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Dietary Guidelines for Children and Adolescents

RETIRED

NHMRC
National Health and Medical Research Council

Dietary guidelines for children and adolescents

RESCINDED

Endorsed June 1995

NHMRC
National Health and Medical Research Council

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TERMS OF REFERENCE AND MEMBERSHIP OF THE PANEL TO REVIEW THE DIETARY GUIDELINES FOR AUSTRALIANS

The Public Health Committee approved that the panel to review the dietary guidelines for Australians be re-convened, with appropriate changes in membership, in September 1992. The terms of reference were as follows:

1. To develop dietary guidelines for children;
2. To inquire into the need for, and if necessary recommend, modifications to the Dietary Guidelines for Australians appropriate to the elderly; and
3. To report to the Food and Health Standing Committee.

Prof Colin Binns, School of Public Health, Curtin University, WA (Chair)

Prof Allan Carmichael, Department of Paediatrics and Child Health, University of Tasmania, Tas

Ms Karen Cashel, Department of Applied Sciences, University of Canberra, ACT

Mrs Ingrid Coles-Rutishauser, Food and Nutrition Monitoring Unit, Australian Institute of Health and Welfare, ACT

Dr Geoff Davidson, Gastroenterology Department, Adelaide Women's and Children's Hospital, SA

Dr Stuart Spencer, Executive Director, Confectionery Manufacturers Association of Australia Ltd., Vic (Nominee of the Food Industry Council of Australia)

Prof Stewart Truswell, Boden Professor of Human Nutrition, University of Sydney, NSW

Ms Rosy Warden, Faculty of Medicine and Health Sciences, University of Newcastle, NSW (Nominee of the Australian Federation of Consumer Organisations)

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Secretariat

Mr Paul van Belkom, Director, Nutrition Section, Commonwealth Department of Human Services and Health, ACT

Mrs Sue Jefferson, Senior Nutritionist, Nutrition Section, Department of Human Services and Health, ACT (Secretary/Convenor)

Observers

The panel is grateful to the Nursing Mothers' Association of Australia for their attendance at meetings and the preparation of the draft background paper for the guideline on breastfeeding.

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PREFACE

This is a companion document to the 'Dietary guidelines for Australians' which were endorsed by the National Health and Medical Research Council (NHMRC) in June 1992.

The 'Dietary guidelines for Australians' were developed for the general population of healthy adults and during the development process of the guidelines, their appropriateness to other groups, particularly children[1], was questioned.

This document therefore discusses how the adult guidelines apply to children and adolescents from birth to 18 years of age. In some cases this has required re-wording and re-ordering of the guidelines, but where possible every effort has been made to keep the wording and the order of the guidelines as close as possible to those for adults. One exception to this is the breastfeeding guideline, which has been moved to the top of the list of dietary guidelines for children in recognition of its importance to the health of this age group.

The focus of the guidelines is the development of healthy eating pathways. This development should be initiated in late infancy and continue throughout childhood and adolescence.

This document should be read in conjunction with the 'Dietary guidelines for Australians'.

Target groups

These guidelines apply to the general population of healthy children from birth to eighteen years of age. For young children, who are unable to select and prepare food for themselves, caregivers and health workers are the primary target group. The guidelines should be able to be used directly by older children and adolescents and will also be of use to caregivers and health workers.

Applications

The guidelines apply to the total diet, and it is not appropriate to use them to assess the 'healthiness' of individual food items. Similarly, the guidelines are designed for consideration as a coherent set of advice or information, and individual guidelines cannot be considered in isolation.

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The guidelines are arranged in order of priority. The priority is intended to reflect the relative importance of each guideline to the population.

Guidelines on specific nutrients

As with the dietary guidelines aimed at adults, the guidelines for children and adolescents contain two additional guidelines on specific nutrients. It is envisaged that the present list of additional guidelines will be expanded if other problems with micronutrients become evident in major sub-groups of the population.

Detailed information on the requirements of specific nutrients in the Australian diet are contained in the 'Recommended dietary intakes for use in Australia' (RDIs) (NHMRC, 1991). The RDIs for children and adolescents are at Appendix 1. In the development of complete nutrition advice to the community and the individual, the RDIs and the dietary guidelines are complementary to each other. In recognition of this, a new core food grouping system has been developed for use in Australia based on the RDIs and dietary guidelines. (NHMRC, 1995) The core food groups provide the scientific basis for the development of nutrition education tools. The core food recommendations for children and adolescents are in Appendix 2.

Background papers

This report contains the draft background scientific papers for each of the guidelines prepared by members of the panel. The paper on breastfeeding was prepared for the panel by the Nursing Mothers' Association of Australia.

Meetings

The panel called widely for submissions prior to the first meeting in November 1992, and many responses were received from health professionals and consumer and industry groups. A second public consultation on the draft guidelines and background papers was undertaken between November 1993 and February 1994. Issues raised in the responses were considered by the panel in the development of the guidelines and background papers. A summary of the consultations is at Appendix 3.

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1 Throughout this document the word 'children' appears. Unless otherwise specified, this term includes all children, including adolescents.

DIETARY GUIDELINES FOR CHILDREN AND ADOLESCENTS

- Encourage and support breastfeeding.
- Children need appropriate food and physical activity to grow and develop normally. Growth should be checked regularly.
- Enjoy a wide variety of nutritious foods.
- Eat plenty of breads and cereals, vegetables (including legumes) and fruits.
- Low fat diets are not suitable for young children. For older children, a diet low in fat and in praticular, low in saturated fat, is appropriate.
- Encourage water as a drink. Alcohol is not recommended for children.
- Eat only a moderate amount of sugars and foods containing added sugars.
- Choose low salt foods.

Guidelines on specific nutrients

- Eat foods containing calcium.
- Eat foods containing iron.

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CHAPTER 1

ENCOURAGE AND SUPPORT BREASTFEEDING

Placing breastfeeding first on the list of 'Dietary guidelines for children and adolescents' emphasises the unequalled value of breastmilk as the sole food for infants for the first four to six months of life. It affirms the contribution of breastfeeding to public health and challenges everyone involved in the care and support of women and families to reflect its importance in their work and attitudes. Support and encouragement are necessary at all levels of the health system and in the wider community if the contribution of breastfeeding to the health of Australians is to be recognised and the prevalence and duration of breastfeeding are to be increased.

Successful breastfeeding results from the combination of knowledge and confidence. In societies where breastfeeding is truly valued as a natural function and the only way to nourish an infant, lactation failure is virtually unknown. Even though mothers may be malnourished and ill, living in unsanitary conditions and undertaking strenuous physical work, their infants are still successfully breastfed. (1)

In developed countries such as Australia, while a physiological inability to breastfeed is rare, milk insufficiency is the reason most often given for not breastfeeding. (2)

A complex set of social, physiological and cultural factors contributes to early weaning. (3) These mothers commonly have little or no information about breastfeeding, little contact with successfully breastfeeding women and, often, little support from close family and friends. Attitudes and practices which interfere with the successful establishment of lactation remain common (4) in a culture where breastfeeding is undervalued and where alternative infant foods are readily available. More mothers are returning to the workforce while their infants are young, and too little assistance is available to help them to continue breastfeeding.

THE BENEFITS OF BREASTFEEDING

In a recent review Cunningham, Jelliffe and Jelliffe (5) concluded that on a global level breastfeeding has advantages for both infants and mothers. While these advantages are less obvious in industrialised nations, which have more sanitary environments and accessible and affordable infant formulae, the epidemiological evidence confirmed the protective effects of breastfeeding in both rich and poor countries.

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Breastfeeding is beneficial nutritionally, immunologically and psychologically and it offers economic benefits to family and society.

Nutritional benefits

The milk of each mammalian species is uniquely adapted to the growth patterns, nutritional needs and metabolic capacities of the young of that species. The human infant's rapid growth and development, at a time when the digestive and excretory systems are still immature, demands optimal nutrition in the early months. Human milk promotes healthy growth and development from birth and provides short and long-term health benefits to children, adults and the community.

Breastfeeding has been associated with a lower risk of juvenile diabetes (6), inflammatory bowel disease (7), and some childhood cancers (8), and a delayed onset of coeliac disease. (2,9)

There are also implications for women's health: lactation protects against premenopausal breast cancer (10,11,12) and osteoporosis (13). While breastfeeding is not regarded as a reliable method of contraception in Australia, the risk of pregnancy during periods of lactational amenorrhoea is as low as 1.7 per cent in the first six months. (14) Even in developed countries, breastfeeding continues to compare favourably with barrier methods of contraception as long as the woman remains amenorrhoeic. (15,16) Globally, breastfeeding makes a significant contribution to the health of women and infants by helping with the spacing of pregnancies and enabling the mother to recover her immune and nutritional status between pregnancies. (17)

Immunological benefits

Resistance to infection is frequently cited as the most important immunological benefit of breastfeeding. The human infant's immune system is undeveloped at birth and the antibodies in breastmilk protect the infant from disease while its own immune system develops.

Prominent among the antibodies contained in breastmilk is the secretory immunoglobulin IgA. The IgA, which is manufactured in and secreted by the breast in response to specific bacteria and viruses to which the mother is exposed, protects against pathogens that infants are most likely to encounter in their local environments. (18) The circulating IgG and IgM antibodies in breastmilk offer further protection against specific pathogens. (19)

Other non-specific factors also have anti-bacterial activity. These include *lactoferrin*, which binds to iron and makes it unavailable to E. *scherischia coli* and *Candida albicans lysozyme*, which increases in concentration during the course of lactation and is bactericidal against gram negative rods and gram positive bacteria; and *cellular components* such as macrophages and monocytes, neutrophils and B- and T- lymphocytes. The functions of these cellular components are not yet entirely understood, but they include the inhibition and, or, destruction of bacteria and viruses. (19)

The concentrations of most of these protective factors is highest in colostrum, and they decrease as lactation becomes established. This reflects the particular value of breastfeeding in the first three to six months while the infant's own immune system is immature. However breastmilk continues to offer some protection into the second year of lactation. (20)

Howie et al (21) in Scotland confirmed the health benefits of breastfeeding in a developed community and showed that infants breastfed for 13 weeks or more had substantially less gastro-intestinal and respiratory illness in the first year of life than those bottle-fed from birth. This reduction in illness was noted also when supplements were given before 13 weeks. It lasted beyond the period of breastfeeding and was accompanied by a reduction in the rate of hospitalisation. Infants breastfed for less than 13 weeks however, had rates of gastrointestinal illness similar to those in the bottle-fed group.

Clinically, breastfeeding has also been shown to offer some protection against otitis media (22), urinary tract infections (23,24), bacteraemia-meningitis (25,26) and SIDS (27). Premature infants fed human milk have a significantly lower incidence of necrotizing enterocolitis (28) and recent studies have suggested that breast-feeding is associated with improved cognitive development in this group. (29,30) Lower rates of serious respiratory illness have been noted in breastfed infants, particularly in households where parents smoke. (31)

Psychological benefits

The contact between a mother and an infant when breastfeeding encourages the development of very close bonds.

Developmentally, some studies have shown increased responsiveness and enhanced cognitive performance among breastfed and previously breastfed children up to seven to eight years of age. (2, 30, 32)

BREASTFEEDING AND ALLERGY

While there have been many studies, the role of breastfeeding in the prevention of allergic disease has not been fully established. However, there is now some evidence to suggest that, in atopic families, breastfeeding can protect against allergic rhinitis, wheezing, colic, asthma and eczema. (2) The studies are confounded by the failure to control for the introduction of cow's milk formulae in hospital in the new-born period. The mother's own feeding history and intake of dietary allergens may also be significant. (33)

THE COMPOSITION OF BREASTMILK

Breastmilk is a balanced, low residue food which is readily utilised and meets the particular needs of the infant in the early months of life. It provides proteins, fats and carbohydrates at levels and in forms uniquely adapted to the infant's metabolic capacities and growth requirements. It is the standard by which manufacturers of modern infant formulae measure their products but its biologically active constituents cannot be replicated in substitute infant foods. These components of breastmilk not only promote growth and development by assisting the digestion and assimilation of nutrients, but also actively protect the infant from disease. The composition of breastmilk is shown in Table 1.

Table 1 Composition of mature breastmilk per 100ml

Energy (kcal)	70.0
(kJ)	293.0
Water (g)	89.7
Protein (g)	1.3
Fat (g)	4.2
Carbohydrate (g)	7.4
Cholesterol (mg)	16.0
Vitamin A (ug)	60.0
Vitamin D (ug)	0.01
Vitamin E (mg)	0.35
Vitamin K (ug)	0.21
Vitamin C (mg)	3.8
Thiamin (ug)	16.0
Riboflavin (ug)	30.0
Nicotinic acid (ug)	230.0
Vitamin B6 (ug)	6.0
Vitamin B12 (ug)	0.01
Total folate (ug)	5.2
Pantothenic acid (ug)	260.0
Biotin (ug)	0.76
Sodium (mg)	15.0
Potassium (mg)	60.0
Chloride (mg)	43.0
Calcium (mg)	35.0
Phosphorous (mg)	15.0
Magnesium (mg)	2.8
Iron (ug)	76.0
Copper (ug)	39.0
Zinc (ug)	295.0
Manganese (ug)	1.2
Chromium (ug)	0.6
Selenium (ug)	1.4
Iodine (ug)	7.0
Fluorine (ug)	7.7

Source: UK Department of Health and Social Security (34).

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The composition of breastmilk changes during the course of a lactation. (35) Mothers of premature infants, for example, produce milk that is more concentrated with respect to protein and minerals such as sodium, chloride, magnesium and iron. Colostrum, which is secreted during the first days after birth, is nutrient dense and has a low solute load. It has high levels of immunoglobulins and other factors that protect the gut from invasion by pathogens, while its enzymes and growth factors stimulate the infant's development. (1)

Once lactation is established, at the beginning of a breastfeed, breastmilk is a translucent fluid, quite different in colour to cow's milk, because breastmilk has very low concentrations of casein proteins. During established lactation, breastmilk composition varies between mothers and, in the same mother, between breasts, between and within feeds as well as over the course of lactation. The concentration of milk fat varies most. The reduced demand of a weaning infant causes the supply to drop and the concentration of immunoglobulins in the milk increases to protect both the infant and the breast. (36)

Lipids

The content of fat in milk increases from the beginning to the end of a breastfeed so that milk expressed at the end of a breastfeed has a creamier appearance. Fats provide 35 per cent to 50 per cent of the energy value of human milk. They provide this energy at little metabolic cost because they are in the form of very small, emulsified, readily-absorbed fat globules. Digestion is further assisted by the presence of lipases in the milk. The total fat content does not seem to be affected by maternal dietary intake, but the fatty acid pattern reflects the types of fatty acids in the maternal diet (in the case of adequately nourished women) or in her adipose tissue (in the case of women whose energy intake is inadequate). This includes a range of omega-3 and omega-6 long-chain polyunsaturated fatty acids not found in infant formulae. These substances are important in brain development and myelinization.

Recent research suggests that the level of long-chain polyunsaturated fatty acids is higher in the tissues of breastfed infants. This difference may have functional implications—higher levels are associated with increased visual acuity and retinal function as well as improved growth and motor development in preterm infants fed human milk. (29,37)

Protein

The very low protein content of human milk reflects the slower rate of growth of infants compared to the young of other mammals. The nutritional value of protein in human milk does not equate exactly to the total nitrogen content, as the anti-infective proteins, such as secretory IgA, are not absorbed and around 25 per cent of the nitrogen is present in the form of non-protein nitrogen, including urea and a variety of free amino acids. (38) Among these are high levels of cysteine, an essential amino acid in the foetus and preterm infant; high taurine levels which assist fat absorption and central nervous system development; and lactoferrin, which may increase iron absorption and also help protect against gastrointestinal diseases.

Carbohydrate

Lactose is the most abundant carbohydrate in human milk. It is digested in the gut by lactase into galactose and glucose -which together supply around 40 per cent of the infant's energy needs. (1) Lactose also enhances calcium absorption. In addition, oligosaccharides in the milk promote the growth of lactobacilli in the intestine, thus increasing intestinal acidity and inhibiting the growth of pathogens. (39)

Vitamins and minerals

Vitamins in the milk, particularly water-soluble vitamins, are influenced by maternal diet and are generally sufficient in the well-nourished mother to meet the needs of the breastfed infant without supplementation. However, mothers eating strictly vegan diets produce milk that contains insufficient vitamin B12 and, therefore, they need to take supplements of this vitamin. (40)

Mineral levels vary little with maternal diet. The low levels in human milk reflect their high degree of bioavailability rather than any deficiency. This is in part due to the action of transfer factors, organic molecules in the milk that form complexes with the minerals and aid their absorption. (41) Thus, not only the nutrients themselves, but the particular relationships between them, facilitate their utilisation. (1)

Other constituents

Like other mammalian milks, human milk contains a wide variety of species-specific enzymes, growth factors, nucleotides and hormones, the precise functions of which are still to be explored.

The influence of maternal diet on lactation

A woman's nutritional needs are increased during lactation, and this is reflected in recommendations for increased intakes of nutrients and foods during lactation (see Appendix 1B – RDIs in lactation and appendix 2B – core food groups). Recent research indicates that even malnourished women can lactate successfully with an energy intake considerably less than their theoretical requirements. (42,43)

In most breastfeeding women a well-balanced diet will lead to the gradual loss of maternal fat stores laid down in pregnancy. Such a diet is particularly important to teenage breastfeeding mothers. Although there may be some compositional differences between the milk of adolescents and mature women (with adolescents producing milk of lower volume but higher nutrient concentration), adolescents can breastfeed successfully. (44,45) Low energy diets and unduly restrictive diets should be avoided during breastfeeding.

HOW BREASTFEEDING WORKS

The production and secretion of milk are under endocrine control. Stimulation of the breast by the suckling infant results in the production of prolactin and oxytocin from the anterior and posterior pituitary respectively. Prolactin is required for the production of milk in the alveoli of the breast. Oxytocin stimulates the myoepithelial cells surrounding the alveoli and ducts to contract and release the milk into the ducts and sinuses where it becomes available to the infant (the let-down or milk-ejection reflex). These hormones are essential for lactation, its regulation depends on how frequently and how efficiently the infant removes milk from the breast. Milk production from breastfeed to breastfeed is probably controlled locally by the completeness of the removal of milk from each breast at a feed. Under this autocrine control mechanism, inhibitory compound(s) that accumulate in the milk and suppress further milk synthesis are removed by the infant and milk synthesis is adjusted according to the amount of milk withdrawn. (46)

Initiation of breastfeeding

The World Health Organization (WHO) and UNICEF have provided guidelines for the effective management of breastfeeding in the early neonatal period (Table 2). These guidelines form part of the Baby Friendly Hospital Initiative, an international program of breastfeeding promotion. (46)

Table 2 10 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 with all healthcare staff
2. Train all healthcare staff in the skills necessary to implement this policy.
3. Inform all pregnant women about the benefits and management of breastfeeding.
4. Help mothers initiate breastfeeding within 30 minutes after birth.
5. Show mothers how to breastfeed, and how to maintain lactation even if they should be 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.

Source: WHO/UNICEF (47).

EXECUTIVE SUMMARY

Early hospital discharge

Concern has been expressed that the trend towards early postpartum discharge is likely to lead to lower rates of breastfeeding. However, where good community support is available, higher rates of breastfeeding are maintained. (48)

Managing breastfeeding problems

Most difficulties with breastfeeding can be prevented by careful education and management of the breastfeeding couple in the early weeks of breastfeeding.

Correctly positioning and attaching the infant at the breast are vital in helping the infant develop an effective suck. Infants who suck well empty the breast effectively and stimulate an ample milk supply. When good milk drainage has been established mothers are less likely to experience blocked ducts or mastitis. If ducts do block continued frequent breastfeeding, the application of warmth, massage and rest usually help them to clear quickly. If the blockages do not resolve within 12 hours or if the mother becomes febrile, then medical assistance should be sought. Frequent mastitis is usually associated with inadequate breast drainage, breast or nipple trauma, poor nutrition, fatigue and stress in the mother. (49)

Nipple soreness and damage is usually a sign of poor attachment and sucking. Early assistance from a health professional experienced in breastfeeding management, a lactation consultant or breastfeeding counsellor should be sought. Nipple problems are likely to be exacerbated by the use of nipple creams and mechanical aids such as breast pumps and nipple shields. (41)

Low weight gains in a breastfed infant are most often associated with inappropriate feeding patterns (spacing out feeds, limiting sucking time, using other fluids or dummies), insufficient suckling stimulus (poor suck, use of nipple shield), illness or physical problems in the infant or maternal causes (inefficient or absent milk-ejection reflex, pregnancy or hormonal factors, smoking). (2)

However, failure to thrive can occur in some apparently contented breastfed infants. (49,50) Poor growth in weight, length and head circumference may be the only sign of starvation. Prolonged exclusive breastfeeding may also be associated with nutritional deficiency which can be demonstrated by subsequent catch-up growth. (51) These situations emphasise the importance of

close follow-up for breastfed infants, especially those who lose excessive weight in hospital and those who are exclusively breastfed after six months. (52)

Mothers should be informed of the changing nature of infant feeding patterns, development and behaviour and be encouraged to seek counselling from a well-informed health professional, lactation consultant or Nursing Mothers' Association of Australia (NMAA) breastfeeding counsellor if they have any concerns about her infant. Mothers will be reassured to know that while problems in breastfeeding may occur, most can be solved quickly with knowledge and support. Because breastfeeding is a learned art, contact with other women who are successfully breastfeeding should be encouraged.

CONTRAINDICATIONS TO BREASTFEEDING

Some rare metabolic disorders, such as galactosaemia, require that the infant be fed on specially formulated mixtures. In other circumstances, such as in an infant with phenylketonuria, partial breastfeeding may be possible with careful monitoring by a health professional.

Some physical disabilities in the infant (for example cleft lip or palate or neurological problems) may interfere with the infant's ability to milk the breast. These infants often have problems with bottlefeeding too. With skilled assistance and support many mothers are able to breastfeed them successfully, if not directly at the breast, then with expressed breastmilk. This option is particularly important in those infants who, because of their physical condition, are particularly prone to infection. (1,53)

It has been estimated that only 1 per cent to 5 per cent of women fail to lactate for physiological reasons (54) and lactation normally persists despite maternal health problems. Breastfeeding is only contraindicated in cases of severe maternal illness, such as heart failure or serious liver, kidney or lung disease. (1) Most other illnesses, even if serious, can be managed in a way that allows the breastfeeding relationship to be preserved, although temporary interruptions may be necessary. While there is of course a need for caution in prescribing medication for breastfeeding women, it is frequently possible to find alternatives that are safe for the infant, and to manage the breastfeeding in a way that minimises passage to the infant through the milk. (39)

Breastfeeding is not contraindicated in the case of mothers with hepatitis B, provided the infant is protected by vaccination immediately after birth. (2)

Breastfeeding and HIV

Research to date indicates that approximately one-third of infants born to HIV-infected women worldwide become infected themselves, most often during pregnancy and delivery. WHO recommends that in countries such as Australia, pregnant women known to be infected be advised not to breastfeed. (55)

INTRODUCING FOODS AND FLUIDS OTHER THAN BREASTMILK

Breastmilk provides all the nutritional needs of a full-term infant for the first four to six months of life and remains an important food for the first 12 months. (56,57)

There are many disadvantages in the early introduction of fluids or foods other than breastmilk. Supplementing with water or glucose water in the neonatal period is associated with higher bilirubin levels, reduced interest in breastfeeding and greater weight loss. (39) Less frequent and efficient suckling at the breast may occur due to the infant's reduced appetite and the disturbance of sucking technique. The feeding relationship between mother and infant is disturbed as the infant adjusts to the different feeding styles required by breast and bottle (40) and the mother's confidence in her capacity to fully nourish her infant may be undermined.

Water supplementation has been associated with decreased breastmilk volume and therefore caloric intake, with subsequent weaning, but supplementation does not affect levels of hydration. (58,59) An infant who is being totally breastfed normally needs no supplementary fluids, even in very hot climates. (60)

The introduction of solid foods is discussed in more detail in the background paper to the guideline on variety.

PREVALENCE OF BREASTFEEDING IN AUSTRALIA

Australia has the following targets for breastfeeding for the year 2000:

- Population: Babies up to two months of age

  To increase the proportion who are breastfed following discharge to 90 per cent.

- Population: Babies up to three months of age

  To increase the proportion who are fully breastfed to 60 per cent and the proportion who are partially breastfed to 80 per cent.

- Population: Babies up to six months of age

  To increase the proportion who are fully breastfed to 50 per cent and the proportion who are partially breastfed to 80 per cent. (61)

In order to monitor progress towards these targets it is often necessary to compare the results of different studies. However, the comparison of rates of breastfeeding between studies is difficult for two reasons:

- the definition of breastfeeding may differ between studies; and
- the age of the infant may be defined differently. For example, an infant being breastfed at three months of age may mean that the infant was being breastfed at any stage during the third month, was breastfed for the entire third month or was breastfed until it was between ten and 14 weeks of age. (62)

These differences should therefore be borne in mind when the rates of breastfeeding described in different studies are compared.

To overcome difficulties in comparing rates of breastfeeding between studies and between countries WHO has developed a list of key breastfeeding indicators and definitions which are currently being used for the WHO global databank on breastfeeding prevalence and duration. These are shown in tables 3A and 3B.

Table 3A Summary list of key breastfeeding indicators

Exclusive breastfeeding rate:

Proportion of infants less than 4 months (120 days) of age who are exclusively breastfed

Infants <4 months (<120 days) of age who were exclusively breastfed in the last 24 hours

Predominant breastfeeding rate:

Proportion of infants less than 4 months (120 days) of age who are predominantly breastfed

Infants <4 months (<120 days) of age who were predominantly breastfed in the last 24 hours

Timely complementary feeding rate:

Proportion of infants 6–9 months (180–299 days) of age who are receiving breastmilk and complementary foods

Infants 6–9 months (180–299 days) of age who received complementary foods in addition to breastmilk in the last 24 hours

Continued breastfeeding rate (1 year):

Proportion of children 12–15 months of age who are breastfeeding

Children 12-15 months of age who were breastfed in the last 24 hours

Continued breastfeeding rate (2 years):

Proportion of children 20–23 months of age who are breastfeeding

Children 20–23 months of age who were breastfed in the last 24 hours

Bottle-feeding rate:

Proportion of infants less than 12 months (<366 days) of age who are receiving any food or drink from a bottle

Infants <12 months (<366 days) of age who were bottle fed in the last 24 hours

Source: WHO (63).

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Table 3B Criteria for inclusion in infant feeding categories

Category of infant feeding	Requires that the infant receive	Allows the infant to receive	Does not allow the infant to receive
Exclusive breastfeeding	Breastmilk (incl milk expressed or from wet nurse)	Drops, syrups (vitamins, minerals, medicines)	Anything else
Predominant breastfeeding	Breastmilk (incl milk expressed or from wet nurse as the predominant source of nourishment)	Liquids (water and water-based drinks, fruit juice, ORS), ritual fluids and drops or syrups (vitamins, minerals, medicines)	Anything else (in particular, non-human milk, food-based fluids)
Complementary feeding	Breastmilk and solid or semi-solid foods	Any food or liquid including non-human milk	
Breastfeeding	Breastmilk	Any food or liquid including non-human milk	
Bottle-feeding	Any liquid or semi-solid food from a bottle with nipple or teat	Any food or liquid including non-human milk Also allows breastmilk by bottle	

Source: WHO (63).

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In the mid-1980s Australia was reported to have one of the highest rates of initiation of breastfeeding in the world. Palmer (3) offered the following figures (derived from data collection for the Australian delegation to the 1983 World Health Assembly) on the prevalence of breastfeeding in Australia in 1983.

Infants' age	Per cent breastfed
At hospital discharge	85
6–8 weeks	72
3 months	54–55
6 months	40–42
12 months	10–12

A survey conducted by the Australian Bureau of Statistics in 1989–90 found that 77 per cent of women had breastfed during the previous five years. (64) This could be interpreted as indicating that breastfeeding rates in Australia had declined during the 1980s, however the two surveys used very different methodologies and therefore the results are not completely comparable.

These surveys suggest that there has been little change in breastfeeding rates in Australia, although in other industrial countries breastfeeding rates may even have fallen. (65,66,67)

The NMAA and other support groups have made a major contribution to the high rates of breastfeeding in Australia. A recent survey of over 5,000 breastfeeding women by NMAA found high rates of breastfeeding, particularly among NMAA members. The average length of exclusive breastfeeding among NMAA members was five months, compared with 4.3 months for non-members while partial breastfeeding continued for an average of 12.9 months (non-members 9.2 months). Among members, 48.6 per cent of infants were fully breastfed for at least six months. (68) These success rates are similar to those observed in studies of mother support groups overseas. (2)

Women with lower education levels and those from non-English speaking backgrounds are less likely to use the services of NMAA or early childhood centres. These women are also less likely to initiate or maintain breastfeeding and are therefore most in need of support.

Social class

Data from other industrialised countries suggest that breastfeeding is less common in lower socioeconomic groups where child health may already be compromised by poverty and educational disadvantage (69).

This situation is similar in Australia. A joint survey of infant feeding practices in Western Australia and Tasmania found that, in Western Australia 100 per cent of women in social Class A (professional/academic) breastfed their infants at hospital discharge, compared to 81 per cent of those in social Class D (unskilled). The corresponding figures for Tasmania were 100 per cent and 64 per cent respectively. At 12 months of age, 35 per cent of infants of mothers in social Class A were still being breastfed compared to 9 per cent of those in Class D in Western Australia. The figures for Tasmania were 50 per cent and 10 per cent respectively. (70)

One of the most common reasons given for the early cessation of breastfeeding in this study was 'insufficient milk'. This finding is supported by a more recent study of women from lower socioeconomic status (social Classes C and D) in Perth. Insufficient milk, sore nipples and the baby demanding too many feeds were the most common reasons given for ceasing breastfeeding. (71)

Lowe (72) in a 1991–92 Victorian survey, also found a positive correlation between breastfeeding and socioeconomic class (as represented by an occupational and educational index).

The positive association between social class and breastfeeding is of particular concern because formulae must be purchased from a limited income. (62)

Ethnicity

The prevalence of breastfeeding differs among Australian ethnic groups, but the relationships are difficult to describe. (62)

> 'Within a given locality, it would seen that the prevalence of breastfeeding is not necessarily lower in all ethnic groups compared to Australians from English-speaking backgrounds. Length of stay in, or age at migration to, Australia may also be an important determinant of breastfeeding in migrant groups.' (62)

For Australian Aboriginals the maintenance of a traditional lifestyle appears to be related to the prevalence of breastfeeding, however the determination of recent breastfeeding rates is hampered by lack of data. A study in Western Australia in the early 1980s found that the prevalence of breastfeeding before the age of nine months in remote, partly tribal areas was 100 per cent. Amongst Aboriginals living near big country towns it was 66 per cent at six months of age, but less than 50 per cent at six months of age for those in the urbanised, south-western area of Western Australia. (62)

Breastfeeding and the media

The NMAA data cited above show the positive influence of exposure to role models for successful breastfeeding. In the broader Australian community however, breasts are seen as sexual objects rather than as sources of nourishment for infants. This may lead to the presentation of breastfeeding as something 'dirty' (as seen in some newspaper reports where breastfeeding along with nappy changing is relegated to the public toilet). Such attitudes are a source of social pressure and sometimes of embarrassment or shame which may make breastfeeding difficult, both psychologically and practically, for women and their families. (73,74)

Infants and bottles are strongly associated in the media, in children's books and toys and in general advertising. While the WHO 'International code of marketing of breastmilk substitutes' (75) prohibits the direct advertising to the public of infant formulae, feeding accessories are frequently advertised. (62)

Breastfeeding and paid employment

While many mothers continue to breastfeed after returning to paid employment, the duration of breastfeeding is generally shorter among employed women than among women who stay at home. (76) Breastfeeding can continue successfully, however, if the mother receives appropriate assistance and support. (77) The following factors are associated with the maintenance of successful breastfeeding while in the paid workforce:

- delayed return to the workforce (until the infant is at least four months old);
- shorter, more flexible working hours, particularly initially;
- expressing milk at work, preferably more than once a day;

- continuing to breastfeed freely when at home (and using the breastfeeding time to relax and enjoy the infant);
- flexible and supportive workplace and care arrangements;
- personal support systems (family, friends, other breastfeeding women);
- having the infant cared for at or near the workplace and the possibility of feeding the infant during breaks;
- short transportation time to and from work; and
- flexible maternity leave provisions allowing the mother to work up to the birth and return later after the birth or to extend leave as partially paid or unpaid leave. (78,79)

The key to combining breastfeeding and paid employment is flexibility. Mothers need to be encouraged to find the particular combination of breast and supplementary feeding that best suits their individual situation. While it is not easy, many mothers find rewards in being able to continue to relate to their infants in a way that no one else can reproduce. They can be assisted by legislation and employment practices which offer easier access to childcare and working conditions which take into consideration their special needs.

INFANT FORMULAE

Breastmilk is the preferred milk for infants up to 12 months of age. Where breastmilk cannot be offered, for whatever reason, a standard infant formulae should form the main milk component of the diet for infants up to 12 months of age. Home-prepared alternatives such as unmodified cow's milk and sweetened condensed and powdered milks are not appropriate for infants and their use should be discouraged.

Currently there is a range of infant formulae available in Australia. The most common are those based on cow's milk, which are either casein-predominant or whey-predominant. The whey-predominant formulae have been the most commonly reported formulae in use in several Australian studies. (70, 80, 81) However, formulae based on soy or goat's milk are also available and have been reported to be given to between 4 per cent and 6 per cent of infants (70, 80), presumably for those infants who are, or are believed to be, cow's milk intolerant. A list of standard, follow-on, soya milk and goat's milk formulae currently available in Australia is at Appendix 4.

When parents choose to use infant formulae it is essential that they be given adequate advice on the preparation to ensure that it is nutritionally balanced and microbiologically safe. (77) Results from two recent studies in Sydney and South Australia indicate that there is a wide range of variability in the accuracy of reconstituting infant formulae compared with manufacturer's instructions. Both studies found a tendency for care-givers to prepare over-concentrated formulae. (80,81) Additionally, the Sydney study measured samples of prepared formulae for bacterial safety and found that 22 per cent of samples collected grew potential pathogens. (80)

While those mothers who decide to use an infant formulae when in hospital receive instruction on formulae preparation, sterilisation and feeding technique, the trend towards earlier discharge after birth could mean that those women who decide to bottle feed after they leave hospital have little opportunity to learn these skills. Thus, health workers who come into contact with parents of formulae-fed infants should ensure that they receive appropriate advice on all aspects of formulae feeding.

CONCLUSION

Although there are relatively few situations in which breast-feeding is not possible, the cultural barriers to breastfeeding are such that there are still many women in Australia who choose not to breastfeed their infants, or who through choice or circumstances wean early.

It has been demonstrated that the health care professional plays an important role in influencing breastfeeding success. (82) One study found that women whose doctors failed to express an opinion about breastfeeding were significantly more likely to have a negative or neutral attitude themselves, while more than 90 per cent of women whose doctors favoured breastfeeding also favoured it. (83) This suggests that maintaining a passive or uncommitted stance, perhaps in an attempt to prevent the bottle-feeding mother from feeling guilty, is likely to have a negative influence. While it is important to respect a woman's choice not to breastfeed, it is also important that women be given the opportunity to make an informed decision about the value of breastfeeding. Many women who are initially unsure are persuaded by gentle encouragement and a positive presentation of its advantages to try breastfeeding and find it a rewarding experience.

People working with young families need to be aware that breastfeeding is an emotional experience. Women who want to breastfeed but are forced to wean early will grieve the loss of the breastfeeding relationship. They may share with the mother who chooses not to breastfeed, feelings of anger, guilt or failure. It is important to the developing family that all mothers be offered sensitive support and help as they adjust to their mothering role.

Community acceptance, comprehensive educational programs and ongoing support, such as that offered by informed health workers and by mother support groups like the Nursing Mothers' Association of Australia (NMAA) are the keys to successful breastfeeding.

RELATIONSHIP TO OTHER GUIDELINES

- Enjoy a wide variety of nutritious foods. The introduction of solids and a more detailed discussion on the use of infant formulae are included in the background paper to this guideline.

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RESCINDED

CHAPTER 2

CHILDREN NEED APPROPRIATE FOOD AND PHYSICAL ACTIVITY TO GROW AND DEVELOP NORMALLY

'Growth' is the acquisition of tissue and increase in body size. 'Development' is the increased ability of the body to function physically and intellectually. Both proceed at different rates for different individuals. (1)

Weight gain and an increase in body size during childhood and adolescence are integral parts of the normal process of growth and development. During childhood and adolescence the focus is on maintaining a rate of physical growth which is consistent with the expected norms for age, sex and the stage of physiological maturity. Physical growth is best assessed by the conventional measures of weight, length or height and head circumference. The maintenance of a positive energy and nutrient balance is critical in achieving and sustaining normal growth and development. (2) In this context, the intentional restriction of weight gain, for example, through dieting, is inappropriate.

GROWTH

Between birth and 18 years of age body weight increases about 20-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. However, during infancy and adolescence the rate of growth changes rapidly over time. For example, after birth the rate of growth 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 around 16 years of age in girls and 18 years in boys.

Children

Children between the ages of one and five are still considered to be nutritionally vulnerable although their growth rate is slower than in infancy and their nutritional needs in relation to body size are proportionally reduced. (3) However, relative to their body weight, the nutrient and energy requirements of children are greater than those for adults.

Young children are unable to exert as much control over what they eat as do adults. Too little or too much food, or an imbalance of nutrients or energy over a period of time, can alter the natural progress of physical growth. The child's rate of growth is a fundamental indicator of dietary adequacy and health. (1)

Caregivers must therefore be aware of, and responsive to, the developmental and nutritional needs of children.

If a child's growth follows expected norms it is unlikely that nutritional problems are an issue.

Adolescents

At adolescence there is a marked increase in the rate of gain in both weight and length which is referred to as *the adolescent growth spurt*. The spurt in height gain begins on average at ten to 11 years in girls and at 12 to 13 years in boys, although there is wide variation in the time of onset in individuals.

During the adolescent growth spurt boys gain an average of 20 cm in height and 20 kg in weight and girls around 16 cm and 16 kg 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, while in boys the development of secondary sexual characteristics is less closely related to the adolescent growth spurt.

Assessment of body weight and growth rate

In adults it is possible to distinguish overweight and obesity in terms of the body mass index (Weight (kg) / Height (m)2) but in children there is no single index which can be used in the same way because of the different rates of gain in weight and height during development. (4,5) The most practical measures of weight status in childhood are comparisons with reference growth charts which indicate the normal range for weight, height and weight-for-height by sex and age.

When only a single measurement of weight and height is available, the traditional method has been to compare the extent to which weight exceeds the median reference value for age and sex or for height and sex. Values in excess of 10 per cent and 20 per cent are defined as overweight and obesity respectively (6) and values below 90 per cent of weight-for-age and 80 per cent of weight-for-height are defined as underweight and wasting respectively. (7)

However, it is now considered more appropriate to use standard deviations or 'Z' scores for this purpose, since the same cut-off score can be used for weight, height and weight-for-height

measurements and, unlike a fixed percentage of the median reference value, represents the same degree of over- or under-nutrition. (8,9,10)

If weight and height are measured on several occasions the measurements are most usefully interpreted by plotting them on reference growth charts. In Australia the US National Centre for Health Statistics (NCHS) growth charts (11) are recommended for this purpose for all ethnic groups. These 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.[2]

The suitability of the NCHS values for use as an international standard has been raised. A study of the anthropometry of Australian children identified several issues for consideration when using the NCHS data as a standard in Australia. The data were considered to be suitable to use for children aged less than eight years, but the appropriateness of the data for adolescents and different ethnic groups was questioned. The need for a well-designed study to clarify this issue was identified. (12)

WHO states that the growth patterns of children living under optimal environmental conditions in many different developing countries very closely resemble those used to develop the NCHS charts. This has been confirmed by the testing of the WHO prototype chart in various countries. (9)

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.[3] If the plotted values show a markedly irregular pattern, this may represent a problem, however some of the measurements may be inaccurate or the data may 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 and the length of time for which the rate of growth deviates from the norm. 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.

2 NHMRC currently is developing new growth rate charts based on NCHS data.

3 This generalisation does not hold during puberty when growth spurts occur at different ages in different children.

Skinfold measurements (a measure of the amount of fat in the subcutaneous compartment) can be used as another practical index of under- or overnutrition. However, generation of reliable skinfold measurements depends to a large extent on the use of trained operators and calibrated instruments, and not all are reliable.

Table 1 Developmental characteristics of toddlers

The toddler years bring:

- A time of *exploration.* They explore their surroundings by touching, seeing, listening, smelling and tasting. Food is of immense interest to most toddlers, but not always to eat.
- Greater *autonomy,* while at the same time being fearful of new experiences. Between 18 and 24 months most can handle a spoon and cup for self-feeding, although spills are common. '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.
- Need for sense of *security.* The need for ritual and a sense of security are very important in the life of the toddler. A desire for the familiar (a special toy or food) often dictates the toddler's daily routine. This is very much a part of the normal transition from infancy to childhood.
- Limited *attention span.* Easily distracted, toddlers may be unable to sit at the family table for the normal duration of the meal.
- *Awareness* of others in their world. Although not skilled in cooperative play, two and three year olds are gradually developing social skills. They frequently imitate those people close to them. A powerful influence on the child's acceptance of foods is watching another child or adult who enjoys the food.

Source: Network of the Federal/Provincial/Territorial Group on Nutrition and the National Institute of Nutrition (1).

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Table 2 Developmental characteristics of preschoolers

In general, in the preschooler there is:

- A progressive acquisition of new skills. Preschoolers are striving for independence and achieving competence in such activities as tying shoes, brushing teeth, pouring milk. The child's level of oral motor development and manual dexterity should be considered in choosing foods of appropriate texture, consistency and ease of eating.
- Boundless energy. Sitting still for more than a few minutes may be difficult. Children need ample time for active indoor play and opportunities to develop gross motor coordination.
- More effective communication. Language is important to the preschooler. Peers become increasingly important. Most children enjoy sharing food with friends and caregivers.
- A keen curiosity. 'Why' has usually replaced 'no' as the most frequently spoken word. The kitchen provides an opportunity for experiments, crafts and participation in food preparation.
- Comfort with the familiar but willingness try new challenges. Food fads are common during this period. They may insist on having a certain food prepared in a particular way for several days. Once it has been experienced to the fullest, another food becomes popular. This has been termed 'fussiness', but it is actually a common characteristic of normal development. Although variety may be limited while the fad persists, the child is gradually expanding food choices.

Source: Network of the Federal/Provincial/Territorial Group on Nutrition and the National Institute of Nutrition (1).

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DEVELOPMENT

The nutritional needs of children should be considered within the context of normal childhood development.

The following characteristics of normal childhood development are identified in the Canadian guidelines for 'Promoting nutritional health during the preschool years'. (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; and
- exploring food as part of their development.

Developmental characteristics of toddlers and preschoolers in relation to food are provided in Tables 1 and 2.

How is normal development assessed?

Unlike growth, there are no simple measures of development. While there is a range of tests available to assess psychosocial development such as intelligence, personality and emotional adjustment, these tests require special training. Development is assessed by primary health care workers with reference to developmental milestones or screening tests. (12)

Every child is an individual, and this is reflected in individual rates of normal development. It should be remembered that development is a gradual process of growth and expansion of skills. Development therefore involves a change from a lower to a more advanced level of complexity. 'Normal' development can therefore be considered as '... the emerging and expanding of capacities of the individual to provide progressively greater facility in functioning'. Development is achieved through the processes of growth, maturation and learning. (14)

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UNDERSTANDING HOW CHILDREN AND YOUNG PEOPLE APPROACH EATING

The role of caregivers

The early years are critical in establishing food attitudes and habits. (1,15,16) Caregivers can foster the formation of sound food habits by understanding eating behaviour as part of the child's normal pattern of development.

Caregivers play a key role in providing a safe environment, which offers opportunities for exploration and learning.

The feeding and nutritional care of the youngster is an integral part of the complex interaction between the primary caregiver and the child and is important to the child's physical and emotional development. (1,15) Contemporary lifestyle patterns may mean that children have several different caregivers. Good communication between different caregivers can ensure that they are able to assess and respond to a child's individual needs.

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. (17) Satter (15) recommends allowing children to determine how much, and even whether, they eat. The responsibility of caregivers is in the buying of the food, setting the times of meals and snacks, making meals, presenting foods in appropriate forms, maintaining standards of behaviour at the table and making mealtimes pleasant.

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

- *Small but frequent amounts of foods* – because 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.

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- *Considerable variation in appetite* – childrens' appetites normally fluctuate from day to day, depending on current rates of growth and levels of physical activity. Many parents typically find their children eat better at certain times of the day. Tiredness and irritability may prevent children from eating, especially at the evening meal.
- *Preference for simplicity* – many children like simply prepared, mild-tasting foods they can easily identify. Children prefer foods they can manage, such as cut-up vegetables they can eat with their fingers or soups they can drink from a cup.
- *A child associates food with more than eating* – foods have unique meanings depending on the 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 influence the attitudes and practices related to food which the child carries throughout life.
- *Young children commonly dawdle over their meals* – it is quite normal for youngsters, who have no concept of time, to lose interest in any activity very quickly. (1)

Strategies for facilitating and monitoring food intake include:

- establish routines for meal times and snacks where the child and caregiver sit down and talk while they are eating;
- establish habits, such as milk with a meal, and water at bedtime, that will help ensure variety and nutritional adequacy;
- establish a 'snack-box' in the fridge or on the kitchen bench that the child can either access directly or be offered to select from. This can contain healthy snack foods (pieces of fruit, vegetables, cheese, small sandwiches etc). This helps to monitor what the child is eating between meals;
- begin the practice of having the child at the table for meal times early, when the infant is able to sit up and able to grasp foods;
- do not place too large a serve on the child's plate. It is better to give small amounts and have extra available if they want more; and

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- provide foods at mealtimes that it is known that 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 foods that the child dislikes but are liked by the rest of the family–continue to serve it but only place a small amount on the child's plate and accept it if the child does not eat it.

Food preferences

Parents and peers

Parental influences on food patterns are critical in the development of food preferences. (18) Parental pressure, even if it is positive, can affect a child's food acceptance. (15)

Using foods as rewards or presenting them paired with adult attention increases a child's preference for that food. (19) When foods are simply presented at snack time or when they are given without a social context, food preferences do not appear to be influenced.

Another influence on children's 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. When children observe adults consuming a food, it is more likely that the children will begin to consume the food. (20)

Peer influence can also affect the food preferences of children as children age (20); adolescents are particularly susceptible to peer group pressure. (21)

Television advertising

There has been much speculation in recent years about effects that advertising and the media have on the food preferences and intakes of children.

Concern has been expressed by public health and nutrition educators 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. (22) Producers of basic foods such as vegetables and fruits and agencies involved in promoting healthy diets frequently lack the funds required to provide some balance in the range of products advertised. However, there is no conclusive evidence that watching these

advertisements has a direct negative impact on the resulting nutritional quality of children's diets.

Several agencies have called for the food advertisements directed at children to be more closely regulated or for guidelines to be developed on the content and balance of advertisements screened. (23,24,25,26,27)

Table 3 provides an outline of some typical physical and social/ personal characteristics related to the eating practices of young children.

Social changes

There are some social trends which may also influence the food preferences and intakes of children:

- the increasing amount of meals purchased and, or, consumed outside the home. Children, either as part of the family or independently, purchase and consume foods from a wide variety of outlets, including child-care centres and school canteens (refer to the background paper for the guideline on variety for more discussion on this); and
- many of the foods and beverages currently available come into the home in a ready-to-eat or convenience form. There are packages of snack foods, biscuits and drinks, which are all easily accessible in the home.

PHYSICAL ACTIVITY

Physical activity during childhood and adolescence is a normal component of everyday activity for all children, including those with physical and other handicaps. Physical activity plays an important role in the physical growth and the development of a wide range of skills, and provides a mechanism for balancing energy intake and energy output.

The role of physical activity

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 a reduced energy expenditure although there is relatively little evidence that obese children as a group consume more energy than their non-obese peers. (28) There is evidence, however, that obese children are less active than lean children and that *inactivity is associated with an increased prevalence of obesity*. (29,30)

Table 3 Typical physical and social/personal characteristics related to eating during the preschool years

Age	Physical	Social/Personal
12-18 mth	• grasps and releases foods with fingers • holds spoon but use poor • turns spoon in mouth • uses cup but release poor	• wants food others eating • loves performing
18 mth–2 yr	• appetite decreases • likes eating with hands • likes experimenting with textures	• ritual becomes important • displays food preferences • distracts easily
2–3	• holds glass in hand • places spoon straight in mouth • spills a lot • chews more foods but choking still a hazard	• definite likes and dislikes • insists on doing it 'myself' • ritualistic • dawdles • food fads • demands foods in certain shapes, whole foods • likes to help in kitchen
3–4	• holds handle on cup • pours from small jug • uses fork • chews most foods	• improved appetite and interest in food • favourite foods requested • likes shapes, colours, ABC's • able to choose between two alternative foods • influenced by TV commercials • likes to copy food preparer
4–5	• uses knife and fork • good use of cup • good self-feeder	• rather talk than eat • food fads continue • motivated to eat by incentives • likes to help • interested in nature of food and where it comes from • peer influence increasing
5–6	• independent at feeding	• conforming • less suspicious of mixtures but still prefers plain foods • social influence outside home increasing • food important part of special occasions

Source: Network of the Federal/Provincial/Territorial Group on Nutrition and the National Institute of Nutrition (1).

Between 12 and 18 years of age the average amount of regular physical activity decreases by 50 per cent; boys are consistently more active and fitter than girls. (31) A similar pattern of fitness was evident in the Health and Fitness Survey of Australian school children 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.* (32) Activity patterns that develop during childhood and adolescence carry over to later life and affect morbidity and longevity.(33,34). It is clearly 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 relation to 'fitness' and 'fatness' in childhood and adolescence, but also in relation to later susceptibility to chronic diseases.

Impact of television on physical activity

In a study of Geelong adolescents (35) the average number of hours of television viewing per week (16 and 18 hours respectively for boys and 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 to 12 year old American children. (36). Williams and Handford (37) have noted a direct inverse relationship between the time spent watching television and the time spent engaged in active sport, while Tucker (38) found that adolescent boys who watched television for less than two hours per day had significantly greater cardiovascular fitness than their peers who watched more than four hours of television daily.

OVERWEIGHT AND OBESITY

Comparable statistics on obesity in children are difficult to obtain. This is partly because different criteria have been used to define overweight and obesity in different age groups and because different growth references have been used as the basis for the derivation of the various indices which have been used to assess the prevalence of overweight or obesity.

In Australia the main concern in recent years has been with the early development of overweight and obesity, on the basis that a high proportion of fat babies and children were destined to become fat adults. (39) Some of the concern regarding obesity in infancy has proved to be unjustified and it is now recognised that obesity persists in only a minority of fat infants after the first year or two of life. (40)

Prevention remains important however, as retrospective studies of obese children show that about one half of such children were already obese by the age of one year. Similarly, for obese children who are referred to hospital clinics about 80 per cent remain obese as adults. It has, however, been suggested that this observation does not mean that prevention and treatment of childhood obesity would necessarily have a great impact on the much larger problem of obesity in adult life. (28) For example, in a large cohort of men and women who at the age of 26 years exceeded the standard weight by 20 per cent or more, only 7 per cent of the men and 13 per cent of the women had been obese at the age of seven, while 28 per cent of the men and 45 per cent of the women had been obese at the age of 14. Thus, prevention and, or, effective treatment of obesity during the first decade of life would have had relatively little effect in reducing the prevalence of obesity in these young adults.

During the second decade, successful prevention or treatment theoretically could have reduced the number of young overweight women by one half and young men by one third. Similar results were found in a study of Australian adolescents for whom earlier weight and height data were available at birth, one year and 80 months of age. (41)

Metabolic consequences of obesity

Obese children may have early signs of metabolic and clinical consequences that are well recognised in adults, including hyperinsulinaemia and hypertriglyceridaemia, particularly during adolescence. (42) Additionally, obese children have been shown to have a reduced exercise tolerance, and therefore get reduced benefits from exercise. (43)

Psychological problems of obesity

The major ill-effects of obesity during childhood are social and emotional. (43) Obese people are stigmatised and labelled with undesirable behavioural characteristics ranging from suspected social deviance to an inordinate desire for self-gratification. (44) Stunkard and Burt (1967), cited in Johnston (44) suggested that the disturbance of body image reported among obese adults seems to have its origin during adolescence when derogation and peer pressure have particularly deleterious effects.

Management of obesity

Information about the recognition and management of different types of obesity during childhood and adolescence and on the prevention of nutritional obesity is provided in the NHMRC 'Statement on obesity in childhood and adolescence'. (45) This statement stresses the need for *all* children who present with obesity to be appropriately assessed in order to obtain a diagnosis which adequately explains the obesity and determines the appropriate management strategy. Inappropriate advice, such as participation in weight loss programs designed for adults, is likely to be not only harmful but also ineffective. Effective treatment of nutritional obesity during childhood and adolescence depends primarily on providing family and peer support and encouragement to maintain an appropriate level of energy intake combined with a more energetic lifestyle.

UNDERWEIGHT, FAILURE TO THRIVE AND DIETARY RESTRICTION

The most serious consequences of inappropriate food intake in infancy and early childhood are underweight and failure to thrive.

In Australia concerns about the prevalence of underweight in infancy and childhood have in recent years largely focused on Aboriginal communities, where the problem of underweight and failure to thrive is primarily related to poor living conditions. (46)

However, failure to thrive among other sections of the community is also most commonly due to psychosocial factors, including poor living conditions. (47) 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 in-patient and out-patient populations in the non-Aboriginal community. (48)

There is evidence from the literature that from time to time cases of failure to thrive also occur in more affluent segments of the community as a consequence of inappropriate restriction of the dietary intake of young children by parents because of fears about obesity and atherosclerosis or the development of 'unhealthy' dietary habits. (49) Such cases, however, are relatively rare compared with the problem of dietary restriction in older children and adolescents. (50)

Perception of body image

A recent Australian study of 133 girls aged 12-14 years living in Sydney found that while 18 per cent could be classified as underweight and 26 per cent as 'fat'; 37 per cent thought that they were too fat and 42 per cent were on a diet to lose weight. (51) Data from the National Dietary Survey of Schoolchildren in 1985 (52) indicated that girls increased their energy intake by less than 10 per cent between ten and 15 years of age whereas over the same age range boys increased their intake by some 45 per cent.

Although the reported dietary data probably exaggerate the real extent of the dietary restriction because of the tendency for reported dietary intake to underestimate habitual intake, (53) the data do suggest that there is a real need to combat the fear of weight gain in this age group by appropriate information and support. Adolescents firstly need reassurance that appreciable weight gain, changes in body shape and increases in food intake are quite normal at this time and secondly 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 longer term health status.

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. (54,55) There are also reports of children having similar weight-related concerns. (50)

These characteristics are more prevalent in females than males. A Melbourne study of year 11 students found that 57 per cent of females had dieted to lose weight, while only 18 per cent of the males had done so. (56) 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 not eating between meals and exercising, to self induced vomiting and abuse of laxatives and diuretics. (57) Similar weight control practices have been reported amongst 15 year old New Zealand girls (58) and Adelaide women aged 18 to 86 years. (59)

Abraham and Mira (57) consider that most adolescent females experience a phase of 'disordered' or' abnormal' eating behaviour. They attribute this to social pressures on young women to be slim and the association of slimness with health, happiness and

attractiveness. This pressure is combined with the biological changes that females experience during adolescence (widening of the hips and deposition of fat on the hips and breasts).

Estimation of the prevalence of anorexia nervosa and bulimia nervosa in Australia are limited. These conditions are often described as affecting large numbers of adolescent girls and young women. However, Ben-Tovim and Morton (60), in a study of the prevalence of anorexia nervosa in a population of 5,705 South Australian girls aged 12 to 18 years, found that true anorexia nervosa was a relatively rare disorder, with a prevalence of 1.05 cases per thousand of the population studied. This study adopted quite rigorous criteria for the definition of anorexia nervosa, and did not indicate the prevalence of more general eating disorders which could potentially lead to the development of anorexia nervosa or bulimia nervosa. However, the study was of one year's duration and the authors stated that none of the milder variants of anorexia nervosa amongst the study population became more severe during the study period.

An earlier study by Ben-Tovim et al (61) on 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 in the community samples were able to be categorised as bulimic. However, when defined with reference to the behaviour of patients undergoing treatment for bulimia nervosa (who not only binge over-ate but took active steps to prevent the weight gain of their overeating), a very different picture emerged; the prevalence of bulimia in the female community was approximately 1 per cent to 2 per cent.

Thus, it would appear that while a small percentage of the female population develops clinical eating disorders, a great many more display disrupted eating behaviour and weight-control problems. As there are indications that children also exhibit some characteristics of disordered eating and concerns about body weight, prevention needs to be aimed at children and young women. Such a program would help young women to accept a wide range of weights and body shapes as being normal and help them develop mechanisms by which to cope with the prevailing societal attitudes to weight and body shape. (57)

RELATIONSHIP TO OTHER GUIDELINES

- Encourage and support breastfeeding. The background paper to this guideline discusses the occurrence of failure to thrive in breastfed infants; and
- Eat foods containing calcium. The background paper to this guideline discusses the importance of adequate intakes of calcium and physical activity in achieving peak bone mass.

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CHAPTER 3

ENJOY A WIDE VARIETY OF NUTRITIOUS FOODS

Encouragement to eat a wide variety of foods is important in childhood and adolescence because growth and maturation are taking place and future eating habits are being established. (1) Variety is a key issue in the development of healthy eating behaviour. The consumption of a wide variety of foods makes it less likely that excessive or inadequate amounts of any one nutrient or other food component will be consumed.

Good eating habits begin in childhood. Parents and other caregivers can set a good example for children to follow by providing a wide variety of foods, regular meal patterns, and sufficient 'training' to establish good dietary behaviour.

INFANTS

Introduction of solid foods

Whereas the infant nursing at the breast of a healthy mother serves as the model for optimal nutrition for young infants, no such model is available for the older infant. (2)

The term 'introduction of solids' describes the process through which the infant, having previously been fed solely on milk, gradually becomes accustomed to a variety of other foods until it can deal with the general family diet. The term is preferred to 'weaning' because it more appropriately conveys that this process does not mean the cessation of breastfeeding. (3)

The main issues involved in this process are:

- at what age should solid foods be introduced?;
- what foods should be introduced?; and
- how should foods be introduced? (3)

When should solid foods be introduced?

Traditionally, the period between four and six months of age has been viewed as being suitable for infants to begin to adapt to different foods, food textures and modes of feeding. (3,4,5,6,7) Although foods introduced at 4 months of age are not important nutritionally, the gradual inclusion of solid foods in the diet from this age enables the infant to gradually become used to different foods and textures. This gradual introduction to new foods means that by six months of age, when these foods do begin to become

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important nutritionally, the infant is more likely to be able to cope with them.

Additionally, this age has been identified as a time when:

- the infant's appetite and nutritional requirements are generally no longer satisfied by breastmilk or infant formulae alone. (8,9) Stores of several nutrients, such as iron and zinc, are often failing in exclusively milk-fed infants (both breast and formulae-fed). (8) (Iron status is a particular concern and is discussed in more detail in the guideline on iron); (3)
- the development of feeding behaviour has progressed from sucking to biting (and subsequently chewing by seven to nine months); (9) This is attributable to the disappearance of the tongue-extrusion reflex (2,3,4,10) and the increasing ability to sit without support, which allows greater manipulation of food before swallowing so that thicker boluses of food can be handled; (4,7)
- the digestive system matures. The young infant's digestive system cannot cope with foods other than milk in the early months. Salivary amylases are present at birth, however it appears that pancreatic amylases are essentially absent up to at least three months of age, and remain inadequate up to six months. Thus, the ability to digest starches is limited, if not absent, until the middle of the first year of life; (3) and
- also by four to six months, most infants have developed some interest in their environment, and at that time become more willing to accept new textures and flavours. It is therefore appropriate to exploit this exploratory phase by the gradual introduction of new food tastes and textures.

Cultural, social and medical factors also appear to influence the age at which solids are introduced. There is a tendency for formulae-fed infants to be started on mixed feeding earlier than those who are fully breastfed. Different societies also have their own traditions about what food is most appropriate to begin with (3) and culturally appropriate foods and preparation methods should be encouraged when these are nutritionally adequate.

The following possible consequences of inappropriate timing of introducing solid foods have been described:

- Introduction too early may lead to:
  - increased morbidity due to diarrhoea and food allergies;
  - undernutrition due to the normal decrease in maternal milk production as the baby is withdrawn from the breast (5)
- Introduction too late may lead to:
  - faltering growth;
  - decreased immune protection; and
  - increased diarrhoeal disease and malnutrition when exclusive breastfeeding becomes inadequate. (5)

What foods should be introduced?

The general timetable for the introduction of foods starts with iron-enriched infant cereals at four to six months, then vegetables, fruits, meats, poultry and fish are added gradually as the infant becomes accustomed to them. There are no set rules about the order in which these should be introduced. (7,8)

An increasing range and amount of foods should be offered in the second six months—solid foods should provide an increasing proportion of the energy intake because infants grow rapidly during this time. Variety is likely to cover the needs for most nutrients and provide a basis for healthy eating habits. (8) The process should lead to consumption of a wide variety of family foods by the end of the first year of life. (3,4)

How should foods be introduced?

The following general recommendations for the introduction of foods apply:

- foods should be introduced individually; no salt, sugar or other material should be added, only water, breastmilk or formulae for dilution. A small amount of cow's milk is also suitable for dilution (see the discussion on cow's milk below); (3)
- new foods should be offered no more frequently than each four to five days initially, to avoid confusion and rule out the possibility of food allergy or sensitivity.; (3,7,8)

RESTRICTED

- 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 the child's wider selection of foods later on. The use of family foods will help ensure that the child will soon get used to eating like the rest of the family; and (7)
- caution should be observed early on to choose food of an suitable texture for the child's age and development. (7) Small hard pieces of foods such as nuts and seeds should be avoided because they can be inhaled and cause choking.

The first foods introduced should be soft and have a smooth texture. The infant will quickly learn to cope with food 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 the infant is able to hold things, finger foods such as pieces of fruit, vegetables or bread can be offered. Other foods, such as meats, can be chopped into small pieces at this stage.

Feeding bottles should be used only for breast milk or infant formulae. Comfort sucking on a bottle can become a habit which is hard to reverse. Lidded feeding cups should therefore be used for any other liquids from six months of age.

Other milks

Infant formulae

Modern infant formulae provide a suitable form of nutrition when an infant, for whatever reason, does not have access to breastmilk. Traditional formulae are based on cow's milk, with varying proportions of casein and whey proteins. More recently, formulae based on soy or goat's milk and lactose-free formulae have been developed for those infants who are intolerant to cow's milk or lactose.

This issue is also discussed in the background paper to the guideline on breastfeeding. A list of standard, follow-on, soy and goat's milk infant formulae currently available in Australia is at Appendix 4.

PREVIOUSLY RECOMMENDED

Follow-on formulae

Breastmilk is the preferred milk for infants up to 12 months of age. Where breastmilk cannot be offered, for whatever reason, a standard infant formulae should form the main milk component of the diet for infants up to 12 months of age.

The rapid increase in the development of follow-on formulae in the 1980s led to a recommendation by the World Health Assembly that it is unnecessary to change to follow-on formulae at six months of age. (11) This recommendation is supported by the American Academy of Paediatrics Committee on Nutrition which states that, while the iron fortification contained in follow-on formulae 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 currently used methods of feeding for infants at this age. (6)

Cow's milk

A number of organisations and individuals have recently made recommendations relating to the delayed introduction of cow's milk as the major source of milk until after the first year of life. (7,12,13,14,15,16)

Cow's milk is not recommended for infants younger than 12 months of age for the following reasons:

- cow's milk is a poor source of iron and the iron in cow's milk is poorly absorbed. Introducing cow's milk before 12 months of age predisposes an infant to iron deficiency at an age when the infant's iron stores become depleted; (15,17,18)
- the composition of cow's milk is not ideal for infants. Cow's milk contains higher levels of protein, sodium, potassium, phosphorous and calcium (13,16,19) and lower levels of iron, vitamin C and linoleic acid than breast milk or infant formulae, adding to the difficulty of providing a balanced diet for older infants; (Refer Table 1)

Table 1 Concentrations of the components of breastmilk and cow's milk (mean values per 100 ml)

Component	Breastmilk	Cows milk
Energy (kJ)	293.0	281.0
Protein (g)	1.3	3.0
Carbohydrate (g)	7.4	4.8
Total fat (g)	4.2	3.9
Linoleic acid (mg)	285.0	52.0
Vitamin C (mg)	3.8	2.0
Sodium (mg)	15.0	50.0
Potassium (mg)	60.0	150.0
Calcium (mg)	35.0	120.0
Magnesium (mg)	2.8	12.0
Phosphorous (mg)	15.0	95.0
Iron (ug)	76.0	50.0
Whey/casein ratio	60/40	20/80
Renal solute load (mOsm/kg H2O)	79.0	221.0

Source: Committee on Medical Aspects of Food Policy (20)

- the high phosphorous and calcium content of cow's milk may decrease the bioavailability of iron from other dietary sources such as infant cereals; (13,15,18)
- 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; and (16,21)
- cow's milk feeding has been shown to lead to increased gastrointestinal tract blood loss in a large proportion of normal infants, further adding to the problem of iron deficiency. (22)

The issue of iron status and deficiency is discussed in more detail in the background paper to the guideline on iron.

RESCINDED

Therefore cow's milk is not recommended for use as the main source of milk for infants aged less than 12 months. However, small amounts of cow's milk in foods such as breakfast cereal, yoghurt and custards that are prepared for the rest of the family can be given.

Table 2 outlines some of the limited data available on the use of cow's milk in infancy in Australia.

Table 2 Proportion of infants fed on cow's milk at before 12 months of age in Australia

		Per cent consuming cow's milk			
Authors/year	**Ref**	**6 weeks**	**3 months**	**6 months**	**12 months**
Hitchcock and Owles, 1980	23	NS#	1.5	14~	NS
Boulton, 1981	24	NS	23	41	84
Williams and Carmichael,1983	25	25	NS	50	>80
Hitchcock and Coy, 1988	26	NS	NS	30	90

#NS = Not stated
~ = approximately

CHILDREN

Toddlers and preschoolers

As discussed in the background paper to the guideline on growth, the period between a child's first and fifth birthdays is a time of rapid social, intellectual and emotional growth. (27) This period is also characterised by a slow down in growth rate, which may be reflected in a less reliable appetite. Children are also discovering their independence and testing their choice in food selection which may lead to less interest in eating what the rest of the family eats.

RESCINDED

These factors combine to give the impression that some younger children are 'poor' or 'difficult' eaters. (17,27) 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 whatever reason, nutritional deficiencies can occur.

It is typical for children of this age to exhibit enormous variation in the amount of food eaten at different meal times. However, although children's food intake varies greatly from meal to meal, daily energy intake is relatively constant, because children adjust their energy intake at successive meals. (28) Food intake also varies significantly between individuals. (10,27)

Toddlers and preschoolers must regularly consume adequate energy to grow normally. (17) Caregivers should be reassured that a child's perceived 'erratic' eating behaviour is common for this age and that the most appropriate way to deal with the situation is to offer and encourage the consumption of a wide variety of foods.

A number of diets that are recommended for and consumed by adults for good health may be unsuitable for young children. This applies particularly to inadequate intakes of fat for this age group and is discussed in more detail in the guideline on fat.

Good eating habits begin at home, but consideration should also be given to other food consumed outside the home. More 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).

Limited information is available on the nutritional quality of food provided in long day care centres in NSW. In two separate studies, weighed records were used to determine whether the centres were meeting the level of 50 per cent of the RDI for nutrients recommended by the NSW Department of Health. Both studies showed that the nutrient content of the food served in the centres met the NSW Department of Health guidelines except for energy, iron, calcium and zinc. Clearly, further studies are required on the total daily diet of children who attend these centres, to determine whether food intake at the centres is adequate and whether the recommendation that long day care centres provide 50 per cent of the RDIs is appropriate. (29, 30)

School children

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

Two important considerations apply for this age group:

- School children select and consume food without supervision. Unlike the preschooler, 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 earn pocket money, which provides them with the means to purchase those foods which they find desirable. A variety of factors will influence this perception of desirability, including family, friends and the media.
- The school canteen provides children with the opportunity to select their own meals. Depending on the frequency with which children purchase their lunches from the canteen, this could make an important contribution to their views about food and their nutrient intake. In recent years there has been a shift towards the provision of healthier food choices in the Australian school canteen. This shift often has been combined with the introduction of broader school education programs on nutrition and health, which provide the information that helps children to select and consume a healthy, varied diet. (10)

ADOLESCENTS

Adolescence is a transitional stage when the structure of food habits is loosened. (8) It is a time of new independence and diminished family influence, especially over food intake.

The need for variety is also 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 (refer Appendix 2).

Adolescence is often perceived as being a time of erratic eating behaviour. Truswell (8) identified those aspects of eating behaviour that are different or more pronounced in adolescents than other people and may cause concern in the older generation. These are listed in Table 3.

Table 3 Facets of eating behaviour that are different or more pronounced in adolescents than other people and may cause concern in the older generation

Behaviour	Comments
missing meals	especially breakfast
eating snacks and confectionery	the major snack is usually in the afternoon after school
takeaway foods	
unconventional meals	those eaten in combinations and permutations that other members of the family do not approve of, but which often add up to an adequate nutritional mix
experimentation with alcohol	
soft drinks and other fun drinks	these are preferable if they are an alternative to alcohol, but otherwise displace water and milk
distinctive likes and dislikes	
high energy intakes	occurs near height velocity in girls (age 12) but in boys may come later than the age of peak height velocity (age 14)
low levels of intake of some nutrients	iron, calcium and in some studies vitamin A, C and zinc
dieting	

Source: Truswell (8).

Two issues of particular concern in adolescence are:

- Dieting and concerns about body image. This is discussed in detail in the background paper to the guideline on growth.
- Pregnancy in adolescence. Adolescence is a period of high nutrient needs—dietary intakes below recommended amounts commonly reported for both pregnant and non-pregnant adolescent girls. (31) However, nutrient demands are higher and the consequences of inadequate nutrition more serious for pregnant adolescents than pregnant adults. In particular, pregnant adolescents face increased risks of pre-eclampsia, low birth weight infants and perinatal infant death. (32)

RESCINDED

Studies separating out the individual effects of maternal factors (socioeconomic and behavioural factors, reproductive maturity, maternal emotional stress, nutritional deficiencies etc) on birth weight indicate that maternal weight gain is one of the most important indicators of infant birth weight, especially among adolescents. (33) It has been suggested that encouraging young adolescents to gain more weight than the standard recommendation of 9–14 kg during pregnancy may be one way to decrease their risk of delivering low birth-weight infants. This suggestion is based on an assumption that adolescent mothers may need to gain more weight during pregnancy than adult mothers because adolescents may still be growing and may have nutritional requirements that compete with and pre-empt those of the foetus. This concept is controversial because it is not known whether adolescents continue to grow during pregnancy. (33)

Deficient intakes of iron, calcium and zinc and vitamins A, C and folate commonly are reported to be of concern in the diets of pregnant adolescents. (33,34) 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 birth weight. Additionally, these low reported intakes of folate are of concern given the relationship between low intakes of dietary folate and higher risk of neural tube defects such as spina bifida. (35) Because these deficiencies have been reported to occur with increased frequency during adolescent pregnancies, it has been suggested that a safer and more appropriate way to reduce the incidence of low birth weight deliveries in adolescents would be to address these specific nutritional deficiencies rather than to aim to increase total maternal weight gain. (33)

There is limited evidence to suggest that adolescents improve the quality of their diets during pregnancy. Skinner et al (31) compared existing dietary data from different groups of pregnant and nonpregnant adolescents and found that pregnant adolescents consumed more milk and dairy products, citrus fruits and juices than non-pregnant adolescents; it was suggested that these foods substituted for carbonated beverages and tea and coffee. They also consumed more breads, cereals, vegetables and confectionery. However, this study did not measure the actual changes that adolescents make to their diets once they become pregnant.

SUPPLEMENTS

Vitamin and mineral supplements are not necessary for healthy, full-term infants or children. (7,36) The only exception to this may be fluoride.

Fluoride supplementation in the breastfed infant is controversial because there is no evidence to suggest that supplementation in the first six months of life alters the prevalence of caries in secondary dentition. (36) However, it is known that unerupted teeth are being mineralised in early infancy and supplemental fluoride would be expected to be beneficial during this period. (36)

NHMRC has expressed concern about the intake of supplementary fluoride by:

- formulae fed infants who obtain fluoride from both the formulae and the water used in its reconstitution (in fluoridated areas); and
- young children who use fluoride drops, tablets, topical applications and fluoridated toothpaste.

NHMRC recommended that proposals be developed to reduce the likelihood of excessive ingestion, by young children, of fluoride from infant formulas and fluoridated toothpaste and that the public be educated on the appropriate use of fluoride supplements in the presence of a fluoridated water supply. (37)

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 per meal and higher needs for nutrients per unit weight. (38)

Each diet must be assessed separately for appropriateness for children; if the regimen becomes very restrictive in the type and amount of animal proteins consumed, it becomes essential to plan a diet carefully that will avoid deficiencies. (38)

In general, lactovegetarian and lacto-ovovegetarian diets provide adequate nutrition if appropriately designed.

Vegan diets constitute more of a risk unless sufficient care is taken to ensure that the diet provides adequate energy, vitamin

B12, protein and iron. (38,39) The background paper to the guideline on breastfeeding discusses the vitamin B12 status of vegan mothers and its effect on the B12 status of breastfed infants.

Food allergy and intolerance

Widespread attention has been given in recent years to the subject of food and drink allergies in children. This has resulted in a number of misconceptions about the manifestations and incidence of such disorders and the misguided use of elimination diets. (40)

NHMRC recommends that:

- 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 one 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; and
- if it is necessary to adopt an elimination diet or to exclude of 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. (40)

RELATIONSHIP TO OTHER GUIDELINES

- Encourage and support breastfeeding. The use of infant formulae if breastmilk is not available, for whatever reason, is discussed.
- Children need appropriate food and physical activity to grow and develop normally. Growth should be checked regularly. This background paper outlines the concerns of adolescents in relation to dieting and body image.

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- Low fat diets are not suitable for young children. For older children, a diet low in fat and in particular, low in saturated fat, is appropriate. The inappropriate restriction of fat in infancy and early childhood is discussed.
- Eat foods containing iron. This background paper discusses iron deficiency in childhood and adolescence.

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UNDER REVIEW

CHAPTER 4

EAT PLENTY OF BREADS AND CEREALS, VEGETABLES (INCLUDING LEGUMES) AND FRUITS

There is a need to promote better choices within the cereal, vegetables and fruit foods, with a greater emphasis on the core forms (eg breads, rice, pasta, breakfast cereals, with little or no added fat, 'fresh' or cooked forms), on the total quantities eaten, and on their regular and frequent inclusion in the daily diet. These foods also should be promoted as preferred snacks. Variety in cereals, vegetables and fruits is to be promoted and encouraged in the development of food habits.

It is particularly important to promote the more regular consumption of fruits and vegetables and to encourage the consumption of fresh or cooked fruits rather than juiced forms. There are nutritional gains to be made by promoting breakfast as a daily meal.

INFANTS

Breads and cereals, vegetables and fruits are the major non-milk (breast or infant formulae) components of the diet of the infant.

These foods provide essential nutrients and food experience for the infant over the age of four to six months. Cereals, such as rice or oat porridge, which are good sources of a range of essential nutrients, and which can be prepared to different levels of viscosity, are recommended for inclusion in the diet early in the process of introducing solids. These inclusions represent a supplementary iron source for the infant. Bread fingers, whether white or wholemeal, are convenient finger foods and they provide healthy alternatives to sweet snacks. Vegetables and fruits follow (then meats and fish), in the process of introducing the infant to a wide range of new experiences in the flavours, colours and textures of foods, and these foods provide additional nutrients in the diet.

Cereals, breads (of all types-white, wholemeal, mixed grain, rye), vegetables and fruits also offer new tactile experiences and the development of physical skills related to the manipulation of foods with implements and fingers, and the chewing of foods. These foods are not only major components of the meals of the family and infant, but they also provide nutritionally and educationally suitable options for the many snacks required by the infant and young child.

Successful and imaginative introduction of these foods in a variety of physical forms and combinations prepares the child for the family food preferences and meal patterns, and determines initial attitudes to food and food-related situations.

Table 1 Energy density of common foods, kJ per gram food, g food per 100kJ, and common measure providing 100kJ

Food		kJ	g	Common measure
Milk Products	Human milk*	2.9	34.5	2T
	Infant formulae	3.0	33.8	2T
	Cow milk	2.7	36.8	150 mL
	Yoghurt, natural	3.0	32.5	1/5 tub
	Cheese, cheddar	17.0	6.0	1/4 comm sl
Fruits	Apple, raw	2.1	48.3	1/3 medium
	Banana, raw	3.6	28.0	3.5cm long
	Orange, raw	1.6	64.0	1/2 medium
	Juice, no added sugar	1.5	68.0	1/4 cup
	Pear canned in pear juice	1.8	55.5	1 half+1T j
	Infant, strained	2.2	46.0	2 1/2T
Vegetables	Potato, boiled	2.6	37.5	1/4 med.
	Pumpkin, boiled	1.8	56.3	1/3 cup
	Peas, boiled	2.0	50.0	1/4 cup
	Carrot, raw	1.0	100.0	1 1/4 med.
	Green beans, boiled	0.7	145.0	1 cup
	Baked beans, (haricot), canned*	3.6	27.5	1/8 cup
	Kidney beans, boiled	4.8	21.0	1/8 cup
	Beans, mixed, canned	3.6	27.5	1/8 cup
Cereals	Oats, cooked in water	2.1	47.5	2 1/2T
	Cornflakes,ricebubbles	15.0	6.5	1/4 cup
	Wheat flakes	14.0	7.3	1/4 cup
	Infant cereal, mixed type dry	15.0	6.8	2T
	Bread, white or w/meal	10.0		1/3 slice
	Rice, brown, boiled	6.3	16.3	2T
	Pasta, w/meal, boiled	5.5	18.8	8 strands
Meats, trimmed	Beef, minced, stewed	8.3	12.0	3t
	Lamb, minced, stewed	9.1	11.0	3t
	Pork, minced, stewed	8.7	11.5	3t
	Chicken, ckd, no skin	7.8	15.8	3t
	Egg, boiled	6.3	16.0	1/3 egg

* = data from Holland et al (1) all other data from Composition of Foods Australia, 1989–1992 (2,3,4,5)

T = level metric tablespoon (20 mL)

t = teaspoon

cup = level metric cup (250 ml)

j = juice

comm = commercial

med. = medium

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It is nutritionally important to introduce and promote these foods in the diet of the infant and young child, but these foods, such as vegetables and fruit, are bulky and have a low energy density.

Table 1 gives a comparison of some common foods that provide the basis of a healthy diet. The comparisons are for the energy in a unit weight of food (kJ/g), and the amount of food (in g and as a common measure) to provide 100 kJ energy. Figure 1 compares the recommended intake for energy at different ages. For infants (0 to 12 months) the direct RDI applies. The energy per kilogram body weight at other ages is derived from the mean RDI for age, and the 50th percentile of weight for age. (6,7) The latter are for comparative purposes only, because energy requirements vary greatly with stage of growth (which is individual) and exercise patterns in children.

TODDLERS

Figure 1 indicates that, relative to weight, energy requirements are highest in the preschool years, increase from six months of age, peak in the toddler period and then generally decrease with age. Yet during this period of highest energy need (infancy and early childhood) the stomach capacity is small and limiting and rapid social and physical changes occur that affect food intake. New foods and new eating patterns are introduced, the child develops physical independence, (including self feeding). Many of the 'distractions' (eg play, other activities) for both the parent and the child influence food intake—often negatively.

Cereal-based foods generally provide more energy per unit weight of food (eg they are of higher nutrient density) than breast milk or infant formulae. Fruit and vegetables provide less energy per unit weight (Table 1). Moreover, in the forms eaten, these foods are bulky—they require chewing, take longer to consume than milks and satisfy the appetite. The use of legumes (eg kidney, mixed or baked beans) in the diet of young children has the advantage of a higher energy content per unit weight of food than most vegetables. Legumes are generally available dried and canned; canned beans are easier to mash or chew.

Table 1 also shows that, for the same energy intake, a small child has to consume a larger volume of fruits and vegetables and some cereals than milk. This difference in consumption together with their small stomach capacity, is reflected in the need for young children to regularly eat small meals and nutritious snacks. If the diet of the toddler and pre-school child is to include and promote the consumption of these healthy foods particular attention must be given to the use of breads and cereal foods, vegetables and fruits as snacks, as well as the major components of main meals.

This early period in which food choices and food habits are being formed is nutritionally vulnerable for the young, dependent child. (8) With the extreme reliance on cereals, fruits and vegetables in the diet, (eg that typical of vegans and to a lesser extent vegetarians), the composition of the diet affects not only bulk and energy intake, but also the intake of major essential minerals such as calcium, iron, and zinc. (9) The intake of these nutrients is lower, and their bioavailability is lower because of the high levels of dietary fibre, phytate and oxalates (10) and the absence of food enhancers of absorption (eg meat enhances inorganic iron absorption). (11) High fibre intakes decrease the bioavailability of amino acids and, therefore, total nitrogen, in the diet. (8) The frequent bulky bowel actions that accompany such diets also reduces absorption of nutrients from such diets.

Energy density, bulk and feeding frequency are important considerations in determining the total diet and eating patterns of the young child. Cereals, fruits and vegetables, which are nutritionally important foods, need to be established and promoted in the usual diet of the young child. Wheat-based cereals (white or wholemeal breads, crumpets, pastas, muffins or breakfast cereals) provide the type of fibre that assists with faecal bulking and normal bowel function, and reduce the risk of constipation. Whether 'white' or 'wholemeal' flour forms the basis for these products, cereal-based foods are excellent sources of many essential nutrients.

Children share the common eating habits of adults by the age of two (12) and in the period from one to three years, the proportion of energy from cereals, meats, fish and eggs decreases, and the proportion from sweet biscuits, cakes, fruit juices and high added sugar foods (cordials, aerated drinks, confectionery) increases. Such changes in eating habits decrease the nutrient density of the diet, and, thus, they are inconsistent with the long term health and nutrition objectives of the 'Dietary guidelines for Australians'. (13)

SCHOOL-AGED AND OLDER CHILDREN

There have been few studies on the dietary intakes of Australian children. The studies focus mainly on older school-aged children (over ten years), and little information is available on preschool or early primary school children, or adolescents aged over 15 years. Further, with few exceptions, the presentation of the data has focused on nutrient information, and not the foods consumed, or foods as sources of nutrients. The major exception is the information from the 1985 National Dietary Survey of school children of 5,224 Australian children aged ten to15 years. (14,15) These data are the major source of the information about the food consumption patterns of children and young adolescents.

Identifiable cereals, fruits and vegetables (including juices and drinks) contributed over 80 per cent of the dietary fibre in the diet of ten to 15 year old children. (15) Mixed foods containing cereal, vegetable or fruit components, including pies, hamburgers, savoury snacks, soups and condiments, contributed the remaining fibre. The total fibre level was the equivalent of 2.07 to 2.28 g per 1000 kJ. Similar levels were reported in other studies, of children aged six, eight and 14 to 15 years and adults aged 18 to 34 years, that mainly describe nutrient intakes. (16,17,18) Fibre densities shown in Table 2 show that these studies have found similar total proportions of cereals, fruits and vegetables in the diets of children. For adults, the nutrient density of fibre has been reported in younger male adults (between 18 and 34 years) as 2.0 to 2.05 g per 1000 kJ and 2.35 to 2.6 g per 1000 kJ in women (19,20); the nutrient density of fibre increases further with age, which suggests that the adult diet has a higher proportion of these foods than is in the diets of children (aged six to ten years) or adolescents (aged 14 to 15 years).

For older children and adolescents, cereals (including breads, breakfast cereals, rice, pasta, biscuits, cakes, pastries), fruits (including fresh, dried, canned and juice) and vegetables (including raw, processed and cooked forms) are major contributors to the nutritional quality of the diet, particularly complex carbohydrate, dietary fibre, iron, magnesium, retinol equivalents, thiamin, riboflavin, and vitamin C. In the reported diets of children aged ten, 12 and 15 years from the national dietary survey, these foods provided over 40 per cent of the energy intake for boys and girls. The percentage decreased for boys, from 44.5 per cent at age ten years to 41.8 per cent at age 15 years, but remained more constant for girls providing 43.6 per cent at age ten years, 43 per cent at age 12 years and 43.5 per cent at age 15 years. (21)

Table 2 Fibre density* in the diets of children and adults

Age yrs	Sex	Sample number	Dietary fibre g per 1000 kJ	Source
6	M	91	1.96	(12)
	F	63	1.99	
8**	M	78	2.02	(13)
	F	63	1.85	
10	M	453	2.2	(10)
	F	465	2.15	
11	M	459	2.16	(10)
	F	460	2.12	
12	M	456	2.1	(10)
	F	479	2.11	
13	M	430	2.11	(10)
	F	414	2.17	
14	M	429	2.07	(10)
	F	380	2.26	
15	M	404	2.09	(10)
	F	395	2.28	
14–15	M	77	1.63	(11)
	F	67	2.02	
18–29	M	363	2.0	(15)
	F	468	2.6	
25–34	M	823	2.05	(14)
	F	869	2.35	

* group means
** median intakes

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Table 3 shows the contribution of these foods to the diets of the children in the survey. Suggestions for including cereals, vegetables and fruits are outlined in Table 4.

Table 3 Contribution of cereals, fruits and vegetables to the intakes of children in the 1985 National Dietary survey of school children aged 10 to 15 years

Nutrient	Per cent contribution	Per cent RDI
Protein	~ 30	50
Dietary fibre	>80	
Calcium	18 – 22	
Iron	62 – 64	57 – 109*
Magnesium	~55	54 – 80*
Zinc	~32	
Retinol equivalents	36 – 47	51 – 80+
Thiamin	54 – 61	68 – 91#
Riboflavin	30 – 36	40 – 61@
Niacin equivalents	36 – 41	51 – 75^
Vitamin C	>90	400 -- 500

* The lower figure is for girls aged 12 years and the higher one is for boys aged ten years

\+ The lower figure is for boys and girls aged 12 years and the higher one is for boys and girls aged 10 years.

\# The lower figure is for girls aged 12 years and the higher one for boys aged 15 years.

@ The lower figure is for girls and the higher one is for boys aged 15 years

^ The lower figure is for girls aged 12 years and the higher one for boys aged 15 years.

Source: Department of Community Services and Health, unpublished data. (21)

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Table 4 Suggestions for snacks based on breads, cereals, vegetables and fruits (22)

- Sandwiches made with peanut butter, VegemiteTM, cheese or cottage cheese, lean meat slices, tuna or jams and jellies.
- Homemade oatmeal biscuits (fat and sugar can be reduced by at least one third without affecting quality).
- Slices of homemade cake or loaf made with less fat and sugar.
- Unsweetened muesli or other wheat cereal, with milk and possibly fresh fruit.
- Washed and cut raw vegetables kept in the refrigerator. Serve with a yoghurt or bean dip.
- Canned or frozen soups, especially in winter.
- Home-made frozen juice popsicles made in an ice tray, especially in summer.
- Fresh fruit 'smoothies' – in a blender mix milk, yoghurt or juice with fresh or frozen fruit. A banana, ice cubes and a spoonful of milk powder can be added to make it more like a milk shake.
- Half an English muffin, Pita bread, or mini pizza base covered with tomato sauce and cheese, can be made in advance, frozen and heated in the microwave*.
- Cheese slices melted on toast or crackers*.
- Cups of soup or leftovers can also be heated*.

* Older children can be taught to use the microwave.

Cereals and cereal products

Cereals and cereal products were the major food group contributor to the energy intake (about 29 per cent of the total), and provided a similar level of all other nutrients except for lower contributions to calcium (12 per cent), retinol equivalent (about 5 per cent to 6 per cent) and vitamin C (less than 1 per cent), and higher contribution to zinc (21 per cent), iron (42 per cent to 47 per cent), thiamin (41 per cent in boys and 35 per cent in girls), and dietary fibre (15). The dietary fibre contribution from cereals

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decreased from 40 per cent to 37 per cent with increasing age in girls, but was fairly constant at 44 per cent in boys of all ages. This finding is consistent with the reported modest increase of 6 per cent in total mean intake of cereals between the age of ten and 15 years in girls compared to the 39 per cent increase in consumption by boys (15). Similarly, whereas the mean intake of breads and breakfast cereals by boys increased by 53 and 52 per cent respectively, for girls modest increases of 15 and 22 per cent were reported.

On the day of the survey, 10 per cent to 20 per cent of children did not include breads in their diet. (14) A similar pattern was reported in 1983 by 6255 adults aged 25 to 64 years. (23) Bread, which is a staple in the diet, commonly eaten at the breakfast and midday meals.

On the day of survey (and at least 94 per cent of the survey days were school days), 25 per cent to 50 per cent of children did not eat breakfast cereals (eg oats, including muesli; processed wheat-, corn-, rice- or oat-based cereals). (14) The proportion of girls who consumed breakfast cereals on the day of survey decreased with age (from 68 per cent at age ten years to 49 per cent at age 15 years. For boys there was a small decrease from 75 per cent to 73 per cent between ten and 14 years, and then a decline to 65 per cent at age 15 years. (14) Data from the national survey of adults suggests that this decline continues—some 60 per cent of surveyed adults aged 25-30 years did not consume any breakfast cereal on the day of the survey. (23)

Breakfast cereals are not only potentially rich sources of nutrients such as iron, zinc, magnesium, thiamin and dietary fibre, but because they usually are consumed with milk, they are also important sources of calcium, riboflavin and retinol.

When asked in the health component of the survey 'Do you usually eat something before school?', 13.5 per cent of boys and 11 per cent of girls aged nine years replied 'No'. This response increased with age and at 15 years, 14 per cent of boys and 22 per cent of girls reported that they did not usually eat before school. (24) In terms of the quality of the diet and appropriate food habits, this finding is of considerable concern.

The iron status of the 1,204 children aged nine, 12 and 15 year old children has been studied in Australia. Assessment was based on blood levels of ferritin, transferrin and transferrin saturation. Nine percent of 15 year old girls had an iron deficiency, but the prevalence in boys aged 15 years and girls aged 12 years was about 2 per cent. Boys and girls in all other age groups had prevalence rates of less than 0.5 per cent. (25)

For children aged ten to 15 years, iron intakes of girls were lower than those of boys, and more girls than boys reported diets with iron intakes of less than 70 per cent or 50 per cent of the RDI for iron. However, iron density was similar for all ages in both boys and girls at a mean of 1.4 mg to 1.5 mg per 1000 kJ.

In terms of foods as sources of iron, the biggest difference between the sexes, was that cereals provided less of the iron consumed. Cereals provided 47 per cent of iron in the diet of boys but only 43 per cent in the diet of girls (adjusted mean, all age groups). (15) When the dietary intakes of those children who usually eat before school are compared with those who do not usually eat before school, for nutrients such as iron (Figure 2) and calcium (Figure 3) the intakes of those who usually eat breakfast are higher. (21) These higher intake levels of both iron and calcium may be related to cereal consumption levels per se, and to a choice of breakfast cereal, respectively. For iron, there is a further problem that, whereas boys increase the quantity of meat-based foods consumed by 60 per cent from the age of ten to 15 years, 15 year old girls report consumption levels equivalent to that of ten year old boys or girls.

The cereal group comprises both basic products such as breads, breakfast cereals, rice, and pasta, as well as mixed foods, such as biscuits, muesli bars, cakes and cake-puddings, which generally have a higher energy density due to the added fat and sugar. These energy dense foods provided over 20 per cent of the energy from the cereal group in the diets of boys, and up to 25 per cent for ten and 15 year old girls, and 28 per cent for 12 year old girls. The contribution of the mixed cereal-based food products (eg biscuits, cakes, puddings etc) to essential vitamins and minerals was low. The exceptions were fat, carbohydrate and retinol activity (related to the milk component of mixed foods).

With the exception of fat (40 per cent to 50 per cent) retinol equivalents (from 25 per cent to 46 per cent, attributable to the milk component of these foods) and carbohydrate (16 per cent to 22 per cent), other essential minerals and vitamins contributions to total nutrients from cereals were all provided at levels mainly below 12 per cent (from 1 per cent of vitamin C to 17 per cent of niacin equivalents for 15 year old girls).

Figure 1 Recommended energy intakes, body weight and age

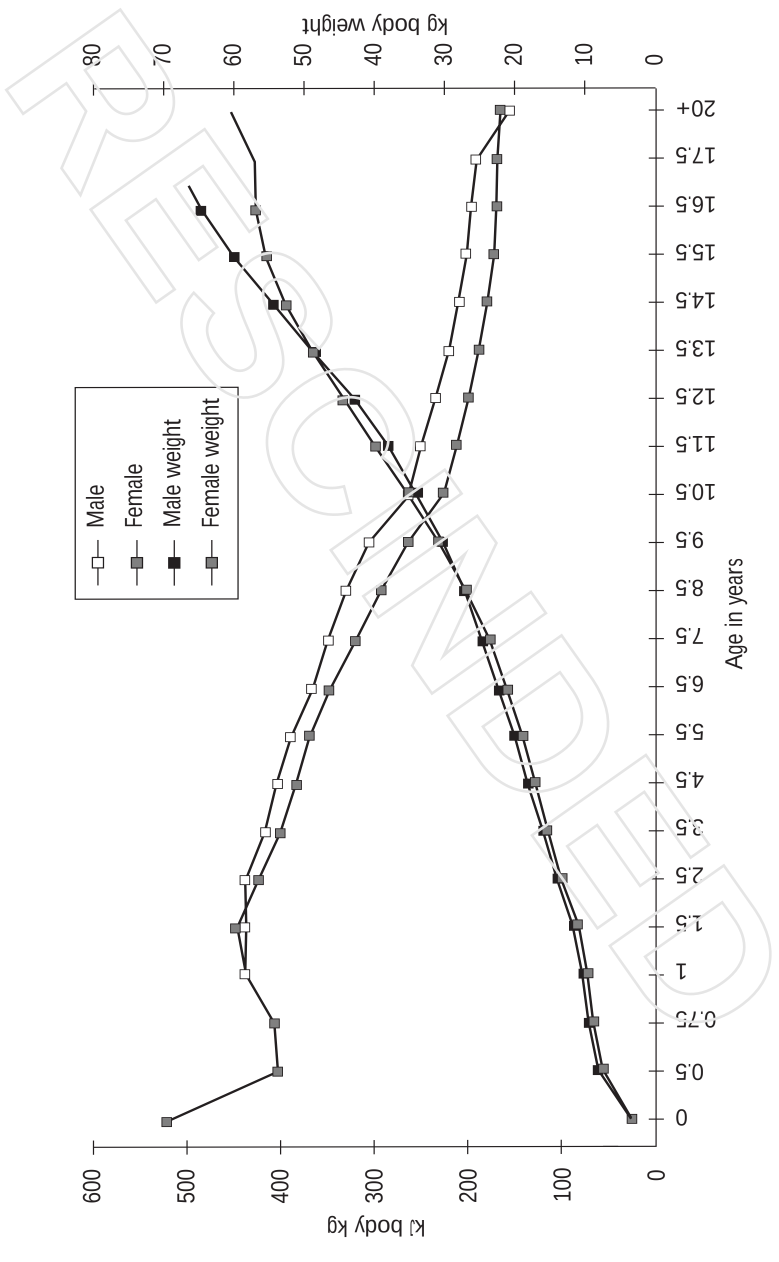

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Figure 2 Mean iron intakes with and without breakfast

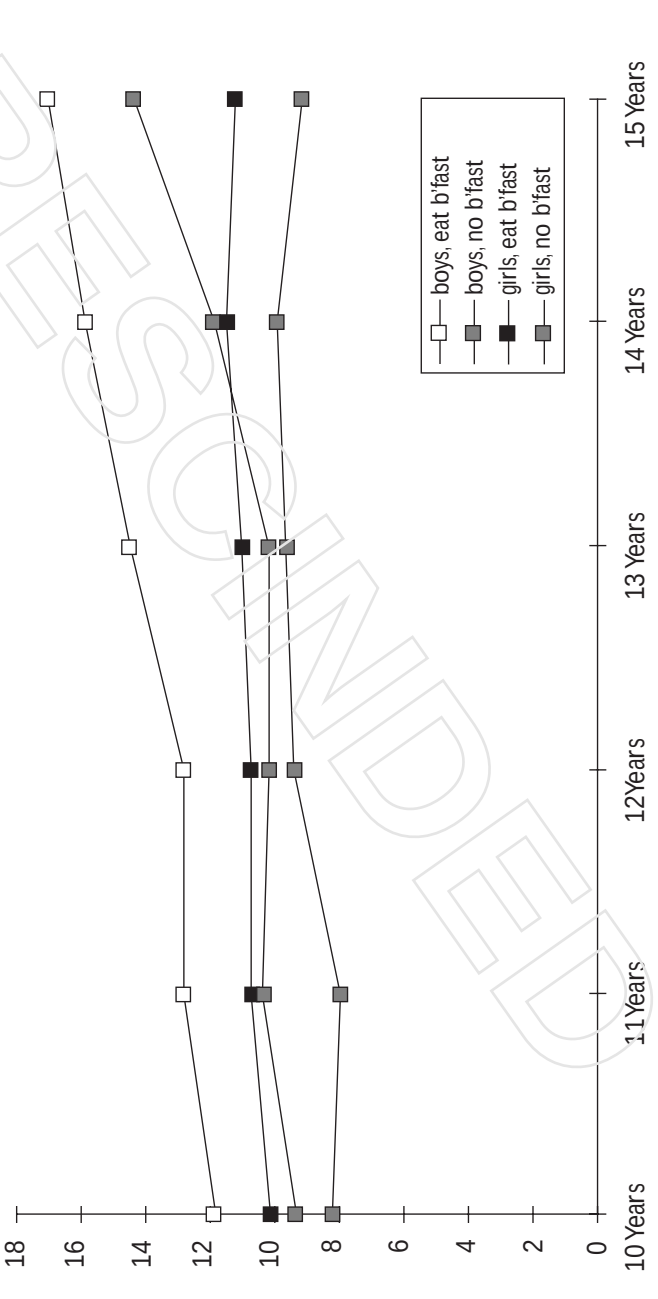

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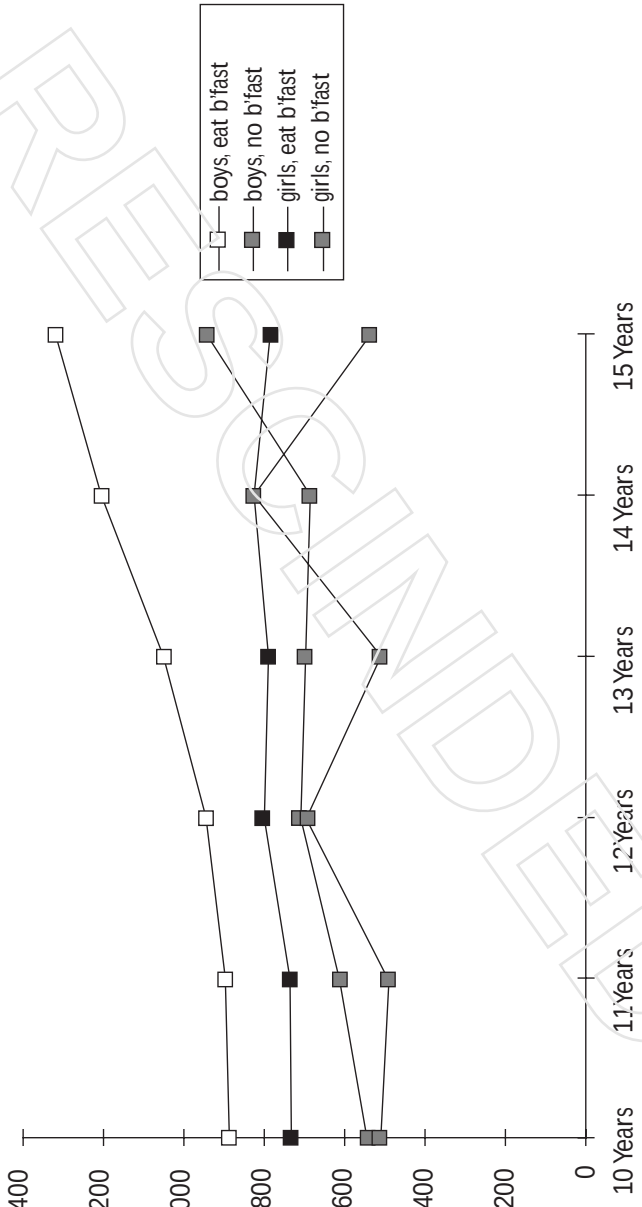
Figure 3 Mean calcium intakes with and without breakfast



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Vegetables

In the National Dietary survey of Schoolchildren vegetables contributed 7 per cent to 8 per cent of total dietary energy; the highest levels of intake were in the diets of 12 year olds (8 per cent for boys and 7 per cent for girls). Vegetables provided a similar level of other nutrients from these foods with the exception of higher contributions to thiamin (about 11 per cent), dietary fibre (25 per cent to 30 per cent), magnesium (12 to 15 per cent), and retinol equivalent (33 to 35 per cent), and lower contributions to riboflavin intakes (about 3 per cent to 4 per cent).

Some children (14 per cent to 18 per cent) did not eat any vegetables on the day of survey. Potato was the major vegetable consumed, both in terms of quantity eaten, and the proportion of children who choose to eat it on the day of the survey. Peas and beans, carrots and marrow-type vegetables were the next most popular based on the proportion of the children who consumed these foods on the day of survey. Less than 5 per cent of children reported eating legumes, and baked beans represented over 85 per cent of the quantity of legumes eaten.

While the quantity of vegetable consumed increased steadily with age in the diet of boys (after a modest increase from the level of consumption of the ten year-old), consumption was steady between the ages of 11 and 15 years in girls. Total mean vegetable consumption by boys increased 33 per cent between the ages of ten and 15 years, but consumption by girls increased by only 14 per cent. (15) In particular, the consumption of potato by girls, which had steadily increased with age from ten to 14 years, fell to the level of consumption of a ten year old girl at 15 years. With the exception of brassica vegetables for girls and peas and beans for boys, (for which the quantities consumed increased with age) there was little change in the intake of other vegetables eaten with increasing age.

Vegetables with added fats were popular. Nearly one-quarter of the potato was consumed as chips, a further 12 per cent was roasted or baked potato. Moreover, 15 per cent to 22 per cent of children included some potato crisps in their diet on the day of the survey. More of the younger girls consumed potato crisps. Added fat was used to prepare 21 per cent of onion, 12 per cent of pumpkin and 31 per cent of mushrooms.

Fruits

On the day of survey, more girls than boys reported consuming some fresh, cooked (including canned) or dried fruit. This varied from 66 per cent of 11 year old girls, to 75 per cent of 15 year old girls compared with 56 per cent in 12 year old boys to 65 per cent in ten year old boys. (14) While the mean quantities consumed increased with age in both boys and girls, as reported for cereals and vegetables, the increase in mean-quantities consumed was much higher for boys (at 35 per cent) than for girls (l9 per cent) between the ages of ten and 15 years.

For both boys and girls, apples and pears were the most popular choices of fruit; citrus and bananas ranked next highest.

Fruit also was consumed as juice and juice-based drinks. The proportion of total energy from fruits (including juice and juice-based drinks) decreased with age in boys (from 7 per cent to 5 per cent), but increased in girls from 7 per cent to 8 per cent. Dietary fibre (14 per cent to 22 per cent), iron (7 per cent to 10 per cent), magnesium (7 per cent to 10 per cent), thiamin (7 per cent to 11 per cent) and vitamin C (73 per cent to 80 per cent) were at levels higher than the energy contribution.

For both boys and girls, juices and juice drinks contributed about one half of the total energy from all fruits. However, except for vitamin C in juices and juice-based drinks (the minimum levels of which are determined by food law[4]) the nutrient contribution of juice products was generally lower than those of the non-juiced products. Dietary fibre is a clear example of this. Thus, choosing juiced products rather than fresh or cooked forms reduces the nutrient density of the fruit component of the diet of children.

RELATIONSHIP TO OTHER GUIDELINES

- Children need appropriate food and physical activity to grow and develop normally. Growth should be checked regularly. The development of food habits and preferences is described in the background paper to this guideline.
- Encourage water as a drink. Alcohol is not recommended for children. The consumption of fruit juice and juice-based drinks by children is discussed.

[4] Often at fortification levels.

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CHAPTER 5

LOW FAT DIETS ARE NOT SUITABLE FOR YOUNG CHILDREN

The guideline on fat for the general population of healthy adults is unsuitable for infants and preschool children in that limitation of fat in the diet may interfere with an optimal energy intake and, hence, adversely affect growth and development. However, it is reasonably applicable to children over five years of age and adolescents.

Because of the high nutrient requirements during childhood, the energy and nutrient density of the diet must be higher than in adults. As growth and tissue replacement requires 30 per cent of the energy intake in infants compared to only 5 per cent in adults, even a small energy deficit may affect the growth rate. (1) Thus, the over riding requirement during the period of rapid growth, in the first two years of life particularly, is to ensure an optimal energy intake.

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 omega-3 polyunsaturated fatty acids required by the body for cell structure, membrane function and the development of the central nervous system. Fat is a source of precursors for eicosanoid synthesis (eg prostaglandins, thromboxanes, leukotrienes) and is a vehicle for transporting fat-soluble vitamins. In addition to these nutritional functions, fat contributes to the taste, texture and palatability of foods. (2)

There is some evidence to suggest that an adequate intake of cholesterol during the growth period is important for cholesterol metabolism later in life, myelinisation of the nervous system, neurologic development in general, the formation of hormones essential for growth and sexual maturation and bile acids. (3,4) However, it has been stated that these concerns largely ignore the fact that the human body is capable of synthesising sufficient cholesterol for all its metabolic needs. (5,6)

SOURCES OF FAT IN THE DIET

For infants, breastmilk or infant formulae is the primary source of fats—fats contribute about 50 per cent of energy intake. The contribution that milks make to the fat content of the diets of older infants and toddlers decreases as solid foods are introduced. As the range and quantity of these foods increases, their contribution to fat intake increases.

Table 1 Contribution of food sources to fat intake by children aged 10 to 15 years (g)

Food group and subgroup	Boys	Girls
Milk and milk products	**26.2**	**23.8**
Milk, all types	18.5	15.8
Ice-creams and ice confections	4.1	3.4
Cheeses	2.7	3.6
Yoghurts and creams	0.9	1.0
Meat and meat products	**23.7**	**22.2**
Take-away	6.7	5.7
Beef and veal	3.7	3.5
Mixed dishes	3.6	3.8
Sausages and frankfurters	2.9	2.4
Lamb	2.3	2.1
Pork	1.8	1.9
Poultry and game	1.7	1.9
Meat offal and delicatessen meats	1.0	0.9
Fats	**16.4**	**17.0**
Margarine, other	4.6	4.5
Margarine, polyunsat	4.4	5.0
Butter	3.4	3.6
Unspecified spreads	2.5	2.3
Oils, solid and unspecified cooking fats	1.5	1.6
Cereals and cereal products	**14.2**	**15.2**
Biscuits and muesli bars	3.8	4.9
Breads, all varieties	2.8	2.6
Cake and cake-type puddings	**2.2**	**2.6**
Breakfast cereals, all types	2.1	1.9
Desserts	1.7	1.7
Other	1.6	1.5
Vegetables	**6.4**	**6.3**
Potato	5.7	5.6
Other	0.7	0.7
Snack foods	**3.8**	**4.9**
Potato crisps	2.4	3.1
Other	1.4	1.8
Confectionery	**2.6**	**3.3**
Eggs	**2.2**	**2.3**
Nuts and seeds	**1.8**	**2.0**
Condiments, flavourings and soups	**1.4**	**1.6**
All other foods	**1.3**	**1.4**

Source: 1985 National Dietary Survey of Schoolchildren (aged ten to 15 years). (7)

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The contributions of food sources to fat intake in the 1985 National Dietary Survey of school children (aged ten to 15 years) are shown in table 1. (7) Table 1 illustrates that dairy products, meat and meat products, added fats and the cereal group were important sources of fats in the diet of the children on the day of the survey. However, it should be noted that these figures relate to the broad food groups, and components of the dairy, meat and cereal *groups* are also important sources of a range of other nutrients, particularly calcium and iron.

For example, under the meat and meat products group, takeaways were the major contributor to fat intakes (6.7 g and 5.7 g for boys and girls respectively), while in the cereal group, biscuits and cakes contributed 3.8 g and 2.2 g for boys and 4.9 g and 2.6 g for girls respectively.

Figures 1 and 2 illustrate the contributions of takeaways, snack products, confectionery, cake and biscuits to fat intake (g) for boys and girls aged ten to 15 years. Figures 3 and 4 illustrate the contribution of these selected foods as a percentage of total fat intake.

The importance of these snack foods to the fat intake of children is further highlighted by Tables 2 and 3, which show the 'top 10' sources of fat in the diets of high school children in the national dietary survey.

While milk was the major contributor to fat intake for boys, ranging from 13.3 g to 18.7 g, the contribution of the butter and table margarine group was similar (12 g to 17.1 g). This situation was reversed for girls, with the butter and table margarine contributing 11.3 g to 12.7 g and milk 9.2 g to 12 g.

Takeaways, savoury snacks, biscuits and ice-cream featured predominantly in the other 'top 10' foods for both boys and girls.

Figure 1 Contribution of selected foods to fat intake, boys (g per day)

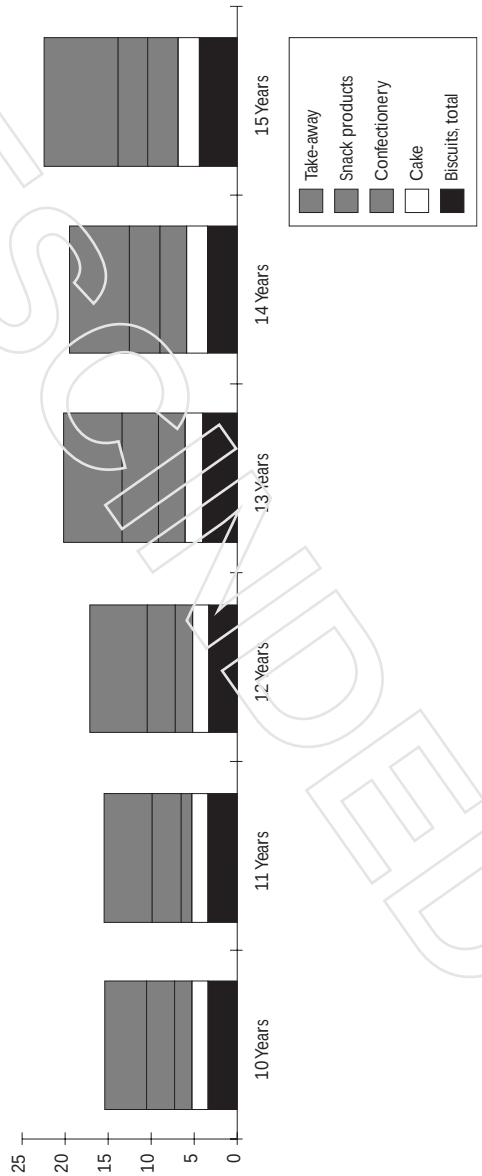

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Figure 2 Contribution of selected foods to fat intake, girls (g per day)

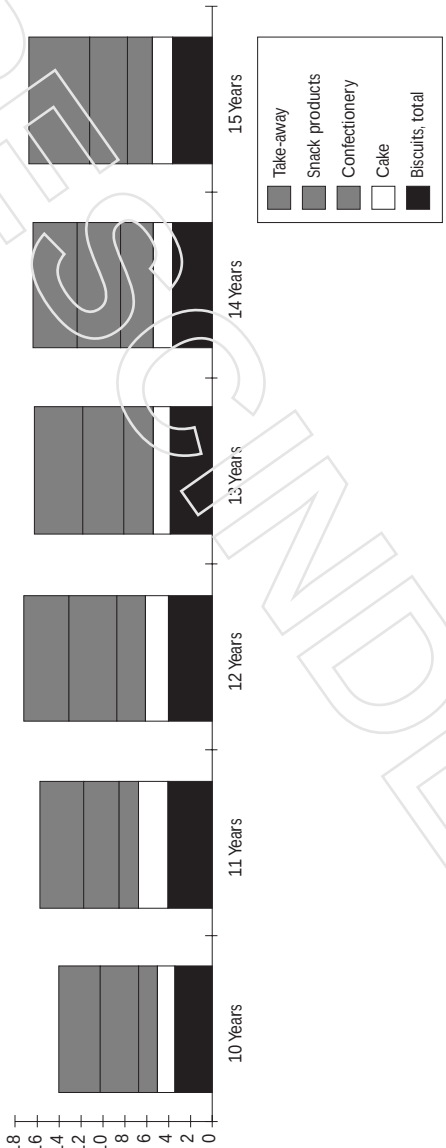

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Figure 3 Contribution of selected foods to total fat, boys (per cent)

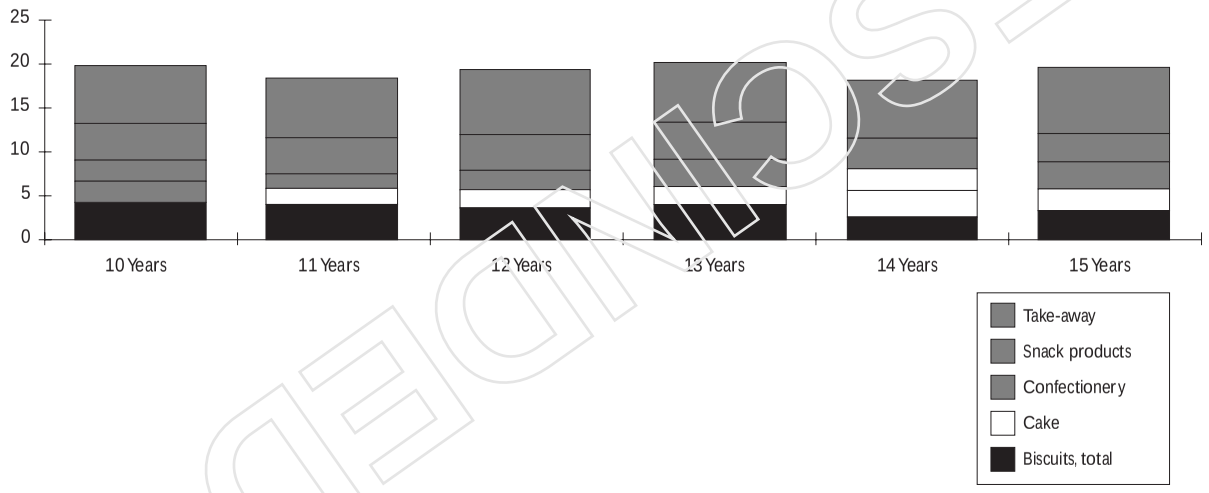

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Figure 4 Contribution of selected foods to total fat, girls (per cent)

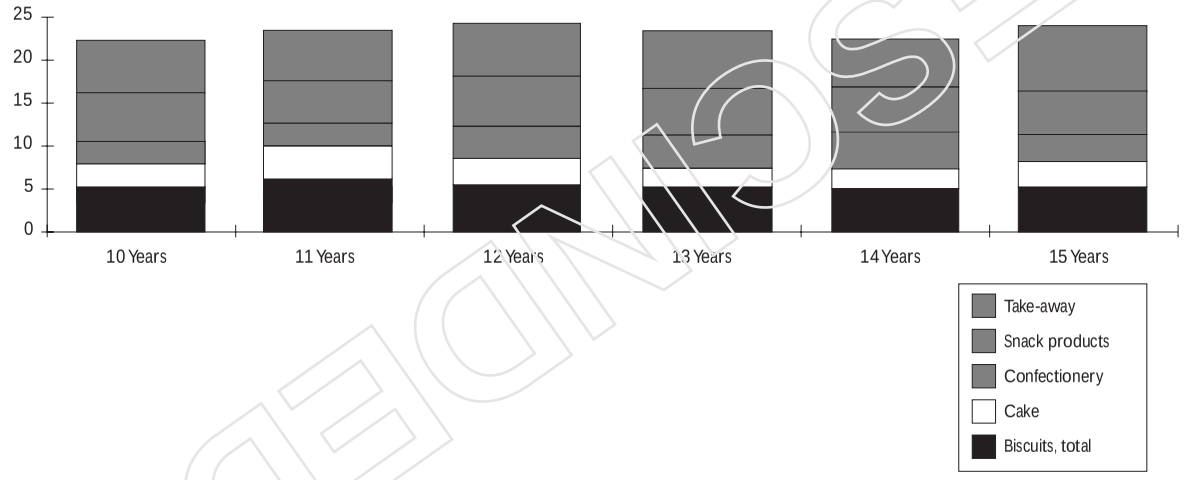

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Table 2 Top ten sources of fat in the diets of girls aged 10 to 15 years (g)

Food	Age					
	10	11	12	13	14	15
Butter/marg as spreads	11.4 (1)	11.5 (1)	11.3 (1)	11.3 (1)	11.4 (2)	12.7 (1)
Milk, whole	10.0 (2)	9.6 (2)	10.4 (2)	10.0 (2)	12.0 (1)	9.2 (2)
Takeaways	3.8 (3)	4.0 (4)	4.3 (4)	4.3 (4)	4.1 (4)	5.3 (3)
Savoury snacks	3.5 (4)	3.2 (6)	4.2 (5)	3.9 (5)	3.8 (5)	3.4 (6)
Biscuits and muesli bars	3.3 (5)	4.1 (3)	3.8 (6)	3.6 (6)	3.7 (6)	3.4 (5)
Mixed dishes	3.0 (6)	2.4	3.2 (7)	2.7 (9)	3.0 (8)	2.6 (9)
Ice-cream	3.0 (7)	2.8 (7)	3.2 (8)	2.5 (10)	2.1	1.6
Potato,cooked	3.0 (8)	3.4 (5)	4.7 (8)	5.3 (3)	4.9 (3)	3.5 (4)
Smallgoods (non-pork)	2.3 (9)	2.5 (10)	2.6	2.5	2.8 (9)	2.1
Beef and veal	2.2 (10)	2.8 (8)	2.6	2.4	2.8 (9)	2.7 (8)
Cheeses	2.2	2.4	2.8 (9)	2.9 (7)	2.7	3.1 (7)
Cakes	1.7	2.6 (9)	2.1	1.6	1.7	2.0
Confectionery	1.7	1.8	2.7 (10)	2.7 (8)	3.2 (7)	2.4 (10)
Total, top 10 (g)	45.5	46.5	50.6	49.2	51.7	48.3
Total, per day (g)	68.0	72.0	79.0	79.0	75.0	
Per cent (top 10/total)	66.9	64.6	65.7	63.9	65.4	64.4

Source: 1985 National Dietary Survey of Schoolchildren (aged ten–15 years). (7)

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INTAKES OF FAT IN THE DIET

Total fat

Intakes of fat from the national dietary survey are shown in Table 4. The mean daily fat intake for boys aged 15 (115 g) was 47 per cent greater than that of boys aged 10 years (78 g), while that for 15 year old girls (75 g) was was only 10 per cent greater than that for ten year old girls (68 g). (7)

The range of fat intakes from this survey was 36 per cent (girls aged 10) to 37 per cent of energy (boys 11 years, girls 11 and 12 years). (7) Approximately 35 per cent of energy came from fat for a group of eight year olds from Adelaide (8), while in a study of 11 and 12 year old children in Western Australia the mean fat intakes as proportions of energy were 36 per cent to 37 per cent for boys and 37 per cent to 38 per cent for girls. (9)

Fatty acids

Children in the National Dietary survey of school children consumed a higher proportion of their fat intake as saturated fat (range 42 per cent to 44 per cent fat) compared with the 1983 National Dietary Survey of Adults (39 per cent to 41 per cent fat); values for PUFA ranged from 13 per cent to 14 per cent for children compared with 14 per cent to 16 per cent fat from the 1983 survey of adults. (2)

Similar results were obtained in surveys of children in Adelaide and Western Australia. The proportions of SFA, PUFA and MUFA were 41 per cent, 33 per cent and 16 per cent fatty acids respectively in the Adelaide study (8) and 41 per cent to 45 per cent, 32 per cent to 33 per cent and 14 per cent to 17 per cent in the Western Australian survey. (9)

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Table 3 Top ten sources of fat in the diets of boys aged 10 to 15 years (g)

	Age					
Food	**10**	**11**	**12**	**13**	**14**	**15**
Milk, whole	13.5 (1)	13.3 (1)	13.8 (1)	14.7 (1)	17.4 (1)	18.7 (1)
Butter/marg as spreads	12.0 (2)	13.2 (2)	13.4 (2)	13.7 (2)	15.9 (2)	17.1 (2)
Takeaways	4.8 (3)	5.4 (3)	6.4 (3)	6.7 (3)	6.7 (3)	8.4 (3)
Potato, cooked	4.1 (4)	4.6 (4)	5.8 (4)	6.2 (4)	6.1 (4)	5.8 (4)
Savourysnacks	3.4 (5)	3.5 (9)	3.5 (6)	4.1 (7)	3.5 (9)	3.6 (10)
Biscuits and muesli bars	3.4 (6)	3.6 (6)	3.3 (8)	3.7 (8)	3.5 (10)	4.3 (6)
Ice-cream	3.0 (7)	3.5 (7)	4.1 (5)	4.5 (5)	4.2 (7)	
Smallgoods (nonpork)	2.7 (8)	3.7 (5)	2.9	4.1 (6)	4.4 (6)	3.7 (9)
Beef and veal	2.6 (9)	3.5 (8)	3.0 (9)	3.7 (9)	3.9 (8)	4.7 (5)
Mixed dishes	2.6 (10)	3.2 (10)	3.4 (7)	3.3(10)	4.3 (7)	3.8 (8)
Cheeses	2.1	2.1	3.0 (10)	2.5	2.7	3.3
Total top 10 (g)	52.12	57.5	59.7	64.4	70.2	74.3
Total, per day (g)	78.0	85.0	88.0	98.0	107.0	115.0
Per cent (top 10/total)	66.8	67.6	67.8	65.7	65.6	64.6

Source: 1985 National Dietary Survey of Schoolchildren (aged 10-15 years). (7)

Table 4 Fat intake (g), sex, age

	Mean	Standard error of mean	Percentiles		
			5th	50th	95th
Boys					
10 years	78	1	34	75	131
11 years	85	2	48	80	145
12 years	88	2	39	82	153
13 years	98	2	39	92	176
14 years	107	2	47	100	184
15 years	115	3	52	107	211
Girls					
10 years	68	1	32	67	108
11 years	72	1	34	68	120
12 years	77	1	34	73	128
13 years	77	2	43	73	129
14 years	79	2	32	75	139
15 years	75	2	36	70	134

Source: 1985 National Dietary Survey of Schoolchildren (aged ten to 15 years). (7)

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RECOMMENDATIONS ON FAT INTAKES FOR CHILDREN

While there is concern that limitation of fat in the diet of young children may compromise growth and development, the most controversial area with respect to fat restriction in children is its relationship to the development of coronary heart disease (CHD) in adulthood.

Several overseas organisations have recommended a general decrease in fat intake for adults and children over two years of age, to between 30 per cent and 35 per cent of energy intake, such as the Canadian Paediatric Society (10), the American Heart Association (AHA)(11), American Health Foundation (AHF)(5),

the National Cholesterol Education Program (NCEP) Expert Panel on Blood Cholesterol Levels in Children and Adolescents (12) and the National Institutes of Health Consensus Development Panel (NIH) (13).

The basis for these recommendations can be summarised as follows:

- US children and adolescents have higher blood cholesterol levels and higher intakes of saturated fatty acids (SFA) and cholesterol, and adults have higher blood cholesterol levels and higher rates of CHD morbidity and mortality compared to their counterparts in many other countries (12, 13, 14);
- autopsy studies indicate that early coronary atherosclerosis or precursors often begin in childhood and adolescence (5, 12);
- high serum total low-density lipoprotein (LDL) and very low-density lipoprotein (VLDL) cholesterol levels and low high-density lipoprotein (HDL) cholesterol levels are correlated with the extent of early atherosclerotic lesions in adolescents and young adults (12);
- children and adolescents with elevated serum cholesterol, particularly LDL, frequently come from families in which there is a high incidence of CHD among adult members (12);
- high blood cholesterol aggregates in families as a result of both shared environments and genetic factors (12);
- children and adolescents with high cholesterol levels are more likely than the general population to have high levels as adults (5, 12, 14); and
- dietary behaviour, the principal modifiable contributor to atherosclerosis, particularly the excessive intake of saturated fats and cholesterol, also has its origins in childhood and probably makes an impact—physiologically and behaviourally—early in life (5).

However, a number of other organisations and individuals, such as the American Academy of Paediatrics (AAP) Committee on Nutrition, and the UK Committee on Medical Aspects of Food Policy (COMA), advocate a more cautious approach in the application of guidelines on fat intake for adults to children and adolescents (3, 15, 16, 17).

PRESCRIBED

The UK National Advisory Committee on Nutrition Education (NACNE) warned of the inherent dangers of modifying young children's diets. The AAP is even more cautious and argues that there is no clear evidence that a low-fat diet will effectively decrease serum cholesterol during childhood and adolescence, or support optimal growth and development. (15)

The following have been expressed about the adoption of the diet recommended by AHA and other groups:

- epidemiologic studies are not of themselves sufficient to establish cause and effect relationships (3);
- in diseases of multiple aetiology involving genetic factors, it is necessary to understand the extent to which dietary intervention and individual responses are related (3);
- clinical trials in the population at risk should be positive before an intervention is instituted in the general population (3, 18);
- the institution of a public health nutrition program requires the active support of the health-related professions (3);
- the safety of diets that are designed to decrease the consumption of fat and cholesterol has not been established in growing children (3, 4, 6);
- adult eating patterns are not necessarily influenced by childhood experiences and there is no strong evidence that adolescent eating patterns persist into adulthood (15, 16);
- it has not been demonstrated directly by appropriately controlled studies whether dietary modification in children will alter the incidence of CHD in later life (11, 15, 16, 19, 20); and
- children who have cholesterol levels in the high range will not necessarily have levels in the same range when they reach adulthood (18).

The AAP states that the Bogalusa study, which found that atherosclerosis has its onset in childhood, has been used to support the recommendations proposed by AHA and AHF. However, regardless of environment, sex, and race, fatty streaks are present in the aorta of virtually every child by the age of ten years; the relationship of these to fibrous plaque and, hence, to atherosclerosis is uncertain and controversial. (15) The fibrous plaque does not have the ubiquitous distribution among the world's population that has been observed for fatty streaks. The AAP

maintains that this limitation in current knowledge means that the contention that fatty streaks in arterial vessels can be taken as evidence for the childhood origin of atherosclerosis must be treated with serious reservations. (15)

In addition, although the association of diet, serum cholesterol values and CHD can be established from population studies, in American children there is no significant correlation between diet and risk factor variables for cardiovascular disease. Among American children and adolescents other factors, such as obesity and aerobic capacity, are more important determinants of the likelihood of cardiovascular risk factors being present. (15)

Thus, it is recommended that, in general, cholesterol lowering diets are inappropriate for children under five years. (4, 21)

IMPLICATIONS OF THE RECOMMENDATIONS TO REDUCE THE FAT CONTENT OF CHILDREN'S DIETS

Unsupervised restriction of dietary fat can lead to growth failure (4, 22) and to chronic non-specific diarrhoea in infants and young children. (23)

Growth failure

Lifshitz and Moses (4) found that eight children out of a group of 40 who were advised to eat a low-fat, low-cholesterol diet by their paediatricians for the treatment of hypercholesterolaemia had failed growth; three had nutritional dwarfing and five lost weight or gained too little weight. (4)

It was concluded that the diagnosis and unsupervised dietary treatment of hypercholesterolaemia in children may have adverse consequences. A high proportion of patients who were advised to eat a low-fat diet (because they were hypercholesterolaemic) selected diets that would not sustain normal pubertal growth and weight gain, eg they consumed too little milk, other dairy products, meat and eggs. Diets often provided insufficient energy and inappropriate quantities of the vitamins and minerals that are essential for normal growth and development.

Pugliese et al (22) also found failure to thrive and compromised growth in children whose parents had instituted diets that were consistent with current health beliefs and recommendations for adults at risk of CHD.

However, the findings of these studies have been attributed to inadequate consumption of energy (13) or to the inadvertent starvation of children by misinformed parents (5).

Chronic non-specific diarrhoea

Chronic non-specific diarrhoea is one of the most common sources of prolonged diarrhoea in infants and toddlers, and there is an association between the persistence of diarrhoea and a history of low fat intake.

Cohen et al (23) reported 5 patients who developed chronic diarrhoea after significant dietary fat restriction (below 27 per cent of total energy) to prevent atheromous coronary artery disease. Total energy intake was adequate.

The mechanism for the diarrhoea is unknown, but it was resolved when the daily dietary fat intake increased to 30 per cent to 50 per cent of total energy consumed. These patients were consuming more carbohydrate to compensate for the decrease in fat, but the diarrhoea stopped when fat intakes increased even without changes in carbohydrate levels, so an osmotic basis for the diarrhoea is unlikely. Fat delays gastric emptying and slows intestinal transit, which may account for the cessation of diarrhoea.

CHILDREN WITH HYPERCHOLESTEROLAEMIA

In older children with a strong family history of cardiovascular disease or familial hypercholesterolaemia, where treatment is appropriate, diets should aim to reduce total and saturated fat, substitute polyunsaturated and monounsaturated fats for saturated fat, and decrease dietary cholesterol. Carbohydrate can replace some of the energy from fat but these children must be carefully monitored for growth and development by an experienced dietitian and paediatrician. (14)

The need for supervision with low fat diets

The quality of the diet primarily will depend on the quality of advice given and the monitoring of the effects of this advice by the health worker. (4, 22) Lifshitz and Moses warned that the physician should keep in mind that some patients and families may be either over-zealous or non-compliant in following recommendations.
A diet needs to be individually designed in accordance with the family's food preferences, and misconceptions regarding the

elimination of specific foods (dairy, meat, eggs) need to be dispelled. (4) The development of good habits of exercise, weight control and smoking avoidance may be as important as monitoring the dietary intake of children who are hypercholesterolaemic.

Another important factor to consider when addressing nutrient adequacy is whether the recommended diet is actually eaten. Some children may not readily take the time to consume all of the needed energy when given foods of low energy density. (20)

Nicklas et al (6) stated that a diet that restricts fat intake, coupled with a moderate protein intake, implies an increase in calories from CHO. In addition, it is claimed that vitamin and mineral intakes on a reduced fat diet would not be deficient because the increased consumption of complex CHO would provide an added source of vitamins and minerals (14, 22). However, one study found that, although consumption of carbohydrates did increase, the increase was primarily as simple, not complex, carbohydrates-the low-fat group (<30 per cent energy from fat) consumed 20 per cent more total sugar than those with a high fat intake (>40 per cent energy from fat). (6)

Thus, when restricting fat in children's diets, careful attention needs to be paid to education of parents on the importance of a well-balanced diet, appreciating the alterations needed for adequate intakes of nutrients. Children should be monitored to ensure that they are consuming an appropriate diet. (4, 6, 20, 22)

RECOMMENDED TARGETS FOR FAT INTAKES DURING INFANCY, CHILDHOOD AND ADOLESCENCE

In the family setting, unless separate diets are prepared for individual members, the need of the youngest child for a diet that ensures optimal growth and development are paramount.

Guidelines are suggested to cover the following paediatric periods:

A. Birth to two years of age

For the first six months of life, fat intake should comprise approximately 50 per cent of energy intake by breastfed and formulae-fed infants.

During the first year of life in non-breastfed infants, infant formulae, not cow's milk, should be the major milk feed because of the lower proportion of saturated fat and higher iron content.

(refer to the background paper to the guideline on variety for more discussion of this recommendation).

In the latter part of the first year of life and during the second year of life, the target is approximately 40 per cent 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 per cent – 2.5 per cent fat) should not be used in children under two years of age.

B. Two to five years

A gradual increase in the proportion of energy from carbohydrate will occur, with a gradual reduction in the proportion of energy from fat. Thirty-five to 40 per cent of energy intake as fat is the target.

Reduced fat and skim milks are not recommended and should not be used for children less than five years of age. (24)

C. Five to 14 years of age

Approximately 35 per cent of energy as fat, with no more than 10 per cent of energy coming from saturated fat, is appropriate for children aged five to 14 years. This can be managed effectively with no deleterious effects on nutrition or growth. (25) For a more complete discussion on types and amounts of fats, refer to the background paper to the guideline on fat in the 'Dietary guidelines for Australians'. (26)

D. Adolescence

Approximately 30 per centof energy intake as fat, with no more than 10 per cent of energy coming from saturated fat, is desirable for children 15 years and over. The dietary guideline on fat for the general population of healthy adults is appropriate for adolescents.

Specific dietary suggestions for the fostering of positive attitudes and practices related to the moderation of fat intake are outlined in Table 5.

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Table 5 Suggestions to foster positive attitudes and practices related to moderation of fat intake in children

- Encourage the child to practice moderation when using high fat sauces, salad dressings and spreads (eg butter or margarine).
- Trim visible fat from the child's meat.
- Limit the use of processed meats such as hot dogs, luncheon meats and sausages.
- Limit fried foods such as french fried potatoes, fried fish or chicken to very occasional use and use polyunsaturated and monounsaturated cooking oils in preparation.
- Choose lower fat foods when eating at fast food restaurants, eg milk instead of milk shake, single meat patties, pasta instead of pizza.
- Provide fruit or vegetables or bread as snacks rather than potato crisps, biscuits or pastries. Use crisps and pastries as treat food only.

Source: Reid J, et al (27)

RELATIONSHIP TO OTHER GUIDELINES

- Children need appropriate food and physical activity to grow and develop normally. Growth should be checked regularly. The importance of children receiving adequate amounts of energy to ensure normal growth and development is discussed.
- Enjoy a wide variety of nutritious foods. The background paper to this guideline includes a discussion on the introduction of cow's milk in infancy.

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CHAPTER 6

ENCOURAGE WATER AS A DRINK – ALCOHOL IS NOT RECOMMENDED FOR CHILDREN

INTRODUCTION

Children should be encouraged to drink water. Water is needed by the body to function effectively. Drinks such as fruit juices and fruit-based drinks, soft drinks, milk and soy beverages, are also good sources of water for children. However, excessive and inappropriate consumption of these products may adversely affect children's health. Encouraging children to consume water when they are thirsty initiates the good drinking habits that all Australians need.

Alcohol is not recommended for children. Alcohol is a powerful drug that impairs perception and may affect short and long-term health. The consumption of alcohol is increasing among teenagers (despite their being 'under-age'), and alcohol, in conjunction with lack of experience, is a significant cause of death from motor vehicle accidents in young people. Children can be encouraged to have a more rational approach to alcohol through public health education initiatives that stress the hazards of alcohol, classroom teaching and parental modelling of appropriate alcohol consumption.

WATER

Water is essential for the maintenance of life. Without it the body cannot function on a cellular or physiological level. Water is required for cell structure, body temperature control and fluid composition, excretion of waste via the kidneys and the gastrointestinal tract, and as the milieu for metabolic reactions (1). It must be consumed as water or other drinks because insufficient can be extracted from solid food. (2)

Inadequate water intake or excessive losses, compared with requirements, may lead to dehydration. Dehydration usually will cause a child to feel thirsty and to drink to satisfy the thirst (3). For a breastfed baby, this can be achieved by breastfeeding on demand. (4) The risk of dehydration is greatest during infancy due to the high proportion of body weight that is water (5) and the infant's relatively high surface area. (3) These decrease as the child grows. (2) Water is normally lost from the body as urine, in expired air from the lungs, in gut secretions and faeces and in perspiration via the skin. (1) Physical activity and heat exacerbate water losses as does gastroenteritis. (3)

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Table 1 Beverage consumption of Australian school children

	10 year olds			*15 year olds*		
Beverage	**Mean intake (ml) total population**	**Per cent consuming**	**Mean intake of consumers**	**Mean intake (ml) Total population**	**Per cent consuming**	**Mean intake of consumers**
Fruit and vegetable juices	82.0	30.5	268.9	96.0	29.2	328.8
Fruit juice drinks and fruit drinks	76.5	26.0	294.2	87.0	22.4	388.4
Soft drinks, sweetened	57.0	17.2	331.4	133.5	29.2	457.2
Milk, liquid, whole	309.0	80.8	382.4	366.5	79.5	461.0
Tea	29.5	11.3	261.1	78.5	22.3	352.0
Coffee and coffee substitutes	9.0	4.9	183.7	70.5	23.1	305.2
Water	236.5	59.1	400.2	319.5	56.7	563.5

Source: National Dietary Survey of Schoolchildren, 1985. (8)

Drinking water in Australia is monitored to ensure its safety, and guidelines prescribe its quality (6). Purification processes such as filtration and disinfection are used to optimise water safety. (1) Water supplies no energy and so can quench thirst without increasing energy intake. Water drinking habits established in childhood encourage this important practice to continue throughout adulthood.

OTHER DRINKS

The range and variety of drinks available is overwhelming: pure fruit juices, fruit juice drinks, cordials, soft drinks, mineral water (flavoured and unflavoured), soy beverages, and milk (plain and flavoured, of various fat contents, and from cows and goats).

Throughout western countries, the consumption pattern for fluids is changing; consumption of milk and dairy products has decreased and the consumption of soft drinks (including fruit juice and carbonated beverages) has increased. (7) Australian children's beverage consumption from the 1985 National Dietary Survey of school children (8) is given in Table 1. More children consumed milk and water than juices, fruit drinks and soft drinks on the day of the survey. However, the mean intake of consumers, rather than that of the population, indicates that those who drank juices, fruit drinks and soft drinks, consumed large quantities of these beverages.

Tea and coffee are consumed by Australian children (8), although not in large quantities. Consumption of herbal teas by infants, young children and breastfeeding women should be discouraged and these beverages should be used with caution, because they contain alkaloids and toxins. (9,10) Caffeine intake is discussed below.

ENERGY CONTENT OF COMMON DRINKS

Many of the drinks currently available to Australian children have high energy contents and only some of them provide significant quantities of other nutrients. Table 2 shows the energy content of some commonly consumed drinks. It is important to differentiate between those drinks that provide other nutrients, such as cows' milk which provides 8.6 g protein and 310 mg calcium in 250 ml (11), and those that provide only energy. For young children who can consume only small volumes of food/fluid, nutrient—and

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energy-dense drinks, such as milk, are important in the diet. However all types of drinks, if consumed in excess, will displace other fluids and foods in the child's diet, and cause an imbalance in nutrient intake.

Table 2 Energy content of commonly consumed drinks (11)

Beverage	Energy content (kJ per 250ml)
Water	0
Fruit juice, commercial, no added sugar	355
Fruit juice, commercial	378
Cordial, lime juice	366
Soft drink, cola	437.5
Milk, whole fluid	677.5
Milk, fat reduced	585

Source: Lewis and English (11)

This imbalance can lead to long-term adverse health outcomes. For example, excessive quantities of fruit juice have been associated with cases of failure to thrive in some young children. (12) This failure to thrive may occur because the child becomes satiated after consuming the large volume of fluid and does not consume a wide variety of foods. Similarly, if every time children feel thirsty, they drink something other than water, the drink will contribute significantly to their overall energy intake (see Table 2). If this causes excessive consumption of energy compared to expenditure, the child may become overweight or obese.

CAFFEINE

Caffeine is found in foods and beverages such as tea, coffee, chocolate and cola flavoured soft drinks. Tea and coffee have approximately three and four times as much caffeine respectively as an equal volume of cola flavoured soft drink. (13) Caffeine is a central nervous system stimulant, the effects of which have been well described. (14) The effects of an average dietary intake of caffeine however, have been found to fall within the range of normal daily physiological changes. (15)

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Cola-flavoured soft drink is the major single dietary source of caffeine in children, although it supplies less than 50 per cent of the total daily caffeine intake for children from six to 17 years old. (15) For children who consume relatively large quantities of tea and coffee (see Table 1), the contribution from cola-flavoured drinks may be even less. No safe level of caffeine consumption has been set for either children or adults in Australia. However, current societal average intakes, including those of children, appear to be safe. (13)

FRUIT JUICE AND DIARRHOEA

Fruit juice is a possible aetiological agent in childhood diarrhoea, including childhood non-specific diarrhoea (CNSD) or toddlers' diarrhoea. (12) The osmolarity of the fruit juices consumed appears less important in the development of gastrointestinal symptoms than carbohydrate malabsorption. (16, 17) In particular, impaired absorption of fructose and sorbitol, has been proposed as a possible mechanism. (12, 16, 17) Additionally, an excess of fructose to glucose in some fruit juices (eg apple juice) seems to be an important factor in fructose malabsorption. (16,17) Children differ greatly in their abilities to absorb fructose and sorbitol (12), and fructose and sorbitol malabsorption can occur as frequently in normal healthy children as in those with CNSD. Nevertheless, removal of apple juice from the diets of children with CNSD normalises their bowel habits. (16)

DRINKS AND DENTAL HEALTH

Drinks that contain both fermentable sugars and acids (such as most commercial drinks), are potential agents for dental caries and erosion. (7) Milk is less cariogenic than many non-dairy drinks because it contains calcium, which enables remineralisation, and it has a relatively high pH. Artificially sweetened soft drinks, while not being cariogenic, can still promote erosion due to their acid content. (7) The practice of bottle-feeding infants for long periods is also a potential risk factor for dental caries (18), particularly when bottles are left with children as they go to sleep.

Drinking fluoridated water significantly lowers children's risk of having and,or, developing dental caries. (19, 20) No adverse effects have been identified in children (or adults) who drink from water supplies that are supplemented at the current recommended levels. (19)

THE EFFECT OF ALCOHOL ON CHILDHOOD AND ADOLESCENT MORBIDITY AND MORTALITY

Alcohol alters many facets of nutrient storage and utilisation in the body. In excess it can be toxic to cells in many organs such as the gastrointestinal tract and pancreas. Alcohol also is a well known teratogen, that causes foetal alcohol syndrome. Alcohol contributes to the development of chronic diseases such as liver disease, obesity, dyslipidaemia and hypertension. (21) This may be attributable to its direct toxic effect, its energy contribution to the diet (29 kJ/g) and,or, its displacement of other nutrients.

Alcohol contributes, directly and indirectly, to childhood morbidity and mortality. Children and adolescents are more susceptible than adults to the effects of alcohol. They have a lower tolerance and relatively small quantities can impair their judgement and control. Adolescents may also deny the harmful effects of their alcohol consumption. (22) Teenage girls who binge drink may not only compromise their own health but if they are pregnant they may also exacerbate the risk of the baby being born with foetal alcohol syndrome. (22)

A significant positive association of alcohol consumption with smoking has been found for both girls and boys, (22, 23, 24) and the use of alcohol also has been correlated with the use of a variety of other drugs, notably cannabis. (22)

Alcohol-related deaths in children have been reported from motor vehicle accidents, poisoning, fire injuries, machine injuries and suicide. (25) Alcohol intake plays a significant role in the risk of fatal car accidents in young male drivers. The combination of inexperience and raised blood alcohol concentrations (BAC) increases the relative risk of a fatal car accident for younger drivers compared with older drivers, despite a lower BAC. (22) In New South Wales in 1991, 16 per cent of the 65 motor vehicle drivers aged 20 years and under who were killed, and 21 per cent of the 675 drivers in the same age group who suffered serious injury, has a blood alcohol concentration of greater than 0.05 per cent. (26)

ALCOHOL CONSUMPTION BY YOUNG AUSTRALIANS

The alcohol consumption of young people reflects the consumption patterns of the community in which they live. Many Australian special occasions are celebrated with alcohol – rites of passage such as an eighteenth birthday, sporting victories and business successes. Excessive consumption of alcohol is often tolerated on such occasions

and moderation may be ridiculed. Participation in a 'shout' further encourages unrestrained drinking. (27)

In Australia, dependence on alcohol is less common in young people than in adults. (22) However, the prevalence of under-age drinking (ie the consumption of alcohol by persons aged less than 18 years) is increasing, and the age at which teenagers have their first drink is decreasing. (28) Interestingly, the trend towards a reduction in the prevalence of drinking in the general population has also been found in school students aged 12 to 17 years. (24) Thus, it appears that those who have left school consume more alcohol. (22)

Alcohol intake increases with age for both girls and boys, and abstinence decreases. (24, 29) Alcohol consumption is generally more prevalent amongst boys than girls. (23, 24, 29) The 1990 data for Australian schoolchildren indicated that 8 per cent of the girls and 13 per cent of the boys aged 12 years drank alcohol during the previous week, while by 17 years of age, 46 per cent of the girls and 51 per cent of the boys had drunk alcohol in the previous week. (24)

The school students who drank alcohol, consumed most of their alcohol on the weekend and it appears that drinking alcohol is a significant part of the teenager's social activities with 11 per cent and 17 per cent of 17 year old boys drinking more than ten drinks on a Friday and Saturday evening respectively. The proportions for girls whose intakes were similar were about half those of boys. (24) Three per cent of the 17 year old boys had an alcohol consumption which categorised them as a 'heavy drinker' according to NHMRC guidelines. (24)

SOCIAL EFFECTORS OF ALCOHOL CONSUMPTION

Parental attitude and behaviour are major predictors of adolescent drinking behaviour. (22, 23, 29) Children are often introduced to alcohol in the family home (23, 27) because it is considered a safe environment in which children can learn about moderate drinking. (23) In some cultures it is usual for children to be offered a small glass of diluted wine as part of the family's main meal. Children introduced to alcohol by their parents or with parental approval appear less likely to drink away from home or have alcohol-related problems than those who do so without their parents knowing that they drink alcohol. (23, 29) Peer pressure is also a strong influence in encouraging adolescents to drink alcohol. (22)

In the 1990 Australian study the schoolboys' most common drink was beer, while that of the schoolgirls was spirits (all ages). (24) Previous studies have noted an upsurge in wine intake in the school age population which has been attributed to the production and marketing of wine coolers. (22) Because children and adolescents often find traditional adult alcoholic drinks such as beer and wine too bitter for their palates, (30) it has been suggested that the sweet taste of wine coolers masks the flavour of alcohol and makes this form more palatable to younger people. (22, 30)

Although most students in the 1990 survey obtained alcohol from others rather than buying it themselves, there was strong circumstantial evidence of illegal purchasing of alcohol. (24) The failure to police the sale of alcohol to minors has been described as unofficial sanctioning of under-age drinking. (27)

EDUCATION PROGRAMS

Significant public health education policies and strategies to prevent alcohol abuse by young people have been implemented in the last five years. The draft National Health Policy on Alcohol in 1988 identified young people as a high-risk group and recommended specific strategies to reduce alcohol consumption by young people and to reduce the combination of drinking and driving in young people. (22) 'the recommended strategies to reduce consumption included legislation linking price with alcohol content, correct food labelling as to alcohol content, requiring 'proof of age' before being served alcohol, and strict controls on advertising. Educational strategies included the provision of adequate and appropriate resources to schools and parents, training in assertiveness and decision making for adolescents, and the provision of role models of abstinence and controlled drinking. Some educational programs based on these and similar policies have been implemented successfully and have resulted in the decline in the prevalence of drinking among school students. (24) However, further strategies are required to target those more likely to drink, eg those who have already left school.

Young people should be taught about alcohol in a population context. For example, the Dietary Guidelines for Australians (31) includes as its fifth guideline, *If you drink alcohol, limit your intake.* This guideline aims to decrease the average consumption of alcohol in Australia, and to provide advice on safe and moderate quantities

to those who want to drink alcohol. (31) Other recommendations about the safe level of daily alcohol consumption were made by NHMRC in 1987 and 1992. (27)

RELATIONSHIP TO OTHER GUIDELINES

- Enjoy a wide variety of nutritious foods. The importance of varied drink consumption is discussed.
- Children need appropriate food and physical activity to grow and develop normally. Growth should be checked regularly. Energy and nutrient content of drinks are addressed with regard to consumption patterns and energy intake of young children.
- Eat only a moderate amount of sugars and foods containing sugars. The possible roles of fruit juice in childhood diarrhoea, and drinks in dental caries, are described.

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CHAPTER 7

EAT ONLY A MODERATE AMOUNT OF SUGARS AND FOODS CONTAINING ADDED SUGARS

Children have a preference for sweet foods, which means that sugars are very often an attractive part of their diet. In this background paper some of the important aspects of sugars and the nutrition of children will be reviewed.

TASTE PREFERENCES OF CHILDREN

Several experiments have shown that infants with no prior feeding experience respond to sucrose solutions with vigorous sucking, lip licking and expressions of contentment; they respond to sour solutions with tongue protrusions, spitting and expressions of dislike. (1) The observation that sweet solutions are consumed by neonates in larger quantities than sour, bitter, salty or unsweetened solutions, lends further support to claims that sweet tastes are naturally preferred. (2) It has been suggested that the preference for sweetness has an adaptive (evolutionary) basis, because in nature most items with a sweet taste are sugars and thus sources of energy. (3)

Some investigators have made the distinction between innate preferences for the sweet taste of sugars, which are present at birth, and the preferences for high-fat foods, which might be learned during childhood or adolescence. (4)

The consumption of sugars is far greater per kilogram body weight in childhood than it is during adolescence or in adult life. (4) Although adults generally find at least mild sweet tastes to be pleasant, positive hedonic responses to strong sweets appear to decline during late childhood/early adolescence and declines in sweet preference may extend into old age. (1)

DENTAL CARIES

Diet can affect teeth in two ways, firstly while the tooth is forming before eruption and secondly, by a local oral effect after the tooth has erupted into the mouth. On present evidence the post-eruptive local effect would seem to be much more important and sugars are the most important dietary factors in this local effect. (5)

Mechanisms of dental caries causation

The observation that food deposits on the teeth cause decay dates back at least to the time of Aristotle who observed ‘the sticking of sweet figs to teeth caused them to rot’. (6)

As experimental science developed in the nineteenth century, a series of investigations indicated that carbohydrates, bacteria and acids were involved in caries causation. This led to Miller's chemico-parasitic theory of caries causation which continues to withstand the test of time. (7)

Dental caries is principally a childhood disease, the onset of which depends on the combination of dental plaque (including micro-organisms), susceptible teeth and fermentable carbohydrates. Dental caries does not occur instantaneously; the element 'time' is an important factor that reflects both the frequency of intake of fermentable carbohydrate and the period for which these cariogenic foodstuffs are in contact with the teeth. (8)

Cariogenic foods

Sucrose-containing foods are potentially cariogenic, and no other sugar has been shown to be more acidogenic or cariogenic than sucrose. In recent years, investigators have demonstrated that other sugars such as glucose and fructose are similarly cariogenic. (9) Lactose and galactose are significantly less cariogenic than other dietary sugars.(5) (10). So-called 'natural' sugars at high concentrations (for example honey) are no less cariogenic than added sugars at the same concentrations (11) In addition, starches may also be hydrolysed by salivary amylase to form acid-promoting sugars. (12)

Since the observation that prolonged acid production follows the ingestion of carbohydrates (13), considerable activity has been directed at developing a methodology that may allow for the identification and ranking of potentially cariogenic foods. However, from the earliest testing models it quickly became apparent that all fermentable carbohydrates were potentially cariogenic. (14) The amount of sugars contained within test foods does not appear to be relevant; critical pH thresholds are achieved at very low concentrations. (9, 15, 16, 17) Furthermore, foods that once were considered 'safe' for teeth, such as apples, have been shown to be potentially cariogenic. (18, 19)

No acceptable method currently is available for ranking carbohydrate foods in accordance with relative cariogenicity; the only scientific judgement that can be made relates to which foods are potentially cariogenic and which foods are non-cariogenic. (20)

Cariogenicity testing has been useful in identifying a number of non-cariogenic foods, such as peanuts (18), certain cheeses and skim milk. (21) In addition, several foods have been found to contain protective factors, including the phospho-protein casein in milk products (22), oat and rice husks, cotton seed, cocoa and barley bran. (23) Chewing gum for 20 minutes after a meal markedly reduces the amount and duration of plaque-mediated acid production (24) as well as the amount of dental plaque formed. (25) However, the gum should be a sugar-free variety, otherwise the teeth are being bathed in syrup during the chewing period. (26) This data suggests a useful role for gum chewing in preventive dental health strategies, in conjunction with regular brushing and flossing of teeth.

Modern food technology can also be used to modify the potential cariogenicity of food. Chandler et al (27) tested the cariogenicity of a fruit bar and concluded that:

> 'the deliberate inclusion of cariostatic ingredients such as milk solids, rice bran and vegetable oil appears to have modified the likely cariogenic potential of the dried fruit base.'

With reference to the guideline 'Eat plenty of breads and cereals, vegetables (including legumes) and fruits', the results of several studies indicate that cooked starchy foods, such as rice, potatoes and bread are of low cariogenicity in humans. (28)

Protective effects of saliva

Acid produced at the tooth surface after cariogenic challenge causes a dissolution of calcium and phosphate ions from the enamel. Saliva plays an important role in increasing the rate of oral carbohydrate clearance; thus there is less time for acid production. Because saliva contains a reservoir of calcium and phosphate ions, it can assist in repairing (remineralising) the enamel defects that result from the acid attack.

If fluoride is present (even in trace amounts), the rate of remineralisation is greatly enhanced. This explains one important benefit of using fluoride-containing toothpaste. If food is eaten frequently between meals, there is less opportunity for saliva to assist the remineralisation of the tooth surface. However, the importance of between meal snacks for children to meet their energy requirements is discussed in the background papers to the guidelines on growth and development and variety. for this reason, children who are

susceptible to caries should be encouraged to consume suitable between meal snacks and to practice good dental hygiene.

The rate at which carbohydrates clear from the oral environment is also important. In general, liquids will clear more quickly than solid fermentable carbohydrates. The perceived 'stickiness' of a food does not necessarily relate to oral clearance times. Although consumers identify caramels, jelly beans and milk chocolates as the most sticky of a range of test foods, these foods clear relatively quickly compared with white bread, potato chips and other starch products. (29)

Bottle fed caries

'Bottle fed caries' (sometimes called 'nursing caries') is a particularly rampant and devastating form of dental caries. It is caused by frequent and prolonged exposure of teeth to liquids that contain sugars, especially sweetened and unsweetened fruit juice, soft drink and cordial. Milk and infant formulae also contain sugar, but that sugar is not as cariogenic as the sugar in many non-dairy drinks because milk and formulae contain calcium, which aids remineralisation.

However, an infant's dental health is threatened when a bottle containing any liquid other than water is used as a pacifier. Prolonged exposure of teeth to liquids that contain sugars gives rise to a characteristic pattern of severe caries, particularly on the maxillary incisors where salivary flow is low during sleep.

To prevent 'bottle fed caries', parents should be counselled to avoid using a bottle as a pacifier (unless it contains only water) and to use a damp gauze to wipe their infants teeth and gums clean following feeding. (30, 31)

Prevalence of dental caries

Australia, along with the rest of the developed world, has experienced a dramatic decline in the prevalence of dental caries. (32) In the late 1960's the number of decayed, missing or filled teeth (DMFT) for 12 year olds was eight to nine. Caries incidence was virtually ubiquitous. By 1989, the DMFT was estimated to be 1.5 for 12 year olds. Moreover, 45 per cent of these 12 year olds were caries-free. (30)

Dental caries is still a major problem for a small group of children, particularly children those from disadvantaged backgrounds who lack access to fluoride and whose oral hygiene measures are inadequate. (33) There is also a high prevalence of caries among children of some ethnic groups.

In a recent Scandinavian study of 15 to 18 year old children, dietary intake studies showed a relationship between the consumption of sweets and the incidence of posterior approximal caries. (34) However, in other age groups of children in Western populations, epidemiological studies of caries in recent years do not show the strong links with consumption of sugars that were evident in past decades. (35) Undoubtedly the use of fluoride preparations and improved dental hygiene have changed the disease patterns. However, for disadvantaged children in our community the association between sugars and caries may remain a stronger link.

It is also important to consider the psychological effect of dental caries. As dental caries in our society decreases, children who suffer from rampant caries may suffer from psychological problems. The poor self-esteem and lack of self-confidence that may affect the child who has severe dental caries can lead to poor social development. Where caries go untreated, there may be disruption of function, such as eating, speaking and participation in school and social activities as a result of pain and discomfort. Dental caries can cause considerable suffering and impair the quality of life. (36)

DIETARY IMPLICATIONS OF DENTAL CARIES

In Australia, the National Health Strategy (30) has indicated that because of compliance problems with dietary counselling (and the changing patterns of dental caries disease), 'to be efficacious, dental health education via dental professionals needs to be targeted'.

The national decline in caries prevalence does not appear to be related to changes in dietary practices. The consumption of sugars has not varied significantly over this period, and the frequency of snacking has, if anything, increased. Yet diet-related dental caries has been ranked first as a cause of direct health costs in Australia. (37)

In the UK, the report of the Committee on Medical Aspects of Food Policy (COMA) concluded that sugars are an important cause of dental caries. (28) A WHO study group noted that very little caries occurs in children when the national per capita sugar (sucrose) consumption is below 10 kg per annum, but a steep increase may occur from 15 kg upwards. (36)

In reviewing the literature, Burt and Ismael (38) concluded that the long held causal relationship between the frequency of fermentable carbohydrate ingestion and dental caries is not always clear. Frequency may be a determinant in communities where consumption of fermentable carbohydrate is low, but in developed countries like Australia, frequency may be less important against a background of generally high intakes of fermentable carbohydrate, fluoridated water and/or toothpastes and improved hygiene status.

In May 1989, the American Academy of Paediatric Dentistry (31) announced:

> '... Dramatic reductions in dental caries following wide spread access to fluorides have resulted in decreased emphasis on dietary counselling as a preventive strategy for all children ... frequency of carbohydrate consumption should be restricted for caries susceptible children (eg those who develop caries in other than fissure surfaces).
>
> This traditional advice may be relaxed for caries-free and low-caries children who are regularly exposed to fluoride and comprehensive dental care.'

Of greater significance however, in the aetiology of dental caries in developed nations, may well be daily exposure to fluoride toothpaste rather than the frequency of food ingestion. (39) The NHMRC also acknowledges that water fluoridation continues to contribute to the prevention of dental caries. (40) While sugars are undoubtedly cariogenic, many other factors also affect rates of dental caries. Nevertheless, moderation of sugars consumption is still a worthwhile public health measure. Rugg-Gunn (5), suggests the reduction of sucrose in the diet by removing/reducing sugars in selected foods, the substitution of non-cariogenic sweeteners for sucrose/glucose in foods and the modification of sugars-containing foods so they are less cariogenic.

Achieving optimum levels of dental health and general health are compatible objectives; the same nutritional advice applies equally to both aims. However, in the case of caries-active children, further effort must be directed at reducing the number of between-meal snacks in order to minimise the duration of acid challenge to the teeth and to maximise the period of saliva-initiated enamel repair.

COMPROMISED NUTRITIONAL STATUS

The WHO report 'Diet, nutrition and the prevention of chronic diseases' (36) states that:

> '... an intake of free sugars, more than 10 per cent of total energy, could be disadvantageous in that free sugars in the diet displace other energy sources such as starches which, when obtained from cereals, pulses and vegetables, are accompanied by a wide variety of micronutrients.'

Reported consumption of sugars from dietary surveys

Intakes of sugars were measured in the National Dietary Survey of Schoolchildren (aged ten to 15 years), 1985. 'Sugars' include both naturally occurring sugars (for example lactose in milk; sucrose, maltose, fructose, glucose in fruit and vegetables) and refined sugars (for example, brown, raw or white sucrose; glucose syrups). (41)

Approximately 30 per cent of both boys and girls were found to consume 15 per cent or more energy from added sugars, while over 13 per cent of both boys and girls consumed 20 per cent or more energy from added sugars (Table 1). These figures indicate an area of concern, given the statement in the WHO report cited earlier.

EXTRACTED

Table 1A Percentage of children consuming 20 per cent or more energy from added sugars by age and sex

	Age (years)						
	10	11	12	13	14	15	Total
Boys	11.65	10.02	16.59	13.58	14.82	13.27	13.29
Girls	11.61	14.32	14.49	13.59	12.79	11.89	13.16

Table 1B Percentage of children consuming 15 per cent or more energy from added sugars by age and sex

	Age (years)						
	10	11	12	13	14	15	Total
Boys	25.05	26.80	32.29	28.81	32.24	32.43	29.52
Girls	30.775	31.02	33.13	28.04	31.39	27.39	30.53

Source: 1985 National Dietary Survey of Schoolchildren aged ten to 15 years. (41)

Boys aged ten to 15 years were found to consume between 55 g and 89 g of sugars at the 10th centile, and between 189 g and 278 g at the 90th centile on the day of the survey. The corresponding figures for girls were 49 g to 57 g and 168 g to 199 g respectively. For adults (all ages) the intake of sugars was less. Men at the 10th and 90th centiles consumed 50 g and 212 g respectively each day. For women the corresponding consumption of sugars was 35 g (10th centile) and 160 g (90th centile).

Table 2 shows the percent contribution of food groups to mean sugars intake. The 'milk and milk products' and 'non-alcoholic beverages' (soft drinks, fruit juice drinks and fruit drinks, cordials and orange juice) groups contributed approximately 50 per cent of sugars intake for both boys and girls. Cakes, biscuits, desserts, confectionery, ice creams and ice confections together contributed approximately 22 per cent to 25 per cent of sugars intake, while sugars, jams, honey and syrups contributed 9 per cent to 10 per cent of total sugars intake.

Table 2 Contribution of food sources to sugars intake, food group, sex (%)

	Boys (years)			Girls(years)		
Food group & subgroup	**10–11**	**12–15**	**All**	**10–11**	**12–15**	**All**
Milk & milk products	**24.5**	**25.4**	**25.1**	**22.4**	**20.8**	**21.2**
Milk, unflav	15.3	14.1	14.4	12.6	12.3	12.4
Icecreams and iceconfections	6.3	6.2	6.2	6.7	4.9	5.4
Milk, flav	1.7	4.0	3.3	1.8	2.5	2.3
Yoghurts	1.1	1.0	1.1	1.3	1.0	1.1
Beverages, non-alc.	**23.0**	**22.5**	**22.6**	**24.4**	**25.7**	**25.3**
Soft drinks	6.3	8.1	7.6	5.7	8.4	7.6
Fruit juice drinks, fruit drinks	6.4	5.0	5.4	6.5	7.0	6.8
Cordials	4.5	4.2	4.3	5.8	3.5	4.2
Orange juice	4.3	4.0	4.0	4.7	5.3	5.1
Other	1.5	1.2	1.3	1.7	1.5	1.6
Cereal and cereal products	**17.0**	**16.3**	**16.5**	**18.0**	**15.8**	**16.5**
B/fast cereals	4.6	4.5	4.5	4.1	3.4	3.6
Cakes	3.5	3.8	3.7	5.1	3.8	4.2
Biscuits	4.1	3.3	3.5	4.4	4.0	4.1
Desserts	2.3	2.1	2.2	2.1	2.2	2.2
Breads	1.5	1.6	1.4	1.4	1.4	1.4
Other	1.0	1.0	1.0	0.9	1.0	1.0
Sugars, jams, honey						
Syrups	**10.4**	**11.0**	**10.9**	**8.9**	**9.0**	**9.0**
Fruits	**11.9**	**10.4**	**10.8**	**12.1**	**13.1**	**12.8**
Confectionery	**6.4**	**8.4**	**7.8**	**7.8**	**9.2**	**8.8**
Condiments etc	**2.7**	**2.2**	**2.4**	**2.6**	**2.4**	**2.5**
Vegetables	**2.6**	**2.3**	**2.4**	**2.4**	**2.4**	**2.4**
All other foods	**1.5**	**1.5**	**1.5**	**1.4**	**1.6**	**1.5**

Source: 1985 National Dietary Survey of Schoolchildren aged ten to 15 years. (41)

RESCINDED

When the percentage contribution of food groups to total carbohydrate intake is compared between children and adults, ice creams and ice confections (2.8 per cent versus 1.3 per cent) and sweetened soft drinks (3.8 per cent versus 2.5 per cent) made a more substantial contribution to the carbohydrate intake of children than of adults. Conversely fruit made a lesser contribution. Confectionery contributed 4.7 per cent of the carbohydrate that the surveyed children consumed.

The CSIRO dietary surveys measured both refined and added sugars in the diets of adults and children. (42) The intake of refined sugars accounted for 41 per cent of total intake of sugars in the children. The major contributor to the total intake of sugars was the 'fruit and fruit juice' category, followed by the 'sugars/jams/syrups' and 'dairy foods' categories. Together, these three groups accounted for approximately 60 per cent of the total intake of sugars. 'Cakes, biscuits and confectionery' accounted for 10.5 per cent of total sugars intake. (42)

Sucrose was the major individual refined sugar and provided 9 per cent—10 per cent of total energy in the diet of 10 year old children. Naturally-occurring sugars accounted for 14 per cent of total energy intake in children.

Two recent Western Australia studies of nutrient intakes in 11 and 12 year old schoolchildren were conducted in 1987 and 1988. (43) Intakes of total sugars (added and naturally-occurring) were measured, and sugars contributed 21 per cent to 24 per cent (median) of energy. The authors state that: 'data from Australian adults suggest that about half of their sugar intake is in the form of refined sugars'.

The American Dietetic Association (ADA) found that, although children tend to eat slightly more added sugars than adults (13 per cent to 14 per cent versus 11 per cent of dietary energy respectively), a diet high in sugars did not predict a nutritionally inadequate diet. ADA (44) recommends that:

> '...educational efforts to ensure adequate nutrient intake should be targeted toward persons who use foods high in added sugars as substitutes for more nutritionally desirable foods, rather than toward persons who apparently use added sugars to meet high energy needs.'

Does the consumption of sugars displace essential nutrients from the diet?

There is a belief that excessive intakes of added sugars by children displaces more nutrient dense foods from the diet and that this in turn may influence intakes of more marginally consumed nutrients such as calcium, iron and zinc.

The National Dietary Survey of Schoolchildren (41) found that on the day of the survey:

- mean zinc intakes were below the current RDI for boys 12 and 13 years and girls 10-15 years of age;
- mean iron intakes for girls were at the lower end of the RDI range for this nutrient;
- the proportion of girls aged ten to 15 years consuming less than 50 per cent of the RDI for calcium ranged from 24 per cent (11 year olds) to 31 per cent (15 year olds). For boys the range was 11 per cent (ten year olds) to 29 per cent (12 year olds);
- more than 30 per cent of girls aged 12 to 15 years were consuming less than 70 per cent of the RDI for vitamin A; and
- the fat content of the diets of children aged ten to 15 years contributed 37 per cent of total energy–saturated fatty acids contributed 16 per cent of total energy. (41)

A study of food intake of Adelaide children found that boys aged four and six years and girls four to eight years had a 50th percentile intake of less than the RDI for calcium. (45) Also, eight year old boys and four and eight year old girls had 50th percentile intake less than the RDI for zinc. (45) Compared with data from the 1950s and 1960s, the Adelaide children had a lower calcium intake, which the authors of this study suggest reflects changes in milk-drinking habits. (45)

The reported consumption of sugars from dietary surveys support the contention that boys and girls consume sugar at above the level recommended in the WHO report. (36) Furthermore, these survey data lend support to the concerns expressed in the WHO report; that excessive sugar intake may be accompanied by lower nutrient intake.

Perhaps excessive intakes of simple carbohydrates by Australian children have displaced more nutrient-dense foods from the diet, and influenced intakes of marginally consumed nutrients, calcium, iron and zinc. The potential implications of reduced intakes apply to both physical and mental growth and development. For example, poor learning and memory have been associated with diets deficient in zinc. (46)

Also, as a result of reduced nutrient density, there is the reduced provision of 'protective factors' against dental caries. Such factors include vitamin C and, probably more significantly, calcium and phosphorous. (5) Considering that calcium already often is considered to be a marginal nutrient in a proportion of Australian children's diets, it would seem reasonable to suggest replacing high carbohydrate soft drinks devoid of nutrients, with more nutrient-dense beverages, such as milk.

Further research is required to estimate the consumption of both naturally-occurring and refined sugars and the correlations between consumption of sugars and micronutrient intakes. This information is essential given the changes in children's eating behaviour over the last decade to a more grazing pattern of eating and increased consumption of snack and convenience foods.

EFFECTS ON BEHAVIOUR

Suggestions that a high intake of sucrose, or other simple sugars, is the cause of antisocial, or criminal behaviour are not based on convincing scientific evidence, but, rather, on anecdote and misinterpretation of scientific data. (45) A recent review of the literature (48) over the past decade reveals there is little evidence to suggest that sucrose ingestion causes hyperactivity or violent behaviour. Many studies have indicated that no relationship exists between the intake of sugars by children and their level of irritability. (49) Double-blind studies have not found that sucrose leads to hyperactivity in children. (50)

SUGAR INDUCED DIARRHOEA

The excessive consumption of fruit juices, particularly apple and pear juices, is a common cause of chronic non-specific diarrhoea, or 'toddlers diarrhoea'. (51) Fruit juices ingested in excess, particularly those that contain fructose in higher concentrations than glucose, such as apple juice, with or without sorbitol, may cause

gastrointestinal discomfort in children. (51) This is discussed in more detail in the guideline on water.

INTENSE SWEETENERS

Corn syrups are used overseas in many food and beverage products and are the main nutritive sweetener used in the soft drink industry. (52) Corn syrup contains mainly fructose, which is sweeter than sucrose and contains less energy per unit of sweetness. (50) High-fructose corn syrup (HFCS) is made by an enzymatic process which converts glucose, derived from corn starch, to fructose. Since fructose has a higher perceived sweetness than sucrose, use of HFCS in food products permits a reduction in the quantity of sweetener used and allows for a lower kilojoule product. (52) However, corn syrups are cariogenic, and little practical dental benefit would be derived from the substitution of these sweeteners for sucrose. (52) Were the use of fructose sweeteners to become commonplace in Australia, the risk of 'toddler diarrhoea' from this source would increase.

OTHER REASONS TO HAVE THIS GUIDELINE

Studies of Australian adults (53) show a lack of concern over the consumption of sugars. Because children generally rely on their parents for the provision of food, this guideline highlights the importance of moderating the intake of sugars in the child's diet for the above stated reasons. Parents need to be informed of the reasons why intake of sugars should be moderated so that they can become motivated to supply the appropriate diet and can guide their children in establishing good eating habits in childhood. Children increase their preferences for foods that are presented by elders, heroes or peers. (3) Therefore, it is vital that parents and other people that children respect acknowledge this responsibility and do not abuse their role in influencing a child's food preferences.

CONCLUSION

The dietary guideline on sugars is appropriate for children and adults because foods that are high in added sugar contribute to dental caries, and may displace more nutrient dense foods in the young children's diets due to appetite reduction.

Naturally-occurring and added sugars improve the palatability of many foods, including nutritious foods such as milks, yoghurts, fruit and breakfast cereals and apparently sweet tastes are naturally preferred. Therefore, the *judicious* use of sugars, given a wise selection of foods, can assist in ensuring an adequate intake not only of energy, but of foods which provide a range of essential nutrients which may otherwise be rejected by children.

Among some population groups, for whom sugars make a substantial contribution to energy consumption, a reduction in consumption of sugars may adversely impact on overall energy intake. If the consumption of sugars decreases too much and,or, the use of non-sugar sweeteners increases significantly, these people will need to return to the principles of the dietary guidelines to identify appropriate foods to replace the energy deficit. Wise food selection will enable adequate energy intake without relying on high sugar foods as an energy source.

As parents are role models for children, they need to encourage children to consume a balanced diet, consistent with a child's needs for growth, activity and development. Children should be encouraged to consume nutritious foods which will contribute only moderate amounts of sugar.

RELATIONSHIP TO OTHER GUIDELINES

- Enjoy a wide variety of nutritious foods. The importance of achieving variety in the types and amounts of foods consumed by children is described.
- Encourage water as a drink. Alcohol is not recommended for children. The consumption of fluids containing sugars by children is discussed.

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CHAPTER 8

CHOOSE LOW SALT FOODS

This guideline is suitable for children as the liking for salt and salty foods is a learned taste preference and the recommendation that the adult population reduce their sodium intake will be more successful if a children do not develop a liking for salt.

The current NHMRC recommendation for the Australian population in general is that sodium intake be under 2,300 mg (100 mmol) per day. (1, 2, 3). Table 1 shows the conversion factors for the units used to express sodium intake.

It is agreed that in the first half of infancy the sodium intake should be low. However, there is less agreement about whether the recommended sodium intake between six months and 18 years of age should be restricted, as it is before and after these years.

Table 1 Conversion factors for specifying sodium content

1 mmol = 23 mg
1 g = 43 mmol
1 g sodium chloride (NaCl) contains 17 mmol sodium

INFANTS

Infants who are solely breastfed receive 92-161 mg (4 – 7 mmol) sodium per day from average intakes of breastmilk. Breastmilk typically contains 161 mg sodium (7 mmol) per litre. Similarly, exclusively formulae-fed infants receive small amounts of sodium, because infant formulae manufacturers have reduced the sodium content of formulae to match that of breastmilk. The sodium content of infant formulae ranges from 149 mg to 184 mg (6.5 to 8 mmol) per litre and the sodium content of cow's milk is 506 mg (22 mmol) per litre.

Two Australian food standards regulate the addition of sodium to infant foods (4, 5):

- Standard R6 'Cereal based foods for infants and young children' places an upper limit for the sodium content of ready-to-eat cereals of 3 g/kg and for products other than ready-to-eat cereals, 750 mg/kg.

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- Standard R5 'Canned foods for infants and young children' places an upper limit for sodium of not more than 1 g/kg in ready-to-eat form or, as the case may be, when prepared in accordance with the directions contained in the label. (4)

Addition at these low levels is supported worldwide by baby food manufacturers and food standards committees; these groups responded to requests from paediatricians which are based on the grounds that:

- breast milk is low in sodium;
- young infants have limited ability to excrete excessive sodium loads (which can result in hypernatraemia); and
- it is unwise to develop a taste for salt in young infants who are unable to control what they eat.

In Canadian weaned infants, given home prepared baby food, Yeung (6) reported that the average sodium intake at 12 months of age was 920 mg (40 mmol) per day (with home prepared foods providing half of this and milk the rest), whereas with commercial baby foods the sodium intake was only about 550 mg (24 mmol) per day, mostly from milk. The provision of more sodium by home-made baby foods than by commercial baby foods has been noted both in the USA (7) and Australia. (8,9) This raises the question as to whether parents who prepare home-made baby foods adjust the taste to suit their own salt preference.

CHILDREN

Compared with the many large studies of the salt/blood pressure relationship in adults, very few studies have been done in children. This is not surprising because it is more difficult to carry out controlled measurements and experiments in children.

Observational epidemiology

Jenner et al (10,11) examined 884 nine year old boys and girls in Perth and estimated nutrient intakes with food frequency questionnaires. There was no consistent relationship between blood pressure (systolic or diastolic) and estimated sodium intake or table salt habits. It might be argued that the food frequency questionnaire is not the ideal way of obtaining true sodium intakes. Jenner et al, however, cite three other negative reports (12,13,14).

Using a different approach, Lauer et al (15) compared taste preferences and thresholds for salt in children with average blood pressures and in those with blood pressures above the 95th percentile and found no significant differences. However, correlations of single point estimates of sodium intake and blood pressure are also sometimes not significant in adults.

Probably the most thorough and informative observational study was made by Geleijnse et al in The Netherlands (16). The blood pressures of over 200 children were measured, then re-measured yearly over six years; also urinary sodium and potassium (K) concentrations were measured. Children with a larger rise of blood pressure (though all within the normal range) had lower urinary potassium, or higher urinary Na/K ratios. Urinary sodium alone was not related to the degree of rise of blood pressure.

In a Swedish study (17), diastolic blood pressures in a total 738 children at four, eight, and 13 years were related positively to sodium intakes at eight years but not in the other two age groups. (Nutrient intakes were calculated from seven day weighed food records).

Average blood pressures rise through childhood and most observers find that children in the upper part of the frequency distribution at one age are more likely to be in the upper part of the distribution at later ages (18,19,20,21,22). However, apart from family studies, we do not know whether children with higher usual blood pressures are more likely to become hypertensive in later adult life.

Intervention trials

Some intervention trials have shown that blood pressure fall when normotensive children consume less sodium. Hofman et al (23) compared the blood pressures of 245 infants on a typical sodium diet with those of 231 infants on low-sodium diets. At six months of age blood pressures were significantly higher in infants on usual sodium diets. Ellison et al (24) found modest but significant reductions in blood pressure in 15 year old children at two boarding schools (n = 341 and 309) that reduced salt in food in a crossover study that lasted for over two years.

Miller et al (25) recruited families with twins to participate in a randomised, controlled, 12-week trial of salt reduction. One hundred and forty-nine school-aged children from 44 families participated. Twenty-four hour sodium excretion was about halved and blood pressures were a little lower during the diet period (diastolic pressures were significantly lower in girls).

In Adelaide, Howe et al (26) found by screening 376 schoolchildren 11 to 14 years of age, 11 girls and ten boys whose blood pressures were around the 90th percentile. The intervention group was then taught how to adopt in a low-salt diet, which they took for three weeks and observations were made on usual diets. In the low-salt period, diastolic blood pressures were significantly lower in girls, whose urinary sodiums averaged 76 mmol/day, but not in the boys, whose urinary sodiums averaged 125 mmol/day. In a subsequent paper, Howe et al (27) repeated this type of experiment on 100 children, aged 11 to 14 years with relatively high, medium and low blood pressures; blood pressure was not significantly reduced (but diastolic pressures were lower for children in the highest blood pressure decile) and do not refer to their first paper in this second paper. Other intervention studies have reported negative results (28,29,30,31).

Thus, the possible existence of a relationship between sodium intake and blood pressure in children is not a compelling reason to restrict children's salt intake. In populations that do not suffer from hypertension, and have low salt intakes, (26,27) sodium intakes are low in both childhood and adult life. There is no national experience of a community with high salt intakes in adult life but low salt intakes in childhood.

RATIONALE FOR RECOMMENDING RESTRICTION OF SALT INTAKE FOR AUSTRALIAN CHILDREN

Consistency of family food selection and food preparation

If the adult and infant family members are advised to moderate or restrict salty foods and added salt, there is no reason to prepare or buy special foods with higher salt for the children. National dietary advice is sometimes expressed as, 'Avoid adding salt in family cooking'.

Evidence suggests that the liking for a moderately or strongly salty flavouris acquired (34)

The UK Department of Health (35) has set new reference daily nutrient intakes for sodium that are related to energy intake, for example:

- 207 mg (9 mmol) in the first three months;
- 276–345 mg (12–15 mmol) for the rest of infancy;
- 506 mg (22 mmol) from one to three years;
- 690 mg (30 mmol) from four to six years;
- 1150 mg (50 mmol) from seven to ten year; and
- 1610 mg (70 mmol)/day from 11 years and into adult life.

Thus, sodium intake should be related to energy intake; for adolescents the energy intake often equals or exceeds that of adults.

Food habits

A special feature of the food habits of children and adolescents is the relatively high intake of fast and take-away foods (36). Most of these foods have a high salt content (37,38) or have salt added at the point of sale. Regular consumption of these foods along with snack foods and processed foods significantly increases the daily sodium intake. The dialogue that has already commenced between nutritionists and food manufacturers (with nutritionists urging lower salt alternative products) should continue to address this problem.

The New Zealand 'Food and nutrition guidelines for children aged two to 12 years' (39) does not have a chapter on salt but under 'Treat Foods' the following points are made:

Sustained intake of a diet containing a large excess of salt appears to be a critical factor in the eventual onset and maintenance of hypertension in those who have a genetic predisposition to this disease … It has been suggested that intakes below 2 g of salt per day (33 mmol) will help prevent hypertension. Families with a history of essential hypertension should accustom their children to intakes below 1 g of salt per day (17 mmol).

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This is not incompatible with Australian recommendations but the inclusion of separate advice for children with a genetic predisposition to hypertension is impractical. Many people have an older family member with some degree of hypertension and most parents of young children have not reached the age at which essential hypertension usually manifests. Therefore, in these circumstances moderation of salt intake for all children is the better public health advice.

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RESCINDED

CHAPTER 9

EAT FOODS CONTAINING CALCIUM

This guideline has been extended to include all infants, children and adolescents in recognition of the relative safety of dietary calcium and its importance in achieving peak bone mass. Infancy, childhood and adolescence are critical periods for establishing healthy eating habits and exercise patterns that lead to the attainment and maintenance of peak bone mass.

THE NEED FOR CALCIUM IN INFANCY, CHILDHOOD AND ADOLESCENCE

The skeleton is in a rapid phase of growth throughout childhood and adolescence; (1,2) from birth to puberty the skeleton increases in mass about seven-fold and a further three-fold in adolescence. (3)

After an initial rapid period of growth in the first year of life, the rate of growth in children from two years of age until puberty remains relatively constant for both boys and girls. Growth again accelerates with the onset of puberty and adolescence, which occurs about two years earlier in girls than in boys. (3)

The best protection against age-related bone loss and subsequent fracture risk is considered to be the attainment of a high peak bone mass at skeletal maturity. (2) Peak bone mass is a product of the interaction between endogenous (hereditary, endocrine) and exogenous (nutritional, exercise-related) factors. Calcium seems to be the most important nutritive factor that determines peak bone mass in young adults. (1)

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, an essential requirement for healthy bone development during childhood and adolescence is a continuous supply of calcium in amounts appropriate to the changing needs of growth. (3)

ABSORPTION

It can be more difficult to ensure an adequate supply of calcium than of other nutrients, because calcium is not widely distributed in the food supply. (2) The major determinants of absorption are the amount of bioavailable calcium in the diet and the vitamin D status. The presence of lactose in a meal also appears to enhance absorption. (3)

SUPERSEDED

The following factors compound the difficulty of obtaining adequate dietary calcium:

- inefficient absorption of calcium at times of high requirements;
- variability in the bioavailability of calcium from the diet—high intakes of dietary phosphates and oxalates, an abnormally high pH in the small intestine, binding by phytates and polyphenols and fat malabsorption can limit the bioavailability of calcium;
- continuous excretion of calcium in the urine, faeces and sweat as an obligatory loss. (2,3); and
- inappropriate restriction of dairy products in cholesterol-lowering diets, and suspected allergy.

The need to retain about 150 mg of calcium per day, from birth to adolescence, for skeletal mineralisation cannot be met if dietary calcium intake and,or, absorption are inadequate. Calcium cannot be manufactured by the body; therefore, the calcium content of the skeleton at any period during childhood and adolescence represents previous absorption from the diet and retention in the bone, after obligatory losses have been met. (3)

INTAKES

The RDIs for calcium by infants, children and adolescents are shown in Appendix 1. (4) Generally, the available data on calcium intakes by infants, children and adolescents confirm concerns that the recommended intakes for calcium are not being achieved by these groups. (5) The effects of these inadequate intakes on bone density and growth are unclear.

- A two year longitudinal study conducted in Perth in the late 1970s and early 1980s found that calcium intakes decreased with age for both boys and girls. Mean intakes fell from 781 and 797 mg/day respectively at age one year to be below the RDI for girls at 18 months of age (692 mg/day) and boys at three years of age (645 mg/day). (6)
- A second longitudinal study undertaken in Adelaide found that the 50th percentile of calcium intake for four and six year old boys was below the RDI (707 and 768 mg/day respectively), while that for eight year old boys was slightly above the RDI at 810 mg/day. Intakes for girls were lower, with intakes of 682, 746 and 751 mg/day at ages four, six and eight respectively. (7)

The authors of both studies compared their findings with those of earlier studies and found that calcium intakes appear to have decreased since the 1950s and 1960s.

The mean daily consumption of cow's milk in 1954 was 490 ml compared with 300 ml at age three in their study. (6) The decline in calcium intake after one year of age in the study by Hitchcock et al persisted despite the doubling of cheese intake in the second year of life—this reflects the displacement of cow's milk by other foods and beverages, such as orange juice.

- The National Dietary Survey of Schoolchildren in 1985 found that dairy products supplied approximately 70 per cent of the calcium consumed on a given day; cereals were the second major source of calcium at approximately 12 per cent. (Table 1)

Table 1 Contribution of food groups to mean calcium intakes for all children aged 10 to 15 years

Food group and subgroup	Contribution (%)
Milk and milk products	**68.2**
Milk, liquid, whole	42.2
Cheeses	9.1
Milk, flavoured	4.4
Ice creams and ice confections	4.8
Milk, liquid, reduced fat	4.0
Yoghurts	1.9
Other	1.8
Cereal and cereal products	**12.5**
Breads, all varieties	5.2
Desserts	2.5
Breakfast cereals, all varieties	1.1
Other	3.7
Meat and meat products	**4.5**
Vegetables	**4.6**
Fruits	**2.3**
Confectionery	**2.0**
Beverages, non-alcoholic	**1.9**
Condiments, flavourings and soups	**1.6**
All other foods	**2.4**

Source: National Dietary Survey of school children, 1985 No. 1 Foods consumed. (8)

WITHDRAWN

The proportion of children who consumed less than the RDI on the day of the survey is shown in Table 2. It can be seen that girls were more likely than boys to have intakes below the RDI; approximately 25 per cent to 30 per cent of girls aged ten to 15 years had intakes below 50 per cent of the RDI. Boys aged 12 and 13 years also had intakes of concern—23 per cent to 29 per cent consumed less than 50 per cent of the RDI. Although these data are based only on a one-day dietary record and intakes below the RDI do not necessarily imply nutritional deficiency, further study is warranted to determine why such a large proportion of a population group has intakes that ate significantly below the RDI. (9)

Table 2 Consumption of calcium at less than the RDI by children aged 10 to 15 years (%)

	<RDI	<0.7 RDI	<0.5 RDI
Boys			
10 years	51.0	26.4	11.4
11 years	49.9	27.0	12.6
12 years	75.1	51.1	29.4
13 years	70.5	42.2	23.4
14 years	59.3	34.8	17.6
15 years	54.1	29.1	5.0
Girls			
10 years	71.0	45.4	26.7
11 years	74.0	44.0	24.1
12 years	71.4	49.5	27.7
13 years	75.5	48.1	26.5
14 years	71.0	44.9	27.2
15 years	73.4	47.0	30.5

Source: National Dietary Survey of Schoolchildren, 1985. (9)

RESCINDED

Table 3 Common dietary sources of calcium and the amounts of different foods required to provide 300mg calcium

Food	Household measure	Weight (g)	Calcium (mg)	Amount of food required to provide 300mg calcium
Milk, fluid				
Whole	1 cup	–	310	1 cup
Reduced fat	1 cup	–	375	4/5 cup
Skim	1 cup	–	310	1 cup
Skim + Ca^{2+}	1 cup	–	410 to 540	~3/5 cup
Cheese				
Cheddar	1 cube (2.5cm^3)	20	130	2+1/3 cubes
Cottage	1 tbsp	20	14	10+1/2 tbsps
Cream spread	1 tbsp	24	67	4+1/2 tbsps
Yoghurt				
Fruit	1 tub	200	255	1+1/5 tubs
Natural	1 tub	200	390	4/5 tub
Low fat fruit	1 tub	200	345	~1 tub
Low fat natural	1 tub	200	520	3/5 tub
Dairy desserts				
Custard	1 cup	–	280	~1 cup
Ice cream	2 level scoops	48 (100ml)	64	9+1/2 level scoops
Soy beverage				
Ca2+ fortified	1 cup	–	295	1 cup
Not fortified	1 cup	–	34	~9 cups
Nuts & Seeds				
Almonds	1/2 cup	85	187	4/5 cup
Sesame seeds	1 tbsp	13	8	37+1/2 tbsps
Tahini	1 tbsp	21	69	4+1/3 tbsps
Fruit & Vegetables				
Oranges	1 medium	122	35	~9 oranges
Brussels sprouts	5 sprouts	100	14	107 sprouts
Broccoli	1 spear	50	15	20 spears
Baked beans	1 cup	275	94	3+1/5 cups
Fish *(only if the bones are consumed)*				
Salmon, canned	1 cup	210	650 (pink) 465 (red)	1/2 cup 2/3 cup
Sardines	5	75	285	5+1/2 sardines
Cereals				
Bread (regular)	1 slice	30	15	20 slices
Other				
Chocolate, milk	6 squares	30	73	24+1/2 squares
Mars Bar*	1 bar	63	101	3 bars

1 cup = 250 ml, * = Registered trademark, ~ = approximately

Sources: Engli R, Lewis J. Food for Health: A Guide to Good Nutrition with Nutrient Values for 650 Australian Foods. National Food Authority. Canberra:AGPS, 1991. (11)
Manufacturers data.

RESCINDED

In recognition of the potential inadequacy of calcium intakes in the general population, a target of 1000 mg of calcium per person per day has been set for the whole population by the year 2000; this represents a 10 per cent increase in intake from the current daily intake of 904 mg. (10) This target probably will be achieved from the diet, without supplementation. The setting of this target further justifies the need to encourage infants, children and adolescents to consume adequate intakes of calcium, preferably from dairy products, each day.

FOOD SOURCES

Table 3 lists the common dietary sources of calcium. The table specifies the amounts of each food that is required to provide 300 mg calcium. This quantity was chosen using one metric cup of full-cream cow's milk as a reference value. The foods listed can be considered in terms of exchanges—each quantity of food in the last column of the table provides as much calcium as 250 ml of milk.

Clearly, the RDI for calcium is easier to meet when dairy products are consumed. For example, for an eight to 11 year old girl to consume the RDI for calcium (900 mg), she could eat one tub of fruit yoghurt, one cup of milk and half cup of pink salmon.

This is more achievable than trying to obtain the same amount of calcium from only non-fortified, non-dairy sources, eg half cup pink salmon, five dried figs, three tablespoons tahini paste, one cup boiled wholemeal pasta, four slices bread, quarter cup blanched almonds and one cup diced honey dew melon.

Calcium-fortified soy beverages (100 mg calcium/100 ml) provide an equivalent amount of calcium to regular milk. The use of these products as a substitute for milk in adequate quantities will still enable the RDI for calcium to be met. However, non-fortified soy beverages do not provide sufficient calcium.

If dairy sources or calcium-fortified soy beverages are not consumed, supplements are likely to be required in order to achieve adequate intakes of calcium.

Table 4 provides a list of practical tips for increasing calcium in the diet.

Table 4 Practical tips to increase calcium in the diet

- Offer children milk to drink rather than sweetened drinks and fruit juices.
- Encourage breakfast cereals (preferably wholegrain, with no added sugar or fat) with milk, as a convenient and nutritious snack for children and adolescents at any time of the day.
- Choose desserts such as milk puddings, milk jellies and jelly whips, custards and yoghurts.
- Add skim milk powder to mashed potato, soups and when baking.
- Try casseroles and pasta dishes using milk-based white sauces, and melt cheese into white sauces to pour over vegetables.
- Sprinkle grated cheese on mashed potato, cauliflower, and other vegetables, and have cheese in pizza toppings, on dry biscuits, in sandwiches or as a finger food snack.
- Substitute natural yoghurt for sour cream in dips, and dollop natural yoghurt on pasta dishes, stir fried vegetables, tacos and nachos.
- Substitute cream cheese spread or plain fromage frais for butter or margarine, on dry biscuits, savoury muffins toast and in sandwiches.

OTHER ISSUES

Exercise

Regular, weight-bearing exercise is also an important component in bone mineralisation. (2) The encouragement to participate in regular physical activity from early childhood (refer to background paper to the guideline on growth and development) will not only contribute to a healthy body weight but also to peak bone mass.

SUPERSEDED

Milk intake and mucus production

There is a common misconception in the general community that milk consumption leads to mucus production. (12) There is also limited evidence to suggest that this perception exists among health professionals. (13)

Pinnock et al (12), found no statistically significant association between the consumption of milk and other dairy products and symptoms of mucus production in healthy adults. A study of asthmatic children (a group more susceptible to mucus hypersecretion), found that the link between milk consumption and mucus production is based on mild, undiagnosed cow's milk intolerance which results in respiratory symptoms. (14)

Milk should only be excluded from the diet of children with diagnosed cow's milk intolerance, including those with proven milk-related respiratory symptoms. The diet of these children should include a nutritionally adequate replacement of milk, eg a calcium-fortified soy formulae or beverage.

Table 5 Prevalence of primary lactase deficiency in adults in different population groups

Population	Prevalence	Per cent
Australian	Anglo Saxon	10
	Aboriginal	80–90
North American	White	5–20
	Black	70–75
Asian	Thai	97
	Indian	50–60
	Chinese	90
	Japanese	90
	Malayan	90
Greek		60–80

Source: Davidson GP. 1984 (15)

Lactase deficiency

Lactose intolerance is the term that usually is applied to the development of gastrointestinal symptoms caused by the malabsorption of lactose due to a deficiency of lactase. Lactose malabsorption can also occur without the development of symptoms.

Lactase deficiency affects most of the world's adult population (15) (see Table 5) and is due to a genetically determined reduction in intestinal lactase activity. The decrease in lactase activity and hence onset of symptoms can develop from as early as three years of age. (16)

Malnutrition in early childhood may hasten the normal age-related decline of lactase activity in individuals who are predestined to become lactase deficient as adults. (17) In Australia this is most likely to occur among Aboriginal Australians and lead to permanent lactase deficiency from an age when milk is still an important energy source. (18) Lactase deficiency itself can also contribute to growth failure in malnourished children. (19)

Secondary lactase deficiency, which most commonly occurs after acute gastroenteritis and is generally related to damage to the intestinal epithelial cells, is generally reversible.

Several studies support the contention that calcium absorption from milk is impaired by unabsorbed lactose, but limited evidence is available. (20) The absorption of calcium in normal infants was shown to be reduced in those fed a lactose-free milk and enhanced in infants fed a proprietary milk and given a lactase preparation. (21) The reason lactose enhances calcium absorption may be related to the presence of its actively absorbed constituent monosaccharides (glucose and galactose) which have been shown to stimulate intestinal calcium absorption.

The major at-risk groups for calcium deficiency in the paediatric population are Aboriginal children, children on dairy product free diets and children who are genetically predisposed to primary lactase deficiency. The latter group includes many children from South East Asia.

RELATIONSHIP TO OTHER GUIDELINES

- Low fat diets are not suitable for young children. For older children a diet low in fat and in particular, low in saturated fat, is appropriate. This background paper discusses the use of reduced fat milk in infancy and childhood.

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CHAPTER 10

EAT FOODS CONTAINING IRON

The background paper on iron in the 'Dietary guidelines for Australians' discussed how iron deficiency is the most common single nutritional deficiency affecting populations in both developed and developing countries. (1)

INFANTS

As neonatal iron stores supply the majority of iron required during the first four to six months of life, iron deficiency rarely develops before this time in infants fed on breast milk or an iron fortified infant formulae. Although breast milk may contain little more than 0.3 mg iron per litre, iron is better absorbed from breast milk than from infant formulae; approximately 50 per cent of the iron in breast milk is absorbed compared to 7 per cent to 12 per cent of the iron in infant formulae. (2,3,4,5,6)

Nevertheless, all infants become vulnerable to iron deficiency when these neonatal iron stores have been exhausted during the first few months after birth. The selection of solid foods largely determines whether the infant will progress from the relatively harmless condition of depleted iron stores to the physiologically handicapping condition associated with iron deficiency. (7)

The practices that are likely to predispose an infant to iron deficiency during the introduction of solids include the consumption of fresh cow's milk and of unfortified infant formulae and cereal products. (7,8) Conversely, practices such as continued breastfeeding, the use infant formulas and cereals that are fortified with iron and vitamin C and the use of meat foods that are rich in vitamin C will decrease the likelihood of an infant's developing iron deficiency. (7)

Preventing iron deficiency in infants

The following recommendations apply to the prevention of iron deficiency in infants:

- term infants who are exclusively breastfed do not need supplemental iron until they are six months of age;
- infants fed on low-iron infant formulae have lower iron stores at six months of age than those fed on standard formulae. Thus, low-iron formulae are not recommended and term infants who are not breastfed should be given an iron-fortified infant formulae from birth;

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- an iron-fortified infant cereal should be one of the first solid foods introduced between four and six months of age. Use of iron-fortified infant cereals should continue at least until red meat and/or, legumes are introduced and the infant is eating a diversified diet (refer to discussions on this issue in the background papers to the guidelines on variety and breads, cereals, vegetables and fruits);
- once the infant is consuming a variety of solid foods, these foods should be combined in ways that increase iron absorption (eg a vitamin C source with a non-haem source of iron);
- infants who are raised as vegetarians should start iron-fortified cereals from four to six months and continue their use at least into the toddler age group. From eight months these infants should have whole-grain cereals, legumes as purees and soups and include green vegetables in the diet. Once weaned, the vegetarian infant should have an iron-fortified formulae until approximately two years of age; and
- cow's milk should not be introduced as the main source of milk until after 12 months of age, when an adequate amount of solid food containing iron and vitamin C is included in the diet. The use of small amounts of cow's milk in cooking, provided to the infant via solid foods, is unlikely to be detrimental to the infant (refer to a discussion on this issue in background paper to the guideline on variety). (8)

Consequences of deficiency

While it is accepted that iron-deficient, anaemic infants perform worse in tests of mental and motor development than iron-sufficient infants of the same age, there are conflicting reports as to whether iron deficiency anaemia has long-term consequences for mental and motor development.

Lozoff et al (9) conducted a follow-up evaluation of a group of Costa-Rican infants whose anaemia was corrected by iron treatment at between 12 and 15 months of age. These children were found on follow-up, approximately four years later, to score lower in tests of mental and motor functioning than those whose iron status was normal at 12 months of age. It was concluded that children who have iron deficiency anaemia in infancy are at risk of long-lasting developmental disadvantage compared to their peers who have better iron status.

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This conclusion was not supported by Idjradinata and Pollitt (10), who studied 12 to 18 month old infants to determine whether treatment of iron deficiency anaemia would reverse developmental delays. Iron deficient anaemic infants who were treated for four months with ferrous sulphate performed as well as iron sufficient infants in mental and motor development tests. Idjradinata and Pollitt concluded that iron deficiency anaemia is not sufficient to cause irreversible developmental delays among 12 to 18 month old infants. However, they acknowledge that this may not apply to more severe forms of anaemia.

To determine whether the results of the supplementation with ferrous sulphate are short or long-term and truly negate the findings of Lozoff et al, a follow-up study of this group is required.

CHILDREN AND ADOLESCENTS

Iron deficiency anaemia has been identified as being a problem in preschoolers, particularly in families from low socioeconomic backgrounds. (11) However, if adequate solid foods have been introduced and children are consuming a wide variety of foods, the risk of iron deficiency in young children appears to be lower than at other ages (3) partly because the growth rate slows between the ages of one and 11 years.

Nevertheless, iron intakes and iron status are still of concern in this age group, particularly at puberty—children grow faster and their requirements increase.

Iron intakes

The RDIs for iron for infants, children and adolescents are shown at Appendix 1.

Very few studies have assessed the dietary intake of young children.

A two-year longitudinal study of Perth children in the late 1970s and early 1980s found that the mean iron intake for one year old boys and girls was 5.7 mg, which is below the mid-point of the RDI (6-8 mg/day). (12) Although mean iron intake tended to increase with age, it has been suggested that many of the children studied would have had intakes below the RDI. These children may not have been iron-deficient but they may have had a higher risk of becoming iron-deficient. (13)

Table 1 Contribution of food groups to mean iron intakes for children aged 10 to 15

Food group and subgroup	Per cent contribution
Cereal and cereal products:	**43.6**
Breakfast cereals, all varieties	18.4
Breads, all varieties	13.1
Biscuits and muesli bars	5.7
Cake and cake-type puddings	1.5
Rice	1.3
Pasta	1.0
Other	2.6
Meat and meat products:	**21.6**
Beef and veal	6.2
Mixed dishes	4.5
Take-away	3.9
Lamb	2.2
Sausages and frankfurters	1.7
Poultry and game	1.1
Pork	1.0
Other	1.0
Vegetables	**10.3**
Beverages, non-alcoholic	**5.1**
Fruits	**4.5**
Condiments, flavourings and soups	**3.9**
Milk and milk products	**2.4**
Eggs	**2.1**
Confectionery	**2.4**
Snack foods	**2.1**
All other foods	**2.0**

Source: National Dietary Survey of School children, 1985 No. 1 Foods consumed. (15)

RESCINDED

Table 2 Consumption of less than the RDI for iron by children aged 10 to 15 years (%)

Gender	<RDI	<0.7 RDI	<0.5 RDI
Boys			
10 years	11.0	3.1	1.1
11 years	10.5	2.0	0.0
12 years	48.9	20.9	5.8
13 years	37.0	15.2	4.2
14 years	30.8	10.4	3.5
15 years	25.1	8.4	2.5
Girls			
10 years	20.9	5.8	1.3
11 years	15.6	4.1	0.7
12 years	64.8	30.0	10.1
13 years	63.3	26.7	8.3
14 years	56.1	29.0	10.4
15 years	62.0	27.9	9.8

Source: National dietary survey of schoolchildren, 1985. (16)

A further longitudinal study undertaken in Adelaide also assessed iron intakes. The mean iron intakes for four year old boys and girls were 6.9 mg and 6.5 mg respectively. Again, intakes increased with age. Boys aged six and eight years had mean intakes of 8.4 mg and 10 mg, while girls of the same age had intakes of 7.4 mg and 8.8 mg respectively. (14)

The National Dietary Survey of Schoolchildren in 1985 found that cereal products supplied approximately 44 per cent of the iron consumed on a given day; meat and meat products were the second major source of iron—they provided approximately 22 per cent (Table 1).

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This survey was important because it provided the only national data on iron intakes. An advantage of this data is that blood samples were collected and serum iron, ferritin and transferrin concentrations were measured.

The proportion of children who consumed less than the RDI for iron on the day of the survey is shown in Table 2. Many more girls than boys consumed too little iron, particularly those aged between 12 and 15 years, 8.3 per cent to 10.4 per cent of whom had intakes below 50 per cent of the RDI. (16)

Iron Status

Blood samples collected as part of the 1985 National Dietary Survey of Schoolchildren confirmed that adolescent girls are at risk for poor iron status.

Plasma ferritin concentrations markedly decreased with age among the girls. Although iron deficiency was uncommon among 15 year old boys and nine and 12 year old boys and girls, the prevalence of deficiency in the 15 year old girls was 9.2 per cent. It has been stated that the significance of this problem of deficiency in the 15 year old girls was highlighted by the decrease in iron status from a much more satisfactory level at nine years (none deficient) and 12 years (1.6 per cent). (17) Additionally, when a ferritin concentration of less than 12 ug/L was used as an indication of complete exhaustion of body stores, 20 per cent of the 15 year old girls were in this category. (17)

In recognition of the importance of the problem of iron deficiency in this age group, a target has been set to reduce the proportion of 15 year old females who are iron deficient by 50 per cent by the year 2000. (18)

Aboriginal children appear to be particularly at risk for iron deficiency. A study of Aboriginal and non-Aboriginal children in Bourke, aged six years and under, found that Aboriginal children were significantly more likely than non-Aboriginal children to have haemoglobin levels below 100 g/L (12.4 per cent vs 3.3 per cent), serum ferritin levels below 10 ug/L (17 per cent vs 7 per cent) and a mean corpuscular volume below 80 (15.7 per cent vs 6.6). (19)

An earlier study in two Aboriginal communities of North Western Australia identified mild anaemia in approximately 20 per cent of subjects aged less than 20 years. Anaemia and more general malnutrition accounted for only a small proportion of childhood mortality, but it accounted for a much larger proportion of the morbidity in childhood and later life. (20)

An adequate supply of iron is critical during adolescence not only for the maintenance of haemoglobin levels but also to increase the total iron mass during this period of rapid growth. (17) Although girls develop less extra muscle tissue than boys, menarche increases the need for iron and this increased need continues throughout reproductive life. (21) The RDI for adolescent girls is 10–13 mg/day compared to 12 to 16 mg/day for women aged between 19 to 54 years. (22) The adolescent girl is at risk for developing iron deficiency due to the combined effects of continuing growth, menstrual iron losses and a low intake of dietary iron. (1,10,17)

Iron requirements for boys increase from 6–8 mg/day to 10–13 mg/day during the growth spurt as new muscle is laid down. With the slowing of growth, at the end of puberty, iron requirements decline. With no further requirements for growth, the RDI for males aged 18 and over is reduced to 7 mg/day. (20)

FOOD SOURCES

Table 3 lists common dietary sources of iron and presents the foods listed in terms of the amount of each food required to provide 3 mg of iron[5]. Both haem and non-haem sources of iron are listed. The absorption of non-haem iron is enhanced by the consumption of food or fluids that contain vitamin C or the combination of haem and non-haem foods at the same meal.

5 A value of 3 mg was chosen arbitrarily, giving consideration to the RDI's for iron. The RDI's for iron can be interpreted in multiples of 3 mg. To meet the RDI for whatever age group, Table 3 provides a means of calculating how many serves of food are required. For example, the RDI for one to 11 years of age is 6-8mg. This equals approximately two to three choices of any of the foods represented in the final column of
Table 3.

Table 3 Common dietary sources of iron and the amounts of different foods required to provide 3 mg iron

Food	Household measure	Weight (g)	Iron (mg)	Amount of food required to provide 3mg iron
Meat and offal				
Beef, all cuts	1 cup diced	190	5.7	1/2 cup
Lamb, all cuts	1 cup diced	190	4.4	4/5 cup
Pork, all cuts	1 cup diced	190	2.5	1+1/5 cups
Veal, all cuts	1 cup diced	190	3.9	4/5 cup
Chicken, all cuts	1/4 chicken	120	1.2	1/2 chicken
Kidney, simmered	1 cup diced	150	17.1	1/5 cup
Liver, fried	1 slice (9x5x1cm)	40	4.4	4/5 slice
Pate	1 slice (9x7x.5cm)	35	3.3	1 slice
Fish				
Tuna, canned, brine	1 cup	190	2.5	1+1/5 cups
Oysters, canned	5 oysters	30	5.0	3 oysters
Flake fillet steamed	(13.5x9cm)	150	0.5	6 fillets
Cereals				
Wholemeal bread	1 slice	30	0.7	4+1/3 slices
White bread, regular	1 slice	30	0.3	10 slices
Wholemeal pasta (cooked)	1 cup spag.	170	3.1	1 cup
White pasta (cooked)	1 cup	180	0.7	4+1/3 cups
Brown rice (cooked)	1 cup	180	0.8	3+3/4 cups
White rice (cooked)	1 cup	190	0.6	5 cups
All bran	1/2 cup	33	2.8	1/2 cup
Bran flakes	1 cup	45	8.1	2/5 cup
Muesli, toasted	1/2 cup	55	2.4	3/5 cup
Weeties*	1 cup	32	1.0	3 cups
Beverages				
Milk, whole	1 cup	250(ml)	0.1	30 cups
Soy beverage cups	1 cup	250(ml)	1.3	2+1/3

RESCINDED

Table 3 Common dietary sources of iron and the amounts of different foods required to provide 3 mg iron (cont.)

Food	Household measure	Weight (g)	Iron (mg)	Amount of food required to provide 3mg iron
Vegetables				
Red Kidney Bean, canned/drained	1/2 cup	95	2.0	3/4 cup
Chickpea, canned/drained	1/2 cup	93	1.7	1 cup
Lentils, dried, boiled	1/2 cup	95	1.9	3/4 cup
Dried fruit				
Apricots	5x1/2s	25	0.8	19x1/2s
Dates	1 cup	105	2.7	1.1 cups
Figs	5	75	1.1	14
Raisins	1 tbsp	35	1.5	2 tbsp
Sultanas	1 tbsp	18	0.4	5 tbsp
Other				
Egg, hard-boiled	1 egg	48	0.9	3+1/3 eggs
Baked beans	1 cup	275	4.4	4/5 cup
McDonald's Big Mac*	1 burger	205	6.4	1/2 burger
Meat Pie, individual	1 pie	190	2.4	1+1/4 pies
Cashews	1/2 cup	75	4.7	1/3 cup
Milo	1 tbsp	8	2.0	1+1/2 tbsps
Tahini	1 tbsp	21	1.1	3 tbsps

1 cup = 250ml, * = Registered Trademark

Source: English R. and Lewis J., *Food for Health: A Guide to Good Nutrition with Nutrient Values for 650 Australian Foods,* National Food Authority, AGPS, 1991. (23) Clearly, the RDI for iron is easier to attain when meat is consumed as part of the daily food intake. Vegetarians, particularly vegans, need to manage their food intake carefully to obtain sufficient iron to meet the RDIs. The selection of food for infants who are raised as vegetarians requires special considerations.

RESCINDED

The diets of male and female adolescents should include food sources that are rich in iron. If the intake of lean red meat increases during puberty then the extra iron requirements will usually be met. However, unless there is a conscious effort to select iron-rich foods, adolescent vegetarians will have difficulty in meeting this increased demand. The diet of a typical teenager would not include iron-rich foods. (21)

RELATIONSHIP TO OTHER GUIDELINES

- Enjoy a wide variety of nutritious foods. The importance of adequate intakes of iron during the introduction of solids are discussed in this paper in relation to the use of iron-fortified infant cereals and the age at which cow's milk is introduced in infancy.
- Eat plenty of breads, cereals, vegetables (including legumes) and fruits. The importance of introducing cereals to ensure a supplementary iron source for infants in the weaning process is discussed in this background paper.
- Low fat diets are not suitable for young children. For older children a diet low in fat and in particular, low in saturated fat, is appropriate. This background paper discusses the importance of lean red meat in the diets of infants, children and adolescents.

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RESCINDED

APPENDIX 1

RECOMMENDED DIETARY INTAKES FOR CHILDREN AND ADOLESCENTS

Table 1A RDIs for children under 7 years (expressed as mean daily intake)

	Infants			*Young children*	
	0–6 m		**7–12 m**	**1–3 y**	**4–7 y**
	Breastfed	**Bottlefed**			
Vitamin A (ug retinol equivalents)	425	425	300	300	350
Thiamin (mg)	0.15	0.25	0.35	0.5	0.7
Riboflavin (mg)	0.4	0.4	0.6	0.8	1.1
Niacin (mg nia equiv)	4	4	7	10	12
Vitamin B-6	0.25	0.25	0.45	0.6–0.9	0.8–1.3
Total folate (ug)	50	50	75	100	100
Vitamin B12 (ug)	0.3	0.3	0.7	1.0	1.5
Vitamin C (mg)	25	25	30	30	30
Vitamin E (mg alpha tocopherol equiv)	2.5	4.0	4.0	5.0	6.0
Zinc (mg)	3	3–6	4.5	4.5	6
Iron (mg)	0.5	3.0	9.0	6–8	6–8
Iodine (ug)	50	50	60	70	90
Magnesium (mg)	40	40	60	80	110
Calcium (mg)	300	500	550	700	700
Phosphorous (mg)	150	150	300	500	700
Selenium (ug)	10	10	15	25	30
Sodium (mmol)	6–12	6–12	14–25	14–50	20–75
(mg)	140–280	140–280	320–580	320–1150	460–1730
Potassium (mmol)	10–15	10–15	12–35	25–70	40–100
(mg)	390–580	390–580	470–1370	980–2730	1560–3900
Protein (g)	*	2/kg bod wgt	1.6/kg bod wgt	14–18	18–24

* No recommendation has been made for protein for breastfed infants under the age of six months, Many observations show that infants fed by healthy well-nourished mothers will grow at a satisfactory rate for the first four to six months. It can therefore be assumed that the protein requirements are met if the volume of milk maintains growth at an acceptable rate.

Source: NHMRC Recommended dietary intakes for use in Australia. Canberra:AGPS, 1991.

RESCINDED

Table 1B RDIs for children over 7 years (expressed as mean daily intake)

	Boys			*Girls*		
	8–11	**12–15**	**16–18**	**8–11**	**12–15**	**16–18**
Vitamin A (ug retinol equivalents)	500	725	750	500	725	750
Thiamin (mg)	0.9	1.2	1.2	0.8	1.0	0.9
Riboflavin (mg)	1.4	1.8	1.9	1.3	1.6	1.4
Niacin (mg nia equiv)	15	20	21	15	18	16
Vitamin B-6	1.1–1.6	1.4–2.1	1.5–2.2	1.0–1.5	1.2–1.8	1.1–1.6
Total folate (ug)	150	200	200	150	200	200
Vitamin B12 (ug)	1.5	2.0	2.0	1.5	2.0	2.0
Vitamin C (mg)	30	30	40	30	30	30
Vitamin E (mg alpha tocopherol equiv)	8.0	10.5	11.0	8.0	9.0	8.0
Zinc (mg)	9	12	12	9	12	12
Iron (mg)	6–8	10–13	10–13	6–8	10–13	10–13
Iodine (ug)	120	150	150	120	120	120
Magnesium (mg)	180	260	320	160	240	270
Calcium (mg)	800	1200	1000	900	1000	800
Phosphorous (mg)	800	1200	1100	800	1200	1100
Selenium (ug)	50	85	85	50	70	70
Sodium (mmol)	26–100	40–100	40–100	26–100	40–100	40–100
(mg)	600–2300	920–2300	920–2300	600–2300	920–2300	920–2300
Potassium (mml)	50–140	50–140	50–140	50–140	50–140	50–140
(mg)	1950–5460	1950–5460	1950–5460	1950–5460	1950–5460	1950–5460
Protein (g)	27–38	42–60	64–70	27–39	44–55	57

CENSEN

Table 1C RDIs for lactating women (expressed as mean daily intake)

	Women 19-54	Lactating women
Vitamin A (ug retinol equivalents)	750	+450
Thiamin (mg)	0.8	+0.4
Riboflavin (mg)	1.2	+0.5
Niacin (mg nia equiv)	13	+5
Vitamin B-6	0.9–1.4	+0.7–0.8
Total folate (ug)	200	+150
Vitamin B12 (ug)	2.0	+0.5
Vitamin C (mg)	30	+45
Vitamin E (mg alpha tocopherol equiv)	7.0	+2.5
Zinc (mg)	12	+6
Iron (mg)	12–16	+0
Iodine (ug)	120	+50
Magnesium (mg)	270	+70
Calcium (mg)	800	+400
Phosphorous (mg)	1000	+200
Selenium (ug)	70	+15
Sodium (mmol)	40–100	+0
(mg)	920–2300	+0
Potassium (mmol)	50–140	+0
(mg)	1950–5460	+0
Protein (g)	45	+16

RESCINDED

APPENDIX 2

CORE FOOD GROUPS

Table 2A Recommended minimum amounts of foods for consumption for children and adolescents[6]

Food group	Age group	Recommended quantity
Cereals~ (g)	4–7	120
	8–11	180
	12–18	180–210
Fruit* (g)	4–11	150
	12–18	300–450
Vegetables@ (g)	4–7	150
	8–11	225
	12–18	300
Meat and alternatives group^ (g)	4–7	35
	8–11	65
	12–18	85
Milk group# (g)	4–7	400
	8–11	450
	12–18	550–600

~ Expressed as weight of bread: 30 g bread is equivalent to 90 g cooked rice, pasta; 20 g ready to eat breakfast cereal.

* Based on edible portions: 150 g fruit is equivalent to one medium apple, banana, orange etc; one cup diced pieces; two apricots, kiwifruit.

@ Cooked weight of vegetables: 75 g is equivalent to half cup cooked vegetables; one cup salad vegetables.

^ Cooked weight of meat: 35 g is equivalent to quarter cup cooked beans; 40 g cooked fish fillet.

\# 250 ml milk is equivalent to half cup evaporated milk; 40 g cheese; one small tub yoghurt (200g).

Source: NHMRC The core food groups: the scientific basis for developing nutrition education tools. Canberra; AGPS,1995.

RESCINDED

6 No recommendations have been made for children younger than four years of age. Children under four should be offered a wide variety of foods from the core food groups as appropriate to their needs.

Table 2B Recommended minimum amounts of foods for consumption for adults and lactating women

Food group	Group	Recommended quantity
Cereals (g)~	Adults	210
	Lactating	330–360
Fruit* (g)	Adults	300
	Lactating	750
Vegetables@ (g)	Adults	300–375
	Lactating	525–600
Meat and alternatives group^ (g)	Adults	85
	Lactating	190
Milk group# (ml)	Adults	450
	Lactating	450–600

~ Expressed as weight of bread: 30 g bread is equivalent to 90 g cooked rice, pasta; 20 g ready to eat breakfast cereal.

* Based on edible portions: 150 g fruit is equivalent to one medium apple, banana, orange etc; one cup diced pieces; 2 apricots, kiwifruit.

@ Cooked weight of vegetables: 75 g is equivalent to 1/2 cup cooked vegetables; one cup salad vegetables.

^ Cooked weight of meat: 35 g is equivalent to 1/4 cup cooked beans; 40 g cooked fish fillet.

\# 250 ml milk is equivalent to 1/2 cup evaporated milk; 40 g cheese; one small tub yoghurt (200g).

RESCINDED

APPENDIX 3

SUMMARY OF CONSULTATIONS

SUMMARY OF CONSULTATIONS UNDERTAKEN IN THE DEVELOPMENT OF THE DIETARY GUIDELINES FOR CHILDREN AND ADOLESCENTS

The *National Health and Medical Research Council Act 1993* provides for the Council to adopt a policy of public consultation.

A general obligation to consult is imposed by subsection 3(2) of the Act which states that:

It is the intention of the Parliament that, to the extent that it is practicable to do so, the Council should adopt a policy of public consultation in relation to individual and public health matters being considered by it from time to time.

Two public consultations were undertaken in 1992 and 1993 in the development of the 'Dietary guidelines for children and adolescents'.

NATURE OF THE CONSULTATIONS

The first consultation, which ran from September 1992 to October 1992, was prior to the introduction of the Act and had two main components:

- sending a copy of the draft document and a covering letter to identified interested individuals and organisations; and
- national advertising in the Weekend Australian announcing the availability of the draft document and inviting submissions.

The second consultation, which ran from November 1993 to February 1994, was in accordance with the procedures for consultation under the Act and comprised:

- publishing a notice in the Commonwealth Gazette inviting submissions on the draft document;
- sending a copy of the draft document and a covering letter to identified interested individuals and organisations; and
- national advertising in the Weekend Australian announcing the availability of the draft document and inviting submissions.

Approximately 4,000 copies of the draft document were distributed for the second consultation.

RESCINDED

List of those from whom submissions were received in each consultation

Symbol explanation:

^ Submission to first consultation
# Submission to second consultation
* Submission to both consultations

- Aboriginal & Torres Strait Islander Commission, BV Johnson ^
- ACT Primary Health Care Service, L Jennings, J Hazelton *
- Albury Community Health Services, K McQuellin #
- Alice Springs Hospital, Alice Springs Paediatric Nutrition Interest Group #
- Attwood E *
- Australian Consumers Association, B Walsh, C Renouf *
- Australian Council of Social Service (ACOSS), L Rogan ^
- Australian Dairy Corporation, J McCann *
- Australian Dental Association Inc, RJF Butler #
- Australian Lactation Consultants'Association, E McIntyre #
- Australian Meat & Livestock Corporation, M Sadler ^
- Australian Nursing Federation, MK Beaumont, P Wilkinson *
- Australian Nutrition Foundation, J Rogers, S Amanatidis *
- Australian Nutrition Foundation, Tasmanian Division #
- Australian Soft Drink Association, JA Barnes, T Gentile *
- Australian Sugar Industry, I Dear ^
- Barwon Child and Family Health Service, J Torode #
- Bread Research Institute of Australia Inc, Consumer Information Division, T Griffiths #
- Central Coast Area Health Service, Nutrition Department, R Giglia #
- Central Sydney Health Service, J Plaskett, AM Lilburne *

RESCINDED

- Chariota, JA Barnes ^
- Child and Family Health Services, Manly Hospital and Community Health Services, H Gough #
- Child & Family Health Services, SA. D Jolly, R Leeson *
- Child & Family Health Services, Victoria, T Collins, V Graham *
- Child & Family Health Nurses Association, J Buchanan ^
- Children's Hospital Camperdown, Paediatric Dietitians ^
- Commonwealth Department of Human Services and Health, Health Development Branch, M Dean #
- Council of Australian Food Technology Associations Incorporated, AH Downer ^
- CSIRO, Division of Human Nutrition, P Clifton, M Noakes #
- CSR Ltd. Mr P. Carter #
- Dental Health Services, Dental Health Promotion, K Jolly #
- Department of Education and Training, ACT, J Hicks #
- Dietitians' Association of Australia, CJ Rae *
- Edelman Public Relations Worlwide, T Irwin #
- Federal Bureau of Consumer Affairs, J Wood *
- Food Industry Council of Australia, G Chalker ^
- Goodman, Fielder, Wattie, W Morgan *
- Health Department of Western Australia, Nutrition Program, C Campbell #
- Health Development Foundation SA, L Kellett *
- H.J.Heinz Company Aust. Ltd, A Hillis *
- Hunter Area Health Service,Child and Family Health Service, G Vimpani #
- John Hunter Hospital, Dept.Paediatrics, TJC Boulton*
- Kamerman M #
- Kellogg(Aust) Pty Ltd, E Farmakalidis *
- Mater Misericordiae Children's Hospital, Nutrition Department ^

SUPERSEDED

- Minchin M ^
- Mead Johnson Australia, C Potechin #
- Meat & Allied Trades Federation of Australia, G Carroll ^
- Menzies Centre for Population Health Research, Tasmania, T Beard #
- Monash Medical Centre, M Blackley, A Caiafa #
- National Food Authority, G Pincus #
- National Heart Foundation of Australia, B Shrapnel #
- NHMRC, Child Health Committee, A Carmichael ^
- NSW Department of Health, E Macoun *
- NSW Nurses' Association, PJ Staunton #
- NT Department of Health & Community Services, CJ Rae, G Devlin *
- Nursing Mothers' Association of Australia, W Brodribb, D Drew, E Whitehill *
- Nutrition Education Service, S Burt, S Woodrow *
- Paediatric Outreach Service, Maroondah Hospital, Vic, J Viney #
- Public Health Association of Australia, M Conley *
- Princess Margaret Hospital for Children, Gastroenterology Department, R Hill #
- Queensland University of Technology, S Capra, B Wright ^
- Royal Alexandra Hospital for Children, NSW #
- Royal College of Nursing,Australia, K McInerney, J Anderson *
- Royal Women's Hospital, Vic. E Gasparini #
- S.A.Dental Health Education Unit, C Bull #
- S.A.Eastern Community Health Service, N Park #
- S.A. Education Department Curriculum Division, K Pech ^
- S.A. Health Commission, J Rakowski *
- Stone, P #
- Sydney City Mission, B Ewing ^
- The Icecream Manufacturers Federation of Australia, R Lyons ^

RESCINDED

- The Hebrew University of Jerusalem, Faculty of Agriculture, S Samish #
- University of Melbourne, Department of Community Medicine and Public Health, B Wood #
- University of Melbourne, Department of Paediatrics, D Francis *
- University of Melbourne, Faculty of Medicine and Dentistry, L Brearley #
- University of New England, School of Health, L Short#
- University of Sydney, Department of Public Health, D Mackerras *
- University of Sydney, Department of Public Health, D Nutbeam #
- University of Sydney, Human Nutrition Department, AS Truswell *
- University of Tasmania, Department of Biochemistry, D Woodward #
- University of Wollongong, Department of Public Health, L Tapsell #
- W.A. School of Nursing, L Johnson ^
- Westmead & Parramatta Hospitals and Community Health Services. J Grossman ^
- Wheeler M, Cronin B. #
- Women's and Children's Hospital, Adelaide, C Ward #
- World Health Organisation, Regional Office for the Western Pacific, I Darnton-Hill *
- Wyeth Pharmaceuticals, F Bassett, C Braithwaite ^

RESCINDED

MAJOR ISSUES RAISED IN THE CONSULTATIONS

Separate sets of guidelines

The development of a separate set of guidelines was not considered to be appropriate as it would lead to confusion. The modification of the adult guidelines to reflect the needs of children was considered to be more appropriate. The need to define the age groups to which the guidelines apply was identified.

Modifications to adult guidelines

Encourage and support breastfeeding.

The positioning of this guideline at number one was supported. Suggestions were made to:

- define the term breastfeeding;
- discuss the differing rates of breastfeeding among different ethnic groups and cultures;
- describe the impact of the following factors on increasing the period of time of breastfeeding: social class, education, prenatal education, return to workforce, early discharge, access to support agencies post discharge;
- identify the health benefits of breastfeeding to the infant, mother, family and society;
- discuss perceived lactation failure;
- compare growth between breast-fed infants and formulae-fed infants;
- encourage breastfeeding on demand; and
- explain that the inclusion of information on formulae does not imply that breastfeeding and formulae feeding are equal.

CHILDREN NEED APPROPRIATE FOOD AND PHYSICAL ACTIVITY TO GROW AND DEVELOP NORMALLY – GROWTH SHOULD BE CHECKED REGULARLY

The guideline should emphasise growth and development. Suggestions were made to:

- include the discussion on body image and management of obesity in this guideline;

- discuss the suitability of current growth charts in assessing Aboriginal and Asian children;
- discuss the risks associated with children being placed on adult weight reduction programs; and
- encourage of regular physical activity.

ENJOY A WIDE VARIETY OF NUTRITIOUS FOODS

This guideline was thought to apply across all age groups.

Suggestions were made to:

- remove the information on dieting and body image from this guideline;
- define the terms variety; food allergy; food intolerance;
- clarify the use of cow's milk as a drink or in combination with other foods;
- replace the phrase 'complementary foods' with 'introducing solids';
- include a discussion on commercial infant foods or mixed foods and snacking;
- include an indication of appropriate types and amounts of foods to be consumed; and
- expand the section relating to the special relationship between the carer and the child.

EAT PLENTY OF BREADS AND CEREALS,VEGETABLES (INCLUDING LEGUMES) AND FRUITS

There was general agreement to delete references to wholegrains for young children. Suggestions also were made to:

- define the terms 'plenty','energy density' and 'fibre density';
- emphasise equally the role of breads and cereals;
- recommend an appropriate fibre intake for children; and
- discuss bioavailability of nutrients and displacement of nutrient dense foods by bulky high fibre foods.

RESCINDED

LOW FAT DIETS ARE NOT SUITABLE FOR YOUNG CHILDREN. FOR OLDER CHILDREN, A DIET LOW IN FAT AND IN PARTICULAR, LOW IN SATURATED FAT, IS APPROPRIATE

Support was expressed by many respondents for the conservative approach adopted. Suggestions, which were wide ranging, were made to:

- raise the positioning or priority of this guideline in the listing;
- be less prescriptive about the reference to 'low in saturated fat';
- include information on the age at which saturated fats should be reduced;
- define the terms 'young', 'older' and 'low';
- clarify the issues surrounding cholesterol, particularly dietary cholesterol vs serum cholesterol;
- emphasise the inappropriateness of cholesterol lowering diets for children under five years of age;
- include specific information on the types of fat recommended for consumption;
- include information on the types of milk and sources of fat in children's diets, particularly for ages five to fourteen and the adolescent group;
- link this guideline to the one on growth and development; and
- develop separate guidelines which apply to the 'under' and 'over' fives.

ENCOURAGE WATER AS A DRINK – ALCOHOL IS NOT RECOMMENDED FOR CHILDREN

Suggestions were made to:

- not link water and alcohol in the same guideline;
- substitute 'encouraged' for 'preferred' in the guideline;
- discuss alcohol in more dismissive terms;
- include information on the role of milk and fruit juices as drinks;
- ensure that adolescents know that the guideline applies to them and not just to children; and
- include information on the hydration status of totally breastfed infants.

REVISED

EAT ONLY A MODERATE AMOUNT OF SUGARS AND FOODS CONTAINING ADDED SUGARS

Suggestions were made to:

- define 'moderate' and 'sugars';
- include information on the frequency of consumption of sugars and sugar-containing foods;
- include information on the use of intense sweeteners;
- include information on the overconsumption of fruit juices;
- include information on the potential cariogenicity of various foods;
- list the guideline higher in the priority positioning;
- clarify the information on the problem of bottle-fed caries;
- discuss the displacement of nutrient dense foods by sugar consumption;
- discuss the role of sugar in the provision of basic energy requirements in Aboriginal communities; and
- discuss the proportion of energy provided from fats and sugars.

CHOOSE LOW SALT FOODS

The following suggestions were made:

- comment specifically about the salt intake from 'fast' or 'take away' foods; and
- discuss the increased intake of highly salted snack foods.

EAT FOODS CONTAINING CALCIUM

This guideline was identified as important for all children regardless of age group. The suggestions were to:

- include information on food sources of calcium, especially non-dairy food sources;
- focus more on foods rather than on nutrients - the focus on a nutrient is inconsistent with the majority of the guidelines;
- emphasise the particular needs of strict vegetarians; and
- emphasise the importance of this guideline for girls, women and athletes.

SUPERSEDED

EAT FOODS CONTAINING IRON

The suggestions were to:

- include information on food sources of iron with differentiate between haem sources and non-haem sources;
- extend the guideline to include all age groups of children and adolescents;
- include information on the introduction of cow's milk in the diet of infants; and
- include information about the iron requirements of children who are strict vegetarian or to the carers of young children being provided with a vegetarian intake.

CONTRIBUTION OF THE CONSULTATION PROCESSES TO THE FINAL DOCUMENT

The consultation process made a valuable contribution to the development of the 'Dietary guidelines for children and adolescents'. The first consultation provided a wide range of comment and useful suggestions. This led to the rewording of some guidelines and the combination of others. The consultations also identified a number of issues which needed to be included or clarified. The second consultation yielded more specific comments but largely agreed with the content of the background papers.

More broadly, the consultations also provided interested individuals and organisations with an opportunity to participate in the process of development of public health nutrition recommendations. Such participation benefits those who are involved in the development of recommendations and the target audience of the recommendations.

EDITED

APPENDIX 4

Types of standard, follow-on, soy and goat's milk infant formulae currently available in Australia

Manufacturer and product name	Age of use	Per 100 ml Energy (kJ)	Fat (g)	CHO (g)	Protein	Type of protein (g)
Douglas						
Karicare	From birth	285	3.8	7.0	1.5	60% whey 40% casein
Karicare	From 6 m	280	3.6	6.6	2.1	60% whey
Follow-on						40% casein
Karicare Soya	From birth	271	3.6	6.7	1.8	soy isolate L-methionine
Karicare Soya	From 6 m	294	3.6	7.7	2.2	soy isolate
Follow-on						L-methionine
Karicare	From birth	287	3.8	7.3	1.4	goat
Goat milk						
Karicare Goat milk Follow-on	From 6 m	285	3.7	6.6	2.2	goat
Mead Johnson						
Enfalac with iron/red iron	From birth	281	3.7	7.0	1.5	60% whey 40% casein
Enfamil	From birth	281	3.7	6.9	1.5	20% whey 80% casein
Enfapro	From 6 m	280	2.7	8.3	2.5	18% whey 82% casein
Prosobee with iron/red iron	From birth	283	3.6	6.6	2.0	soy isolate L-methionine

RESCINDED

Types of standard, follow-on, soy and goat's milk infant formulae currently available in Australia (cont.)

Manufacturer and product name	Age of use	Per 100 ml Energy (kJ)	Fat (g)	CHO (g)	Protein	Type of protein (g)
Nestle'						
Nan 1	From birth	273	3.4	7.6	1.5	60% whey 40% casein
Nan 2	From 6 m	274	3.2	7.3	2.3	30% whey 70% casein
Lactogen	From birth	273	3.4	7.4	1.7	30% whey 70% casein
Wyeth						
S-26	From birth	274	3.6	7.2	1.5	60% whey 40% casein
S-26 Progress	From 6 m	271	3.2	7.2	2.2	20% whey 80% casein
SMA	From birth	271	3.6	7.0	1.5	20% whey 80% casein
Infasoy	From birth	274	3.6	6.9	1.8	soy isolate L-methionine

Note: Article 4.2 of the World Health Organisation 'International code of marketing of breastmilk substitutes' requires that informational and educational materials dealing with the feeding of infants and young children intended to reach pregnant women and mothers of infants and young children should include clear information on all the following points:

a) the benefits and superiority of breastfeeding;
b) maternal nutrition and the preparation for and maintenance of breastfeeding;
c) the negative effect on breastfeeding of introducing partial bottle-feeding;
d) the difficulty of reversing the decision not to breastfeed; and
e) where needed, the proper use of infant formulae.

Health workers dealing with pregnant women and mothers of infants and young children should refer to the background paper to the breastfeeding guideline contained in this document, and the 'Guidelines for health workers to encourage and support breastfeeding' (NHMRC, 1994, draft) for further information.

RESCINDED

GLOSSARY

Adolescents	Persons 13 to 18 years of age.
Breads	Wholemeal, white, mixed grain, rye, Lebanese (unleavened flat) breads, bread rolls, bagels, pumpernickel etc
Cereals	Breakfast cereals (preferably no added sugar or fat), rice, pasta, flour, dry biscuits, other cereals (eg polenta, semolina, barley, sago, tapioca, burgul etc).
Core food groups	Those foods that form the basis of a healthy diet. Based on or developed with consideration of the 'Recommended dietary intakes for use in Australia' and 'Dietary guidelines for Australians'. Used as the basis for developing nutrition education tools such as food selection guides.
Dietary guidelines	A set of statements providing advice to the general population about healthy food choices, so that their usual diet contributes to a healthy life-style and is consistent with minimal risk for the development of diet-related disease. The 'Dietary guidelines for Australians' (providing advice to the general population of healthy adults) were first developed by the Commonwealth Department of Health in 1979 and endorsed by NHMRC in 1983. They were revised by NHMRC in 1992.
Fruits	All fruits, including citrus fruits, apples, pears, bananas, tropical fruits, stone fruits and berries.
Infants	Persons less than 12 months of age.
Legumes	Includes all canned or dried bean products – baked beans, lentils and lentil flour products (eg papadams), soya beans and soya flour products (eg tofu, bean curd) red kidney beans, haricot (navy) beans, chick peas, pinto beans, butter beans, mung beans.
Low fat foods*	The food must not contain more than 3 g total fat per 100 g of food, or 1.5 g total fat per 100 g liquid food. If the claim is made for a food naturally or intrinsically low in fat,it must refer to the whole class of similar foods.

RESCINDED

Low salt foods*	The foods must not contain more than 120 mg of sodium per 100 g, or not more than 50 per cent of the sodium content of the normal counterpart food, whichever is less.
NHMRC	The National Health and Medical Research Council is an independent body with the responsibility of advising the Commonwealth,State and Territory governments regarding health matters, convening expert committees regarding scientific matters and distributing public health and medical research funds.
Nutritious foods	This term is used to describe foods which make a substantial contribution towards providing a range of nutrients, have an appropriate nutrient density, and are compatible with the overall aims of the 'Dietary guidelines for children and adolescents'.
Older children	Persons five to 12 years of age.
Recommended dietary intakes (RDIs)	Levels of intake of essential nutrients considered by NHMRC on the basis of available scientific knowledge to be adequate to meet the known nutritional needs of practically all healthy people, derived from estimates of requirements for each age/sex category which incorporate generous factors to accommodate variations in absorption and metabolism.
Toddlers	Persons twelve to 23 months of age.
Variety	A mixture of foods across the range of food types, eg cereal foods, fruit, vegetables, animal foods (eg meat, fish, dairy). 'Variety' further refers to choosing a range of foods from within each food type.
Vegetables	All vegetables, including potatoes, sweet potatoes, peas, beans, tomatoes, all leafy green vegetables, all root vegetables, pumpkin, squash, cucumber, zucchini, peppers, onion, shallots, garlic, sweetcorn, asparagus, mushrooms etc.
Young children	Persons two to four years and 11 months of age.

RESCINDED

THE NATIONAL HEALTH AND MEDICAL RESEARCH COUNCIL

The National Health and Medical Research Council (NHMRC) is a statutory authority within the portfolio of the Commonwealth Minister for Health and Aged care, 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.

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