting, and sometimes a bath or a walk. Occasionally the crying is caused by a clearly defined medical problem such as a urinary tract infection, which can be treated.

• Unexplained crying for short periods is ‘unexpected crying’ for a reason that is hard to determine. Unexplained crying for short periods every 24 hours is normal for about 80 per cent of healthy babies.\(^5\) Parents find their baby cries for one to four hours every 24 hours, in spite of prompt attention to his or her needs. It usually happens in the evening and rarely in the morning before lunch, but it may occur at any time during the 24-hour period.

• Third, there is unexplained crying for long periods. Researchers estimate that about 10 to 35 per cent of healthy babies cry for long periods of the day and night.\(^6\) This sort of crying in healthy, well–cared for babies is difficult to resolve—no one really knows what the cause is, the baby can’t tell us, and there is no single solution that suits every baby.

Management

• Rule out hunger with care. Breastfed babies commonly have times when they feed frequently, and it does not necessarily indicate a low milk supply. Unexplained crying in healthy babies is usually not caused by breastfeeding problems. Weighing the baby—and thus assessing their continuing growth—remains the most reliable way of checking the likelihood of hunger. Once hunger has been ruled out, the baby’s crying and sleeping patterns should be seen as unrelated to breastfeeding.

• Exclude medical causes.

• Parent counselling that emphasises safe options rather than solutions can be valuable. Advice needs to be tailored to individual mothers and babies.

• Mothers may find that a return to their antenatal relaxation techniques is a help.

The following strategies work sometimes:

• rocking and patting
• wrapping the baby firmly in a flexed position
• carrying the baby in a sling
• taking the baby for a walk or trying some other gentle, rhythmic activity
• playing music or other rhythmic sounds
• giving the mother permission to let her baby cry for short periods when there is nothing else she can do—well-fed tired babies sometimes sleep after crying for 20 to 30 minutes.

Parents should be encouraged to be flexible and try whatever strategy they think is reasonable at the time. They should be reassured that they will not ‘spoil’ their
baby by picking her up all the time, nor will they ‘damage’ her by allowing her to cry for short periods.

In general, there are no easy answers and research suggests that parent counselling, support and practical help are more effective remedies than medical diagnoses and medications.57,58

REGURGITATION AND GASTRO-OESOPHAGEAL REFLUX

Regurgitation is common and may occur in about 40 per cent of infants aged less than 3 months. It is probably a normal physiological response to food in the stomach. Gastro-oesophageal reflux is a condition of frequent regurgitation or vomiting, often beginning between 2 and 6 weeks of age. If severe, it can lead to complications such as failure to thrive, recurrent aspiration (which may be associated with apnoea) and pneumonia.59 Most infants with regurgitation or reflux remain healthy and thrive, and the symptoms settle down between 6 and 10 months of age, when the infant begins to spend more of the day in an upright posture.

The symptoms in young infants differ from those seen in older children and include excessive crying, irritability, back arching, breast refusal and feeding difficulties. Oesophagitis (inflammation of the oesophagus) is extremely rare in infants under 4 months of age.

Diagnosis

The diagnosis of gastro-oesophageal reflux is made on clinical grounds. It is important to exclude other causes of vomiting in infants—such as pyloric stenosis, infections, chronic renal or cardiac disease, allergy, anatomical abnormalities of the gastrointestinal tract, or metabolic disorders. Heacock et al. showed that physiological gastro-oesophageal reflux was significantly less common in breastfed infants than in those fed formula.60 This finding was unrelated to feed volume. Investigation is required only when complications are present or if the infant does not respond to simple management measures.

Management

Reassurance

The majority of infants will have physiological regurgitation and will settle spontaneously. Provided the infant is thriving, no investigation or intervention is required. It is important not to label these children as having a condition such as gastro-oesophageal reflux.
**Posture**

Placing the infant in a more upright feeding position can be helpful for regurgitation. Keeping the infant upright for 15 to 30 minutes after feeding also helps; a baby sling is useful in this setting. The best position for reducing reflux is prone but, because this position has been associated with an increased incidence of sudden infant death syndrome, it is not generally recommended.\(^6^1\) No other lying position has been shown to be effective.

**Food thickening**

Thickening feeds with rice cereal or carob has been shown to be effective in clinical trials in regurgitating infants but not in complicated gastro-oesophageal reflux. Thickening is difficult with breastfeeding, and in that case liquid Gaviscon is sometimes effective, although it can cause constipation. Recently infant formulas containing a thickening agent (AR formulas) have become widely available. Data on their clinical efficacy are limited but they offer no benefit over rice cereal. They should be considered only for reducing regurgitation; they are not an anti-reflux formula.\(^6^2\)

**Drug therapy**

Drug therapy should be given only under medical supervision. There are two possible therapies: acid reduction and use of prokinetic agents.

At present there is no drug available that is truly anti-reflux. The ideal drug would reduce the frequency of transient lower oesophageal sphincter relaxations, the major contributor to gastro-oesophageal reflux. Medications containing antacids for treatment of reflux act only for a short time. The response of an irritable infant to antacid suggests that the symptoms are related to acid reflux. H\(_2\) receptor antagonists provide more potent acid reduction. Proton pump inhibitors are the most potent reducers of gastric acid and also have an anti-reflux effect.

Cisapride, the most widely used prokinetic agent for gastro-oesophageal reflux, has been withdrawn from use in reflux for safety reasons.\(^6^3\) Drugs in this class worked on the premise that delayed gastric emptying was an important cause of reflux, but this now seems unlikely. Several studies have also shown that Cisapride in fact offered no symptomatic benefit in children with reflux.\(^6^4\) No other agents have proven benefit.\(^6^5\)

A study of the natural history of reflux\(^6^6\) showed that active medical management produces control of symptoms such that approximately 50 per cent of cases need no further therapy beyond 8 to 10 months of age and 30 per cent beyond 18 months of age. However, 17 per cent of patients have ongoing symptoms or complications requiring anti-reflux surgery.
Surgical intervention

Surgical intervention is restricted to infants for whom medical management has failed and/or who have potentially life-threatening complications such as apnoea or aspiration.\textsuperscript{66}

Physiological jaundice

Some degree of physiological jaundice—or early-onset jaundice—occurs in almost half of all infants; it shows up after 24 hours of age, peaks on the third or fourth day of life, and declines steadily through the first week. An early first breastfeed (within an hour or so of birth) and frequent breastfeeds with no restrictions help to prevent or reduce jaundice. Frequent stimulation of the infant’s gut speeds up the elimination of meconium, which contains jaundice-causing bilirubin.\textsuperscript{67}

If an infant requires phototherapy breastfeeding should continue. The infant should be removed from under the lights to be breastfed: intermittent phototherapy is as effective as continuous therapy.\textsuperscript{68} If the infant becomes sleepy or requires extra fluids while under phototherapy, the mother can express milk to be given in addition to breastfeeds.

Breastmilk jaundice

A small percentage of infants have prolonged jaundice, which cannot be distinguished from early-onset jaundice in the first week. Any infant jaundiced beyond 2 weeks of age should have a serum-conjugated (direct) bilirubin determination, together with serum amino transferase levels, in order to exclude a pathologic cause of hyperbilirubinaemia (for example, biliary atresia). Breastmilk jaundice—or late-onset jaundice—manifests itself in the second week of life with a rising serum bilirubin concentration. The exact cause is unknown, but it appears to be a syndrome associated with the milk of a particular mother. Varying degrees of the syndrome are likely to occur with subsequent pregnancies.\textsuperscript{69} Usually the infant is thriving, healthy and gaining weight and has normal bowel motions. Once other causes of prolonged or excessive jaundice (such as haemolytic disease, hypothyroidism, G6PD deficiency and intestinal obstruction) are ruled out, late-onset jaundice requires no intervention. No cases of kernicterus caused by breastmilk jaundice have been reported.\textsuperscript{69}

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IV. BREASTFEEDING: COMMON PROBLEMS AND THEIR MANAGEMENT


49. Suri, Altshuler et al. 1998


V EXPRESSING AND STORING BREASTMILK

It is important that instructions for collecting and storing breastmilk do not seem daunting; nor should they promote anxiety by implying that there is a risk of harming the infant.1,2

Expressing breastmilk

Mothers may need to express their breastmilk for a variety of reasons:

- The infant is sick or premature.
- Mother and baby are temporarily separated.
- The mother is returning to paid work.
- The milk supply needs to be increased.
- The mother's breasts are uncomfortably full.

The requirements for collecting breastmilk for sick or premature babies in hospital are more stringent than those applying to collecting milk for healthy babies at home. Midwives, lactation consultants, early childhood nurses and Australian Breastfeeding Association counsellors are available to provide advice about expressing, both in hospital and at home.

There are three methods of expressing: hand expressing, hand pump expressing, and electric pump expressing. The mother’s choice will depend on her reason for expressing and her personal preference. The following general hints apply, regardless of the method chosen:

- Express in a comfortable, private place.
- Disable the telephone.
- Have a glass of water nearby.
- Have all expressing equipment ready.
- Relax! Music may help.

Hand expressing

Every mother should be shown how to hand express her milk. This method has many advantages: no equipment is required; it is convenient; and the skin-to-skin contact stimulates milk production. In spite of initial reservations, many women find hand expressing becomes easier with practice. Here are the steps:

- Wash hands with soap and warm water.
V. EXPRESSING AND STORING BREASTMILK

- Gently massage the breast. Start from the top of the breast and stroke towards the nipple; massage the underside too. Do this several times to ensure that the whole breast is massaged.
- Hold a clean plastic dish under the breast to collect the milk. This may be difficult for some mothers to manage when they are learning: instead, a wide bowl can be held between the legs or placed on a low table, leaving both hands free; a towel may be needed to catch any spills.
- Place thumb and finger diagonally opposite each other on the edge of the areola.
- Gently press inward towards the centre of the breast, squeezing the finger and thumb together.
- Repeat with a rhythmic rolling movement, feeling for the milk sinuses. The fingers should not slide over or pinch the skin.
- Once the milk flow has stopped, move the fingers around the nipple and press again. This helps express more milk and empty all sectors of the breast.
- Repeat the process on the other breast.
- If more milk is required, the mother can change from breast to breast until she has the amount of milk needed or she can wait and try again later.

Hand pumps

Hand pumps are portable and relatively inexpensive. They are recommended if a mother is breastfeeding and needs to express regularly once or twice a day when away from her baby. Many types are available; they should be used according to the manufacturers’ instructions. The following steps relate to piston hand pumps:

- Wash hands with soap and warm water.
- Have a clean, sterilised pump ready.
- Gently massage the breast. Start from the top of the breast and stroke towards the nipple; massage the underside too. Do this several times to ensure that the whole breast is massaged.
- Place the flat rim of the breast cup on the breast, centring the nipple.
- Gently work the pump with a smooth action, pulling the piston and releasing the suction rhythmically. By releasing the suction, the blood circulation to the areola and the nipple will be maintained.
- Continue working the pump until the breast is soft and about half the required amount of milk has been expressed.
- Change to the other breast and repeat the process, starting with the gentle massage.
- If more milk is required the mother can change from breast to breast until she has the amount needed or she can wait and try again later.
- Pour the collected milk into a storage container and put it in the refrigerator (see ‘Storage of expressed breastmilk’, below).
Electric pumps

Electric breast pumps are recommended when the baby is sick or premature, mothers are separated from their babies for long periods, mothers are not getting enough milk using other expression methods, and babies cannot attach well at the breast. Here are the steps to follow when using an electric pump:

- Wash hands with soap and warm water.
- Have the sterilised pump equipment ready.
- Gently massage the breast. Start from the top of the breast and stroke towards the nipple; massage the underside too. Do this several times to ensure that the whole breast is massaged.
- Place the breast cup on the areola, centring on the nipple.
- Turn the suction strength to low, start the pump, and relax.
- Gradually increase the suction strength—as long as there is no discomfort. The strength should not be increased above the recommended level for the type of pump being used.
- Continue until the breast is soft and about half the required amount of milk is collected.
- Change the cup to the other breast, turning the suction to low, and repeat the process, beginning with the gentle breast massage.
- If more milk is required, the mother can change from breast to breast until she has the required amount or she can wait and try again later.
- Pour the collected milk into a storage container and put it in the refrigerator (see ‘Storage of expressed breastmilk’).

Electric breast pumps can be hired from many pharmacies or from the Australian Breastfeeding Association.

Feeding with expressed breastmilk

Expressed breastmilk can be fed to an infant by bottle, cup or spoon. Using a cup will minimise problems with nipple confusion. Whether a bottle, a cup or a spoon is used, the same procedures for sterilisation and storage apply.

Storage of expressed breastmilk

The requirements for storing breastmilk are more stringent for sick or premature babies in hospital than for healthy babies at home.

Storing breastmilk in hospital

Mothers and health workers should wash their hands thoroughly with soap and water before handling breastmilk.
V. EXPRESSING AND STORING BREASTMILK

- Breastmilk is best used when fresh. A mother should try to provide fresh breastmilk daily for her baby; if this is not possible, the milk can be stored in a refrigerator or freezer in sterilised plastic containers.
- Breastmilk refrigerated at 4°C for 48 hours suffers little loss of nutrients or immunological properties and the bacterial count is actually reduced.³
- Freshly expressed milk should be chilled in the refrigerator before being added to frozen milk.
- Warmed milk should be given straight away and any amount left over should be discarded.
- Never refreeze or reheat breastmilk.
- Label the container with surname, date, and time of expression.
- Do not thaw or warm breastmilk in the microwave.
- Thaw breastmilk by placing it in either cool or warm water. Shake the milk gently before using it if it has separated.
- Thawed milk should be used within 24 hours.

Mothers should be given advice about cleaning, storing and sterilising equipment—see Section VIII.

Storing breastmilk at home

Very little special handling of a mother’s milk is necessary. Since it is already sterile when it comes from the breast, expressed breastmilk is safer to use than prepared infant formula. It can be stored in glass or plastic containers, including sealable plastic bags. Freshly expressed milk can be chilled in the refrigerator and added to frozen milk in the freezer.

The following is a simple guide for mothers storing expressed breastmilk at home⁴:
- Wash hands thoroughly with soap and water.
- Refrigerate or freeze milk after expressing.
- Use fresh milk whenever possible.
- Freeze milk that will not be used within two days.
- Use the oldest milk first; date the container at the time of collection.

Table V.1 shows how long breastmilk can be stored.
Table V.1  Storing breastmilk for home use\textsuperscript{1,2,4–6}

<table>
<thead>
<tr>
<th>Breastmilk status</th>
<th>Room temperature (26\textdegree{} C or lower)</th>
<th>Refrigerator (4\textdegree{} C or lower)</th>
<th>Freezer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freshly expressed into container</td>
<td>6–8 hours</td>
<td>3–5 days</td>
<td>2 weeks in freezer compartment inside refrigerator</td>
</tr>
<tr>
<td></td>
<td>If refrigeration is available store milk there</td>
<td>Store at back, where it is coldest</td>
<td>3 months in freezer section of refrigerator with separate door</td>
</tr>
<tr>
<td></td>
<td></td>
<td>6–12 months in deep freeze (–18\textdegree{} C or lower)</td>
<td></td>
</tr>
<tr>
<td>Previously frozen—thawed in refrigerator but not warmed</td>
<td>4 hours or less—that is, the next feeding</td>
<td>24 hours</td>
<td>Do not refreeze</td>
</tr>
<tr>
<td>Thawed outside refrigerator in warm water</td>
<td>For completion of feeding</td>
<td>4 hours or until next feeding</td>
<td>Do not refreeze</td>
</tr>
<tr>
<td>Infant has begun feeding</td>
<td>Only for completion of feeding</td>
<td>Discard</td>
<td>Discard</td>
</tr>
</tbody>
</table>

Transporting breastmilk

- Transport breastmilk in an insulated container—an Esky with a freezer brick.
- If some milk has thawed it should be used within 24 hours. Do not refreeze it.
- Place the milk in the refrigerator (or in the freezer if it is still frozen) immediately upon arrival.

References

VI  BREASTFEEDING IN SPECIFIC SITUATIONS

There are very few situations for which breastfeeding is contra-indicated. Even mothers who have serious conditions are able to breastfeed successfully; among these conditions are¹:

- type 1 diabetes
- type 2 diabetes
- gestational diabetes
- multiple sclerosis
- systemic lupus erythematosus
- hypothyroidism
- hypertension
- Crohn’s disease and ulcerative colitis
- phenylketonuria
- cystic fibrosis
- fibrocystic disease.

ABSOLUTE CONTRA-INDICATIONS TO BREASTFEEDING

In a limited number of situations breastfeeding is absolutely contra-indicated:

- active tuberculosis that has not yet been treated. Any contact with the infant, including breastfeeding, is not permitted until the mother has finished two weeks of treatment. The infant is usually prescribed prophylactic treatment. Lactation is initiated and maintained by expressing breastmilk until contact is approved
- brucellosis (undulant fever), which, like tuberculosis, can pass from the mother’s blood to the breastmilk
- recently acquired maternal syphilis with an unaffected infant. Mother–infant contact and breastfeeding can begin after 24 hours of therapy, provided there are no lesions around the breasts or nipples. If there are lesions around the breasts or nipples, feeding may begin or resume once treatment is complete and the lesions are healed
- breast cancer detected during pregnancy¹
- HIV infection. In Australia, women who are HIV positive are advised not to breastfeed. Transmission of the human immunodeficiency virus through breastfeeding is well documented. The US Centers for Disease Control and
Prevention advise women with HIV infection not to breastfeed.\textsuperscript{2,3} The NHMRC\textsuperscript{4} and the American Academy of Pediatrics\textsuperscript{5} have issued statements in support of this position. Other countries may have different policies. For developing countries, the WHO and other UN agencies currently recommend exclusive breastfeeding by HIV-positive mothers until 6 months of age and then transfer to other methods of feeding. Use of retroviral drugs assists in reducing mother-to-infant transmission. It is estimated that the rate of mother-to-infant transmission during breastfeeding is 10–20 per cent, but all the studies are fraught with problems of definition of exclusive breastfeeding\textsuperscript{6}

- rare metabolic disorders of infants such as galactosaemia and maple syrup urine disease, which severely limit or render impossible the infant’s use of certain milk components. In cases of phenylketonuria, partial breastfeeding may be possible, provided there is careful monitoring by a paediatrician and a dietitian with expertise in metabolic disease
- hepatitis B infection, although breastfeeding may begin or resume once the infant has been immunised.

**Relative contra-indications to breastfeeding**

Some conditions may need to be considered on their merits before use of infant formula is advised:

- maternal medications. Most drugs are excreted into the breastmilk but usually in concentrations less than 1–2 per cent of the maternal dose, which rarely poses a danger to the infant.\textsuperscript{7–9} Some drugs may be contra-indicated during breastfeeding, but this is a complex subject and advice given may depend on factors such as the drug dose, the duration of treatment, and the nature of the illness. The advice of the general practitioner who prescribed the medication or the pharmacist at the nearest women’s or children’s hospital should be sought if there is any doubt.
- hepatitis C. There is as yet no evidence that hepatitis C is transmitted through breastmilk
- specific illnesses in the infant. Breastfeeding can continue in almost all circumstances
- maternal illness and malignancy, depending on the mother’s health and the medications used
- maternal psychiatric illness if there is definite danger to the infant. A psychiatrist’s advice should be sought.
NICOTINE, ALCOHOL AND OTHER DRUGS

Nicotine

Cigarette smoking can affect the mother’s milk supply and may cause gastrointestinal upsets in the infant, so mothers are advised to give up smoking. If this is not possible, they should reduce their smoking as much as possible, and they should completely avoid smoking in the hour before feeding, and during feeding, to reduce the harmful effects. No one should smoke in the same room as an infant because of the dangers of passive smoking. Smokers are less likely to breastfeed, but they should be encouraged to do so because of the modifying effect breastfeeding has on the ill-effects of smoking.

Alcohol

The level of hepatic alcohol dehydrogenase activity in infants is less than 50 per cent of that in adults. Ingestion of alcohol by breastfeeding mothers can lead to impaired neurologic development in their infants. One study found that Psychomotor Development Index scores were lower among infants who were exposed to alcohol through breastmilk than among those who were not exposed. When a breastfeeding mother takes even one standard alcoholic drink, a small quantity of ethanol passes into her milk and is subsequently taken by the suckling infant, so lactating women are advised not to drink alcohol. The average woman takes about two hours to metabolise one standard drink. Thus, a mother who does take alcohol should limit the amount to one drink, consumed just after a breastfeeding; this will allow the alcohol to be substantially metabolised before the next feed. The level of alcohol in the breastmilk is the same as the level in the mother’s blood. Larger amounts of alcohol inhibit the let-down reflex.

Other drugs

Marijuana should not be smoked by breastfeeding mothers. Use of other mood-altering substances is also contra-indicated: these substances may be excreted in the breastmilk. In addition, a mother who is not fully alert can be a hazard to herself and her infant while breastfeeding or preparing infant formula.

Use of methadone for the treatment of narcotic addiction is justified during lactation.

Appendix F provides information about breastfeeding and pharmaceutical and other drugs.
Women and paid work

Returning to paid work has a significant impact on the experience of breastfeeding and is commonly cited as a reason for ceasing to breastfeed. Among the factors that have limited mothers’ ability to continue breastfeeding are the relative brevity of maternity leave, inflexible hours of work, and the lack of paid breastfeeding (or pumping) breaks while at work. Until recently, the rights of a woman in paid employment to breastfeed her baby have been neglected; increasingly, though, the social environment in Australia is allowing mothers the choice of working and breastfeeding and this is being recognised in employment contracts.

The booklet *Balancing Breastfeeding and Work* outlines the benefits of promoting breastfeeding—for employers, mothers and infants. The facilities that should be provided are listed and a number of other useful recommendations are made. A number of websites also provide useful information (see Appendix I).

The International Labour Organisation’s Convention 103 on Maternity Protection (1952) calls on member nations to provide, by national legislation, an entitlement of at least 12 weeks’ maternity leave. During this period the mother is to be entitled to cash benefits provided by a compulsory social insurance scheme or from public funds. The convention also calls for nursing breaks for women in the workplace.

In Australia, most employed women are entitled to maternity (or parental) leave, although there is variation in the benefits available. In some areas of the public sector a period of maternity leave is paid; in the private sector maternity leave is generally unpaid.

Regardless of their eligibility for paid maternity leave, many women, for economic or personal reasons, return to paid work before they want to stop breastfeeding. They commonly find that their workplace lacks the flexibility and facilities—such as work-based child care or the time and a suitable place to express and store milk—that would allow them to combine breastfeeding and their job. Because of this, some women who intend to return to work may be discouraged from initiating breastfeeding and others may feel that breastfeeding has to stop once paid work starts.

This is usually not the case. Health workers need to be well informed and positive when advising parents about combining breastfeeding and paid work. When it is not possible for the mother to go to her baby during working hours, several options are available:

- replacing breastfeeds during work hours with expressed breastmilk fed from a cup or a bottle
- for babies aged 6 months and over, replacing breastfeeds during work hours with food from a spoon and a cup
- replacing breastfeeds during work hours with infant formula fed from a cup or a bottle.
Health workers need to be aware that breastfeeding and formula feeding can be combined: using formula does not mean the mother has to cease breastfeeding. When formula is used during working hours, breastfeeding can still continue before and after work and during weekends. A combination of both expressed breastmilk and formula can be given to a baby when there is not enough expressed milk.

It is important that in the first six weeks to three months of a baby’s life health workers give the mother as much assistance as possible to establish breastfeeding successfully; that way, the mother has a greater range of options. Accurate advice on expressing, storing and using frozen breastmilk, as well as on bottle-feeding and using formula, is also necessary.

Health workers should become advocates for workplace adoption of policies that enable women to breastfeed. Such policies entail flexible working hours, work-based child care, and provision of rooms for expressing breastmilk or breastfeeding and of refrigerators for storing expressed milk.

**LOW-BIRTHWEIGHT INFANTS**

Management of low-birthweight infants is beyond the scope of this document. Infants weighing less than 2000 grams at birth have relatively higher requirements for nutrients—such as protein, calcium, phosphorus and zinc—and often need breastmilk that has been fortified. Feeding infants of low or very low birthweight with breastmilk reduces the incidence of infection, including septicaemia, meningitis and necrotising enterocolitis.17–19

**REFERENCES**


7. Colvin J. *Drugs and breastfeeding guide*. The Royal Women’s Hospital, 1994/95.


Complementary feeding is not helpful for the early establishment of successful breastfeeding. When complementary feeds are to be used in hospital, the mother should give her informed consent. If an infant has become dehydrated, rehydration may enable him or her to begin breastfeeding successfully: a paediatric assessment should be made before seeking the mother’s consent for this. It should be emphasised, however, that such a situation is uncommon, even in Australia’s climate. A consent form that tells the mother about the advantages of breastfeeding and the risks associated with not breastfeeding should be signed. The implications of complementary feeding for establishing and maintaining successful breastfeeding should be the subject of discussion between health worker and mother; an example of a consent form is shown in Appendix H.

It is also important that women be informed about their options for feeding before they are admitted to hospital, preferably during the antenatal education period. The decision to breastfeed, or not to do so, should be an informed one. To assist in this decision making, all pregnant women and their partners should have the opportunity to discuss feeding methods with their midwife or doctor. They should be encouraged to read the wide selection of material available on infant feeding, and they should be told about community groups that offer information and support for women who intend to breastfeed—for example, the Australian Breastfeeding Association and La Leche League.
The primary objective of the WHO International Code of Marketing of Breast-milk Substitutes is to ensure safe and adequate nutrition for infants by protecting and promoting breastfeeding and by ensuring the safe use of infant formula, when it is necessary, on the basis of adequate information and through appropriate marketing and distribution. The Code states that feeding with infant formula should be demonstrated only by health workers or other community workers and only to those mothers or family members who need to use formula. In giving this information, health and other community workers should inform parents and others of the hazards of improper use of infant formula (WHO Code, Article 6.5).

It is important that health workers know how to demonstrate the reconstitution of infant formula and how to feed an infant with a bottle. (Bottles may, of course, also be used to feed infants expressed breastmilk.) While breastfeeding is the objective for all infants, if formula is to be used it is essential that health professionals demonstrate the correct methods and that the methods be regularly monitored.

**Infant formulas**

Compared with cow’s milk, all modern infant formulas contain reduced protein and electrolytes and added iron and vitamins A, B group, C, D, E and K. The protein in the formula is either casein or whey dominated and, since its amino acid content is not the same as that in human milk, a slightly higher protein content is required in formula. The fat in formula is either butterfat or mixtures of vegetable oils. The mixtures of vegetable oils are closer to the pattern of saturated fatty acids in human milk, but the fatty acids’ actual composition is very different.

Although human milk constituents are used as a reference point for the development of infant formula, it is not possible to duplicate human milk. Infant formula lacks many factors present in human milk, including numerous types of living cells, cholesterol, polyamines, free amino acids, glycosamine, and enzymes and other bioactive substances. Furthermore, the sterilisation (pasteurisation) processes used in manufacturing formula slightly modify the structure of the cow’s milk proteins, with a consequent loss of any cross-species protection against infection. The processing does, however, reduce the allergenicity of the cow’s milk protein. Although research into the development of formulas is continuing, it is unlikely that these products will provide the variety of nutrient and active factors present in human milk in the foreseeable future. In spite of
this, when a baby is not breastfed use of an infant formula offers a better way of meeting their primary nutritional needs than using modified raw cow’s milk.

Standards for the quality, composition and labelling of infant formulas sold in Australia are regulated through Standard 2.9.1—Infant Formula in the joint Australia New Zealand Food Standards Code (volume 2). For the purposes of the standard, an infant is defined as being a person aged up to 12 months.

Cows’ milk–based formula is suitable for most normal-term infants and is recommended over formulas made from soy beans or goat’s milk, modified lactose formula, or specialised formula designed for babies with nutritional problems, which should be used only in the case of medically diagnosed conditions. Changing the type of formula because of minor rashes or irritability and infant or parent distress is usually of no benefit.

Although soy formulas offer no advantages over cow’s milk formulas, soy protein–based formulas have been demonstrated to permit normal growth and development in infants. Vegans may prefer a soy-based formula. Soy formula can also be used as an alternative to cow’s milk formula in infants with an allergy to or intolerance of cow’s milk protein.

A number of concerns have, however, been raised about soy-based infant formulas, on the basis of possible physiological effects of the isoflavone compounds on the infant’s developing neuro-endocrine system. There is no clear clinical or scientific evidence to support the position that these compounds are harmful, although there have been no long-term studies that conclusively document the product’s safety in infants.

The Australian College of Paediatrics policy for the use of soy formula in infants (1998) is as follows:

1. The indiscriminate use of soy formula for vague symptoms and signs not proven to be due to cow’s milk protein intolerance (CMPI) is to be avoided. Casual treatment in this manner is undesirable because it leads to over-diagnosis of food intolerance, with potential long-term effects on child health and behaviour.

2. Soy formula should not be used routinely as prophylaxis in infants thought to be at risk of the development of allergy. Soy protein is an allergen in its own right. The diagnosis of gastrointestinal CMPI should not be made without careful evaluation by an expert in the field. When proven, it should be treated with formulas containing protein hydrolysates.

3. Conditions in infancy for which soy formula may be appropriately prescribed are galactosaemia and lactose intolerance.

4. The use of soy formula may not be without side-effects. There is some evidence that soy formula may impair immunity and the long term effects of contaminants of soy (eg aluminium and phytoestrogens) are unknown.

During its review of infant formula (Proposal P93), Food Standards Australia New Zealand (formerly the Australia New Zealand Food Authority) completed an assessment of the risks to infants from soy-based infant formula. FSANZ.
concluded, ‘The currently available information suggests that, while phytoestrogens have the potential to cause adverse effects, there is no evidence that exposure of healthy infants to soy-based infant formula has been associated with any demonstrated harm’. It recommended that the use of soy-based infant formula be limited, that support be given for education strategies that promote breastfeeding, and that, when breastfeeding is not an option, modified cow’s milk formula be chosen in preference to soy-based formula. A more recent review reached similar conclusions.

In the past there was concern about aluminium levels found in soy formulas, but these have now been lowered to within the acceptable range.

Many infants who are allergic to cow’s milk are also allergic to goat’s milk and soy milk. Although there is a range of cow’s milk–based formulas on the market, there is little evidence that one is better than another for normal-term infants.

The prices of different infant formulas and the types of retail outlets that sell the formulas are not related to quality or nutritional value. All infant formulas sold in Australia meet the relevant nutritional and quality-control standards. Use of a particular formula by a hospital does not mean that formula is the ‘best’ one. Interchange between formulas within the same generic group is optional and can be decided on the basis of cost.

Standard formulas labelled ‘suitable from birth’ are for infants from birth to 12 months. ‘Follow-on’ formulas labelled ‘suitable only for babies over 6 months’ are for infants aged from 6 to 12 months, but their use is not considered necessary for most and there have been no studies showing advantages over the infant formula they are already having. The American Academy of Pediatrics recommends that infants be fed breast milk for the first 6 to 12 months and states that the only acceptable alternative to breast milk is iron-fortified infant formula. By 12 months of age infants should be eating a wide variety of family foods, and cow’s milk should be introduced at this time.

**Long-chain polyunsaturated fatty acids and infant formulas**

Long-chain polyunsaturated fatty acids, or LCPUFAs, are important structural components of lipid-rich cell membranes in the infant’s developing central nervous system, particularly the brain and retina. They are also precursors to eicosanoids, which are oxygenated, highly active lipid mediators such as leukotrienes, prostaglandins and thromboxanes. Eicosanoids have key roles as modulators of renal function, mediators and messengers of allergic and inflammatory reactions, and messengers in cellular signalling cascades.

In infants, LCPUFAs are preferentially accumulated by the brain during the last trimester of pregnancy and the first months of life. Breastmilk contains LCPUFAs, among them docosahexaenoic acid (DHA, C22:6n-3) and arachidonic acid (AA, C20:4n-6), and their precursors alpha linolenic acid and linoleic acid. Evidence suggests that formula-fed premature and newborn infants have limited
capacity to synthesise sufficient DHA and AA from the precursor fatty acids
normally included in infant formula\textsuperscript{10}: they have lower levels of DHA and AA in
their plasma and red blood cell lipids compared with breastfed infants.\textsuperscript{17,18} A
developing body of evidence suggests that formula-fed infants require dietary
preformed DHA and AA to match the tissue accretion rates of infants receiving
DHA and AA from breastmilk.\textsuperscript{11,19,20}

Clinical studies have evaluated the dietary benefit of supplementation of DHA
and AA and reached different conclusions. A systematic Cochrane Review of
supplementation in pre-term infants found evidence that n-3 LCPUFA
supplementation of formula increases the early rate of visual maturation in these
infants.\textsuperscript{21} A similar review in term infants did not identify a benefit for visual or
cognitive development.\textsuperscript{22} These reviews established that DHA and AA
supplementation of formulas does not influence the growth of term and pre-term
infants, which is a consistent conclusion.\textsuperscript{23,24,19} More recently, two large trials have
shown that visual acuity and cognitive development in formula-fed infants
supplemented with LCPUFAs were increased compared with infants fed
unsupplemented formula.\textsuperscript{25,26} The failure of earlier studies to find a significant
benefit could be a result of protocol differences, evaluation methodology,
limiting levels of supplementation, differing LCPUFA sources, trial sample sizes
and other confounding variables.\textsuperscript{22} Any benefits LCPUFAs in infant formulas offer
for cognitive development are smaller than the advantage of breastmilk over
formula for infants.\textsuperscript{27}

\textbf{Fluoride in infant feeding}

Fluoride is an essential nutrient, being part of the structural componentry of
bone and teeth. The US National Research Council recommends a fluoride intake
of 0.1–1.0 milligrams a day for infants aged less than 12 months. An extra
0.25 milligrams a day is recommended for breastfed infants and those fed ready-
to-use formula that has been made with non-fluoridated water.\textsuperscript{28}

The water supply in most metropolitan and many regional areas in Australia is
fortified with approximately 1 milligrams per litre of fluoride. The National
Health and Medical Research Council\textsuperscript{29} recommends that infant formula
manufacturers assume that formula powder will be reconstituted using
fluoridated water, so the level of fluoride in the infant formula powder should be
kept as low as possible. An intake above 2 milligrams a day can be regarded as
undesirable and may result in mottled teeth in the infant.

In order to limit the amount of fluoride in formula, infant formula manufacturers
use non-fluoridated or de-fluoridated water in processing. This results in infant
formula powders that contribute minimal amounts of fluoride to the reconstituted
liquid and levels of less than 1.5 milligrams a litre in the reconstituted formula.
In areas where the water supply is not fluoridated, an inadequate intake of
fluoride by infants and the general community poses a public health problem
that may need to be redressed by health professionals.
PREPARATION OF FORMULA

Safe bottle-feeding depends on a safe water supply, sufficient family income to meet the costs, effective refrigeration, clean surroundings, and satisfactory arrangements for sterilising and storing equipment. Health workers should be aware that parents without literacy skills or from a non–English speaking background might need extra help to make sure bottle-feeding is done safely.

Equipment

The following equipment is needed for preparing formula:

- two to six large bottles. A large variety of bottles made of glass or polycarbonate (rigid plastic) are available. Bottles made of plastic are preferred over glass because of the potential for glass to break. Many bottle manufacturers offer differently shaped bottles and bottles with ‘anti-colic’ devices. Decorations and odd shapes make bottles hard to clean and there is no evidence that a particular shape of bottle prevents wind or colic.
- several teats. Teats are made from rubber, also called latex (brown-coloured), or silicone (clear-coloured). Shape variations (as in ‘orthodontic’ teats) offer no particular advantage unless the infant prefers that shape
- a knife for levelling the formula powder
- a bottle brush to clean the bottles
- sterilising equipment.

After use, all equipment should be rinsed in cold water, washed in detergent and hot water, using a bottle brush to thoroughly clean bottles and teats; then rinsed again before sterilising. Careful cleaning and safe storage of equipment should continue for as long as bottles and teats are used.

It is recommended that equipment be sterilised until the infant is 12 months of age.

Sterilisation of equipment and water by microwaving is not recommended because microwaves do not heat evenly and this may lead to some equipment or parts of equipment not being properly sterilised.

STERILISATION METHODS

It is recommended that all equipment used in the preparation of infant formula be boiled in fresh water for five minutes. Water used in the preparation of formula should also be brought to the boil and boiled for five minutes. In most cases it is safe to use cold tapwater and then boil it. The water used should meet the standards specified in the Australian Drinking Water Guidelines <http://www.health.gov.au:80/hfs/nhmrc/publications/synopses/eh19syn.htm>: ‘drinking water should be clear, colourless, well aerated, no unpalatable taste or odour and contain no suspended matter, harmful chemical substances or pathogenic
micro-organisms’. If your tapwater does not meet these standards, plain bottled water can be used, but it should still be boiled for 5 minutes. Bottled natural or sparkling mineral water should not be used in the preparation of infant formula: its high mineral content raises the renal solute load of the formula and places stress on the infant’s kidneys.

Boiling water for extended periods (10 minutes or more) is not recommended because of the possibility of concentrating heavy metals such as lead in the water.

Sterilisation of water is recommended until the age of 12 months.

Microwaving is not recommended because microwaves do not heat evenly. Similarly, using microwaves to reheat formula prior to use is not recommended because hot spots can form in the formula and may burn the infant.30–33

**Boiling**

Boiling is the preferred option for sterilisation. It will give consistent and reliable results if the following steps are taken:

- Place utensils—including bottles, teats and caps—in a large saucepan on the back burner of the stove.
- Cover utensils with water, making sure to eliminate all air bubbles from the bottle.
- Bring water to the boil and boil for five minutes. Turn off—don’t allow it to boil dry.
- Care needs to be taken to avoid scalds, so allow the equipment to cool in the saucepan until it is hand hot, then remove it. Be extra careful if children are present.
- Store equipment that is not being used straight away in a clean container in the fridge.
- Boil all equipment every 24 hours, even if it has not been used during that time.

*Note.* It is common practice to use an electric jug or kettle with an automatic cut-off to boil water. After the cut-off has activated, reset the cut-off switch and boil again. This will be about the same as boiling for five minutes.

**Sterilising using chemicals**

A chemical sterilant is an antibacterial solution that comes in liquid or tablet form. Follow the manufacturer’s instructions carefully when making up the solution to ensure the correct dilution. After 24 hours discard the used solution, thoroughly scrub the container and equipment in warm water with detergent, and make up a new solution. Make sure all equipment is made of plastic or glass: metal corrodes when left in chemical sterilant.
Completely submerge everything, making sure there are no air bubbles, and leave it in the solution for at least the recommended time. Equipment can be left in the solution until it is needed. Allow the equipment to drain; do not rinse the sterilising liquid off it or there will be a risk of re-contamination.

Store the sterilising concentrate and solution well out of the reach of children.

Chemical sterilisation is not as effective as boiling; unless bottles and other utensils are meticulously cleaned, the process will not be effective.

**Steam sterilisers**

Steam sterilisers are automatic units that raise the temperature quickly to the range that kills harmful bacteria.

Place thoroughly cleaned equipment inside the unit, add water according to the manufacturer’s instructions, and switch on. The unit switches itself off when the sterilisation process is complete.

**Microwave steam sterilisers**

Sterilising units designed for use in a microwave oven are available. The caveats that apply to chemical sterilisation also apply to microwave sterilisation.

**Using infant formula**

Manufacturers’ information about formula composition is based on accurately made-up mixtures, but accuracy is not always achieved in practice. A survey of 274 Sydney mothers who were bottle-feeding showed that 30 per cent made mistakes in reconstituting feeds; in 52 cases there were potentially serious errors.34 A study by Bennett and Gibson suggests there is an inherent limitation in accuracy when measuring powdered formula with scoops.35 A review of the US Food and Drug Administration’s Infant Feeding Practices Study, a national longitudinal survey, found a high level of non-compliance with best practice; this included 33 per cent of mothers who mixed formula with warm tapwater and up to 48 per cent who heated bottles in a microwave oven.36

Health professionals need to instruct parents how to reconstitute formula correctly.

**Important points for preparing formula**

- Formula is designed to remain at a constant strength. As an infant grows it is the amount of formula that should increase, not the strength. Never, for any reason, add any more scoops than instructed.
- Always use the scoop provided with the brand of formula being used: scoops are not interchangeable between brands. All scoops used in
Australia should be filled to the level: never use half scoops of powder. When a container of formula is finished, throw away the scoop with the container, to ensure that the correct scoop is used next time.

- If using concentrated liquid formula, use equal proportions of formula and water unless otherwise instructed.
- If the brand of powdered formula is changed, it is important that the parent is reminded to check the number of millilitres of boiled water per scoop. Brands differ.
- It is important to use cooled boiled water: hot water can destroy vitamins and other nutrients.

**Making the feeds**

Prolonged boiling of water is unnecessary when making the feeds. To prepare water for mixing with powder or liquid formula, empty the kettle or electric jug, refill it with water, and bring the water to the boil. Kettles and jugs with no automatic cut-off should be switched off within 30 seconds of boiling. Always allow the water to cool before adding the powder or liquid. Bottled water is safe to use but still should be boiled. Mineral waters and soda water are unsuitable.

The preferred—and safest—way of making formula at home is ‘in the bottle’, one at a time. This reduces the potential for contamination, the amount of equipment needed, and the possibility of mistakes when counting out the scoops of formula.

**The procedure**

- Measure the required amount of cooled, boiled water and pour it into each bottle.
- Using the scoop from the formula container, measure the required number of scoops and place them in each bottle. Use a knife to level off each scoop, and do not pack down the formula in the scoop.
- Seal the bottle with a cap and disc and shake it gently to mix the formula. Note that the total volume will be greater than the measured water because of displacement.
- Store all made-up formula in the centre at the back of the fridge, where it is coldest—not in the door, where it is warmer.
- Throw out any unused formula after 24 hours.

**Safety points**

- Always wash your hands and work surfaces before preparing formula.
- Put formula straight into the refrigerator as soon as it is made.
- Discard the contents of partially used bottles after an hour. Re-using half-empty bottles is risky once they have been heated and sucked on.
Check the expiry date on formula containers and discard them if they are out of date. Discard any opened container of formula after a month. In very hot climates formula can deteriorate before its expiry date.

The safest way to transport formula is to take the cooled, boiled water and the powdered formula in separate containers and mix them when needed. When it is necessary to transport prepared formula (or expressed breastmilk), it must be icy cold when leaving home and be carried in an insulated pack to keep it cold. It can be given cold to the infant if there is no way of warming it.

The time taken to warm a bottle of formula should not exceed 10 minutes: bacteria multiply rapidly in warm formula, and extended warming time has the potential to create this environment and then cause diarrhoea.

**Feeding formula**

It is not harmful to feed babies cold formula, but formula warmed to room temperature flows faster and generally babies seem to prefer it warm. Standing the bottle in warm to hot water is the traditional, and safest, way of heating formula.

Bottle warmers are convenient and safe, provided they have a thermostat control, but bottles should not be left to warm in them for longer than 10 minutes. Microwaves are not recommended for warming for safety reasons: they do not heat the milk evenly, so the temperature of the milk can be misjudged; and, because of ‘hot spots’ in the milk, an infant can receive burns to the mouth.

**Teats and flow rates**

It can be difficult to get the milk to flow at just the right rate: several types of teat may have to be tried until a suitable one is found. ‘Orthodontic teats’ offer no particular advantage, and there is some evidence they could be harmful because of the reduced tongue movement in the suck–swallow cycle, leading to an increased risk of speech problems, particularly in boys. Their shape is also implicated in an increased risk of later orthodontic problems as a result of pressure on the gums and developing jaw.

To test the flow of a teat, hold the bottle upside down when it is filled with room-temperature milk mixture: the milk should drip steadily. If the bottle has to be shaken vigorously, the teat is too ‘slow’ and the infant may go to sleep before drinking as much as he or she needs. The milk should drip easily at a steady rate, without pouring out in a great stream. A little leakage at the corners of the mouth while an infant feeds is nothing to worry about; it stops as he or she gets older. When the ideal teat cannot be found, a faster teat is usually preferable to a slower one.
Teats need to be checked and replaced regularly. Silicone and rubber teats are prone to perishing and can become dangerous if they crack: they can harbour bacteria, and there is a risk of pieces coming off and being inhaled or ingested.

**Reducing the risks of bottle feeding**

Before giving the bottle to the infant, always check the temperature of the feed by shaking a little milk from the teat onto the inside of the wrist. It should feel warm, not hot.

It is important to hold an infant while feeding him or her with a bottle. Not only is parent–infant contact extremely important, but leaving infants to feed on their own can place them at risk. Feeding should be a pleasurable experience for both mother and infant, regardless of the feeding method. It is dangerous for parents to ‘prop up’ a bottle and leave the infant to manage alone. The milk may flow too quickly and cause the baby to splutter, or even choke. In addition, infants who feed a lot on their own are at greater risk of ear infection and tooth decay. Infants need to be held, cuddled and talked to when they are fed.

Infants should never be put to sleep while drinking from a bottle. Apart from the risk of choking, they can end up with a severe form of tooth decay called *bottle decay*.39

**How much milk?**

As with breastfeeding, bottle-feeding according to need is appropriate. Bottle-fed young infants need about 150 millilitres per kilogram of body weight each day to meet their nutrient needs before solids are introduced. Some will require more (up to 200ml/kg); others less. It is important for parents to be aware that there are many individual variations in the amount of formula and the number of bottles consumed each 24 hours. Information on formula packages recommending certain amounts for various ages is a guide only and does not necessarily suit every infant. Plenty of wet nappies, consistent (but not excessive) weight gain, and a thriving, active infant indicate that all is well.

Following are the average formula requirements for infants and toddlers:

- day 1—30 millilitres per kilogram of body weight each day
- day 2—60ml/kg/day
- day 3—90ml/kg/day
- day 4—120ml/kg/day
- day 5 to 3 months—150ml/kg/day. Some, especially premature, babies will require up to 180–200ml/kg/day
- 3 to 6 months—120ml/kg/day
- 6 to 12 months—100ml/kg/day. Some may reduce to 90ml/kg/day
- 1 to 2 years—90ml/kg/day.
**Using a cup**

A feeding cup can be used instead of a bottle for feeding infant formula or expressed breastmilk. The technique used by an infant to suck on the teat of a bottle differs from that used on the breast[^40], and use of a feeding cup instead of a bottle reduces the risk of confusion. Cups can be used from birth.[^41] When the decision to wean is made, infants of all ages can be weaned onto a cup. This practice is widespread in developing countries, where difficulties with cleaning make a cup a potentially safer option than a bottle. The techniques used for sterilising equipment and preparing formula apply equally to feeding cups.

**References**


13. Kurlak and Stephenson, 1999


IX FOODS NOT SUITABLE FOR INFANTS OR THAT SHOULD BE USED WITH CARE

Honey

Honey can contain the spores of Clostridium botulinum, and it is recommended that it not be given to children aged less than 2 years. Previously, honey was prohibited in foods for infants in Australia, but it is now permitted providing it has been treated to inactivate C. botulinum. This is indicated on the label by the term sterilised honey.\(^1\) After the age of 12 months, children are less susceptible to this bacterium.\(^1\)

Tea

Tea contains tannins and other compounds that bind iron and other minerals, thereby reducing their bioavailability. Furthermore, sugar is often added to tea, increasing the risk of dental caries.

Nuts

Nuts are a problem with small children because of the risk of inhalation. For this reason, they should not be given to children aged less than 5 years. In addition, peanuts pose a risk of allergy: it is estimated that 0.6 per cent of the US population—that is, 1.6 million people—suffer from peanut allergy.\(^2\)

Fruit Juices

Juices made from compressed fruit contain all the nutrients present in fruits but not the dietary fibre. They have historically been given to children to prevent vitamin C deficiency and scurvy.

An Adelaide study found that, in addition to milk, fruit juice and water were the main fluids given to infants aged less than 8 months.\(^3\) This was especially the case with non-breastfed infants. The study results suggest that inclusion of juice in infants’ diets is common: 85 per cent of the children on juice in the study had begun drinking juice by the age of 6 months.

Fruit juice offers no nutritional benefits to infants under 6 months of age; for infants over 6 months of age, drinking water or milk and consuming whole fruit are preferable.\(^4,5\) Excess consumption of fruit juice by young children has been
associated with gastrointestinal symptoms, failure to thrive, decreased appetite, loose stools, and failure to gain weight.\textsuperscript{6-8} In the case of older children and adolescents, see Section 3.8 in the Dietary Guidelines for Children and Adolescents for a discussion of sugar-containing drinks and the risk of obesity. Milk drinks (for children aged more than 12 months) or water are good substitutes; milk is particularly beneficial because of its calcium content.

**Cow's milk**

It is recommended that children under the age of 12 months not be given cow's milk. The evidence for this recommendation is discussed in Section 3.4 of the Dietary Guidelines for Children and Adolescents.

**Reduced-fat milks**

In Australia reduced-fat milks are recommended for older children and for all adults as part of a healthy diet. They are not recommended for children aged less than 2 years.

**References**

X  INTERPRETATION OF THE WHO CODE FOR HEALTH WORKERS IN AUSTRALIA

All health workers in Australia have a responsibility to promote and support breastfeeding. This section outlines aspects of the WHO Code—the WHO International Code of Marketing of Breast-milk Substitutes—and subsequent World Health Assembly resolutions that are relevant to health workers. Some aspects of the Code are actually the responsibility of others, such as government or industry, but it is important that health workers be aware of their responsibilities. The marketing in Australia of infant formula is regulated on a voluntary basis by the Advisory Panel on the Marketing in Australia of Infant Formula, through the MAIF Agreement. All health professionals have an obligation to do their best to promote breastfeeding. The extracts that follow are taken from the Advisory Panel’s 1999–2000 annual report. More details about the MAIF Agreement are available from the Department of Health and Ageing.

The aim of the WHO Code is to contribute to the provision of safe and adequate nutrition for infants by protecting and promoting breastfeeding and by ensuring the proper use of breastmilk substitutes, when these are necessary, on the basis of adequate information and through appropriate marketing and distribution. (The box at the end of the Introduction to these Infant Feeding Guidelines summarises the Code.)

The whole purpose of these Infant Feeding Guidelines, and of the WHO Code, is to protect the nutritional wellbeing of infants. Breastfeeding is to be encouraged and should be protected from practices that undermine it. Health workers are seen by the public as the source of advice on infant feeding. This advice is to be available to all mothers, regardless of the feeding option they have chosen for their infant. When mothers do not breastfeed, or do so only partially, they should use a suitable infant formula until their child is 12 months of age. They should be fully informed about the health implications of using formula, the potential cost, and the hazards of improper use.

THE MARKETING IN AUSTRALIA OF INFANT FORMULA AGREEMENT: STATUS

The MAIF Agreement is a voluntary agreement between the manufacturers, importers and distributors of infant formula and is not law. The Agreement has been authorised by the Australian Competition and Consumer Commission under the TPA [Trade Practices Act]. An Agreement must be submitted for authorisation where it contains marketing restrictions and
authorisation is only granted where the public benefit is shown to outweigh any anti-competitive effect. The signatories can legally follow the provisions of the authorised Agreement, but could be in breach of the TPA if they agree to any further marketing restriction, which is not covered in the Agreement, even if it is recommended in the WHO Code. Similarly, for aspects of the WHO Code for which there is no authorised Agreement, agreements by companies to restrict marketing practices may result in penalties for breaching the TPA.

**The Advisory Panel on the Marketing in Australia of Infant Formula: Terms of Reference**

The aim of APMAIF is to:
- receive and investigate complaints regarding the marketing in Australia of infant formulas;
- act as a liaison point for issues relating to the marketing in Australia of infant formulas;
- develop guidelines on the interpretation and application of the MAIF Agreement; and
- provide advice to the Commonwealth Minister for Health and Aged Care, on the operation of the Agreement.

**Interpretations of the Advisory Panel on the Marketing in Australia of Infant Formula**

**Clause 4: Information and education**

Clause 4(a): Manufacturers and importers of infant formulas in Australia agree that informational and educational materials, whether written, audio or visual, dealing with the feeding of infants and intended to reach pregnant women and parents of infants and young children, should always include clear information on all the following points:

(i) the benefits and superiority of breastfeeding;
(ii) maternal nutrition, and the preparation for and maintenance of breastfeeding;
(iii) the negative effect on breastfeeding of introducing partial bottle-feeding;
(iv) the difficulty of reversing the decision not to breastfeed; and
(v) where needed, the proper use of infant formula, whether manufactured industrially or home prepared. (WHO Code, Article 4.2)

Clause 4(b): When such materials contain information about the use of infant formulas, they should include the social and financial implications of its use, the health hazards of inappropriate foods or feeding methods and, in particular, the health hazards of unnecessary or improper use of infant
formulas. Such materials should not use any pictures or text which may idealise the use of infant formulas. (WHO Code, Article 4.2)

**Inclusion of information**

The information required by clauses 4(a) and 4(b) must be included in any video or written material which refers to infant formula that is produced or sponsored by an infant formula manufacturer. (December 1993)

- The information required by clauses 4(a) and 4(b) must be included in the main body of the video in the same type of presentation as the rest of the material, and at a level suitable for the target audience. A mother should be able to understand what it means. (December 1993)
- The print size of the information required by clauses 4(a) and 4(b) should be the same size as the majority of the main text or at least 8 point. (September 1993)
- The Panel sees the social and financial implications as interrelated. They may include the following points:
  - cost will be (about $20 per week) (at least 1 can per week) (each company should insert the most appropriate quantity);
  - infant formula will need to be purchased until the baby is 12 months of age; and
  - the costs affect the family budget. (March 1994)

**Pictures on informational or educational material for health professionals**

- Certain pictures may be acceptable on materials for health professionals. (1994)
- The Panel considered that cartoons and pictures of animals and toys do not necessarily idealise the use of infant formulas and therefore may be acceptable. They should not depict an animal or toy being fed, whether by breast or by bottle, nor should they depict animal or toy ‘mothers’, because the Panel considers that these would idealise the use of infant formula. (1994)
- The Panel considers that real babies depicted in a normal context do not necessarily idealise the use of infant formulas and may legitimately draw a health professional’s attention to information about an infant formula.
- However:
  - babies (with or without bottles) in fantasy situations (e.g. stars, heavens, clouds, sitting up in school) are unacceptable because they suggest formula-fed babies are in some way ‘ahead’ of breastfed babies (March 1994);
  - babies with slogans over or adjacent to the pictures (such as ‘Every baby deserves the best’ or ‘A little extra something’) are unacceptable. The Panel believes this implies that the product is better than breastmilk and idealises the use of infant formula (March 1994); and
  - the Panel feels that it is inappropriate to use a picture of an apparently newly born baby to draw attention to information about
infant formula. Breastmilk is the best milk for babies up to 12 months old, but it is particularly valuable in the first few weeks of life when the baby is most vulnerable. Baby models for such pictures should be no younger than three months (February 1995).

- The Panel considers that a picture of a woman breastfeeding is never acceptable because it:
  - creates an impression that their product is equivalent to breastfeeding;
  - appropriates the image of breastfeeding for the purpose of promoting a product; and
  - is a misleading way of gaining attention (March 1994).

Clause 4(c): Manufacturers and importers of infant formulas should not donate informational or educational equipment or materials unless it is at the request of, and with the written approval of, the appropriate government authority or within guidelines given by the Commonwealth, State or Territory Governments for this purpose. Such equipment or materials may bear the donating company’s name or logo, but should not refer to a proprietary infant formula, and should be distributed only through the health care system. (WHO Code, Article 4.3)

- Instructions how to prepare a specific infant formula may include the brand logo and should include the product name. Such materials should be limited to preparation instructions only and should not include other educational or promotional information. (March 1994)

- The Panel has determined that the distribution at conferences of pens and monogrammed paper which bear a brand name and not just a logo is unacceptable. (March 1994)

- The Panel considers that a slogan is different to a logo. For example, ‘Every baby deserves the best’ and ‘A little extra something’ are slogans. When used in conjunction with the brand name of a product, it is implied that feeding a baby the product would be better than breastfeeding. (March 1994)

- Inexpensive materials likely to be used only in the process of professional duty (provided they are not readily given to mothers, for example small ‘tear off’ note pads) may be acceptable. However, materials of a personal nature such as coffee mugs are not considered acceptable. Any such materials should bear only the company name and logo, and not a product brand name. The use of slogans on these materials is unacceptable. (March 1994)

- The provision of ordinary food (morning/afternoon tea or lunch) is acceptable provided it is in association with a presentation that coincides with a mealtime and that is not of a lavish nature. (March 1994)

- The Panel agreed that manufacturers should keep in mind clause 7 that prohibits any donations, or activities, which can be construed as a material inducement. (September 1993)
Clause 5: The general public and mothers

Clause 5(a): Manufacturers and importers of infant formulas should not advertise or in any other way promote infant formulas to the general public. (WHO Code, Article 5.1)

Advertisements to the general public

- The Panel is aware of its obligation under both the Australian Agreement and the TPA. We wish to minimise harm to breastfeeding while allowing consumers to obtain formula at a competitive price. (March 1994)
- The Panel feels that parents have a right to information about availability of infant formula. However:
  - announcements regarding changes to availability of infant formulas (for example, in supermarkets) are acceptable, but only on a one-off basis. Advertisements may appear only once in any one publication over a maximum of a three-month period (to allow for inclusion in quarterly publications);
  - references to outlets of availability should be restricted to generic locations such as ‘toy stores’ or ‘supermarkets’, but not to specific locations such as ‘Coles’ or ‘Woolworths’;
  - such advertisements should have no promotional content. There should be no slogans and the logo should not include a slogan;
  - advertisements should not promote or encourage use of formula;
  - changes in formulation should be referred to only on the container, not promoted in advertisements (March 1994); and
  - pack shot size is to be restricted to 4 cm x 3 cm. (February 1996)
- New infant formula products may not be advertised or ‘announced’ to the general public. (1994)
- When infant formula manufacturers widened the distribution of their product from pharmacies to supermarkets, it was accepted by the Panel that it was in the interest of consumers to be aware of this change of availability. However, infant formula products have now been available in a range of retail outlets for over two years. The Panel therefore does not consider it necessary for further changes in availability to be announced to consumers and such announcements are no longer acceptable. (June 1996)
- When an infant formula manufacturer advertises to the general public a product with the same name as an infant formula, the product name should be followed either by the range name (e.g. toiletries) or the specific product (e.g. baby powder). Generalised terms such as ‘Brand X Baby Care Products’ or ‘Brand X, Best for Baby’, should not be used where Brand is the name of an infant formula. (June 1996)

Price promotions of infant formula by manufacturers through retailers

- Price tickets on the ‘shelf-talkers’ that simply advertise the price of the product or the fact that it has a ‘special’ price are acceptable. The ticket may also state the saving to be made; e.g. ‘Special. Save $1’. Shelf
tickets should have no content other than the price, the name of the product and, if wanted, the amount to be saved.

- The Panel believes that descriptors such as ‘soy formula’ or ‘lactose free’ should not be allowed on these price promotion announcements or ‘shelf-talkers’. This is because manufacturers may claim that a list such as ‘cholesterol-free, cow’s milk protein-free, lactose-free’ should be allowed, as these are all ‘descriptors’. Also, the Panel believes that infant formula other than standard formulas based on cow’s milk should only be used if there is a medical indication. If these descriptors are used in promotion, some parents may mistakenly believe that ‘lactose-free’ or ‘cow’s milk protein-free’ formulas are superior to cow’s milk formula.

- For the purpose of in-store price promotions, ‘pack shots’ (i.e. depictions or photographs of the product) are allowable in store specific catalogues but the depiction of the product should be relative to the size, colour etc., the other products similarly depicted.

- This is in recognition that ‘pack shots’ may be necessary for those retail customers with a non–English speaking background or low literacy. Such ‘pack shots’ should not include slogans or descriptors.

- Large stacks of cans (gondola ends or shelf stacks) are not necessary to make consumers aware of the price of the product, but the Panel recognises that they are apparently necessary to provide ‘stock weight’ (sufficient stock) for the increased demand created by ‘special offers’. Stock in gondola end stacks and shelf stacks should be kept in their boxes and efforts should be made to ensure that the stack is not overly promotional.

- Window displays, window stacks and pavement displays are not acceptable.

- Care should be taken not to display infant formula products or the name of the product under generic slogans for a range of products, such as ‘Everything that is best for baby’.

- There should be no price or product promotion on radio, television or any other electronic media. (May 1995)

- Information materials for health professionals should not contain pictures, music or other devices that are likely to be attractive to young children, and therefore might lead to health professionals putting them on display or giving them to children and parents to look at or play with. Examples might include use of music, posters or mobiles. (December 1995)

Clause 5(b): Manufacturers and importers of infant formulas should not provide samples of infant formulas to the general public, pregnant women, parents or members of their families. (WHO Code, Article 5.2)

- The Panel considered that the provision of free samples by manufacturers through pharmacies breaches the Agreement. However, small packs could be made available in retail outlets for purchase at commercial competitive rates. (February 1993)
Clause 7: Health care professionals

Clause 7(a): Manufacturers and importers of infant formulas providing information about the formulas to health care professionals should restrict the information to scientific and factual matters. Such information should not imply or create a belief that bottle-feeding is equivalent or superior to breastfeeding. It should also include the information specified in clause 4(a) above. (WHO Code, Article 7.2)

Interpretation of the term 'scientific'

- By 'scientific', it is meant that the total current scientific knowledge is reflected in total, not simply selective parts that can be used in a misleading way. (February 1993)

Use of the terms ‘resembles’, ‘is close to’ and ‘is similar to’

- The Panel does not consider that it is scientific or factual to claim that a product resembles, or is similar to, or is close to breastmilk unless the component that the company claims is similar to that in breastmilk is specified, and evidence is provided which satisfies the Panel that this specific claim is valid.
- Where these terms are used without a specific claim, the Panel considers that the manufacturer is implying equivalence with breastmilk and is therefore in breach of the Agreement.
- In informational material for health professionals, a manufacturer sometimes wishes to point out that mothers who cannot breastfeed should be advised that they should use an infant formula that resembles breastmilk more closely than cow’s milk. The Panel considers that the use of the term ‘resembles breastmilk’ is acceptable only in this context of the comparison with cow’s milk. (December 1993)
- Requirement for tables used in promotional pieces to compare breastmilk with infant formula or components of infant formula. The following information should be included:
  (i) the units of measurement;
  (ii) the specific type of breastmilk sample which is being compared;
  (iii) the average or mean values and the standard deviation; and
  (iv) the references for the source of date. (January 1999)

Access to health professionals

- It is up to health care professionals to decide whether they wish to see representatives of formula manufacturers. The Panel agrees that there is nothing in the MAIF Agreement, nor in the WHO Code, which prevents the access of representatives to health care professionals, and indeed believes that such access plays an important part in providing information about infant formula to health care professionals. (June 1994 – February 1995)
- Information materials for health professionals should not contain pictures, music or other devices that are likely to be attractive to young children, and therefore might lead to health professionals putting them
on display or giving them to children and parents to look at or play with. Examples might include use of music, posters or mobiles. (December 1995)

- In the new marketing environment of infant formula in Australia it is reasonable for manufacturers to provide information for retailers of their products in trade journals only. The information should comply with the restrictions of clause 7(a) and clause 4(a) of the MAIF Agreement. They should not be promotional in any way, and the information should be restricted to the scientific and factual. In addition, such information should be able to be understood by retailers who are not health professionals. (June 1996)

Competitions

Clause 7(c): Manufacturers and importers of infant formulas should not offer any financial or material inducement to health care professionals or members of their families to promote infant formulas, nor should such inducements be accepted by health care professionals or members of their families. (WHO Code, Article 7.3)

- The Panel considers it is acceptable to hand out gifts such as pens and papers (with the company name or logo only) designed for personal use at a conference. However, if the gifts were designed to be taken home, this would be classed as an inducement. It was considered unacceptable for these materials to be left in a hospital ward (September 1993). The Panel considers that anything intended or likely to be taken home is an inducement.

- The Panel considers that competitions, included in information material for health professionals, which are clearly for the purpose of emphasizing information that is restricted to the scientific and factual, may be acceptable. Such competitions, however, should not be an inducement to promote infant formulas. Therefore the prize should not exceed a value of $100. Manufacturers should also be mindful of clause 4(c). (February 1996)

Clause 7(d): Manufacturers and importers should not provide samples of infant formulas, or of equipment or utensils for their preparation or use, to health care professionals except when necessary for the purpose of professional evaluation or research at the institutional level. (WHO Code, Article 7.4)

- Infant formula given to child care or day care centres for distribution in single or small quantities to parents or when a mother has forgotten to bring her own formula or when the baby’s formula has unexpectedly been exhausted, will be considered, according to the definition in the MAIF Agreement, as a ‘sample’. Child care centres are not a setting in which professional evaluation of infant formula occurs. There is therefore no valid reason for manufacturers to give samples of infant formula to child care centres. Such provision will be considered by the Panel as a breach of the Agreement. (May 1995)

- Samples should not be distributed unless for valid professional evaluation or research at the institutional level implying sound scientific scrutiny and methodology. (January 1999)
The position of APMAIF on conferences, seminars or publications, under the auspices of another organisation, by manufacturers of infant formula

- Sponsorship of conferences, seminars or publications by manufacturers of infant formula does not necessarily breach the Agreement.
- The Panel believes that any sponsorship of meetings, seminars or conferences should be declared. There should be no conditions which relate to the marketing of the sponsor’s product or to restrictions on promotion of breastfeeding.
- The sponsor should not exert any influence on the choice of speakers or the content of presentations.
- In line with clause 4(c) of the Agreement, any conference materials may bear the donating company’s logo, but should not refer to a proprietary infant formula, and should be distributed only through the health care system.

References

APPENDIX A

MEASUREMENT OF BREASTFEEDING RATES

The review of breastfeeding indicators recommends a large number of indicators. For comparison of studies in Australia, the following indicators are a useful minimum:

- percentage ever breastfed—that is, the rate of initiation of breastfeeding
- median duration of breastfeeding among children who have ever been breastfed
- mediation of the introduction of solid foods. This should specify the exact question asked because it may mean a first taste or more established feeding
- prevalence (percentage) at ages 4 months and 6 months of
  - exclusively breastfed
  - predominantly breastfed
  - fully breastfed—that is, exclusively plus predominantly
  - infants receiving solid foods.

It is usual to also collect information on ‘any or some’ breastfeeding.

For precise definitions, see references 1 to 3.

It is important to state the method used to record the data. Evidence suggests that mothers can recall relatively accurately—even over a long period—the incidence and duration of breastfeeding, but their recall is not as accurate for the timing of the introduction of other fluids and solid foods.²

Data on ‘ever breastfeeding’ and ‘some breastfeeding’ can usually be collected by cross-sectional, retrospective studies, but for more detailed data longitudinal studies have advantages, among them interviewing the mother close to the event to reduce recall bias and the ability to obtain data related to different stages of breastfeeding. The problem of recall is demonstrated by comparing the results of the Donath and Amir analysis of the National Health Survey³, which is cross-sectional, and the Perth breastfeeding study, which is longitudinal.⁴ Donath and Amir reported the exclusive breastfeeding rate at 57 per cent at age 3 months and Scott and Binns reported 47 per cent; overall rates of breastfeeding were similar. It is likely that the difference is a result of the recall bias inherent in the National Health Survey methodology, which is based on recall over a long period.

The way the questions are asked and the timing of the questions is important when studying breastfeeding and the introduction of solids.
Data from India are illustrative of the way the questions influence the results for rates of introduction of solids in infant feeding: the proportions of exclusive breastfeeding at 3 months from three national surveys were 52 per cent, as determined retrospectively using one question; 38 per cent when determined retrospectively with multiple questions and a checklist of foods; but only 15 per cent in a prospective cohort study using multiple questions.

For these reasons—to be accurate—data on the time of introduction of solids and on the proportion exclusively breastfeeding should be collected prospectively or at least as close to the event as possible.

REFERENCES


APPENDIX B

THE INNOCENTI DECLARATION ON THE PROTECTION, PROMOTION AND SUPPORT OF BREASTFEEDING

The Innocenti Declaration was developed and adopted by participants in the WHO–UNICEF policymakers' meeting ‘Breastfeeding in the 1990s: a global initiative’, which was jointly sponsored by the United States Agency for International Development and the Swedish International Development Authority and held at the Spedale degli Innocenti in Florence, Italy, from 30 July to 1 August 1990. The declaration reflects the content of the original background document for the meeting and the views expressed in group and plenary sessions.

RECOGNISING that

Breastfeeding is a unique process that:

• provides ideal nutrition for infants and contributes to their healthy growth and development
• reduces incidence and severity of infectious diseases, thereby lowering infant morbidity and mortality
• contributes to women’s health by reducing the risk of breast and ovarian cancer, and by increasing the spacing between pregnancies
• provides social and economic benefits to the family and the nation
• provides most women with a sense of satisfaction when successfully carried out

and that Recent Research has found that:

• these benefits increase with increased exclusiveness* of breastfeeding during the first six months of life, and thereafter with increased duration of breastfeeding with complementary foods, and
• programme intervention can result in positive changes in breastfeeding behaviour

WE THEREFORE DECLARE that

As a global goal for optimal maternal and child health and nutrition, all women should be enabled to practise exclusive breastfeeding and all infants should be fed exclusively on breastmilk from birth to 4–6 months of

* Exclusive breastfeeding means that no other drink or food is given to the infant; the infant should feed frequently and for unrestricted periods.
Thereafter, children should continue to be breastfed, while receiving appropriate and adequate complementary foods, for up to two years of age or beyond. This child-feeding ideal is to be achieved by creating an appropriate environment of awareness and support so that women can breastfeed in this manner.

Attainment of this goal requires, in many countries, the reinforcement of a ‘breastfeeding culture’ and its vigorous defence against incursions of a ‘bottle-feeding culture’. This requires commitment and advocacy for social mobilization, utilizing to the full the prestige and authority of acknowledged leaders of society in all walks of life.

Efforts should be made to increase women’s confidence in their ability to breastfeed. Such empowerment involves the removal of constraints and influences that manipulate perceptions and behaviour towards breastfeeding, often by subtle and indirect means. This requires sensitivity, continued vigilance, and a responsive and comprehensive communications strategy involving all media and addressed to all levels of society. Furthermore, obstacles to breastfeeding within the health system, the workplace and the community must be eliminated.

Measures should be taken to ensure that women are adequately nourished for their optimal health and that of their families. Furthermore, ensuring that all women also have access to family planning information and services allows them to sustain breastfeeding and avoid shortened birth intervals that may compromise their health and nutritional status, and that of their children.

All governments should develop national breastfeeding policies and set appropriate national targets for the 1990s. They should establish a national system for monitoring the attainment of their targets, and they should develop indicators such as the prevalence of exclusively breastfed infants at discharge from maternity services, and the prevalence of exclusively breastfed infants at four months of age.

National authorities are further urged to integrate their breastfeeding policies into their overall health and development policies. In so doing they should reinforce all actions that protect, promote and support breastfeeding within complementary programmes such as prenatal and perinatal care, nutrition, family planning services, and prevention and treatment of common maternal and childhood diseases. All healthcare staff should be trained in the skills necessary to implement these breastfeeding policies.
Operational targets

All governments by the year 1995 should have:

- appointed a national breastfeeding coordinator of appropriate authority, and established a multisectoral national breastfeeding committee composed of representatives from relevant government departments, non-governmental organizations, and health professional associations
- ensured that every facility providing maternity services fully practises all ten of the Ten Steps to Successful Breastfeeding set out in the joint WHO–UNICEF statement ‘Protecting, promoting and supporting breastfeeding: the special role of maternity services’**
- taken action to give effect to the principles and aim of all Articles of the International Code of Marketing of Breast-Milk Substitutes and subsequent relevant World Health Assembly resolutions in their entirety, and
- enacted imaginative legislation protecting the breastfeeding rights of working women and established means for its enforcement.

We also call upon international organizations to:

- draw up action strategies for protecting, promoting and supporting breastfeeding, including global monitoring and evaluation of their strategies
- support national situation analyses and surveys and the development of national goals and targets for action; and
- encourage and support national authorities in planning, implementing, monitoring and evaluating their breastfeeding policies.

APPENDIX C

ROYAL AUSTRALIAN COLLEGE OF GENERAL PRACTITIONERS: BREASTFEEDING POSITION STATEMENT

The RACGP position statement on breastfeeding was endorsed on 9–10 December 2000 and formally published on 7 February 2001. It reads as follows.

Aim

- To protect, promote and support breastfeeding in Australia in ways that optimise maternal and child health.
- To assist GPs to provide information and support for breastfeeding women, their babies and their families.
- To raise awareness among GPs of the important role they can play in supporting breastfeeding women.

Principles

In 1999, UNICEF recommended that babies be exclusively breastfed for about the first 6 months of life. They recommended that breastfeeding should be sustained until the baby was at least 2 years old, but beginning at about 6 months breastmilk should be complemented with appropriate solid food.

They stated that mothers have the right to breastfeed wherever and whenever their baby requires and that breastfeeding mothers in the paid work force should be supported to continue breastfeeding.

Background

Breastfeeding provides infants with optimal nutrition; human milk is specific for human babies. Research studies have demonstrated that when infants are not fed on human milk they may be more likely to experience gastrointestinal and respiratory infections, asthma, otitis media, urinary tract infections, necrotising enterocolitis, insulin-dependent diabetes, inflammatory bowel disease, lymphoma and atopy. Continued research is required to determine the full health benefits of human milk for infants.

Breastfeeding is also beneficial for women’s health. Breastfeeding women have less postpartum bleeding, delayed resumption of ovulation, improved bone remineralization postpartum and less ovarian and premenopausal breast cancer.
Breastfeeding may facilitate mother-infant bonding, saves the family money and protects the environment.

**Position of the College**

The RACGP supports the NHMRC Infant Feeding Guidelines (1996). General practitioners should have the knowledge and skills to help mothers and babies with common breastfeeding difficulties.

The WHO International Code of Marketing of Breast-milk Substitutes [see Appendix J] seeks to ensure that infant formula is not marketed or distributed in ways that interfere with breastfeeding. The RACGP supports the WHO Code and will not accept practices that undermine the Code. Only information that is scientific and factual should be accepted by GPs from the infant formula industry. GPs should also be careful not to inadvertently undermine, by the display of artificial feeding materials, industry’s public commitment not to advertise its products to the general public.

The RACGP supports the Baby Friendly Hospital Initiative (BFHI) in Australia. This is a global UNICEF–WHO initiative based on the ‘Ten Steps to Successful Breastfeeding’. The BFHI improves breastfeeding practices in maternity hospitals, as the basis of protection, promotion and support of breastfeeding in the community. Mothers of newborn babies should receive adequate assistance to establish and maintain breastfeeding, whether in hospital or at home.

The RACGP supports breastfeeding as a normal part of life, and will continue to facilitate education in normal lactation and common breastfeeding difficulties for GP registrars and practicing GPs. The RACGP supports breastfeeding women GPs and registrars in medical settings.

**Recommended role for GPs**

The RACGP recommends that:

- GPs support and encourage breastfeeding in the community
- GPs promote breastfeeding as the optimal infant feeding method to pregnant women and their partners
- GPs maximise maternal physical and emotional well being to assist new mothers in the early postpartum weeks during establishment of breastfeeding
- GPs make mothers aware of mother-to-mother support groups, such as the Australian Breastfeeding Association (ABA)
- GPs become skilled in the diagnosis and management of common breastfeeding problems. When specialised help is needed, doctors should refer to experienced health workers, such as International Board
Certified Lactation Consultants (IBCLCs), NMAA breastfeeding counsellors or other qualified workers. The NH&MRC Infant Feeding Guidelines (1996) provide information on the management of breastfeeding problems:

- GPs prescribe medication that is compatible with breastfeeding. If in doubt, consult a reference centre knowledgeable about drugs in lactation.
- GPs encourage exclusive breastfeeding for the first 6 months and then gradual introduction of suitable foods. Breastfeeding may continue as long as the mother and child wish to continue, and weaning should be gradual.
- GPs support and advise women who, for a variety of reasons, are unable to breastfeed their babies.
- GPs acknowledge that even partial breastfeeding is of great value.

References

1. UNICEF. Breastfeeding: foundation for a healthy future.


Relatively simple, cost-effective measures such as breastfeeding can have a significant impact on the health of women and children.

In recognition of this, the Commonwealth Government made a commitment through the policy document *Health throughout Life* to encourage breastfeeding awareness, with the aim of increasing Australia’s rate of breastfeeding, particularly for babies up to 6 months of age. Australia’s target for breastfeeding for the year 2000 was to have 80 per cent of babies at least partially breastfed up to 6 months of age.

The National Breastfeeding Strategy takes a multi-faceted approach:
- family education
- national accreditation standards for maternal and infant care services
- employer support
- education of health professionals
- Indigenous health
- data collection
- antenatal educators.

**Family education**

Education materials target the family, particularly fathers, ethnic and cultural groups, and disadvantaged socio-economic groups. Hard copies of these materials are available through the Australian Breastfeeding Association. Online versions can be downloaded, as follows:

- 7 Helpful Hints for Learning to Breastfeed (1998)
- 7 Helpful Hints for Solving Breastfeeding Problems (1998)
- 7 Reasons Why Mother’s Milk is Better for Your Baby and You (1998)
- 7 Important Facts for Fathers about Breastfeeding (1998)
- 7 Suggestions for Breastfeeding Your Baby—anwbere, anytime (1998)
- Let’s Give Our Baby the Best (1998)
- Mother’s Milk—perfect anytime anywhere (1998)

A practical, evidence-based antenatal education breastfeeding package is being developed. The package will be provided to antenatal educators nationally for
inclusion in antenatal education programs. A video produced as part of this package will be provided to obstetricians nationally.

**National accreditation standards for maternal and infant care services**

The national accreditation standards for integrated maternal and infant care services have a strong emphasis on support for the initiation and maintenance of breastfeeding and on the transfer of support and encouragement from hospital to community health services.

**Employer support**

The Department of Health and Ageing has produced an insert, on the topic of supportive workplace initiatives for women who are breastfeeding, for the Department of Workplace Reform and Small Business newsletter *Work and Family*; it has also been distributed nationally to employers. The insert is based on the DWRSB’s booklet *Guide to Combining Breastfeeding and Work*. Materials aimed at employers, employees and workplaces and providing information about combining breastfeeding and employment are also being developed:

- *Balancing Breastfeeding and Work*—booklet
- *Balancing Breastfeeding and Work*—poster
- *Balancing Breastfeeding and Work*—pamphlet
- non–English language materials in Arabic, Chinese, Spanish, Turkish and Vietnamese.

**Education of health professionals**

A companion document to the *Infant Feeding Guidelines for Health Workers* has been developed. Titled *Naturally: the facts about breastfeeding*, it contains fact sheets for health workers to use during consultations with mothers and is available for purchase through government bookshops. Breastfeeding education kits have been produced for community-based health professionals by the Australian Breastfeeding Association (formerly the Nursing Mothers Association of Australia) in partnership with the Royal Australian College of General Practitioners, the Division of Paediatrics, the Royal Australasian College of Physicians (formerly the Australian College of Paediatrics), the Royal College of Nursing, Australia, and the Pharmaceutical Society of Australia. The kits contain a best-practice guide to the management of breastfeeding problems, a lactation resource guide, and examples of consumer materials drawn from the family education project. They have been distributed to all practising GPs and paediatricians, all child health clinics, and all pharmacies nationally. A continuing education module on breastfeeding has also been produced for each group of health professionals, as well as pharmacy assistants. Online versions can be downloaded:
Indigenous health

An audit has been undertaken of current training in breastfeeding support and infant nutrition for Aboriginal and Torres Strait Islander health workers and other professionals providing health care to Aboriginal and Torres Strait Islander women. A review has also been undertaken of current interventions and identification of best practice currently used by community-based Indigenous health service providers in promoting and supporting breastfeeding and appropriate infant nutrition. The outcomes of these reviews will be taken up in the broader context of the development of a national approach to the nutrition of Indigenous Australians.

A book of breastfeeding stories has been prepared for Indigenous communities. It presents case histories of programs and projects run by Indigenous services and organisations to promote and support breastfeeding and infant nutrition.

Data collection

A framework for monitoring national breastfeeding rates will be established as part of a National Nutrition Monitoring Program. This project will involve the development of consistent breastfeeding definitions and standardised questions to monitor breastfeeding rates, thereby establishing a framework through which, for the first time, breastfeeding rates across Australia can be consistently and accurately monitored.

Antenatal educators

The following resources are available for antenatal educators:

- Breastfeeding and You: a handbook for antenatal educators
- Breastfeeding and You: preparing the way.

For further information, see the Breastfeeding Fact Sheet.

[Last updated on 15 August 2000 by the Population Health Division, Commonwealth Department of Health and Ageing (www.health.gov.au/publth/strateg/brfeed/index.htm). For further information, contact the Population Health Division (telephone 02 6289 1555).]
APPENDIX E

FEEDING LOW-BIRTHWEIGHT PRE-TERM INFANTS
(FINGER FEEDING)

Wendy Oddy

When supplementation is thought necessary, alternatives to bottles and teats—including lactation aids and feeding with a cup, spoon or eyedropper—or finger feeding, may be sought. Although finger feeding is a technique that allows a baby to be fed without giving him or her an artificial nipple, it is also a method that helps train the baby to take the breast and is particularly useful for pre-term infants.

Finger feeding can be used in a number of situations:

• The baby refuses the breast or is too tired to nurse.
• The baby does not latch on well and therefore does not get milk well.
• The baby is separated from its mother.
• Breastfeeding is stopped temporarily.
• The mother’s nipples are so sore that she cannot put the baby to her breast, although proper positioning and good latching-on help sore nipples more often than finger feeding.

Finger feeding is more like breastfeeding than bottle-feeding and is best used to prepare a baby to take the breast. The baby must keep his or her tongue down and forward over the gums, with the mouth wide open and jaw forward. The motion of the tongue and jaw is similar to that when feeding at the breast.
Box E.1 Instructions for finger feeding

1. Wash your hands.

2. Position yourself and the baby comfortably, the baby’s head being supported with one hand behind the shoulders. Any comfortable position is appropriate.

3. Use a feeding tube—#5F, 36 inches (90 centimetres) long—and a feeding bottle with expressed breastmilk or, if necessary, formula, depending on the situation. The feeding tube is passed through an enlarged feeding hole in the bottle into the fluid.

4. Line up the tube so it sits on the soft part of the index finger, with the end of the tube protruding no further than the end of your finger. Grip the tube about where it makes a gentle curve between the thumb and middle finger and position your index finger above the tube. There should be no need to tape the tube to your finger.

5. Using the finger with the tube, tickle the baby’s mouth gently until they open their mouth wide enough to let the finger enter. Usually the baby will begin to suckle; and receiving food will usually awaken a sleeping baby.

6. Insert your finger with the tube so that the soft part of the finger remains upwards and flat. The baby will probably begin sucking on the finger and will not gag unless full from another feed.

7. Pull the baby’s chin down if the lower lip is sucked inwards.

8. The technique is working if the baby is drinking. If the flow is slow, raise the bottle above the baby’s head. Keep the finger as straight as possible, flattening the baby’s tongue and working the lower jaw forward.

Note: This technique is in use at Baby Friendly hospitals in Australia, although no published references to any clinical trials using this technique have been found.

# Appendix F

## Pharmaceutical and Other Drugs and Breastfeeding

<table>
<thead>
<tr>
<th>Table F.1</th>
<th>Drugs and other substances requiring careful assessment of risk before prescription to breastfeeding women</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Category</strong></td>
<td><strong>Drug or compound</strong></td>
</tr>
<tr>
<td>Analgesic drugs</td>
<td>Pethidine (C), oxycodone (C)</td>
</tr>
<tr>
<td>Anti-arthritis drugs</td>
<td>Gold salts, methotrexate (D), high-dose aspirin</td>
</tr>
<tr>
<td>Anticoagulant drugs</td>
<td>Phenindione (D)</td>
</tr>
</tbody>
</table>

*continued next page*
### Table F.1 continued

<table>
<thead>
<tr>
<th>Category</th>
<th>Drug or compound</th>
<th>Management plan and rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Antidepressant drugs and lithium</strong></td>
<td>Fluoxetine (C), doxepin (C), lithium (D)</td>
<td>Use with caution. Although the concentrations of these drugs in breastmilk are low, colic (with fluoxetine) and sedation (with doxepin) have been reported in exposed infants. Near therapeutic plasma concentrations of lithium were reported in an infant exposed to the drug in utero and through breastfeeding. The incidence of these adverse events is unknown.</td>
</tr>
<tr>
<td><strong>Anti-epileptic drugs</strong></td>
<td>Phenobarbital (D), ethosuximide (D), primidone (D)</td>
<td>In breastfed infants, the level of exposure to these drugs may exceed 10 per cent of the weight-adjusted therapeutic dose. Consider alternatives such as carbamazepine (D), phenytoin (D), and valproic acid (D).</td>
</tr>
<tr>
<td><strong>Antimicrobial drugs</strong></td>
<td>Chloramphenicol (D), but considered (A) for topical use; tetracycline (D)</td>
<td>Use alternatives. Idiosyncratic aplastic anaemia is a possibility among breastfed infants whose mothers are receiving chloramphenicol. Although tetracycline-induced discoloration of the teeth of breastfed infants has not been reported, the potential risk of this event needs to be clearly communicated to lactating women.</td>
</tr>
<tr>
<td><strong>Anticancer drugs</strong></td>
<td>All—for example, cyclophosphamide (D), methotrexate (D), doxorubicin (D)</td>
<td>Because of their potent pharmacological effects, cytotoxic drugs should not be given to breastfeeding women.</td>
</tr>
<tr>
<td><strong>Anxiolytic drugs</strong></td>
<td>Diazepam (C), alprazolam (C)</td>
<td>Avoid long-term use. Intermittent use poses little risk to breastfed infants, but regular use may result in the accumulation of the drug and its metabolites in the infants. Lethargy and poor weight gain have been reported in an infant exposed to diazepam in breastmilk and withdrawal syndrome was reported in a breastfed infant after the mother discontinued alprazolam.</td>
</tr>
<tr>
<td><strong>Cardiovascular and antihypertensive drugs</strong></td>
<td>Acebutolol, amiodarone (C), atenolol (C), nadolol (C), sotalol (C)</td>
<td>Use of these agents may cause relatively high levels of exposure in breastfed infants, so caution is warranted. The two beta-adrenergic antagonists propranolol (C) and labetalol (C) are considered safe.</td>
</tr>
<tr>
<td><strong>Endocrine drugs and hormones</strong></td>
<td>Oestrogens (D), bromocriptine (A)</td>
<td>These agents may suppress milk production. Oral contraceptives containing little or no oestrogen pose a smaller risk than formulations with higher concentrations of oestrogen. Nevertheless, caution is warranted.</td>
</tr>
<tr>
<td>Category</td>
<td>Drug or compound</td>
<td>Management plan and rationale</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>-----------------------------------------</td>
<td>------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Immuno-suppressant drugs</td>
<td>Cyclosporin (C), azathioprine (D)</td>
<td>Maternal plasma concentrations should be monitored. In nine reported cases of breastfed infants who were exposed to azathioprine in breastmilk, no obvious adverse effects were noted.</td>
</tr>
<tr>
<td>Respiratory drugs</td>
<td>Theophylline (A)</td>
<td>Use with caution. When the mother’s doses are high, the levels of exposure in the infant may be substantial—10 per cent of the therapeutic dose.</td>
</tr>
<tr>
<td>Radioactive compounds</td>
<td>All</td>
<td>Breastfeeding should be stopped until the radioactivity of the radio-labelled compound used has returned to safe levels.</td>
</tr>
<tr>
<td>Drugs of abuse</td>
<td>All</td>
<td>The use of drugs of abuse precludes breastfeeding. Cocaine-induced toxicity has been reported among breastfed infants whose mothers abused cocaine. Methadone used for the treatment of addiction is safe at doses of up to 80 milligrams per day. Buprenorphine may be a safer alternative to methadone (C).</td>
</tr>
<tr>
<td>Non-medicinal substances</td>
<td>Ethanol, caffeine (A), nicotine. Nicotine as used in transdermal patches or chewing gum (C)</td>
<td>To avoid exposing a breastfed infant to ethanol, the mother should not consume alcohol or should consume no more than one drink two to three hours before breastfeeding. Ingestion of moderate amounts of caffeine should be safe. Because of the effects of second-hand smoke and the fact that nicotine is excreted in breastmilk, smoking is contra-indicated in breastfeeding women.</td>
</tr>
<tr>
<td>Miscellaneous compounds</td>
<td>Iodides and iodine, ergotamine (C), ergonovine (C)</td>
<td>Use alternatives to iodine-containing antiseptic agents. Ergotamine and ergonovine may suppress prolactin secretion in breastfeeding women. However, the use of methylergonovine to stimulate uterine involution is considered safe.</td>
</tr>
</tbody>
</table>

Note: Letters in parentheses refer to the Australian categorisation of risk of drug use in pregnancy—see the final section of this appendix.

### Table F.2 Drugs of choice for breastfeeding women

<table>
<thead>
<tr>
<th>Drug category</th>
<th>Drug or drug group</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analgesic drugs</td>
<td>Paracetamol (A), ibuprofen (C), flurbiprofen (B2), ketorolac (C), mefenamic acid (C), sumatriptan (B3), morphine</td>
<td>Sumatriptan may be given for migraines. For potent analgesia morphine may be given.</td>
</tr>
<tr>
<td>Anticoagulant drugs</td>
<td>Warfarin (D), heparin (regular and low molecular weight)</td>
<td>Among breastfed infants whose mothers were taking warfarin the drug was undetectable in plasma and the bleeding time was not affected.</td>
</tr>
<tr>
<td>Antidepressant drugs</td>
<td>Sertraline (C), tricyclic anti-depressant (C)</td>
<td>Other drugs such as fluoxetine may be given with caution (see Table F.1).</td>
</tr>
<tr>
<td>Anti-epileptic drugs</td>
<td>Carbamazepine (D), phenytoin (D), and valproic acid (D)</td>
<td>The estimated level or exposure to these drugs in infants is less than 10 per cent of the therapeutic dose standardised by weight.</td>
</tr>
<tr>
<td>Antihistamines (histamine H&lt;sub&gt;1&lt;/sub&gt; blockers)</td>
<td>Loratadine (B1)</td>
<td>Other antihistamines may be given, but data on the concentrations of these drugs in breastmilk are lacking.</td>
</tr>
<tr>
<td>Antimicrobial drugs</td>
<td>Penicillins (A), cephalaxin (A), cephalothin (A), aminoglycosides (D), macrolides—erythromycin (A)</td>
<td>Avoid chloramphenicol and tetracycline (see Table F.1).</td>
</tr>
<tr>
<td>Beta-adrenergic antagonists</td>
<td>Labetalol (C), propranolol (C)</td>
<td>Angiotensin-converting-enzyme inhibitors (D) and calcium–channel blocking agents (C) are considered safe.</td>
</tr>
<tr>
<td>Endocrine drugs</td>
<td>Propylthiouracil (C), insulin, levothyroxine (A)</td>
<td>The estimated level of exposure to propylthiouracil in breast feeding infants is less than 1 per cent of the therapeutic dose standardised by weight; the thyroid function of the infants is not affected.</td>
</tr>
<tr>
<td>Glucocorticoids</td>
<td>Prednisolone and prednisone</td>
<td>The amount of prednisolone the infant would ingest in breastmilk is less than 0.1 per cent of the therapeutic dose standardised by weight.</td>
</tr>
</tbody>
</table>

Notes: The list is not exhaustive. Cases of overdoses of these drugs must be assessed on an individual basis.

Letters in parentheses refer to the Australian categorisation of risk of drug use in pregnancy—see the next section of this appendix.

AUSTRALIAN CATEGORISATION OF RISK OF DRUG USE IN PREGNANCY

The Australian categorisation of the risk of drug use in pregnancy is as follows:

- **Category A**—drugs that have been taken by a large number of pregnant women and women of child-bearing age and for which no proven increase in the frequency of malformations or other direct or indirect harmful effects on the foetus has been observed

- **Category B1**—drugs that have been taken by only a limited number of pregnant women and women of child-bearing age but for which no increase in the frequency of malformation or other direct or indirect harmful effects on the human foetus has been observed. Studies in animals have not shown evidence of an increased occurrence of foetal damage.

- **Category B2**—drugs that have been taken by only a limited number of pregnant women and women of child-bearing age but for which no increase in the frequency of malformation or other direct or indirect harmful effects on the human foetus has been observed. Studies in animals are inadequate or may be lacking, but the available data show no evidence of an increased occurrence of foetal damage.

- **Category B3**—drugs that have been taken by only a limited number of pregnant women and women of child-bearing age but for which no increase in the frequency of malformation or other direct or indirect harmful effects on the human foetus has been observed. Studies in animals have shown evidence of an increased occurrence of foetal damage, the significance of which is considered uncertain in humans.

- **Category C**—drugs that, owing to their pharmacological effects, have caused or may be suspected of causing harmful effects on the human foetus or neonate but not malformations. These effects may be reversible. Accompanying texts should be consulted for further details.

- **Category D**—drugs that have caused, are suspected to have caused or may be expected to cause an increased incidence of human foetal malformations or irreversible damage. These drugs may also have adverse pharmacological effects. Accompanying texts should be consulted for further details.

- **Category X**—drugs posing such a high risk of permanent damage to a foetus that they should not be used in pregnancy or when there is a possibility of pregnancy.
## Appendix G

### The Composition of Human Milk

**Table G.1 The composition of human milk**

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Early milk</th>
<th>Mature milk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Constituent</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Energy (kJ)</td>
<td>n.a.</td>
<td>2730–2940</td>
</tr>
<tr>
<td>Lactose (g)</td>
<td>20–30</td>
<td>67</td>
</tr>
<tr>
<td>Glucose (g)</td>
<td>0.2–1.0</td>
<td>0.2–0.3</td>
</tr>
<tr>
<td>Oligosaccharides (g)</td>
<td>22–24</td>
<td>12–14</td>
</tr>
<tr>
<td>Total nitrogen (g)</td>
<td>3.0</td>
<td>1.9</td>
</tr>
<tr>
<td>Non-protein nitrogen (g)</td>
<td>0.5</td>
<td>0.45</td>
</tr>
<tr>
<td>Protein nitrogen (g)</td>
<td>2.5</td>
<td>1.45</td>
</tr>
<tr>
<td>Total protein (g)</td>
<td>16</td>
<td>9</td>
</tr>
<tr>
<td>Casein (g)</td>
<td>3.8</td>
<td>5.7</td>
</tr>
<tr>
<td>Beta-casein (g)</td>
<td>2.6</td>
<td>4.4</td>
</tr>
<tr>
<td>K-casein (g)</td>
<td>1.2</td>
<td>1.3</td>
</tr>
<tr>
<td>Alpha-lactalbumin (g)</td>
<td>3.62</td>
<td>3.26</td>
</tr>
<tr>
<td>Lactoferrin (g)</td>
<td>3.53</td>
<td>1.94</td>
</tr>
<tr>
<td>Serum albumin (g)</td>
<td>0.39</td>
<td>0.41</td>
</tr>
<tr>
<td>sIgA (g)</td>
<td>2.0</td>
<td>1.0</td>
</tr>
<tr>
<td>IgM (g)</td>
<td>0.12</td>
<td>0.2</td>
</tr>
<tr>
<td>IgG (g)</td>
<td>0.34</td>
<td>0.05</td>
</tr>
<tr>
<td>Total lipids (%)</td>
<td>2.0</td>
<td>3.5</td>
</tr>
<tr>
<td>Triglyceride (% total lipids)</td>
<td>97–98</td>
<td>97–98</td>
</tr>
<tr>
<td>Cholesterolb + (% total lipids)</td>
<td>0.2–1.3</td>
<td>0.4–0.5</td>
</tr>
<tr>
<td>Phospholipids (% total lipids)</td>
<td>1.1</td>
<td>0.6–0.8</td>
</tr>
<tr>
<td>Fatty acids (% weight)</td>
<td>88</td>
<td>88</td>
</tr>
<tr>
<td>Total saturated</td>
<td>43–44</td>
<td>44–45</td>
</tr>
<tr>
<td>C12:0</td>
<td>n.a.</td>
<td>5</td>
</tr>
<tr>
<td>C14:0</td>
<td>n.a.</td>
<td>0</td>
</tr>
<tr>
<td>C16:0</td>
<td>n.a.</td>
<td>20</td>
</tr>
<tr>
<td>C18:0</td>
<td>n.a.</td>
<td>6</td>
</tr>
<tr>
<td>Mono-unsaturated</td>
<td>n.a.</td>
<td>40</td>
</tr>
<tr>
<td>C18:omega-9</td>
<td>32</td>
<td>31</td>
</tr>
<tr>
<td>Polyunsaturated</td>
<td>13</td>
<td>14–15</td>
</tr>
<tr>
<td>Total omega-3</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>C18:3 omega-3</td>
<td>0.7</td>
<td>0.9</td>
</tr>
<tr>
<td>C22:5 omega-3</td>
<td>0.2</td>
<td>0.1</td>
</tr>
<tr>
<td>C22:6 omega-3</td>
<td>0.5</td>
<td>0.2</td>
</tr>
</tbody>
</table>

*continued next page*
Table G.1 continued

<table>
<thead>
<tr>
<th>Constituenta</th>
<th>Early milk</th>
<th>Mature milk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total omega-6</td>
<td>11.6</td>
<td>13.1</td>
</tr>
<tr>
<td>C18:2 omega-6</td>
<td>8.9</td>
<td>11.3</td>
</tr>
<tr>
<td>C20:4 omega-6</td>
<td>0.7</td>
<td>0.5</td>
</tr>
<tr>
<td>C22:4 omega-6</td>
<td>0.2</td>
<td>0.1</td>
</tr>
<tr>
<td>Vitamins</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ascorbic acid (mg)</td>
<td>n.a.</td>
<td>100</td>
</tr>
<tr>
<td>Thiamin (µg)</td>
<td>20</td>
<td>200</td>
</tr>
<tr>
<td>Riboflavin (µg)</td>
<td>n.a.</td>
<td>400–600</td>
</tr>
<tr>
<td>Niacin (mg)</td>
<td>0.5</td>
<td>1.8–6.0</td>
</tr>
<tr>
<td>Vitamin B₆ (mg)</td>
<td>n.a.</td>
<td>0.09–0.31</td>
</tr>
<tr>
<td>Folate (µg)</td>
<td>n.a.</td>
<td>80–140</td>
</tr>
<tr>
<td>Vitamin B₁₂ (µg)</td>
<td>n.a.</td>
<td>0.5–1.0</td>
</tr>
<tr>
<td>Pantothenic acid (mg)</td>
<td>n.a.</td>
<td>2.0–2.5</td>
</tr>
<tr>
<td>Biotin (µg)</td>
<td>n.a.</td>
<td>5–9</td>
</tr>
<tr>
<td>Retinol (mg)</td>
<td>2</td>
<td>0.3–0.6</td>
</tr>
<tr>
<td>Carotenoids (mg)</td>
<td>2</td>
<td>0.2–0.6</td>
</tr>
<tr>
<td>Vitamin K (µg)</td>
<td>2–5</td>
<td>2–3</td>
</tr>
<tr>
<td>Vitamin D (µg)</td>
<td>n.a.</td>
<td>0.33</td>
</tr>
<tr>
<td>Vitamin E (mg)</td>
<td>8–12</td>
<td>3–8</td>
</tr>
<tr>
<td>Minerals</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>250</td>
<td>200–250</td>
</tr>
<tr>
<td>Magnesium (mg)</td>
<td>30–35</td>
<td>30–35</td>
</tr>
<tr>
<td>Phosphorus (mg)</td>
<td>120–160</td>
<td>120–140</td>
</tr>
<tr>
<td>Sodium (mg)</td>
<td>300–400</td>
<td>120–250</td>
</tr>
<tr>
<td>Potassium (mg)</td>
<td>600–700</td>
<td>400–550</td>
</tr>
<tr>
<td>Chloride (mg)</td>
<td>600–800</td>
<td>400–450</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>0.5–1.0</td>
<td>0.3–0.9</td>
</tr>
<tr>
<td>zinc (mg)</td>
<td>8–12</td>
<td>1–3</td>
</tr>
<tr>
<td>Copper (mg)</td>
<td>0.5–0.8</td>
<td>0.2–0.4</td>
</tr>
<tr>
<td>Manganese (µg)</td>
<td>5–6</td>
<td>3</td>
</tr>
<tr>
<td>Selenium (µg)</td>
<td>40</td>
<td>7–33</td>
</tr>
<tr>
<td>Iodine (µg)</td>
<td>n.a.</td>
<td>150</td>
</tr>
<tr>
<td>Fluoride (µg)</td>
<td>n.a.</td>
<td>4–15</td>
</tr>
</tbody>
</table>

n.a. Measures not available.

a. All values are expressed per litre of milk, with the exception of lipids, which are expressed as a percentage on the basis of milk volume or weight of total lipids.

b. The cholesterol content of human milk ranges from 100 to 200 milligrams per litre in most samples after day 21 of lactation.
REFERENCES


APPENDIX H

SAMPLE CONSENT FORM FOR COMPLEMENTARY FEEDS

Consent form for the USE of complementary feeds

At ______________________________ (name of hospital), we believe that breastmilk is the best food for infants and want to support you in your choice to breastfeed. We believe that it is important for you to know the likely effects of giving your baby complementary feeds, so that you can make an informed decision.

What are complementary feeds?

Complementary feeds are any fluid other than breastmilk given to your baby—such as water, glucose water or infant formula in addition to the normal breastfeed.

The effects of complementary feeds

Introducing complementary feeds may have the following effects:

1. Breastfeeding works on a demand–supply basis. The more milk your baby takes, the more milk your breasts make. When your baby is given complementary feeds your breasts have less stimulation. This means less milk will be made.
2. It is important that your breasts are suckled frequently. If feeds are missed or replaced by a complement your breasts can become too full and painful. This is known as engorgement. Your body will stop making milk if your breasts are too full.
3. There is also evidence to suggest that approximately 1 to 3 per cent of infants who are given infant formula will develop an allergy to cow’s milk protein.

These effects of giving complements or supplements may make it difficult for you to continue breastfeeding. However, you should be assured that we will undertake to make every effort to help you re-establish breastfeeding once the reason for requiring the complementary feed has been overcome, should you wish to do so.
In the event of complementary feeding, the potential for these problems can be minimised by:

- expressing regularly to maintain supply and to prevent engorgement
- using expressed breastmilk where available to minimise the potential for cow’s milk protein allergy.

This information sheet was issued to ________________________________

on ___________ and discussed with me by ____________________________

**Consent to complement new-born infants**

I, ________________________________, wish/have been advised to give the following complementary feed to my baby.

Name of complement ______________________________________________

I have read and understand the information sheet for mothers.

Date ___________ Time ___________ Reason __________________________

Signed by mother __________________________________________________

Health worker _____________________________________________________

The above consent applies only for complementary feed(s) necessary for the above stated reason. Each time the reason for a complement changes, a new consent form should be filled out.

[Based on a consent form produced by the New Zealand College of Midwives Inc.]
APPENDIX I

AUSTRALIAN NUTRITION AND BREASTFEEDING RESOURCES AND WEBSITES

The following websites provide relevant nutrition information in Australia.

National Health and Medical Research Council

Commonwealth Department of Health and Ageing population health strategies

SIGNAL—the Strategic Intergovernmental Nutrition Alliance
  - Food Chain newsletter
  - Eat Well Australia: an agenda for action in public health nutrition, 2000–2010 (draft) 135 pages, PDF file, 793k
  - National Aboriginal and Torres Strait Islander Nutrition Strategy and Action Plan, 2000–2010 (draft) 56 pages, PDF file, 456k

Other government sites
- NSW Health—www.health.nsw.gov.au
- Victorian Department of Human Services—www.dhs.vic.gov.au
APPENDIX I

- ACT Health—www.health.act.gov.au
- WA Health Department—www.health.wa.gov.au
- NT Territory Health Services—www.nt.gov.au/nths
- Queensland Health—www.health.qld.gov.au
- Tasmanian Department of Health and Human Services—
  www.dhhs.tas.gov.au
- Food Standards Australia New Zealand—www.foodstandards.gov.au

Indigenous health and nutrition
- Office for Aboriginal and Torres Strait Islander Health—

Breastfeeding
- Australian Breastfeeding Association—www.breastfeeding.asn.au
- The breastfeeding newsletter of the American Academy of Pediatrics—
  www.aap.org/advocacy/bf/bfnewsletter.htm

UNICEF
- www.UNICEF.org
APPENDIX J
MARKETING OF BREASTMILK

THE INTERNATIONAL CODE OF MARKETING OF BREAST-MILK SUBSTITUTES

Aim of the WHO Code

The aim of this code is to contribute to the provision of safe and adequate nutrition for infants, by the protection and promotion of breastfeeding, and by ensuring the proper use of breast-milk substitutes, when these are necessary, on the basis of adequate information and through appropriate marketing and distribution.

The Code includes these 10 important provisions\(^1\):

- No advertising of these products to the public.
- No free samples to mothers.
- No promotion of products in health care facilities.
- No company mothercraft nurses to advise mothers.
- No gifts or personal samples to health workers.
- No words or pictures idealising artificial feeding, including pictures of infants, on the labels of the products.
- Information to health workers should be scientific and factual.
- All information on artificial infant feeding, including labels, should explain the benefits of breast feeding, and the costs and hazards associated with artificial feeding.
- Unsuitable products, such as sweetened condensed milk, should not be promoted for babies.
- All products should be of a high quality and take account of the climatic and storage conditions of the country where they are used.

…

Ten Steps to Successful Breastfeeding\(^2\)

Every facility (see below) providing maternity services and care for newborn infants should:

Have a written breastfeeding policy that is routinely communicated to all health care staff.
Train all health care staff in skills necessary to implement this policy.

Inform all pregnant women about the benefits and management of breastfeeding.

Help mothers initiate breastfeeding within a half-hour of birth.

Show mothers how to breastfeed and how to maintain lactation even if they should be separated from their infants.

Give newborn infants no food or drink other than breastmilk, unless medically indicated.

Practice rooming-in—allow mothers and infants to remain together—24 hours a day.

Encourage breastfeeding on demand.

Give no artificial teats or pacifiers to breastfeeding infants.

Foster the establishment of breastfeeding support groups and refer mothers to them on discharge from the hospital or clinic.

Note: The term ‘facility’ refers to maternity facilities, not general practices.

**THE MARKETING IN AUSTRALIA OF INFANT FORMULA (MAIF) AGREEMENT**


**Section 5.1 The status of the MAIF Agreement**

The MAIF Agreement is a voluntary agreement between the manufacturers, importers and distributors of infant formula and is not law. The Agreement has been authorised by the Australian Competition and Consumer Commission under the TPA [Trade Practices Act]. An Agreement must be submitted for authorisation where it contains marketing restrictions and authorisation is only granted where the public benefit is shown to outweigh any anti-competitive effect. The signatories can legally follow the provisions of the authorised Agreement, but could be in breach of the TPA if they agree to any further marketing restriction, which is not covered in the Agreement, even if it is recommended in the WHO Code. Similarly, for aspects of the WHO Code for which there is no authorised Agreement,
agreements by companies to restrict marketing practices may result in penalties for breaching the TPA.

**Section 5.2 APMAIF terms of reference**

The aim of APMAIF is to:

- receive and investigate complaints regarding the marketing in Australia of infant formulas;
- act as a liaison point for issues relating to the marketing in Australia of infant formulas;
- develop guidelines on the interpretation and application of the MAIF Agreement; and
- provide advice to the Commonwealth Minister responsible for Consumer Affairs, and the Commonwealth Minister for Health and Aged Care, on the operation of the Agreement.

**Section 6 Signatories to the MAIF Agreement**

Six manufacturers and distributors signed the MAIF Agreement in 1992, with later entrants to the market signing after that time. In 1998–1999 there were nine signatories. Amcal Ltd notified APMAIF of its withdrawal from being a signatory to the MAIF Agreement. This was due to a change in ownership and took effect on 1 July 1999.

The signatories as at 30 June 2000 are:

- Abbott Australasia Pty Ltd
- Bristol-Myers Squibb Australia Pty Ltd (Mead Johnson) *
- HJ Heinz Company Australia Ltd *
- Nestlé Australia Limited *
- Nutricia Australia Pty Ltd *
- Sharpe Laboratories Pty Ltd *
- Snow Brand (Australia) Pty Ltd
- Wyeth Australia Pty Ltd *

*Member companies of IFMAA

APMAIF invited other infant formula companies that are manufacturing and distributing infant formula, to become signatories to the MAIF Agreement. The Panel has contacted the companies Sigma (Amcal and Guardian brands) and Fauldings (Chem mart and Health Sense Brands) to invite them to become signatories to the Agreement. Both companies have infant formula products in the Australian market place. As at 30 June 2000 neither of these manufacturers have become signatories. Discussions are continuing.
The Panel has also contacted Snow Brand (Australia) Pty Ltd regarding its position in the Australian market. The Panel has asked them to become financial signatories to the MAIF Agreement.

REFERENCES


The National Health and Medical Research Council

The National Health and Medical Research Council (NHMRC) is a statutory body within the portfolio of the Commonwealth Minister for Health and Ageing, established by the National Health and Medical Research Council Act 1992. The NHMRC advises the Australian community and Commonwealth; State and Territory Governments on standards of individual and public health, and supports research to improve those standards.

The NHMRC advises the Commonwealth Government on the funding of medical and public health research and training in Australia and supports many of the medical advances made by Australians.

The NHMRC also develops guidelines and standards for the ethical conduct of health and medical research.

The Council comprises nominees of Commonwealth, State and Territory health authorities, professional and scientific colleges and associations, unions, universities, business, consumer groups, welfare organisations, conservation groups and the Aboriginal and Torres Strait Islander Commission.

The Council meets up to four times a year to consider and make decisions on reports prepared by committees and working parties following wide consultation on the issue under consideration.

A regular publishing program ensures that Council’s recommendations are widely available to governments, the community, scientific, industrial and educational groups.

The Council publishes extensively in the following areas:

- Aged care
- Child health
- Dentistry
- Drugs and poisons
- Environmental health
- Ethics – Human
- Health promotion
- Mental health
- NHMRC – National Health and Medical Research Council
- Public health
- Sport/Injury
- Workforce
- Communicable diseases
- Clinical practice guidelines
- Diabetes
- Drug and substance abuse
- Ethics – Animal
- Health procedures
- Infection control
- Men’s health
- Nutrition
- Research
- Women’s health

A list of current publications is available from:

The Publications Officer
NHMRC
MDP 100
GPO Box 9848
Canberra ACT 2601

Phone: (02) 6289 9520 (24-hour answering machine)
Toll free: 1800 020 103
Fax: (02) 6289 9197
E-mail: nhmrc.publications@nhmrc.gov.au
Internet: http://www.nhmrc.gov.au