3 ENJOY A WIDE VARIETY OF NUTRITIOUS FOODS

Colin Binns and Mi Kyung Lee

Terminology

Food variety

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

Nutritious foods

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

Weaning

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

Background

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

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

**Scientific basis**

**Infants**

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

*Introduction of solid foods*

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

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

- At what age should solid foods be introduced?
- What foods should be introduced?
- How should foods be introduced?
- How can the risk of infection be reduced?

*When should solid foods be introduced?*

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

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

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

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

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

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

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

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

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

Introducing solid foods too soon can lead to several problems:

- If less time is spent on the breast, maternal milk production may decline because of reduced stimulation. In extreme cases under-nutrition could result.¹¹
- If solid foods are introduced before an infant is developmentally ready—while the tongue-extrusion reflex is still strong—the infant will reject the spoon (a hard object). The mother might then feel that the infant is rejecting the food, when in fact it is rejecting the object placed in its mouth. Early introduction of foods does not lead to earlier loss of the tongue-extrusion reflex: it just prolongs the length of introduction.
- Food allergies can develop.
- Exposure to pathogens present in foods can cause increased rates of diarrhoeal diseases and other problems.

Introducing solid foods too late can also cause problems:

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

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

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

**Current Australian practices**

In a study of infants in Melbourne, Graham et al.\(^ {17}\) found that the majority of mothers were following the 4–6 months recommendation current at the time of the study: the mean age for the introduction of solids was 4.3 months. The average age for the introduction of cow’s milk was 10.3 months, although some ethnic groups introduced it earlier. The groups most likely to introduce solids before 4 months were very young mothers, first-time mothers and mothers speaking languages other than English. In an Adelaide study, 40 per cent of infants under 4 months of age were having solid foods and the majority of these were not being breastfed.\(^ {18}\)

**Infant formulas and other milks**

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

**Table 3.1** Composition of mature human milk and cow’s milk (per 100ml) and recommended composition for infant formula

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

\(^ {a}\) Acceptable range.

\(^ {b}\) True protein = 0.85g per 100ml (excluding non-protein nitrogen), although a proportion of the non-protein nitrogen is used for maintenance and growth in infants.

\(^ {c}\) Iron in breastmilk is highly bioavailable, with absorption of 50–70 per cent.

\(^ {d}\) Iron in infant formula is poorly bioavailable, with absorption of only about 10 per cent.

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

Breastmilk is the preferred milk for infants up to at least 12 months of age and offers benefits beyond this time. When, for whatever reason, breastmilk cannot be offered, a standard infant formula should form the main milk component of the diet for infants up to 12 months of age. The main advantage of ‘follow-on formulas’ lies in their iron content: infants at this age should ideally be getting iron from a varied and expanding range of solid foods, including meat-containing products. But, although the iron fortification contained in follow-on formulas is an advantage for infants who are receiving inadequate amounts of solid food, other compositional changes in protein, fat, carbohydrate, sodium and calcium have no clearly established superiority over ordinary formula provided together with appropriate solid foods.19 The Infant Feeding Guidelines for Health Workers provide more information about infant formulas.

Cow’s milk

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

- It is a poor source of iron and the iron it does contain is poorly absorbed. Introducing cow’s milk before 12 months of age predisposes an infant to iron deficiency at an age when their iron stores become depleted.20,21
- The composition of cow’s milk is not ideal for infants. Compared with breastmilk and infant formula, cow’s milk contains higher levels of protein, sodium, potassium, phosphorus and calcium22–24 and lower levels of iron, vitamin C and linoleic acid, adding to the difficulty of providing a balanced diet for older infants.
- The high phosphorous and calcium content of cow’s milk may decrease the bioavailability of iron from other dietary sources such as infant cereals.20–22
- 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.23,25
- Feeding with cow’s milk has been shown to lead to increased gastrointestinal tract blood loss in a large proportion of normal infants, exacerbating the problem of iron deficiency.26 The problem can be severe enough to result in unnecessary surgery.27 In a longitudinal study of 6209 Swedish infants, 1.9 per cent were found to develop IgE cow’s milk antigens; the proportion was lower for exclusively breastfed infants.28
- Early introduction of cow’s milk may be associated with increased rates of subsequent adult disease such as type 2 diabetes.29–31

A prospective study in Adelaide showed no association between the duration of breastfeeding or the introduction of cow’s milk and the development of islet auto-immunity in high-risk children.32 Overall, infants fed cow’s milk have low intakes of iron, linoleic acid and vitamin E and excessive intakes of sodium, potassium and protein. Iron status and deficiency is discussed in more detail in Section 3.3.
Given all these factors, cow’s milk is not recommended for use as the main source of milk for infants aged less than 12 months. Small amounts of cow’s milk in foods such as breakfast cereal, yoghurt, cheese and custards that are prepared for the rest of the family can, however, be given after about 9 months.

**Practical aspects of this guideline**

**Infants**

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

*What foods should be introduced?*

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

Solid foods should provide an increasing proportion of the energy intake because infants continue to grow rapidly during this time. Variety is likely to meet the need for most nutrients and provide a basis for healthy eating habits. By the end of the first year of life, an infant should be consuming a wide variety of family foods, having progressed from pureed or mashed foods to foods that are chopped into small pieces.212
### Table 3.2  Developmental stages and examples of foods

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

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

If there is a strong history of family allergy, introduction of cheese, yoghurt, ice-cream, fish and wheat cereal should be delayed until 12 months of age. If there is a strong history of peanut allergy, peanut products (including peanut butter) should be avoided until after 3 years of age. Peanut allergy is common and can be very severe. Peanut allergen can be found in breastmilk, and if there is a family history of peanut allergy breastfeeding mothers should avoid peanuts.34

**How should foods be introduced?**

The following are general recommendations for the introduction of foods:

- Foods should be introduced individually, and no salt, sugar or other flavourings should be added. Water, breastmilk or infant formula can be mixed with cereals. If cow’s milk is used at all, only small amounts of it should be used for mixing with foods.2

- Initially, new foods should be offered no more often than each five to 10 days, to avoid confusion and rule out the (remote) possibility of food allergy or sensitivity.2,9,11
Once most foods have been successfully introduced, the types of foods offered should be changed frequently. This helps to ensure that the infant receives a good balance of nutrients. It may also play a part in their choosing a broader range of foods later on. Using family foods will help the child become used to eating like the rest of the family.9

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

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

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

Foods that are unsuitable or that should be used with care

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

Honey

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

Tea

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

Nuts

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

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

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

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

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

Reduced-fat milks

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

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

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

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

Children

Toddlers and preschoolers

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

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

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

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

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

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

**School children**

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

Two important considerations apply to this age group:

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

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

### Adolescents

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

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

**Table 3.3 Facets of eating behaviour that are different or more pronounced in adolescents than in other people and may cause adults to be concerned**

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

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*Dietary Guidelines for Children and Adolescents in Australia*
There are two matters of particular concern in adolescence: dieting and concerns about body image (discussed in Chapter 2) and pregnancy.

### Pregnancy in adolescence

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

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

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

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

Vitamin and mineral supplements are not necessary for healthy, full-term infants or children.\(^9\) The only exception to this may be fluoride for children living in areas without fluoridated water.

If infant formula is used, it is assumed that the formula will be prepared using fluoridated water. Where fluoridated water is not available the fluoride content of the formula is consequently lower. In the absence of fluoridated water or if bottled water is used to prepare feeds, further supplementation will be required.\(^{59}\)

Special diets

Vegetarianism

A vegetarian diet that is adequate for adults is not necessarily suitable for infants and young children, who face constraints such as limited stomach capacity and higher needs for nutrients per unit weight.\(^60\) Each diet must be assessed separately for its suitability for children; if the regimen is very restrictive in terms of the type and amount of animal proteins consumed, it is essential to plan a diet carefully so as to avoid deficiencies.\(^60\) In general, lacto-vegetarian and lacto-ovo-vegetarian diets provide adequate nutrition if they are properly planned. Vegan diets pose a risk if care is not taken to ensure that the diet provides adequate energy, vitamin B\(_{12}\), protein and iron.\(^{60,61}\) Plant foods can provide some iron and zinc, albeit with lower bioavailability, but vitamin B\(_{12}\) is found only in animal products. Chapter 1 discusses the vitamin B\(_{12}\) status of vegan mothers and its effect on the B\(_{12}\) status of breastfed infants.

Food allergy and intolerance

The subject of food and drink allergies in children has received widespread attention in recent years. This has resulted in a number of misconceptions about the manifestations and incidence of such disorders and the use of elimination diets.\(^62\) The National Health and Medical Research Council\(^62\) recommends as follows:

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

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

Healthy eating for children and adolescents

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

Table 3.4 The Australian Guide to Healthy Eating\textsuperscript{1}: suggested sample servings for children and adolescents

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

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

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

Relationship to other guidelines

Encourage and support breastfeeding

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

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

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

Include lean meat, fish, poultry and/or alternatives

Section 3.3 discusses iron deficiency in childhood and adolescence.

Include milks, yoghurts, cheese and/or alternatives
3. ENJOY A WIDE VARIETY OF NUTRITIOUS FOODS

Limit saturated fat and moderate total fat intake

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

The Dietary Guidelines for Australian Adults

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

Conclusion

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

Evidence

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

References

3. **Enjoy a wide variety of nutritious foods**


3. Enjoy a wide variety of nutritious foods


3. Enjoy a wide variety of nutritious foods


