Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2 –18 years)

A background paper

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Foreword

The health and wellbeing of our children and young people are extremely important, not only for their lives now, but also for their futures and ultimately for the future of New Zealand. Good nutrition and adequate physical activity are key contributors to both health and development. The *Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2–18 Years): A background paper* (2012) provides the information to educate and encourage children, young people and their families or whānau to follow healthy lifestyles. This population health document aims to promote health while also preventing obesity and diet-related chronic diseases.

These Guidelines have been developed from the update and amalgamation of the *Food and Nutrition Guidelines for Healthy Children (Aged 2–12 years): A background paper (1997)* and the *Food and Nutrition Guidelines for Healthy Adolescents: A background paper* (1998). They aim to provide up-to-date, evidence-informed advice and technical information for health practitioners working with children and young people (aged 2 –18 years). These practitioners include nurses, dietitians, doctors, nutritionists, health promoters and educators.

In recognition of the many factors that influence the food choices of children and young people, some new topics have been included. For example, new sections outline considerations for selected population subgroups, the influence of environmental factors on food choice, and related topics such as physical activity and oral health.

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Acknowledgements

The development of the *Food and Nutrition Guidelines for Children and Young People (Aged 2 –18 Years): A background paper* has involved a number of stages. The final document is the result of input that many individuals and organisations have provided throughout this process.

Initially the following stakeholders provided feedback on the proposed structure and content of the background paper: Dietitians New Zealand, the Paediatric Society of New Zealand, Public Health Nurses, Plunket, the Home Economics & Technology Teachers' Association of New Zealand, Te Hotu Manawa Māori, the Pacific Island Food and Nutrition Advisory Group (PIFNAG), the Asian Health Foundation and the Health Sponsorship Council.

The Clinical Trials Research Unit at the University of Auckland prepared the initial draft of the *Food and Nutrition Guidelines for Children and Young People: A background paper* for the Ministry of Health during 2009 and early 2010. Maria Turley wrote the draft background paper, with technical advice and input from Dr Cliona Ni Mhurchu, Delvina Gorton, Helen Eyles and Dr Andrew Jull. The initial draft then underwent external peer review by Dr Clare Wall, Kate Sladden, Kathy Hamilton, Eruera Maxted (Part 9 on Māori), PIFNAG (Part 10 on Pacific peoples), Geeta Gala (Part 11 on Asian and 'Other' peoples) and the Ministry of Agriculture and Forestry (topics related to food safety).

Further development of the document by the Nutrition and Physical Activity Policy Team at the Ministry of Health produced the *Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2–18 Years): A background paper – draft for consultation,* which was published in October 2010. During the public consultation 44 submissions were received from individuals and organisations representing the public and personal health sector, industry, non-governmental organisations, academic and research sector, education and training sector and Crown agencies.

Comments and recommendations (including some additional references) from the submissions were considered and further specialist input was sought to produce the final document. Tammy Kaiwai, Soana Muimuiheata and Pratibha Balu provided specialist input to the meal plans in Appendix 5. Jenny Heyward, Rhonda Ackroyd and Dr Jan Sinclair reviewed the allergy section in Part 12. Te Hotu Manawa Māori provided information for Part 9: Considerations for Tamariki and Rangatahi Māori and Their Whānau.

The Ministry of Health is grateful to all who contributed to this document, including those who made submissions during the public consultation process.

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Introduction

Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2–18 Years): A background paper is one in a series of population-specific background papers on food and nutrition. The population groups targeted in other papers are healthy infants and toddlers; adults; older people; and pregnant and breastfeeding women.

Aim

This background paper:

- details up-to-date nutrition and physical activity policy based on current evidence considered for the New Zealand context. It also provides information to support the development of strategic policy that aims to achieve and maintain the best possible health for New Zealand's children and young people
- presents reliable and detailed background information for health practitioners who provide nutrition advice and develop nutrition programmes (including dietitians, nutritionists, doctors, nurses, primary care providers, health promoters and teachers)
- provides the basis for developing health education resources that focus on this age group and that are intended for use by the general public
- provides information on current dietary patterns, nutrient intake, nutritional status, body size, physical activity and sedentary behaviour patterns in New Zealand children and young people.

Note that the advice in this paper is intended to apply to healthy children and young people who have no special dietary requirements. For children and young people with special dietary requirements, this advice should be adapted by a dietitian or appropriate health practitioner.

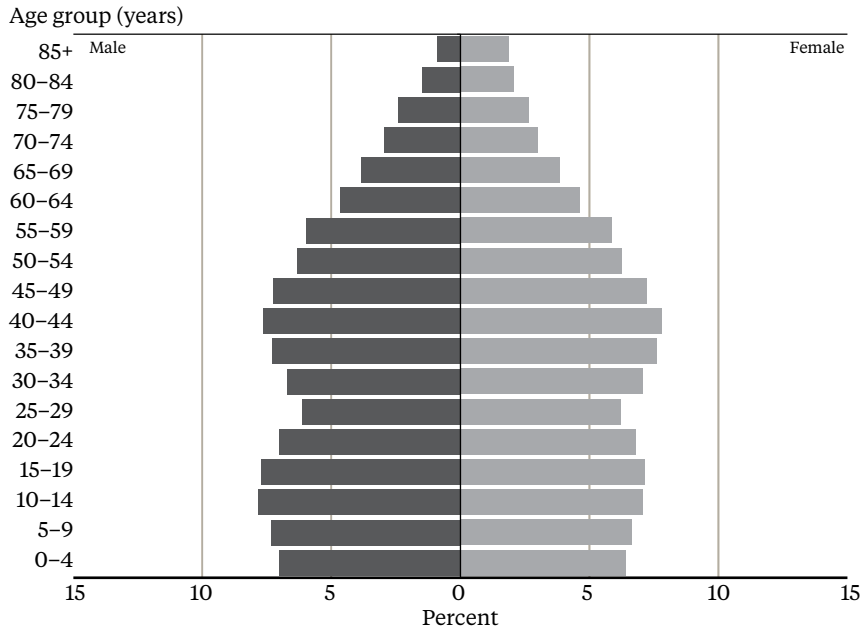
Description of the population

For the purposes of this background paper, 'children and young people' are those aged from 2 to 18 years. When referred to separately, 'children' are those aged 2–12 years, while 'young people' are those aged 13–18 years. The term 'preschoolers' refers to children aged from two years up until their fifth birthday.

These definitions may differ to those used elsewhere. For example, the World Health Organization (WHO) defines young people as those aged 10–24 years. This background paper encompasses adolescence, which is defined (physiologically) as the period between puberty and when reproductive organs are mature. The age of adolescence varies, in terms of both onset and maturity. While it is acknowledged that some aspects of growth and development continue beyond 18 years of age and into the early 20s, young people aged 19 years and over are covered in the *Food and Nutrition Guidelines for Healthy Adults: A background paper* (Ministry of Health 2003a).

Children and young people represent a substantial proportion of the New Zealand population (Figure 1). At 31 December 2009, there were over 1 million (1,021,630) children and young people aged 2–18 years, representing 24 percent of the total population (Statistics New Zealand 2010). Based on total response ethnicity from the 2006 Census (and noting that those selecting more than one ethnic group are counted in all groups so percentages do not total 100), 72 percent of children and young people were European, 23 percent were Māori, 12 percent were Pacific and 10 percent were Asian.

Figure 1: Age and sex structure of the New Zealand population, 2006 Census

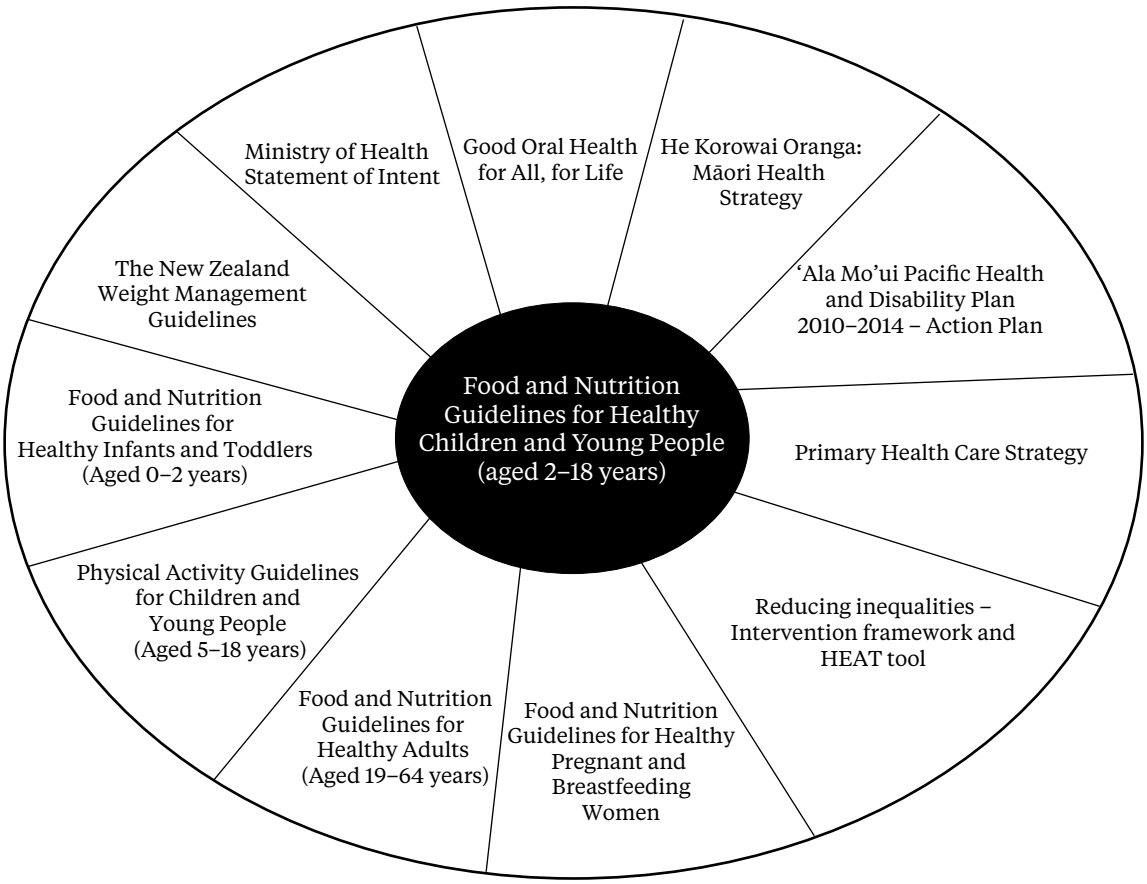


Source: 2006 Census of Population and Dwellings

New Zealand policy context

Food and nutrition guidelines for the New Zealand population are produced in the context of other policies and strategies applying in New Zealand and/or internationally. Key Ministry of Health policies and strategies relevant to healthy children and young people are summarised in Figure 2. This diagram shows the broader national policy context for the *Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2–18 Years): A background paper*.

Figure 2: New Zealand policy context for the *Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2–18 Years): A background paper*



More detailed information on the policies and strategies outlined in Figure 2 is provided in Appendix 1 and on the Ministry of Health website: www.health.govt.nz

International context

As a member of the United Nations and World Health Organization, New Zealand participates in a number of international strategies and conventions that relate to the wellbeing and health of children and young people, and include aspects of nutrition and physical activity. These Guidelines have been developed within the context of the following strategies and conventions:

- United Nations Convention on the Rights of the Child (UNICEF 1990)
- *Diet, Nutrition and the Prevention of Chronic Diseases* (WHO 2003a)
- *Global Strategy on Diet, Physical Activity and Health* (WHO 2004)
- *Food, Nutrition, Physical Activity and the Prevention of Cancer: A global perspective* (World Cancer Research Fund and American Institute for Cancer Research 2007)
- *Global Strategy for the Prevention and Control of Non-communicable Diseases and 2008–13 Action Plan* (WHO 2008)
- *Interventions on Diet and Physical Activity: What works – Summary report* (WHO 2009b)
- *Improving Lifestyles, Tackling Obesity: The health and economic impact of prevention strategies* (OECD/WHO 2009).

More information on these strategies and conventions is provided in Appendix 2.

Food and nutrition for children and young people

Childhood and adolescence are periods of rapid physical, social, cognitive and behavioural change. Optimal nutrition during childhood and adolescence is essential for the maintenance of growth and good health. The dietary requirements of children and young people are different to those of adults and are constantly changing as individuals grow and develop.

Establishing good nutrition and physical activity patterns in childhood contributes to good health throughout life. The values, habits and behaviours developed during this period often influence behaviours in adulthood. In addition there is emerging evidence that health during childhood and adolescence impacts on health during adulthood.

Structure of this paper

Food and nutrition guidance for children and young people is aimed at ensuring optimal growth and preventing nutritional deficiencies. It aims to promote health, while also preventing obesity and diet-related chronic diseases. Topics designed to achieve these goals are included in this paper.

In recognition of changing nutritional concerns for children and young people and the strong influence of environmental factors on food choice, some topics included are additional to those in previous editions of the guidelines for healthy children (aged 2–12 years) (1997) and healthy adolescents (1998). For example, new sections outline considerations for selected population subgroups, the influence of social, economic and other environmental factors on food choice, and related topics such as oral health.

A 'Summary' box is included at the beginning of most parts and major sections, which brings together the key points made in the part or section. Where appropriate these 'Summary' boxes also contain practice points for health practitioners, which are specific to the topics discussed.

Part 1: New Zealand Food and Nutrition Guidelines presents the guideline statements that set out the key food, nutrition and physical activity recommendations for healthy children and young people. This part also outlines the four food groups and recommended number of servings.

Part 2: Meal Patterns of New Zealand Children and Young People presents information from New Zealand based studies illustrating the current meal patterns of children and young people along with recommendations for ideal meal patterns.

Part 3: Growth and Body Size provides information on growth, assessment of growth using growth charts, and current body size of New Zealand children, along with an overview of overweight, obesity and underweight.

Part 4: Energy and Nutrients includes information on the function of key nutrients, recommended levels of intake, current levels of intake, nutrient status (where possible) and sources in the diet.

Part 5: Fluids provides information on the function of fluids, recommended intake, current fluid consumption patterns and sources in the diet.

Part 6: The Home Environment and Its Influence on What Children and Young People Eat provides information on how family/whānau and related sociocultural and economic factors influence eating, including food and nutrient intake.

Part 7: The Wider Environment and Its Influence on What Families and Individuals Eat provides information on the impact of the social, cultural and economic environment beyond the family and whānau. It focuses particularly on the food environment and how it influences the purchase and consumption of food, including food access and availability, food price, portion size, food marketing, and the nature of food in schools.

Part 8: Physical Activity provides information on the benefits of physical activity, recommendations for physical activity and screen time, and an overview of current physical activity and sedentary behaviour patterns. It also sets out strategies for increasing physical activity and reducing sedentary behaviour.

Part 9: Considerations for tamariki and rangatahi Māori and their whānau provides information on the Māori view of health, illness and kai, broader determinants of health, and current nutrition-related issues. Its aim is to enhance the cultural competence of health practitioners working with Māori.

Part 10: Considerations for Pacific children, young people and their families provides information on Pacific concepts of health, traditional foods, broader determinants of health, and current nutrition issues. Its aim is to enhance the cultural competence of health practitioners working with Pacific peoples.

Part 11: Considerations for Asian and other populations provides demographic information and a summary of nutrition and health issues for this diverse population group, which includes refugee and migrant population.

Part 12: Special Dietary Considerations provides information on vegetarian and vegan diets, food-related choking in young children, food allergy and intolerance, and pregnancy and breastfeeding for young women. Problems with eating such as picky eating, including neophobia (the rejection of new or unknown foods), are also discussed.

Part 13: Other Issues provides information on a range of topics related to nutrition, including body image, disordered eating and eating disorders; dietary supplements; oral health; alcohol; food safety; food additives; intense (artificial) sweeteners and caffeine.

This background paper concludes with a glossary, list of abbreviations, appendices and list of references cited.

Part 1: New Zealand Food and Nutrition Guidelines

1.1 The New Zealand Food and Nutrition Guideline Statements, including physical activity

The New Zealand Food and Nutrition Guideline Statements for healthy children and young people are the key recommendations to ensure optimal growth and prevent nutritional deficiencies, obesity and diet-related chronic diseases.

The guideline statements are as follows.

1. Eat a variety of foods from each of the four major food groups each day:
   - vegetables and fruit, including different colours and textures
   - breads and cereals, increasing wholegrain products as children increase in age
   - milk and milk products or suitable alternatives, preferably reduced or low-fat options
   - lean meat, poultry, fish, shellfish, eggs, legumes, nuts and seeds*.
2. Eat enough for activity, growth and to maintain a healthy body size.
   - Eat regularly over the day, that is, have breakfast, lunch and dinner, and include in-between snacks for young children or if hungry.
3. Prepare foods or choose pre-prepared foods, snacks and drinks that are:
   - low in fat, especially saturated fat
   - low in sugar, especially added sugar
   - low in salt (if using salt, use iodised salt).
4. Drink plenty of water during the day. Include reduced or low-fat milk every day.
   - Limit drinks such as fruit juice, cordial, fruit drink, fizzy drinks (including diet drinks), sports drinks and sports water.
   - Energy drinks or energy shots are not recommended for children or young people.
   - Do not give children less than 13 years of age coffee or tea. If young people (13 years and older) choose to drink coffee or tea, limit to one to two cups per day.
5. Alcohol is not recommended for children or young people.
6. Eat meals with family or whānau as often as possible.
7. Encourage children and young people to be involved in shopping, growing and cooking family meals.
8. Purchase, prepare, cook and store food in ways to ensure food safety.
9. Be physically active.
   - Take part in regular physical activity, aiming for 60 minutes or more of moderate to vigorous activity each day.
   - Spend less than two hours a day (out of school time) in front of television, computers and gaming consoles.
   - Be active in as many ways as possible, for example, through play, cultural activities, dance, sport and recreation, jobs and going from place to place.
   - Be active with friends and whānau, at home, school, and in your community.

1.2 Food groups and recommended serving sizes

The Food and Nutrition Guideline Statements refer to the four food groups:

1. vegetables and fruit
2. breads and cereals
3. milk and milk products
4. lean meat, poultry, seafood, eggs, legumes, nuts and seeds*.

As outlined in more detail below, each of the four food groups is important for different reasons and each provides a range of essential nutrients. Eating a variety of foods in the recommended amounts from each of the four food groups should provide sufficient energy and nutrients for most healthy children and young people (see sample meal plans in Appendix 5).

The Ministry of Health developed **standard serving sizes** for use when providing advice about the amount of food to eat from each food group to meet energy and nutrient requirements. Standard serving sizes were developed as part of the report *Food for Health* (Department of Health 1991). These serving sizes were intended to reflect usual serving sizes based on the 1989 Life in New Zealand Survey, and to be convenient in terms of the forms of food that are readily available (eg, whole piece of fruit, pottle of yoghurt). The standard serving sizes are used for all population groups covered by the Food and Nutrition Guidelines series, regardless of age or nutrient requirements, but the number of servings varies.

The difference between recommended serving size and portion size

Although standard serving sizes are designed to provide consistent advice on food and nutrition, in some instances the standard serving size seems large for younger children. For example, one standard serving of milk and milk products is a 250 ml glass of milk, a 150 g pottle of yoghurt, or two slices (40 g) of cheese. However, the total number of servings can be consumed in smaller portions during the day.

A **portion size** refers to the amount of food offered at a single eating occasion. For example, although it is recommended that children consume two standard servings of milk and milk products each day, they can meet this requirement by consuming the following portions: half a glass of milk with breakfast cereal, 75 g yoghurt as a morning snack, 20 g of cheese with lunch, and half a glass of milk with dinner.

Vegetables and fruit

Vegetables and fruit provide energy, carbohydrate, dietary fibre, vitamins (including vitamin A, vitamin C and folate) and minerals (including potassium and magnesium). Starchy root vegetables (eg, potatoes, kūmara and taro) are important sources of carbohydrate in the New Zealand diet. In addition to providing many nutrients, most vegetables and fruit are low in energy and contribute to satiety (feeling of abdominal fullness after eating), so may help people maintain a healthy weight. High intakes of vegetables and fruit have been shown to reduce the risk of cardiovascular disease, type 2 diabetes and many cancers.

* Do not give small, hard foods such as whole nuts and large seeds until children are at least five years old to reduce the risk of choking (see section 1.3: Summary of food groups, serving sizes and recommended intake).

Plant foods such as vegetables and fruit contain a wide range of different compounds that promote good health. Some of these compounds have already been identified (eg, dietary fibre, phytochemicals) and others are as yet unknown. It is the synergistic effect of this mixture of protective compounds that provides the benefit. For this reason, eating a wide range of whole or minimally processed vegetables and fruit is the best method for gaining optimal nutrient intake and reducing the risk of chronic disease.

To obtain a wide range of nutrients it is important to eat many different types of vegetables and fruit every day. Colour is a good guide to ensuring variety with vegetables and fruit, which are often classified as green (eg, broccoli, spinach, kiwifruit), yellow/orange (eg, carrots, pumpkin, mandarins), red (eg, tomatoes, red peppers, strawberries), blue/purple (eg, beetroot, eggplant, plums) or brown/white (eg, onions, potatoes, bananas). These colours also indicate high levels of protective compounds in vegetables and fruit. Useful resources on vegetables and fruit are available on the 5+ A Day website, www.5aday.co.nz

Fresh, frozen or canned vegetables and fruit are all usually good dietary options. Commercially frozen vegetables and fruit are usually picked at their prime and 'snap frozen' so they should retain many of their nutrients. Canned vegetables and fruit are also picked at their prime and retain many nutrients, although beware of added sugar and salt. Juiced vegetables and juiced or dried fruit contain fewer beneficial compounds than whole foods. Juiced or dried fruit are high in sugar. If vegetable or fruit juice or dried fruit is consumed, it contributes up to one serving only of the total recommended number of servings for this food group so that additional servings of fresh, frozen or canned vegetables and fruit are still required to meet recommendations.

See Table 1 for more information on recommended intakes of vegetables and fruit, including descriptions of serving sizes.

Breads and cereals

The breads and cereals food group includes all breads, cereals, rice, pasta and foods made from grain. Breads and cereals provide energy, carbohydrate, dietary fibre (especially wholegrains), protein and B vitamins (except B12). Breads and cereals are also an important source of energy for children and young people.

What are 'wholegrains'?

There is no widely accepted definition of the term **wholegrain** (Cummings and Stephen 2007). It generally means the entire grain seed or kernel is intact and so includes the bran, germ and endosperm. The bran and germ provide dietary fibre, vitamins and minerals; the endosperm provides carbohydrate and some protein. A kernel that has been cracked, crushed, flaked or milled can only be described as wholegrain if it retains the same relative proportions of bran, germ and endosperm found in the original grain. Wholegrain foods include the following foods and products: whole wheat, whole-wheat flour, wheat flakes, bulgur wheat, whole and rolled oats, oatmeal, oat flakes, brown rice, whole rye and rye flour, whole barley and popcorn (Cummings and Stephen 2007). Note that 'wholegrain' claims on food labels are currently unregulated and often misleading. Refined grains have had most or all of the bran and germ removed, leaving only the endosperm, so they provide substantially fewer nutrients and less fibre. Refined cereals include white bread, cakes, muffins, sweet or savoury biscuits, pasta, white rice and refined grain breakfast cereals.

Aim to increase the proportion of breads and cereals that are wholegrain as children get older. Note that older children and young people, particularly those who are highly active, will need more servings of breads and cereals to meet their energy requirements.

See Table 1 for more information on recommended intakes of breads and cereals, including descriptions of serving sizes.

Milk and milk products

Milk and milk products provide energy, protein, fats (mostly saturated), vitamins (riboflavin, B12, A) and minerals (calcium, iodine, phosphorus, zinc). They are particularly important for children and young people to ensure optimal bone health. Reduced or low-fat milk and milk products are the best choices because these foods include less saturated fat, and often more protein and calcium than high-fat alternatives.

All types of milk and milk products (eg, yoghurt, cheese) from all animal sources (eg, cow, goat) are included in this food group. Milk alternatives, such as soy and rice milk fortified with calcium and other nutrients, also belong to this food group. Some plant milks contain significantly lower levels of nutrients (eg, energy, protein) than cow's milk so should not be considered equivalent (see section 5.4: Sources of fluid in the diet). Breast milk is included for children being breastfed.

See Table 1 for more information on recommended intakes of milk and milk products, including descriptions of serving sizes.

Lean meat, poultry, seafood, eggs, legumes, nuts and seeds*

This food group includes lean meat (eg, beef, lamb, pork and venison), poultry (eg, chicken, turkey), seafood (eg, fish and shellfish), as well as other protein-rich foods such as eggs, legumes, nuts* and seeds. For those who eat meat, choose lean meat, poultry and fish where possible. The intake of processed meats needs to be limited. Processed meats (eg, luncheon, salami, ham, bacon and sausages) are usually high in saturated fat and/or salt, and have also been linked to bowel cancer in adults (World Cancer Research Fund and American Institute for Cancer Research 2007, 2011).

Lean meat, poultry, seafood, eggs, legumes, nuts* and seeds provide energy, protein, fats (more often saturated in meat; mostly unsaturated in seafood, nuts* and seeds), carbohydrate (especially from legumes), vitamins (B12, niacin, thiamin) and minerals (iron, zinc, selenium, magnesium, potassium, phosphorus).

While legumes, nuts* and seeds provide many important vitamins and minerals, in general they contain significantly less protein per serving size (see Table 1) than meat. For those choosing more of those foods than meat foods or those following a vegetarian diet, additional servings of those foods are required as described in Table 1. For more information see section 12.1: Vegetarian eating).

Table 1 gives more information on recommended intakes of lean meat, poultry, seafood, eggs, legumes, nuts and seeds, including descriptions of serving sizes.

1.3 Summary of food groups, serving sizes and recommended intakes

Table 1 shows the four food groups, specific foods included in each group, the minimum number of servings of each group recommended for healthy children and young people, and examples of standard serving sizes.

* Do not give small, hard foods such as whole nuts and large seeds until children are at least five years old to reduce the risk of choking (see section 1.3: Summary of food groups, serving sizes and recommended intake).

Table 1: Food groups, specific foods in each group, advice and serving size examples

Food group	Specific foods included	Recommendation (per day)	Serving size examples
Vegetables and fruit	All vegetables and fruit, including potatoes, kūmara and taro Vegetables and fruit – fresh, frozen or canned If consumed, only one serving of no-sugar-added fruit juice or dried fruit can count as contributing a serving to the recommended dietary intake[1]	**Preschoolers:** at least 2 servings of vegetables and at least 2 servings of fruit **Children:** at least 3 servings of vegetables and at least 2 servings of fruit **Young people:** at least 3 servings of vegetables and at least 2 servings of fruit	1 medium potato or kūmara (135 g) ½ cup cooked vegetables (eg, broccoli, peas, corn, spinach, pūhā) (50–80 g) 1 carrot (75 g) ½ cup salad (60 g) 1 tomato (80 g) ½ avocado (80 g) 1 apple, pear, banana or orange (130 g) 2 small apricots or plums (100 g) ½ cup fresh fruit salad (120 g) ½ cup stewed or canned fruit (135 g) 1 cup no-added-sugar fruit juice (250 ml)^
Breads and cereals	All breads, cereals, rice and pasta (increasing wholegrain options as children age)	**Preschoolers:** at least 4 servings **Children:** at least 5 servings **Young people:** at least 6 servings	1 medium slice of bread (26 g) 1 roll (50 g) 1 pita pocket or tortilla (50–80 g) 2 breakfast wheat biscuits (34 g) ½ cup muesli (55 g) ½ cup porridge (130 g) 1 cup cornflakes (30 g) 1 cup cooked pasta or rice (150 g) 4 grainy crackers (40 g) 2 plain sweet biscuits (14 g) 1 cup plain popcorn
Milk and milk products	Milk (includes calcium-fortified milk alternatives), cheese and yoghurt (choose low-fat options)	**Preschoolers and children:** at least 2–3 servings **Young people:** at least 3 servings	Glass of milk or calcium-fortified milk alternative (250 ml) Pottle of yoghurt (150 g) 2 slices of cheese (40 g)
Lean meat, poultry, seafood, eggs, legumes, nuts and seeds*	Lean meat, poultry, seafood, eggs, legumes (eg, peas, beans, lentils), nuts and seeds* (Limit processed meats)	**Preschoolers and children:** at least 1–2 servings **Young people:** at least 2 servings **Vegetarians:** **Preschoolers (2–5 years):** at least 1–2 servings **School children (5–12 years):** at least 2 servings **Young people (13–18 years):** at least 3 servings	2 slices of cooked meat (100 g) ¾ cup of mince or casserole (195 g) 1 medium fish fillet (100 g) 1 chicken leg or 2 drumsticks (110 g) 1 medium pāua or kina (100–120 g) 1 egg (50 g) ½ can tuna or salmon (90 g) ¾ cup dried cooked beans, peas or lentils (135 g) 1/3 cup nuts or seeds* (50 g)

Notes:

^ The Ministry of Health recommends choosing vegetables and fruit that are fresh, frozen or canned. If vegetable/fruit juice or dried fruit is consumed, it contributes a maximum of only one serving of the total recommended number of servings for this food group. Servings of fresh, frozen and canned vegetables and fruit are still required to meet the recommendations.

* Do not give small, hard foods such as whole nuts and large seeds until children are at least 5 years old to reduce the risk of choking.

Many factors other than the number of servings from each food group will influence the total energy and nutrient intake of the diet. For example, nutrient intake will depend on whether people choose the healthiest options within food groups (eg, wholegrain breads and cereals, low-fat and reduced-fat milk and milk products, and lean meats, legumes, etc) and how they prepare and cook the food. Total energy, sugar and fat content will increase if higher fat and sugar options of the food groups are chosen or if fat and sugar are added during preparation and cooking.

Minimising the risk of food related choking in young children

People can choke on food at any age but children under five years of age are at higher risk of choking, with children under three years of age at greatest risk.

To reduce the risk of food-related choking in young children:

- Always make sure young children sit down while they eat, and that an adult is with them while they are eating or drinking.
- Offer food that matches their chewing and grinding ability.
- Be aware of foods which are more likely to cause choking:
  - small hard foods that are difficult for children to bite or chew (eg, nuts, raw carrot, apple, celery)
  - small round foods that can get stuck in children's throats (eg, grapes, berries, peas, watermelon and other large seeds, lollies, raisins/sultanas)
  - foods with skins or leaves that are difficult to chew (eg, sausages, chicken, lettuce, nectarines, peaches, plums)
  - compressible* food that can get stuck in children's throats (eg hot dogs, sausages, pieces of cooked meat, popcorn)
  - thick pastes that can get stuck in children's throats (eg, chocolate spreads, thick peanut butter)
  - fibrous or stringy foods that are difficult for children to chew (celery, rhubarb, raw pineapple)
- To reduce the risk of choking on these foods, you can:
  - alter the food texture – grate, cook, finely chop or mash the food
  - remove the high risk parts of the food – peel off the skin, or remove the strong fibres
  - avoid giving small hard foods, such as whole nuts and large seeds, until children are at least 5 years old.
- Parents and caregivers need to learn choking first aid and CPR.

For information on choking first aid and cardiopulmonary resuscitiation (CPR), see your *Well Child Tamariki Ora Health Book* or the Ministry of Health website www.health.govt.nz

For more information on food related choking see the Ministry of Health website www.health.govt.nz

* These are foods that can squash into the shape of a child's throat and get stuck there.

For background information see section 12.3: Food-related choking in young children aged 2–5 years and the Ministry of Health website www.health.govt.nz

Current intakes

The recommended intakes of the four food groups provide a guide to the types and amounts of foods required to meet the recommended intake requirements for nutrients. As foods are generally consumed in combination (ie, more than one food group at a time) and not necessarily in standard serving sizes, it is difficult to calculate intake of each food group to compare with the recommendations. For some food groups the only information available relates to how often selected foods are consumed. The following summaries provide an indication of current intakes in New Zealand based on what can be established from these surveys:

- 2002 National Children's Nutrition Survey (Ministry of Health 2003b)
- 2008/09 National Survey of Children and Young People's Physical Activity and Dietary Behaviours in New Zealand (Clinical Trials Research Unit and Synovate 2010a and 2010b)
- 2008/09 New Zealand (NZ) Adult Nutrition Survey (University of Otago and Ministry of Health 2011).

(See Appendix 7 for a summary of these surveys.)

Vegetables and fruit

In 2008/09:

- 40 percent of 5–24 year olds reported they met the recommendation for vegetable intake (three or more servings each day)
- 69 percent reported they met the recommendation for fruit intake (two or more servings each day)
- the proportion of children and young people who reported meeting the recommendation for fruit intake declined with age but there was no clear age-related pattern with vegetable intake (Clinical Trials Research Unit and Synovate 2010a).

In the 2008/09 NZ Adult Nutrition Survey:

- 51 percent of males and 62 percent of females aged 15–18 years reported they had three or more servings of vegetables per day
- 61 percent of males and 65 percent of females aged 15–18 years reported they had two or more servings of fruit per day (University of Otago and Ministry of Health 2011).

Breads and cereals

In 2008/09:

- nearly all 5–19 year olds ate bread every day, with approximately half (49%) eating brown, wholemeal or wholegrain bread most often, and the remainder eating white bread (43%), high-fibre white (7%) or other bread (1%) (Clinical Trials Research Unit and Synovate 2010a).

In the 2008/09 NZ Adult Nutrition Survey:

- 50 percent of males and 49 percent of females aged 15–18 years reported they ate white bread
- 44 percent of males and 48 percent of females aged 15–18 years reported they ate light or heavy grain bread (University of Otago and Ministry of Health 2011).

Milk and milk products

In 2008/09:

- nearly two-thirds (64%) of 5–19 year olds drank unflavoured milk at least once a week, including 26 percent who drank unflavoured milk seven or more times a week
- the proportion of children and young people drinking unflavoured milk decreased as age increased
- overall, 21 percent of 5–19 year olds never drank unflavoured milk, with females more likely than males to never drink unflavoured milk (Clinical Trials Research Unit and Synovate 2010b).

In the 2008/09 NZ Adult Nutrition Survey:

- 61 percent of males and 51 percent of females aged 15–18 years reported they drank whole or homogenised milk
- 33 percent of males and 39 percent of females aged 15–18 years reported they drank either reduced-fat, skim or trim milk
- only 2 percent of males and 6 percent of females aged 15–18 years reported they drank no milk (University of Otago and Ministry of Health 2011).

Lean meat, poultry, seafood, eggs, legumes, nuts and seeds*

According to the 2002 National Children's Nutrition Survey:

- one in two children and young people (51%) consumed two or more servings of meat, fish, poultry and eggs each day (Ministry of Health 2003b).

In the 2008/09 NZ Adult Nutrition Survey:

- 4 percent of males and 8 percent of females aged 15–18 years reported never consuming red meat or not doing so within the previous four weeks
- most 15–18 year olds reported having red meat either three to four times a week (43%) or one to two times a week (33%)
- most 15–18 year olds reported having chicken either one to two times a week (49%) or three to four times a week (30%)
- most 15–18 year olds reported consuming fresh or frozen seafood (fish or shellfish) either never or not within the previous four weeks (52%), or less than once a week (24%)
- most 15–18 year olds reported consuming canned fish either never or not within the previous four weeks (72%), or less than once a week (16%)
- 36 percent of 15–18 year olds reported having processed meat one to two times per week and 28 percent reported consuming it three to four times per week.

* Do not give small, hard foods such as whole nuts and large seeds until children are at least five years old to reduce the risk of choking (see section 1.3: Summary of food groups, serving sizes and recommended intake).

Part 2: Meal patterns of New Zealand children and young people

Summary

Three meals and two to three small snacks, at regular times during the day, are recommended for children and young people.

- Continuous eating or 'grazing' is not recommended.

Children and young people need a nutritious breakfast every day.

- Breakfast consumption is associated with a range of positive outcomes, including better nutrient intake and a healthy body weight.
- Skipping breakfast may impact negatively on cognitive function, academic performance, school attendance, psychosocial function and mood in children and young people.
- Around 10 percent of New Zealand children and young people do not eat breakfast regularly. Consumption tends to decrease with increasing age.
- Breakfast consumption by parents and caregivers, and the availability of breakfast foods are important determinants of regular breakfast consumption.
- Encourage those who skip breakfast because of lack of time to take 'portable' food from home to eat on their way to school (eg, banana, peanut butter sandwich).

Encourage a healthy lunch every day.

- Lunch contributes significantly to daily energy and nutrient intakes, and provides energy when levels may be decreasing.
- Research shows foods brought from home are likely to be more nutritious and cost-effective than foods bought either at school or on the way to school.
- Most (> 90%) young children have at least something to eat for lunch when at school. Only around two-thirds of young people eat lunch on four or more school days.
- Nearly half of 12–18 year olds get their lunch from the school canteen or tuckshop. Encourage school boards to actively promote and sell healthy food and drinks through their canteens or tuckshops.

Encourage nutritious family/whānau dinners, during which everyone eats together.

- Although the proportion of young people having their main meal together with family/whānau decreases as they grow older, it still occurs reasonably regularly for most young people in New Zealand.

Offer mainly healthy and nutritious snacks.

- Examples of healthy and nutritious snacks are: fruit, yoghurt, vegetable sticks with a low-fat dip (eg, hummus or yoghurt-based dips), mini-sandwiches, mini homemade 'pizzas', 'mousetraps' (toasted cheese and yeast extract spread on bread), nuts and milk.

Limit high fat, sugar and salt (HFSS) foods and drinks to occasional (less than once a week) consumption only.

- HFSS foods and drinks generally provide very few vitamins and minerals relative to their energy content (ie, these foods are energy-dense and low in nutrients).
- HFSS foods and drinks contributed to 20 percent of total energy intake for 5–14 year olds which indicates healthier foods are being displaced in the diet.
- Limiting the consumption of HFSS foods and drinks can be difficult as they are widely available, often inexpensive and heavily marketed.
- Encourage healthier choices when the family/whānau is deciding on takeaways. For example, choose kebabs, wraps, pizza with lots of vegetables and minimal cheese, non-fried Asian rice or noodles dishes with lots of vegetables, sushi, or some takeaway hot-filled bread roll choices, pasta with tomato-based sauces or baked potatoes with meat, beans and salad.

Appendix 5 presents three-day sample meal plans for children and young people aged 2–3 years, 4–8 years, 9–13 years and 14–18 years. Although only indicative, these meal plans provide examples of regular eating periods throughout the day and food from each food group.

Because young children are growing rapidly and typically engage in moderate to high levels of physical activity, they have energy requirements that are high relative to their small size and limited stomach capacity. Similarly significant growth and, for some, relatively high activity levels can increase energy and nutrient requirements for young people. Eating regular meals and small snacks during the day from the four food groups (see section 1.2: Food groups and recommended serving sizes) is the key to healthy eating for children and young people. This practice can help them to have enough energy available when they need it and to meet all the nutrients requirements.

Most people eat meals on a daily basis at particular times (eg, breakfast, lunch, dinner). Meals and snacks should be limited to a maximum of six over the day. Continuous eating or 'grazing' is not recommended as it prevents saliva from neutralising acids in the mouth and remineralising tooth enamel between eating occasions (see section 13.2: Oral health).

2.1 Breakfast

Eating breakfast is associated with a range of positive health outcomes, including better nutrient intake and a healthy body weight (Rampersaud et al 2005; de la Hunty and Ashwell 2007). Skipping breakfast during childhood has been associated with higher body mass index (BMI) (Utter et al 2007b) while skipping this meal during adolescence predicts increased BMI in young adulthood (Niemeier et al 2006). The association between skipping breakfast and overweight/obesity does not appear to be explained by energy intake, so breakfast consumption may be a marker for other healthy dietary and physical activity behaviours (Rampersaud et al 2005; de la Hunty and Ashwell 2007). Skipping breakfast may also have an adverse effect on cognitive function (including memory), academic performance, school attendance, psychosocial function and mood in children and young people (Pollitt and Matthews 1998; Rampersaud et al 2005). Skipping breakfast tends to be more common among girls than boys (Rampersaud et al 2005).

Breakfast contributes substantially to energy and nutrient intake. A secondary analysis of data from the 2002 National Children's Nutrition Survey (5–14 years) showed that breakfast contributed 16 percent of children's daily energy intake, approximately one-third of daily calcium, iron, thiamin, riboflavin and folate intake, and approximately one-fifth of daily zinc intake (Wilson et al 2006c). Compared with children who did not eat breakfast,

breakfast eaters had significantly better daily nutrient intakes, including lower intakes of total fat (as a percentage of total energy) and higher intakes of dietary fibre, vitamin A, thiamin, riboflavin, calcium, iron, zinc and folate (Wilson et al 2006c). Another study based on these data showed that after adjustment for potential confounders, skipping breakfast was associated with less healthy eating patterns, such as lower consumption of fruit and milk, as well as higher consumption of unhealthy snack foods (Utter et al 2007b).

Several nationally representative surveys have shown that approximately 10 percent of New Zealand children and young people do not eat breakfast regularly (Adolescent Health Research Group 2003, 2008; Ministry of Health 2003b, 2008g). The prevalence of skipping breakfast tends to increase with age, especially in girls. Pacific children and young people are most likely to skip breakfast, followed by Māori children and young people. The 2008/09 NZ Adult Nutrition Survey identified that 55 percent of males and 45 percent of females aged 15–18 years have breakfast every day. In this age group, 31 percent of males and 35 percent of females have breakfast between three and six mornings a week while 14 and 21 percent respectively have it two or fewer mornings per week (University of Otago and Ministry of Health 2011).

The availability of breakfast foods and parental modelling are the most important determinants of regular breakfast consumption (Pearson et al 2009a). Parental breakfast consumption is a strong predictor of breakfast consumption in children and young people (Rampersaud et al 2005).

A healthy breakfast should include foods from a variety of food groups (eg, breads and cereals, fruit and vegetables, and milk and milk products). For breakfast ideas, refer to the three-day sample meal plans in Appendix 5.

2.2 Lunch

Lunch contributes substantially to energy and nutrient intake. In the 2002 National Children's Nutrition Survey, lunch provided approximately 20 percent of daily energy, protein, fat and carbohydrate intake, as well as approximately 15 percent of daily calcium, iron and vitamin A intake (Regan et al 2008).

Most children and young people usually eat lunch at school. The 2002 National Children's Nutrition Survey found that nearly all children (94%) usually had something to eat at lunch time when at school (Ministry of Health 2003b). Foods commonly consumed at lunch time (between 12 and 2 pm) included: sandwiches (by 44% of children); fruit including dried fruit and roll-ups (36%); biscuits, muesli bars and crackers (16%); potato chips, corn snacks, popcorn and other snacks (16%); and sweetened drinks (16%) (Regan et al 2008).

Foods sourced from home are likely to be a more nutritious and economic option for lunch. In the 2002 National Children's Nutrition Survey, home was the predominant source of food eaten at school, with 84 percent of children sourcing 'most', and 11 percent sourcing 'some' of their school food from home. About half of the children sourced some food from the school canteen, and it was the source of most food for 5 percent of children. School canteen use increased as children got older, and Pacific and Māori children were more likely to use the school canteen than other ethnic groups. Secondary analyses showed school canteen use was associated with poor dietary patterns (eg, lower intakes of vegetables and fruit, and higher intakes of foods high in fat and/or sugar) and higher BMI (Utter et al 2007a).

In the Obesity Prevention in Communities study[1] (summarised in Appendix 7), approximately two-thirds of secondary school students aged 12–18 years (65% of females, 68% of males) ate lunch on four to five school ™days each week (Utter et al 2008a). One-third of students (35% of females, 37% of males) sourced their lunch from home, whereas nearly half of students (49% of females, 46% of males) sourced their lunch from the school canteen or tuckshop (Utter et al 2008a).

The school environment has long been recognised as an important setting for promoting healthy eating. According to the National Administration Guidelines, Boards of Trustees must promote healthy food and nutrition for all students (see section 7.3: The wider food environment.

The following webpage includes food safety messages for keeping school lunchboxes 'cool': www.foodsmart.govt.nz/information-for/people-with-children

2.3 Dinner

The dinner or evening meal has historically been the main meal of the day for New Zealanders. As such, it provides a significant proportion of daily energy and nutrient requirements. Traditionally dinner has also been the meal most families or whānau have together.

Family/whānau meals still seem a reasonably regular activity for most New Zealand young people. In the 2007 New Zealand Children's Food and Drinks Survey (National Research Bureau 2008), nearly all (98%) of parents and caregivers said their child sometimes had their main meal sitting down with the rest of the family/whānau. In a national survey of secondary school students, just over half of students reported that their family/whānau ate meals together on five or more days of the week (Adolescent Health Research Group 2008). In the Obesity Prevention in Communities study, 42 percent of New Zealand secondary school students had eaten a family/whānau meal on all of the previous five school nights and a further 30 percent had eaten a family/whānau meal on three to four of the previous five school nights (Utter et al 2008b). The proportion of children and young people eating dinner with the family/whānau tends to decrease with age.

2.4 Snacks

Snacks can be considered 'mini-meals' that make a valuable contribution to energy and nutrient intake between main meals. Many children will need snacks mid-morning and mid-afternoon, while after-dinner snacks can also be included for older children, especially during the adolescent growth spurt. The size and timing of snacks need to be considered with the aim of not interfering with appetite for main meals.

The ideal snacks provide energy, protein, carbohydrate, vitamins, minerals, dietary fibre and a good balance of dietary fats. However, foods high in fat, sugar and salt and low in vitamins, minerals and fibre are commonly produced, packaged and marketed as appropriate snacks for children and young people.

Data from the 2002 National Children's Nutrition Survey suggest children's morning snacks are often unhealthy. The most commonly consumed foods from 9.00 am to 11.59 am were: potato chips, corn snacks, flavoured popcorn and other extruded snacks (29%); fruit, including dried fruit and roll-ups (22%); and biscuits, muesli bars and crackers (21%) (Regan et al 2008). Foods consumed during the morning contributed significantly to daily nutrient intake in children and young people, providing approximately 12 percent

1 The Obesity Prevention in Community study used a non-representative sample of 12–18 year olds.

of daily energy, fat and carbohydrate intake, but only about 8 percent of daily protein, calcium, iron and vitamin A intake (Regan et al 2008). These findings suggest morning snacks contribute nearly as much energy as breakfast, but fewer beneficial nutrients. Such snacks can contribute to problems of excess energy intake, and overweight and obesity in some children and young people.

Examples of more appropriate snacks are fruit, yoghurt, vegetable sticks with a low-fat dip (eg, hummus or yoghurt-based dips), mini-sandwiches, nuts and seeds, fresh fruit smoothie, plain popcorn, and unsweetened breakfast cereal with milk. The Food and Beverage Classification System provides criteria for identifying healthy snacks among processed foods (see section 7.3: The wider food environment).

2.5 High fat, sugar and salt foods

Foods high in fat (especially saturated fat), sugar and/or salt (HFSS foods) that provide few vitamins and minerals are not essential in the diet and provide very few nutrients relative to their energy content (ie, they are energy-dense and nutrient-poor). Examples of HFSS foods include chocolate, confectionery, potato chips, chocolate or cream-filled biscuits, fast food and sugary drinks. High intakes of many of these foods are associated with overweight and obesity (see section 3.3: Obesity).

New Zealand children and young people consume HFSS foods regularly. For example, 85 percent of children consume potato chips, corn snacks or chips at least once per week (Ministry of Health 2003b). Chocolate, confectionery, fancy biscuits and soft drinks are consumed at least once a week by nearly 50 percent of children (Ministry of Health 2003b). In the 2006/07 New Zealand Health Survey, over two-thirds of children (71%) aged 2–14 years had eaten fast food in the previous week (Ministry of Health 2008g). Table 2 shows the percentage of 15–18 year olds having high intakes of HFSS food and drinks.

Table 2: Proportion (%) of males and females aged 15–18 years having high intakes per week of high fat, sugar and/or salty foods and drinks

Total population 15–18 years	Takeaways 3+ times a week	Hot chips 3+ times a week	Juice and fruit drink 3+ times a week	Soft drinks 3+ a week	Lollies/ sweets 3+ a week
Males	14	25	44	53	35
Females	17	19	49	40	43

Source: University of Otago and Ministry of Health (2011)

HFSS foods and drinks, specifically sugary drinks, biscuits, sugar and sweets, and cakes and muffins, contributed 20 percent of total energy intake in the 2002 National Children's Nutrition Survey, which indicates healthier foods are being displaced in the diet (Ministry of Health 2003b). Limiting the consumption of these foods can be difficult. They are widely available, relatively inexpensive and heavily marketed, which contributes to the perception that they can be eaten every day. Many of these foods are also very convenient, requiring little or no preparation or cooking so they appeal to time-poor parents and caregivers as alternatives to more traditional home-cooked meals. There is also evidence that restricting access to these types of foods too strictly can increase a child's preference for them (Savage et al 2007).

With busy lifestyles, eating out and having takeaways are becoming increasingly more common options for many families/whānau. However, there are many healthier commercially prepared meal options available, which means a takeaway can still be a healthy choice for families/whānau. Examples are kebabs, wraps, pizza (with lots of vegetables, and with smaller amounts of cheese and high-fat meats, eg, salami), non-fried Asian rice or noodle dishes with lots of vegetables, sushi, and some takeaway hot-filled bread rolls, pasta with tomato-based sauces and baked potatoes with meat, beans and salad.

The use of herbs and spices in cooking can help to lower salt, fat and sugar intakes, by providing alternative and appealing flavours to food. In addition the culinary use of herbs and spices may contribute to health through their antioxidant and other properties (Tapsell 2006). Practical suggestions for the use of herbs and spices and further discussion of their potential health benefits can be found in 'Health benefits of herbs and spices: the past, the present, the future' available at: www.mja.com.au/public/issues/185_04_210806/supplement_210806.html

Intake of HFSS foods and drinks needs to be limited; that is, they should not be thought of or consumed as 'everyday' foods and drinks. Where possible, healthier choices should be made or food adapted to be lower in fat, sugar or salt. HFSS foods and drinks can be enjoyed as occasional (less than once a week) foods only.

Part 3: Growth and body size

Summary

Growth

Adequate energy and nutrient intakes are necessary to maintain normal growth, development and activity.

Normal growth is an important indicator of health, so growth should be assessed regularly.

- For children aged 2–5 years, use the New Zealand – World Health Organization Growth Charts (0–5 years) to monitor growth. The charts are reproduced in Appendix 4, and both the charts and fact sheets are available online at: www.health.govt.nz
- For children and young people aged 5–18 years, use either the WHO Reference 2007 or the Centers for Disease Control Growth Charts to monitor growth.

Repeated measurements plotted on the same growth chart are most useful for monitoring growth.

- If a child is growing normally, growth will usually 'track' parallel to one of the centile lines on the chart.
- If a child's growth starts to 'track' up or down significantly (ie, there is a consistent change in centile position by two or more inter-centile spaces* for weight, or by one or more inter-centile spaces* for height), further investigation is necessary to identify the cause.
- A difference of two or more inter-centile spaces* between the weight and height values of a child also requires further investigation.

Body size

Obesity in children and young people has serious short- and long-term health consequences.

Specific lifestyle factors linked with obesity in children and young people include frequent snacking; frequent meals away from home; large portion sizes; skipping breakfast; consumption of fizzy/soft drinks and fast food; watching TV for more than two hours per day and low levels of physical activity.

In the 2006/07 New Zealand Health Survey, 21 percent of New Zealand children and young people aged 2–14 years were overweight and a further 8 percent were obese. For 15–24 year olds, 24 percent were overweight and a further 14 percent obese.

- For the assessment and management of obesity, refer to the *New Zealand Guidelines for Weight Management in Children and Young People* (Ministry of Health and Clinical Trials Research Unit 2009b). The guidelines are available at: www.health.govt.nz

Māori and Pacific children and young people are more likely to be obese than children and young people overall. For tamariki and rangatahi Māori the risk of obesity is two times higher; and for Pacific children it is three times higher.

Underweight is much less prevalent than overweight and obesity, but has serious consequences so every case needs to be investigated.

* Inter-centile space is the area between two adjacent centile lines.

3.1 Growth

Background

Growth refers to the gaining of body tissue and the subsequent increase in body size (body mass). Adequate energy and nutrient intakes are necessary for growth. From birth to the age of 2 years, body weight increases by a factor of four, then from 2 to 18 years body weight increases by a factor of five.

Children and young people grow continuously and undergo particular periods of very rapid growth. During early childhood, height and body weight increase steadily at a similar rate (Mann and Truswell 2007). During adolescence there is a rapid increase in the rate of growth in both height and weight, which is referred to as the adolescent growth spurt. On average, the adolescent growth spurt begins at approximately 10 to 11 years in females and 12 to 13 years in males, and lasts about three years (Gibson 2005) (see New Zealand–WHO Growth Charts in Appendix 4). The rate of growth then rapidly decreases, with height reaching a plateau at about 16 years in females and 18 years in males. The increase in body weight tends to continue for slightly longer. Some young people, especially males, continue to grow physically beyond 18 years.

Assessment of growth

The most common measures of growth are height, weight and body mass index (BMI). In countries where food is widely available during childhood and adolescence, most individuals reach their genetically predetermined height. Body weight reflects height and body composition, which comprises lean body mass (ie, muscle, bone and water) and fat (ie, adipose tissue). BMI is an index of weight adjusted for height, and is calculated by dividing weight in kilograms by height in metres squared (kg/m^2). BMI is often used as an indirect measure of body fatness because it is relatively simple to measure and is correlated with total body fat in populations and most individuals (WHO 2000). A limitation of BMI is that it does not differentiate between lean and fat mass, so two individuals with the same BMI may have different proportions of lean and fat mass. Factors affecting the relationship between BMI and fat mass include ethnicity, gender, stage of development and physical fitness.

Normal growth is an important indicator of health in children and young people. Growth is assessed by comparing measures of a child's body size (eg, height, weight, BMI) with reference growth charts. Reference growth charts display the growth pattern of a population similar to the individual being monitored. The individual's growth is compared with that of the reference population, a task made easier by centile lines on the charts which describe the range of growth of the reference population. For example, if a child is positioned on the 85th centile for height, this means 85 percent of the reference population are shorter than or of equal height to the child and 15 percent of the reference population are taller than the child. Growth charts are usually different for boys and girls, given that growth occurs at different rates.

The following are general practice points regarding assessment of growth.

- Plotting repeated measurements on the same growth chart is the most useful approach to assessment.
- If a child is growing normally, the lines connecting the plotted values will usually be parallel to one of the centile lines on the chart and lie within one of the inter-centile spaces (area between two adjacent centile lines).
- If a child's growth values start to 'track' up or down significantly (ie, there is a consistent change in centile position by two or more inter-centile spaces for weight or by one or more inter-centile spaces for height), further investigation is necessary to identify the cause (Ministry of Health 2010a).

- A difference of two or more inter-centile spaces between weight and height values also requires further investigation.

(For recommendations specific to the use of the New Zealand–WHO Growth Charts, see section 3.3: Obesity, and section 3.4: Underweight).

Weight is a better indicator of short-term nutritional status, whereas height reflects longer-term nutritional status (Gibson 2005). If the weight centile is substantially lower than the height centile, this difference may indicate acute nutritional problems. With long-term nutritional problems, both the weight and height centiles may be low. Growth charts should be used cautiously during adolescence because the timing of the pubertal growth spurt and subsequent slowing of growth vary between individuals (Mann and Truswell 2007).

Growth charts used in New Zealand

From birth to five years: New Zealand–World Health Organization Growth Charts

The Ministry of Health recommends the use of the New Zealand–World Health Organization (WHO) Growth Charts to monitor growth from birth to five years of age (see Appendix 4). These charts are based primarily on data used for the World Health Organization Growth Standards (0–5 years) as adapted by the United Kingdom (UK) Department of Health and Royal College of Paediatrics and Child Health in 2009. With permission the Ministry of Health in New Zealand adapted the UK–WHO Growth Charts, creating the New Zealand–WHO Growth Charts (0–5 years) in June 2010.

WHO Child Growth Standards (0–5 years)

The WHO Child Growth Standards for children aged from birth to five years, released in 2006 (WHO 2006a), are different to other growth charts previously used worldwide.

The WHO Child Growth Standards are the result of a large study initiated by the World Health Organization in 1997. The Multicentre Growth Reference Study was a longitudinal study involving over 8000 children in Brazil, Ghana, India, Norway, Oman and the United States. The study was purposely designed to produce a growth standard (as opposed to a growth reference) by selecting children living in conditions in which they would be likely to reach their full genetic growth potential. These conditions include optimal feeding practices (eg, breastfeeding and appropriate introduction of complementary foods); good health care (eg, prevention and control of infection); and a healthy environment (eg, mother not smoking during and after pregnancy). This study demonstrates that when children born in different regions of the world are given the optimal start to life, they have the potential to grow and develop at a similar rate.

The WHO Child Growth Standards establish the breastfed infant as the normative model for growth and development. The adoption of these standards aligns with the recent WHO and now New Zealand recommendation that infants are exclusively breastfed to around six months of age, then introduced to appropriate complementary food while breastfeeding is ongoing.

As with the WHO Growth Standards, the benefit of the New Zealand–WHO Growth Charts (0–5 years) is to show how infants and children should grow, rather than how they do grow which may not be optimal.

The question of whether the WHO Child Growth Standards are appropriate for Pacific children has been raised due to evidence that Pacific children born in New Zealand are bigger and grow at a faster rate than reference children (Rush et al 2008). The study providing this evidence established that the growth rate increased irrespective of whether babies were breastfed or bottlefed, although bottlefed babies grew faster. A limitation of the study noted by the authors (Rush et al 2008) was that the glycaemic status of the

mothers during their pregnancy was unknown. There is evidence that Pacific mothers have a substantially higher rate of gestational and non-gestational diabetes, which is known to increase the birthweight (Simmons et al 2006). Given that further research is required to better understand growth patterns in Pacific children born in New Zealand, care should be taken when interpreting the growth of Pacific children against New Zealand–WHO Child Growth Charts (0–5 years).

The critical issue in assessing growth for any child is growth velocity (speed of growth). In general, any child (Pacific or otherwise) whose growth is following parallel to the centile lines is doing well. If the child is dropping down from or rapidly climbing towards the next centile line, possible reasons need to be investigated (B Taylor, personal communication, May 2010) (see section 3.3: Obesity and section 3.4: Underweight).

Of note is that the centile lines on the New Zealand–WHO Growth Charts (0–5 years) differ from those marked on other charts commonly in use. The New Zealand–WHO Growth Charts (0–5 years) use the centile lines advocated by Cole (1994): 0.4th, 2nd, 9th, 25th, 50th, 75th, 91st, 98th and 99.6th. Two key benefits of using these centile lines are that:

- they cover more of the population being used for comparison so are more inclusive of those people who are bigger or smaller than the majority
- unlike the previous centile lines, they are equidistant. They divide the total population up evenly and all represent the same degree of change in growth measure. This layout helps to standardise the recommendation related to 'crossing two or more inter-centile spaces' and so is more meaningful (see page 21).

See Appendix 4 for the New Zealand–WHO Growth Charts (0–5 years), including height-for-age and weight-for-age growth charts for boys and girls aged from two to five years, and the weight–height to BMI conversion chart.

Further electronic copies of the growth charts and information for Well Child providers on measuring, plotting and assessing growth using the New Zealand–WHO Growth Charts (0–5 years), see: www.health.govt.nz

The Ministry of Health recommends that the new charts are used for all new births but there is no need to re-plot older children where they already have charts unless the health practitioner deems it appropriate in particular circumstances.

From 5 to 18 years of age

Two growth charts are currently (at time of document publication) recommended for the assessment and monitoring of growth for 5–18 year olds. These are:

- the WHO Reference 2007
- the Centers for Disease Control (CDC) Growth Charts.

WHO Reference 2007 (5–19 years)

The WHO Reference 2007 provides growth reference data for school-aged children and adolescents (5–19 years) for the following indicators: weight-for-age (5–10 years), height-for-age (5–19 years) and BMI-for-age (5–19 years). Each indicator is presented on a separate chart (WHO 2007).

The WHO Reference 2007 was developed to provide growth curves for school-aged children and adolescents that align with the WHO Child Growth Standards for preschool children. The WHO Reference 2007 is based on merged data sets from the 1977 reference of the National Center for Health Statistics (NCHS) and the WHO Child Growth Standards. This approach allows a smooth transition at 5 years between the WHO Child Growth Standards (0–5 years) and the WHO Reference Charts (5–18 years) (de Onis et al 2007).

The 1977 NCHS data are from the United States, and are based on a series of nationally representative cross-sectional health examination surveys from the early 1960s. Therefore, reference children reflect the ethnic mix of the United States at that time, and include children exposed to a range of feeding practices (eg, breastfed, bottlefed), environmental conditions (eg, smoking, non-smoking) and health care practices. The 1977 NCHS data have been superseded by the CDC Growth Charts (Kuczmarski et al 2000) (see below). The 1977 NCHS data were used to develop the WHO Reference 2007 because it was considered less likely to contain data affected by the growing trend in overweight and obesity than the data used to develop the 2000 CDC Growth Charts (B Taylor, personal communication, July 2010).

The WHO Reference 2007 does not provide weight-for-age charts beyond 10 years of age. The reason given is that weight-for-age is considered inadequate for monitoring growth beyond childhood due to its inability to distinguish between relative height and body mass (de Onis et al 2007). The BMI-for-age chart is provided for the full age range (5–19 years) to complement height-for-age in the assessment of growth in school-aged children and young people.

WHO Reference 2007 (5–19 years) growth charts are available at: www.who.int/growthref/en

Centers for Disease Control Growth Charts (2–20 years)

In 2000 the revised CDC Growth Charts for the United States were released (Kuczmarski et al 2000). They comprise growth reference data for several indicators, including weight-for-age (2–20 years), height-for-age (2–20 years) and BMI-for-age (2–20 years).

These growth charts are based on data collected in a series of nationally representative cross-sectional health examination surveys conducted from 1963 to 1994, supplemented by data from administrative data sets (eg, birth certificates). As for the children surveyed for the WHO Reference 2007, the CDC reference children reflect the ethnic mix of the United States during the period of the surveys, and include children exposed to a range of feeding practices (eg, breastfed, bottlefed), environmental conditions (eg, smoking, non-smoking) and health care practices.

To access the CDC Growth Charts (2000), visit the Centers for Disease Control website at: www.cdc.gov/growthcharts

The CDC Growth Charts are recommended for the assessment of obesity in the *New Zealand Guidelines for Weight Management in Children and Young People* (Ministry of Health and Clinical Trials Research Unit 2009b).

The Ministry of Health prefers the consistent use of one type of growth chart for the New Zealand population aged 5–18 years. However, to allow all health professionals to reach a consensus on the preferred charts the Ministry recognises the need for further consultation.

3.2 Body size

Body size of New Zealand children and young people

Data on the average body size of New Zealand children and young people are summarised in Table 3. All measures of body size increase with age, with little difference between males and females from 2–14 years.

Table 3: Mean height, weight and body mass index for New Zealand children and young people, 2006/07

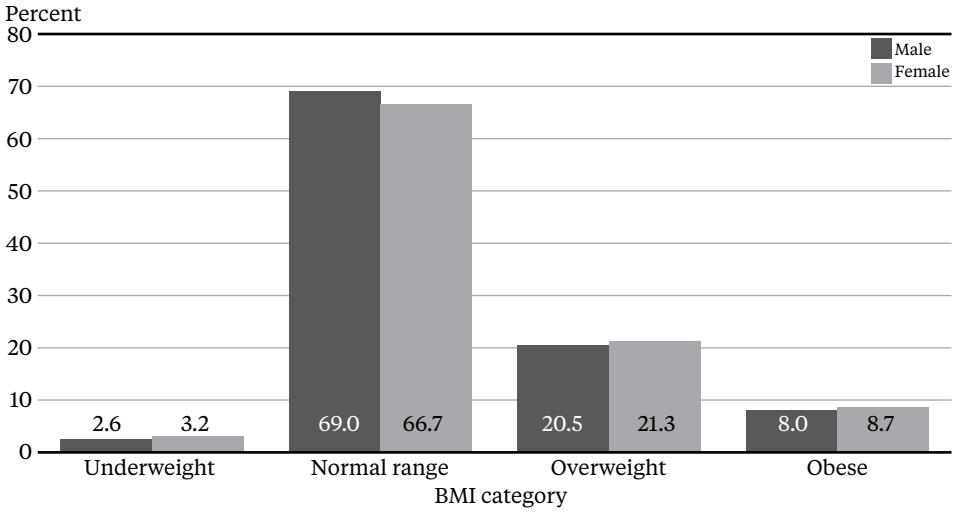
Age group (years)	Height (cm)		Weight (kg)		BMI (kg/m²)	
	Male	Female	Male	Female	Male	Female
2–4	99.8	98.5	17.2	16.7	17.2	17.2
5–9	125.5	125.4	28.3	28.0	17.7	17.5
10–14	154.9	154.2	49.9	50.6	20.4	21.0
15–19	175.8	164.1	73.1	66.3	23.7	24.5

Source: 2006/07 New Zealand Health Survey (Ministry of Health 2008g, 2008h)

Most children and young people have a BMI in the normal range (see Figures 3 and 4). For children and young people aged 2–14 years, 2.9 percent were underweight, 20.9 percent were overweight and a further 8.3 percent were obese. For young people aged 15–19 years, 3.5 percent were underweight, 22.1 percent were overweight and a further 12.6 percent were obese (Ministry of Health 2008g, 2008h).

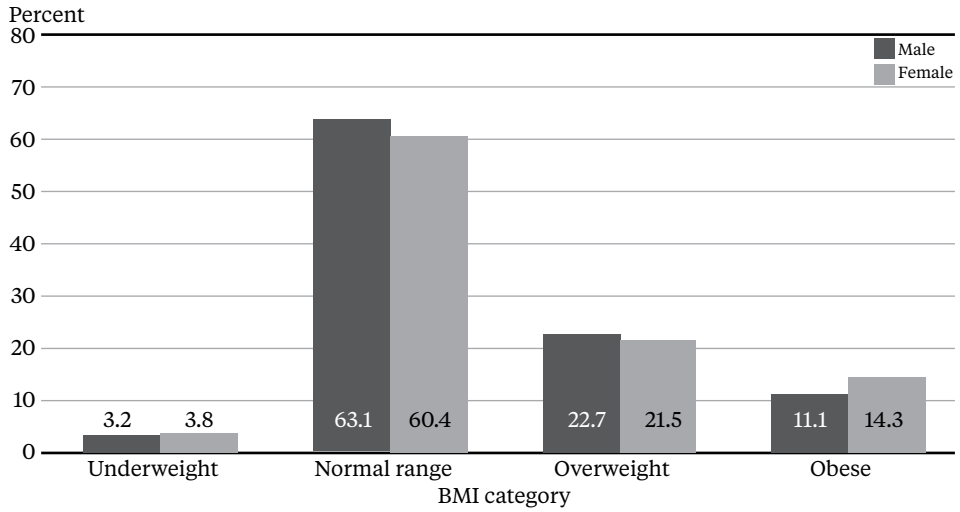
Information used to classify underweight, normal weight, overweight and obesity is given in section 3.3: Obesity.

Figure 3: Body size for children and young people aged 2–14 years, 2006/07



Source: 2006/07 New Zealand Health Survey (Ministry of Health 2008g, 2008h)

Figure 4: Body size for young people aged 15–19 years, 2006/07



Source: 2006/07 New Zealand Health Survey (Ministry of Health 2008g, 2008h

3.3 Obesity

Background

Obesity is defined as excess weight for height to the extent that health may be affected (WHO 2000). Obesity in childhood and adolescence can have serious short-term health consequences. For example, children and young people who are obese can suffer psychosocial problems, including body dissatisfaction, poor self-esteem, depression and other mental health problems (Lobstein et al 2004; Puhl and Latner 2007). Obesity in children and young people is also associated with cardiovascular risk factors, such as hypertension and high cholesterol, as well as impaired glucose tolerance, type 2 diabetes, musculoskeletal problems, sleep apnoea, asthma and subsequent premature mortality (Gunnell et al 1998; Reilly et al 2003; Lobstein et al 2004; Wearing et al 2006). In New Zealand, type 2 diabetes has been diagnosed in obese children as young as 11 years (Hotu et al 2004). Other New Zealand studies indicate obese young people are at increased risk of insulin resistance and other metabolic syndrome components (AM Grant et al 2008), and have lower bone mineral density and/or are at increased risk of fracture (Goulding et al 2000, 2005).

Obesity in childhood and adolescence can also have longer-term health consequences, as obese children and young people often become obese adults. A recent systematic review showed that one-half to two-thirds of obese children and adolescents become obese adults (Singh et al 2008). As well as being associated with the conditions listed above, obesity in adulthood is a risk factor for arthritis and reproductive abnormalities (WHO 2000; Haslam and James 2005) and a number of cancers (World Cancer Research Fund and American Institute for Cancer Research 2007); and is a strong predictor of both total and cardiovascular mortality (Neovius et al 2009; Prospective Studies Collaboration 2009). In New Zealand, higher than optimal BMI in adults was estimated to account for more than 10 percent of all deaths in 1997 (Ministry of Health and University of Auckland 2003; Ni Mhurchu et al 2005).

Obesity in childhood may also be linked to coronary heart disease in adulthood, independent of adult weight as suggested by Baker et al (2007).

Parents and caregivers do not always recognise overweight or obesity in their children. A New Zealand study of children aged three to eight years found that parents consistently underestimated their child's weight status, with fewer than one in four parents correctly identifying their child as overweight (Miller et al 2007). Parents who are overweight

themselves are most likely to incorrectly perceive their child's weight status (Doolen et al 2009). The reasons for these misperceptions are unclear. Recent increases in the prevalence of obesity may have changed norms regarding body size. Other possible reasons include a reluctance of parents to acknowledge their child as being overweight, perhaps for fear of being judged a bad parent, or an unwillingness to label their child as overweight. Cultural differences in body size ideals may also play a role (Doolen et al 2009).

Assessment of obesity

BMI is the most widely used indicator of obesity because it is relatively simple to measure and is correlated with total body fat in populations and most individuals (WHO 2000). As discussed in section 3.1, a limitation of BMI is that it does not differentiate between lean and fat mass, so two individuals with the same BMI may have different proportions of lean and fat mass. In New Zealand, there is evidence that Māori and Pacific children and young people have a lower proportion of body fat at the same BMI as European children and young people (Rush et al 2003, 2009; Sluyer et al 2011). However, given there is currently no evidence that this lower level of body fat in Māori and Pacific children and young people at a given BMI is associated with a lower risk of obesity-related complications, the same BMI cut-offs are recommended for assessing obesity in all ethnic groups.

Unlike for adults, there are no internationally accepted BMI cut-offs for classifying overweight and obesity in children and young people. The Ministry of Health's Well Child programme (0–5 years) recommends the use of the New Zealand–WHO Growth Charts (0–5 years) for the assessment of growth. For children aged two years and over who are plotted as being above the 99.6th centile on the growth chart, calculate body mass index using the Well Child weight–height to BMI conversion chart. A BMI above the 91st centile suggests that the child is overweight, whereas a child above the 98th centile is obese (Ministry of Health 2010a).

The *New Zealand Guidelines for Weight Management in Children and Young People* (Ministry of Health and Clinical Trials Research Unit 2009b), developed for those aged 2–18 years, recommend the CDC gender-specific BMI-for-age growth charts for classifying overweight and obesity (> 85th and > 95th centile, respectively) (Kuczmarski et al 2000). Some studies show that these BMI cut-offs used to classify overweight and obesity are related to body fatness (Flegal et al 2010) and disease risk (Freedman et al 2007; Bjorge et al 2008).

The WHO Reference 2007 has overweight and obesity cut-offs that relate to the z-score curves. Currently there are no published studies linking the WHO Reference 2007 BMI cut-offs to body fatness or disease risk.

Prevalence of obesity

Table 4 shows the prevalence by age and sex of obesity in children and young people as identified in the 2006/07 New Zealand Health Survey (Ministry of Health 2008g).

Table 4: Prevalence of obesity in children and young people

Age group (years)	Prevalence (%)		
	Male	Female	Total
2–4	7.6	9.1	8.3
5–9	5.4	8.0	8.2
10–14	7.7	9.2	8.5
15–19	11.1	14.3	12.6

Source: 2006/07 New Zealand Health Survey (Ministry of Health 2008g)

Note: Obesity is defined using the International Obesity Taskforce population-specific BMI cut-offs up to 18 years (Cole et al 2000) and the WHO BMI cut-offs for adults (WHO 2006b).

Of those aged 2 to 14 years, 8.3 percent were obese and a further 20.9 percent were overweight. After adjustment for age, Māori children and young people aged 2–14 years were two times more likely and Pacific children and young people three times more likely to be obese than children and young people overall (Ministry of Health 2008g).

In young people aged 15 to 19 years, 22.1 percent were overweight and a further 12.6 percent were obese (Ministry of Health 2008g). The prevalence of obesity was similar in all age groups up to 15 years, suggesting that early intervention is necessary to prevent obesity in New Zealand children and young people.

It is difficult to compare the prevalence of obesity in New Zealand children and young people with that in other countries because there is no internationally accepted method for classifying obesity, and survey dates (eg, year) and populations (eg, age range) can differ. One comparison that can be made is with the 2007 Australian National Children's Nutrition and Physical Activity Survey, where the same BMI cut-offs were used to define obesity. In Australian children and young people aged 2–16 years, the prevalence of obesity was 6 percent (University of South Australia 2008), which is slightly lower than the 8.3 percent found in New Zealand children and young people aged 2–14 years.

Regional studies suggest the prevalence of obesity in New Zealand children and young people has increased from the late 1980s to early 2000s (Dawson et al 2001; Turnbull et al 2004; Utter et al 2009). National data from 2002 to 2006/07 show no significant change in the age-standardised prevalence of obesity among children and young people aged 5–14 years (9.0 vs 8.4%) (Ministry of Health 2008g).

Causes of obesity

Obesity is the result of a positive energy balance, which means energy intake from food and drink exceeds energy expenditure from physical activity and metabolism. There has been considerable debate about the relative contributions of diet and physical activity to obesity. A recent study suggests increases in energy intake explain most of the increase in body weight in adults and children in the United States (Swinburn et al 2009). However, the view that physical inactivity plays a key role in the development and management of obesity has been held for a long time (Hohepa et al 2004). Both good nutrition and adequate physical activity should be promoted for prevention and management of obesity and for overall good health.

Obesity is an interaction between genetic and environmental factors. Although some people are more genetically susceptible to weight gain than others, the increase in the prevalence of obesity in the last two to three decades has occurred too quickly to be explained by genetic factors alone (WHO 2006b). In parallel with the increase in obesity over the last few decades, there have been major changes to the food and physical activity environment (James 2008). The current environment is considered to promote obesity because of the many ways in which it promotes over-consumption of food and limits opportunities for physical activity (Egger and Swinburn 1997; Swinburn et al 1999). See Part 7: The Wider Environment for more information on environmental factors that influence food, nutrition and obesity.

International research has identified that risk factors associated with the development of obesity in children include certain health conditions, medications, exposure to maternal obesity or gestational diabetes in utero, parental obesity, birthweight, television viewing, physical inactivity, sleep, diet, family structure, ethnicity and socioeconomic status (Lobstein et al 2004; Kipping et al 2008; Birch and Ventura 2009). Well-established dietary risk factors for obesity in adults and children include skipping breakfast, and frequent consumption of energy-dense foods (eg, fast foods) and drinks (eg, sugary drinks) (Malik et al 2006; Moreno and Rodriguez 2007; Vartanian et al 2007; World Cancer Research Fund and American Institute for Cancer Research 2007; Gibson 2008; Rosenheck 2008; Must et al 2009). Other dietary risk factors for obesity include frequent snacking, habitual meals away from home, and large portion sizes (Lobstein et al 2004; Birch and Ventura

2009). Many dietary habits associated with obesity also increase the risk of dental decay (see section 13.2: Oral health). Parenting styles and the family/whānau food environment are important determinants of eating behaviour and have also been linked to the risk of obesity (see Part 6: The Home Environment).

In New Zealand children and young people, the following risk factors have been associated with obesity in cross-sectional surveys: skipping breakfast, frequently consuming sugary drinks, and watching two or more hours of television each day (Utter et al 2007d; JS Duncan et al 2008). The Children and Young People's Physical Activity and Dietary Behaviours in New Zealand 2008/09 Survey ((Clinical Trials Research Unit and Ministry of Health 2011),showed those who were overweight and obese were more likely to consume more fizzy/soft drinks; eat fast foods/takeaways; and have a significantly lower level of daily physical activity with more light but less vigorous physical activity time per day. In the Dunedin Multidisciplinary Study, television viewing and shorter sleep time in childhood and adolescence were strongly associated with obesity in young adulthood (Hancox et al 2004; Landhuis et al 2008a, 2008b). Another Dunedin-based study (Carter et al 2011) found children (three to seven years of age) who did not get enough sleep were at increased risk of becoming overweight, even after adjustment for confounding factors like initial weight status and diet. The weight gain was due to increased fat deposition rather than extra accumulation of fat free mass.

Prevention of obesity

Prevention of obesity in children and young people is important because there are few effective treatments (Lobstein et al 2004). Given that one in 12 (8.3%) preschoolers in New Zealand is already obese (Table 4), it is necessary to intervene early to prevent obesity. Unfortunately, there is currently little evidence of what works in this age group because very few interventions targeting preschool children have been developed (Birch and Ventura 2009). A recent Australian community-wide intervention study promoting healthy eating and active play in children aged up to five years found an improvement in children's diets and reduced obesity at age two and three-and-a-half years (de Silva-Sanigorski et al 2010).

Even for interventions with older children and young people, well-designed obesity prevention studies are relatively scarce, particularly studies with long-term follow-up. Based on the limited evidence available, a Cochrane systematic review found that most interventions combining diet and physical activity in children resulted in some improvement in these behaviours, but had little impact on BMI (Summerbell et al 2005).

A recent meta-analysis of randomised controlled trials showed there was convincing evidence that school-based interventions are effective in reducing the prevalence of obesity, and that interventions conducted for more than one year are the most effective (Gonzalez-Suarez et al 2009). A New Zealand study targeting increased activity and healthy eating in primary school children found that children who completed the full intervention (one year) were less likely to be overweight at the two-year follow-up (Taylor et al 2008).

Management of obesity

For the management of obesity in children and young people, please refer to the *New Zealand Guidelines for Weight Management in Children and Young People* (Ministry of Health and Clinical Trials Research Unit 2009b). The aim of these guidelines is to provide evidence-based advice for the management of overweight and obesity in children and young people. The guidelines stand alongside the *New Zealand Guidelines for Weight Management in Adults* (Ministry of Health and Clinical Trials Research Unit 2009a). It is anticipated that these guidelines will be used mainly in primary care and community-based initiatives.

To access the *New Zealand Guidelines for Weight Management in Children and Young People*, visit the Ministry of Health's website at: www.health.govt.nz

3.4 Underweight

Background

Underweight is defined as body weight that is extremely low for age and/or height (Gibson 2005). Underweight is usually the result of inadequate energy intake, and can include inadequate intakes of certain macronutrients and micronutrients. Underweight can result from an underlying undiagnosed health condition, for example, coeliac disease. If a child or young person is underweight, it indicates that further investigation is required. Being underweight is associated with increased risk of infection and can delay growth and development.

The most serious consequences of underweight during childhood are wasting and stunting, although both of these conditions are rare in developed countries (de Onis and Blossner 2003). Wasting is the failure to gain sufficient weight (both lean and fat mass) relative to height, or is the result of losing weight (Gibson 2005). Stunting is the failure to gain sufficient height, usually due to inadequate nutrition (Gibson 2005). Note that with stunting, weight may be appropriate for height.

Prevalence of underweight

In the 2006/07 New Zealand Health Survey the prevalence of underweight in children and young people aged 2–14 years was 2.9 percent. There was no significant difference by gender (Ministry of Health 2008g). When adjusted for age, Asian children aged 2–14 years were three times more likely to be underweight than children overall (Ministry of Health 2008h). For young people aged 15–24 years, the prevalence of underweight was 3.2 percent, with no significant difference by gender (Ministry of Health 2008h).

Assessment of underweight and undersize

Underweight can be assessed using a range of indices: weight-for-age combined with height-for-age, weight-for-height and BMI-for-age.

If a child's weight starts to 'track' down significantly (ie, there is a consistent change in centile position by two or more inter-centile spaces for weight, or by one or more inter-centile spaces for height), further investigation is necessary to identify the cause.

Another indicator of the need for further investigation is if the child's weight value is two or more inter-centile spaces lower than their height value for the same age.

Using the Well Child weight–height to BMI conversion chart (see Appendix 4), a BMI below the 2nd centile is unusual and may reflect under-nutrition, though it may also be seen in children with unusual body shapes, particularly if they have chronic illness or disability (Ministry of Health 2010a). The training material associated with the New Zealand–WHO Growth Charts (0–5 years) indicates that children below the 0.4th centile for height, weight or BMI should be referred for further evaluation of growth and development. See the New Zealand–WHO Growth Charts (0–5 years) at: www.health.govt.nz

Using the CDC gender-specific BMI-for-age growth charts, underweight is defined as BMI-for-age under the 5th centile. For children aged five years and over the WHO Reference 2007 defines underweight using its BMI-for-age z-score charts (WHO 2007).

Wasting and stunting are extreme forms of underweight. Wasting is usually defined as weight-for-height two standard deviations (SD) below the median for age (ie, z-score of –2), while stunting is usually defined as height-for-age less than 2 SD below the median (Mann and Truswell 2007). For more detailed information on the assessment of underweight, refer to a clinical nutrition textbook, for example, *Principles of Nutritional Assessment* (Gibson 2005).

Part 4: Energy and nutrients

4.1 Introduction

This part covers energy, all macronutrients and a selection of vitamins and minerals. Most nutrients included have been identified, in national nutrition surveys or other literature, as being at risk for low or high intake by New Zealand children and young people. Note that the order in which nutrients are covered does not reflect the order of importance. For each nutrient, the following sections are included: background, recommended intake, current levels of intake and sources in the diet; for some, nutrient status is also covered.

The **background** section provides a brief overview of the function of each nutrient, deficiency diseases or states, and other relevant information such as absorption and metabolism. Unless otherwise specified, the information in this section is sourced from the following publications:

- *Nutrient Reference Values for Australia and New Zealand* (NHMRC 2006)
- *Essentials of Human Nutrition* (Mann and Truswell 2007)
- *Principles of Nutritional Assessment* (Gibson 2005).

The **recommended intake** section uses the Australia and New Zealand Nutrient Reference Values (NRVs) (NHMRC 2006) as the basis of the nutrient recommendations. It summarises the NRVs by gender and age group (2–3, 4–8, 9–13 and 14–18 years). The NRVs for pregnant and lactating young women aged 14–18 years are not included here, but are summarised in Appendix 3. Where there is no recommended dietary intake (RDI), the adequate intake (AI) is presented. When available, the upper level of intake (UL) is also included. In some instances the values for acceptable macronutrient distribution range (AMDR) and suggested dietary target (SDT) are included. For definitions of RDI, AI, UL, AMDR and SDT, see the Glossary.

The **current levels of intake** section summarises the most recent data on usual daily nutrient intake for New Zealand children and young people. Data are mainly derived from the national nutrition surveys listed below, so are limited to children aged five years and over:

- 2002 National Children's Nutrition Survey, which included children and young people aged 5–14 years (Ministry of Health 2003b)
- 2008/09 New Zealand (NZ) Adult Nutrition Survey, which included young people aged 15–18 years (University of Otago and Ministry of Health 2011).

Interpreting percentage estimates of inadequate intake

Note that it is not appropriate to assess adequacy of intake by comparing current levels of intake (ie, median usual daily intake) with the RDI or AI presented in the recommended intake section. The RDI and AI are intended to meet the needs of nearly all (97–98%) individuals within the gender–age group and a margin of safety. If median usual daily intake is at or above the RDI or AI, it is reasonable to conclude that there is a very low probability of inadequate intake. However, median usual daily intake below RDI or AI level is not necessarily inadequate.

For some micronutrients, this section also includes an estimate of the prevalence of inadequate intake, using probability analysis. The most rigorous method of assessing adequacy of nutrient intake is a complex statistical method that examines the entire usual intake distribution (not just the median) in relation to the estimated average requirement (EAR) (Murphy and Poos 2002). The prevalence of inadequate intake for 5–14 year olds in the 2002 National Children's Nutrition Survey (Ministry of Health 2002) was originally calculated using the UK dietary reference values (DRVs) (UK Department of Health 1991). However, the Ministry of Health has recalculated the inadequate intake values using the NRV EARs, which have been used in the 2008/09 NZ Adult Nutrition Survey (University of Otago and Ministry of Health 2011).

Note that even if dietary intake appears to be inadequate, this may not translate into inadequate nutritional status or have any clinical implications.

For some nutrients, a section on **nutrient status** is included. Measuring nutrient levels in biochemical specimens (eg, blood and urine) or undertaking clinical examinations (eg, measuring thyroid volume) provides an objective measure of nutrient status for most nutrients. This measure can be compared with internationally accepted reference values to determine if there is a risk of deficiency.

The **sources in the diet** section provides information on good and key dietary sources of the nutrient in the New Zealand diet.

- **Good** sources of a nutrient are foods that are known to contain high levels of the nutrient, even though these foods may not be consumed very often. Information on good sources is derived from publications listed in the background section (Gibson 2005; NHMRC 2006; Mann and Truswell 2007), as well as *The Concise New Zealand Food Composition Tables* (Athar et al 2006).
- **Key** sources of a nutrient are the food groups that contributed most to nutrient intake in national nutrition surveys. The foods in these groups were defined in the national nutrition surveys. Key sources may include foods that are not listed as good sources because they can be foods that do not contain high levels of the nutrient but are consumed often (eg, daily) so contribute substantially to nutrient intake.

4.2 Energy

Summary

Generally a normal linear growth path and normal body mass index are helpful guides to adequacy of energy intake in children and young people (see Part 3: Growth and Body Size).

Follow the Food and Nutrition Guideline Statements to ensure the best balance of energy and nutrients. This practice means encouraging nutrient-rich foods as good sources of energy in the diet for children and young people.

Nutrient-rich foods include wholegrain breads and cereals, vegetables and fruit, low- and reduced-fat milk and milk products, and lean meat, poultry, seafood, eggs, legumes, nuts* and seeds.

* Do not give small, hard foods such as whole nuts until children are at least five years old to reduce the risk of choking (see section 1.2: Food groups and recommended serving sizes).

Background

Energy is not a nutrient but is required for growth, metabolic and physiological functions, heat production and muscular activity. Additional energy is required for growth in children, or when recovering from serious illness, or during pregnancy and breastfeeding. Even during times of rapid growth, the energy required for growth is much less than that required for maintenance of normal body functions (Mann and Truswell 2007).

Energy is measured in kilojoules (kJ) or megajoules (1 MJ = 1000 kJ). It was previously measured in calories (cal) and kilocalories (kcal): 1 kcal is equivalent to 4.18 kJ. The main sources of energy in the diet are carbohydrates, fats and proteins. Energy is released from food during the digestive process. Carbohydrate and protein both provide 17 kJ (4 kcal) of energy per gram, and fat provides 37 kJ (9 kcal) per gram. Alcohol is another source of energy, providing 29 kJ (7 kcal) per gram.

Energy requirements vary widely according to gender, age, body size and physical activity level. In healthy children and young people, energy requirements include energy required for growth and energy required to balance energy expenditure. Non-growth related energy expenditure has three main components: basal metabolic rate (BMR), diet-induced thermogenesis and physical activity (WHO 2000; Mann and Truswell 2007).

BMR is the amount of energy expended while at rest in a post-absorptive state for the functioning of vital organs, including the heart, lungs, brain and nervous system. It is closely related to body size, particularly lean body mass. BMR represents the largest component of energy expenditure, ranging from 40 to 70 percent depending on age, gender, body size and composition.

Diet-induced thermogenesis (also called the thermic effect of food) is energy required to absorb, digest, transport and store food. Diet-induced thermogenesis represents the smallest and most stable component of energy expenditure (10%).

Physical activity refers to all movement produced by skeletal muscles that increases energy expenditure, whether it is incidental, occupational or recreational. Physical activity is the most variable component of energy expenditure, ranging from 20 to 50 percent.

Recommended intake

The estimated energy requirement (EER) is the average dietary energy intake that is predicted to achieve growth or maintain energy balance in a healthy child or young person of a defined age, gender, weight and level of physical activity. EERs are closely linked to body size, so vary by gender and single year of age in children and young people. EERs are also closely linked to physical activity level (PAL), so for each gender and year of age EERs

are provided for six physical activity levels ranging from bed rest (PAL 1.2) to vigorous activity (PAL 2.2) (see Tables A.1 and A.2 in Appendix 3). It is recommended that children and young people aim for 60 minutes or more of moderate (PAL 1.8) to vigorous (PAL 2.2) activity each day. Sedentary activity is estimated to be around PAL 1.4.

Note that the EER should be taken as a guide, given that energy requirements vary considerably even between individuals of the same age, sex, weight, height and physical activity level (NHMRC 2006). Monitoring growth, both linear and BMI, is a useful indicator that children and young people are meeting their energy requirements.

Current levels of intake

Current energy intakes are higher for males than females in all age groups (Ministry of Health 2003b; University of Otago and Ministry of Health 2011), as shown in Table 5.

Table 5: Median daily energy intake for children and young people

Age group (years)	Median daily energy intake (MJ)	
	Male	Female
5–6	7.6	6.7
7–10	8.9	7.8
11–14	10.3	8.3
15–18	11.0	7.6

Source: 2002 National Children's Nutrition Survey (5–14 years) (Ministry of Health 2003b) and 2008/09 NZ Adult Nutrition Survey (15–18 years) (University of Otago and Ministry of Health 2011)

Sources of energy in the diet

In New Zealand children and young people, the main sources of energy are: carbohydrate (48–54% of energy), fat (33–35%) and protein (14–16%) (Ministry of Health 2003b; University of Otago and Ministry of Health 2011).

Good sources of energy for children and young people are foods that provide a wide range of nutrients (ie, are nutrient-rich) as well as energy. Nutrient-rich foods include wholegrain breads and cereals, vegetables and fruit, low-fat and reduced-fat milk and milk products, and lean meat, poultry, seafood, eggs, legumes, nuts and seeds.

Key food sources of energy in the diet of New Zealand children and young people (5–14 years) are: bread (13%); potatoes, kūmara and taro (8%); biscuits (6%); non-alcoholic beverages (6%); and milk (6%) (Ministry of Health 2003b). Key food sources of energy for 15–18 year olds are: bread-based dishes (11%); bread (10%); potatoes, kūmara and taro (9%); non-alcoholic beverages (8%); and grains and pasta (7%) (University of Otago and Ministry of Health 2011).

4.3 Carbohydrate

Summary

Dietary carbohydrates are the main source of energy in the New Zealand diet.

There are limited data on which to base RDIs, AIs or UL for carbohydrate, so these levels have not been set. The acceptable macronutrient distribution range for carbohydrate for young people aged 14 years and over is 45–65 percent of total energy.

Although most New Zealand children and young people have an appropriate proportion of carbohydrate in their diet, a high proportion of it comes from refined cereals (or foods made with these) and free sugars.

Refined grain products have had most or all of the bran and germ removed, so provide considerably lower amounts of dietary fibre, vitamins and minerals.

Good sources of dietary carbohydrate are wholegrain breads and cereals, vegetables and legumes.

- Aim to increase the proportion of breads and cereals that are wholegrain as children grow older.
- Prepare foods or choose pre-prepared foods, snacks and drinks that are low in 'free sugars'.

Background

Carbohydrates are the main source of energy in the diet. Other macronutrients (ie, fat and protein) can provide energy, but metabolism of carbohydrate is the most efficient source of energy to cells, particularly the brain which requires glucose to function.

The FAO/WHO Scientific Update on carbohydrates in human nutrition (Mann et al 2007) endorsed the primary classification of carbohydrate based on chemical form described in Table 6.

Table 6: Classification of major dietary carbohydrates

Class (degree of polymerisation)	Subgroup	Examples
Sugars (1–2)	Monosaccharides	Glucose, galactose, fructose
	Disaccharides	Sucrose, lactose, trehalose
	Polyols	Sorbitol, mannitol
Oligosaccharides (3–9)	Malto-oligosaccharides	Maltodextrins
	Other oligosaccharides	Raffinose, stachyose, fructo-oligosaccharides
Polysaccharides (> 9)	Starch	Amylose, amylopectin, modified starches
	Non-starch polysaccharides	Cellulose, hemicellulose, pectins, hydrocolloids

Source: FAO and WHO (1998)

However, it was acknowledged that classification of carbohydrates should also have dimensions of physical effects, functional/physiological effects and health outcomes. The chemical classification described above provides a basis for measuring and labelling carbohydrates, but does not give a simple translation of nutritional, physiological or

health effects. As a result, other terms are used to describe the functional properties of carbohydrates – for example, 'free sugars' (see below), resistant starch and non-starch polysaccharides (see section 4.4: Dietary fibre).

Sugars are naturally present in a wide range of foods, including vegetables, fruit, cereals and milk. Sugars can also be added to foods in various forms, for example, granulated sugars, syrups and extracts. The physiological effects of naturally occurring sugars differ from those of sugars added to foods. A range of terms has been used to try to distinguish between these different types of sugars (eg, added sugars, extrinsic and intrinsic sugars); however, no consensus about nomenclature has been reached (Cummings and Stephen 2007).

More recently, the term **free sugars** has been used to refer to 'all monosaccharides and disaccharides added to foods by the manufacturer, cook or consumer, plus sugars naturally present in honey, syrups and fruit juices' (WHO 2003a). This was the preferred term of the WHO/FAO Expert Consultation on Diet, Nutrition and the Prevention of Chronic Diseases, which recommended that intakes of 'free sugars' are limited to less than 10 percent of total energy (WHO 2003a). However, the major problem with this term is that there is currently no analytical method to measure intakes of 'free sugars' (Mann et al 2007).

Glycaemic index (GI) and glycaemic load (GL) have been advocated as useful tools to control blood glucose levels in people with diabetes as well as markers of other chronic disease amongst the general population (Barclay et al 2008; Brand-Miller 2009). The consumption of low GI foods has been linked to increased feelings of satiety and lower energy intakes (Ludwig 2000), as well as potentially having a role in weight control (Warren et al 2003). However, questions as to the reliability and usefulness of these glycaemic tools, in particular for use in populations with normal glycaemic control (ie, those who do not have diabetes or pre-diabetes), have been raised (Mann et al 2007; Venn and Green 2007; Williams et al 2008).

Recommended intake

There are limited data with which to set an RDI, AI or UL for carbohydrate. The AMDR for carbohydrate for young people aged 14 years and over (and adults) is 45–65 percent of total energy (NHMRC 2006).

Current levels of intake

Carbohydrate is the major source of energy in the diets of New Zealand children and young people, providing 48–54 percent of energy (Ministry of Health 2003b; University of Otago and Ministry of Health 2011). Although this range of carbohydrate intake is within the AMDR, a high proportion of carbohydrates is from refined cereals and sugars (see Table 7 below).

Table 7: Median carbohydrate intake for children and young people

Age group (years)	Total carbohydrate (g)		Sugars^ (g)	
	Male	Female	Male	Female
2–3	244	225	109	103
4–8	279	250	123	113
9–14	322	265	140	123
15–18	307	231	135	111

Source: 2002 National Children's Nutrition Survey (5–14 years) (Ministry of Health 2003b) and 2008/09 NZ Adult Nutrition Survey (15–18 years) (University of Otago and Ministry of Health 2011)

^ Total of monosaccharides and disaccharides.

Sources in the diet

Good sources of dietary carbohydrate are wholegrain breads and cereals, vegetables, legumes and whole fruits. These foods are also good sources of dietary fibre, vitamins and minerals (Mann et al 2007). (For more information see section 1.2: Food groups and recommended serving sizes) Refined grains (eg, white flour and white rice) have had most or all of the outer layers of the grain removed during processing. As a result, foods made from refined grains and/or containing lots of 'free sugars' provide carbohydrate, but considerably lower amounts of dietary fibre, vitamins and minerals. Legumes are the main source of resistant starch (starch not absorbed in the gut) (American Dietetic Association 2008).

Key sources of carbohydrate in the diets of New Zealand children and young people aged 5–14 years are: bread (20%); non-alcoholic beverages (11%); potatoes, kūmara and taro (9%); fruit (8%) and sugar and sweets (7%) (Ministry of Health 2003b). Key sources of sugars (sucrose and fructose) include beverages, fruit and sugar/sweets. For 15–18 year olds key sources of carbohydrate are: bread (15%); non-alcoholic beverages (14%); potatoes, kūmara and taro (11%); bread-based dishes (10%); and grains and pasta (8%). Key sources of total sugars are non-alcoholic beverages (29%); fruit (13%); sugar and sweets (10%); milk (9%); and dairy products (5%) (University of Otago and Ministry of Health 2011).

4.4 Dietary fibre

Summary

Dietary fibre is required for adequate functioning of the bowel.

Dietary fibre improves blood lipid and blood glucose levels, so reduces the risk of cardiovascular disease and diabetes. It also probably decreases the risk of colorectal cancer in adults and may help to maintain a healthy body weight by displacing more energy-dense, nutrient-poor foods, increasing satiety and reducing the efficiency of absorption in the small intestine.

To achieve an appropriate intake of dietary fibre:

- encourage consumption of a range of foods from all four food groups (including vegetables and fruit, wholemeal and wholegrain and other less refined breads and cereals) in the proportions and amounts recommended (see section 1.3: Summary of food groups, serving sizes and recommended intake) for appropriate growth, adequate gastrointestinal function and laxation. A diet that includes both foods that contain fibre and foods that do not, especially for young children, helps avoid excessive fibre intake and the negative effects associated with it
- increase the proportion of breads and cereals that are whole grain as children grow older
- offer the appropriate amount of fluids (see section 5.2: Recommended intake).

Wholegrain breads and cereals, legumes, vegetables and fruits are good sources of dietary fibre and many other nutrients.

Introduce foods high in fibre gradually along with adequate fluids to avoid constipation, diarrhoea, excessive wind and abdominal discomfort, especially for younger children.

Based on New Zealand intake data, older children (11–12 years) and young people (13–18 years) are more likely to have a dietary fibre intake lower than that recommended. Encourage older children and young people to:

- increase their dietary fibre intake by choosing wholegrain breads and cereals, and increasing their intake of legumes, vegetables and fruit.

Background

Dietary fibre is required for healthy bowel function. Dietary fibre also reduces the risk of cardiovascular disease and diabetes by improving blood lipid and blood glucose levels, and reducing indicators of inflammation (American Dietetic Association 2008). Consuming foods containing dietary fibre is considered likely to decrease the risk of colorectal cancer (World Cancer Research Fund and American Institute for Cancer Research 2007) which is New Zealand's second most common cause of death from cancer (University of Otago and Ministry of Health 2011). Foods high in dietary fibre may help with maintaining a healthy body weight and preventing obesity by displacing more energy-dense, nutrient-poor foods, increasing satiety and reducing the efficiency of absorption in the small intestine (American Dietetic Association 2008). Foods high in dietary fibre are also good sources of many vitamins and minerals.

There is no universal definition of dietary fibre, as classifications can be based on chemical, physiological or nutritional properties. A recent 'scientific update on carbohydrates in human nutrition' (Mann et al 2007) endorsed the definition given by the 1997 Joint WHO/FAO Expert Consultation on Carbohydrates in Human Nutrition, which stated that dietary fibre is 'intrinsic plant cell wall polysaccharides' (FAO and WHO 1998). This definition includes non-starch polysaccharides and some components of resistant starch. However, the scientific update acknowledged that this chemical classification did not allow a simple translation into nutritional benefits (Cummings and Stephen 2007; Mann et al 2007).

Resistant starch is defined as starch and starch degradation products that are not absorbed in the small intestine. Resistant starch occurs naturally in some foods (mainly legumes) and can be produced by the modification of starch during the processing and baking of some cereals and grain products (American Dietetic Association 2008).

Non-starch polysaccharides (NSPs) are the non-alpha-glucan polysaccharides and include cellulose, hemicellulose, pectin and hydrocolloids (Cummings and Stephen 2007). NSPs are found in plant foods (eg, vegetables and fruit), legumes (eg, peas, beans, lentils) and wholegrain cereals (eg, barley, wheat, rye, oats and brown rice). Levels of NSP are usually higher in the outer layers of plant foods, so peeling vegetables and fruit and milling cereals significantly lowers their NSP content. NSPs used to be further categorised as soluble and insoluble, but the recent 'scientific update on carbohydrates in human nutrition' recommended phasing out these terms (Mann et al 2007).

Recommended intake

Assessment of dietary fibre requirements is complex, as the endpoints of inadequate or excessive intake are not well defined. There is no biochemical marker that can be used, so the appearance or disappearance of clinical endpoints has been used. The endpoints chosen in the setting of NRVs were adequate gastrointestinal function and adequate laxation (passing of a bowel movement) (NHMRC 2006).

There was insufficient information with which to establish an RDI for dietary fibre, but the AI was set based on the median dietary fibre intake in Australian and New Zealand national nutrition surveys, plus an allowance for the resistant starch (starch not absorbed in the gut) component not included in the food composition databases used for these surveys (NHMRC 2006). For children and young people (aged 2–18 years), the AI for dietary fibre ranges from 14 g to 28 g in males and 14 g to 22 g in females (Table 8).

Table 8: Adequate intake for dietary fibre for children and young people

Age group (years)	All (g)	
	Male	Female
2–3	14	14
4–8	18	18
9–13	24	20
14–18	28	22

Source: NHMRC (2006)

Accurately describing an appropriate dietary fibre intake in practical terms is not easy. The DONALD study, which evaluated the dietary fibre intake of more than 7000 infants, children and young people (6 months to 18 years), found a positive association between energy intake and fibre density of the diet (Alexy et al 2006). The authors recommended a reference value for dietary fibre based on a diet that met all other nutrient requirements (including energy) as the most appropriate guide to fibre intake in the absence of specific research in the area.

An appropriate fluid intake is important as fluid softens fibre and allows it to swell and move through the gut effectively (for more on fluids, see section 5.2: Recommended intake).

Negative effects of too much fibre

It was not possible to set a UL for dietary fibre, but diets that are very high in fibre should be avoided for younger children (eg, preschool children aged 2–5 years), as their stomachs are relatively small. Potential negative effects of excessive dietary fibre intakes in young children include reduced absorption of some nutrients, diarrhoea and other gastrointestinal symptoms, and inadequate energy intakes due to filling up on bulky, high-fibre foods (American Dietetic Association 2008).

To avoid excessive amounts of fibre, choose foods from the four food groups in the recommended proportions (see section 1.3: Summary of food groups, serving sizes and recommended intake). This approach encourages a balanced intake of both foods containing fibre (vegetables and fruit; breads and cereals; legumes) and foods that contain no or low levels of fibre (milk and milk products; meat, fish, seafood, eggs). Increase the proportion of breads and cereals that are wholegrain as children grow older.

Current levels of intake

The estimates of dietary fibre intake shown in Table 9 do not include resistant starch, as this is not able to be measured in the national nutrition surveys.

Table 9: Median dietary fibre intake for children and young people

Age group (years)	Median dietary fibre intake (g)	
	Male	Female
5–6	17	15
7–10	19	17
11–14	21	17
15–18	21	16

Source: 2002 National Children's Nutrition Survey (5–14 years) (Ministry of Health 2003b) and 2008/09 NZ Adult Nutrition Survey (15–18 years) (University of Otago and Ministry of Health 2011).

The results shown in Table 9 indicate that older children (11–12 years) and young people (13–18 years), especially females, may not increase their dietary fibre intakes when they increase their energy intakes.

Sources of fibre in the diet

Good sources of dietary fibre are wholegrain cereals (and products made with them such as wholegrain breads and breakfast cereals), legumes (eg, lentils, beans, peas), vegetables and fruit.

Key sources of dietary fibre in the diets of New Zealand children and young people aged 5–14 years are: bread (20%); potatoes, kūmara and taro (14%); fruit (14%); vegetables (11%); and breakfast cereals (11%) (Ministry of Health 2003b). Key sources for young people aged 15–18 years are: bread (16%); potatoes, kūmara and taro (16%); bread-based dishes (12%); fruit (9%); and vegetables (8%) (University of Otago and Ministry of Health 2011).

4.5 Fat

Summary

Dietary fats:

- are a source of fat-soluble vitamins and also aid in their absorption
- act as precursors of many hormones
- are an important structural component of cell membranes.

Dietary fats are the most concentrated sources of energy, providing more than twice as many kilojoules per gram (37 kJ/g) as carbohydrate and protein do (17 kJ/g).

Dietary fats are classified according to their structure. They are either saturated or unsaturated (monounsaturated, polyunsaturated).

In general, saturated fat and trans fatty acids increase total and LDL cholesterol (increasing the risk of cardiovascular disease), monounsaturated fatty acids are neutral, and polyunsaturated fatty acids decrease total and LDL cholesterol.

Most fats can be synthesised in the body so there are no AI, RDI or UL values set for most of them. For people aged 14 years and older, the AMDRs are:

- total fat: 20–35 percent of total energy
- saturated + trans fats: 10 percent or less of total energy.

While total fat intake is within the AMDR, saturated fat intakes are relatively high in young people (14 years and older) in New Zealand.

Although cardiovascular disease is rare in children and young people, the disease process (eg, atherosclerosis) begins in childhood so dietary fat intake is important for children and young people.

To lower total saturated and trans fat intake while increasing the proportion of fat intake coming from monounsaturated and polyunsaturated fats:

- choose lean meat (eg, lean beef and/or lamb, venison) and poultry, and trim fat off before cooking and eating
- use less spread on bread and crackers, and when using spreads choose reduced- or low-fat monounsaturated and polyunsaturated spreads rather than butter (saturated fat)

- for children who are aged two years or older and growing well, choose reduced- or low-fat milk (eg, light-blue top (1.5% fat), yellow (0.1% fat) or green top (0.3% fat)) and milk products (eg, reduced-fat yoghurt, edam and cottage cheese)
- use less fat in cooking and, when using fat, use oils such as sunflower, canola and olive
- reduce intake of manufactured baked products, such as cakes, biscuits, pastries, pies and snack foods
- limit fried foods (eg, chips, fish, chicken).

The following polyunsaturated fatty acids cannot be synthesised in the body and must be provided by the diet:

- linoleic acid
- α-linolenic acid.

These fats have a number of positive effects on the body and their intake, as part of a balanced diet, is recommended.

Vegetarians need an adequate intake of linoleic and α-linolenic acid to meet requirements for these nutrients and also to act as precursors for longer-chain fatty acids which only come from animal sources in the diet.

Good sources of linoleic acid and α-linolenic acid include plant oils and plant-based spreads, nuts and seeds (see Table 10). Good sources of long chain omega-3 fatty acids include oily fish (eg, fresh or canned salmon, canned sardines, fresh mackerel, kahawai, flounder, fresh or canned tuna). Include a regular intake of oily fish and a small amount of a variety of unsalted raw or dry roasted nuts* and seeds and plant oils in the diet.

* Do not give small, hard foods such as whole nuts until children are at least five years old to reduce the risk of choking (see section 1.3: Summary of food groups, serving sizes and recommended intakes).

Background

Dietary fats have many important metabolic, physiological and structural functions in the body. Fats are an excellent source of energy for the body, providing 37 kJ per gram, compared with 17 kJ per gram for carbohydrate and protein. Dietary fats contain fat-soluble vitamins and also aid in their absorption in the body. They also act as the precursors of many hormones, and are an important structural component of cell membranes. Finally fat increases feelings of satiety (fullness) and enhances taste.

Classification of dietary fats

All fats are comprised of fatty acids attached to a backbone carbon atom structure. Most dietary fats are triglycerides, which are made up of three fatty acids attached to a unit of glycerol. Fatty acids are classified according to their atomic structure and are known as saturated, monounsaturated or polyunsaturated (including omega-3 and omega-6) fatty acids. Each type of fatty acid has particular characteristics and affects the body in different ways. Trans fatty acids are a type of unsaturated fat that occur naturally in some of the fat from ruminant animals (eg butter, meat fat) but are also produced during food processing by partial hydrogenation of polyunsaturated fats. Other types of dietary fats include phospholipids, phytosterols and cholesterol.

Fatty acids in the diet

Saturated fatty acids and monounsaturated fatty acids can be synthesised in the body. Some polyunsaturated fatty acids can be synthesised in the body, although their precursors must be obtained in the diet. The polyunsaturated fatty acids that must be obtained in the diet include linoleic acid and α-linolenic acid. Collectively, eicosapentaenoic acid (EPA), docosapentaenoic acid (DPA) and docosahexaenoic acid (DHA) are referred to as long-chain omega-3 polyunsaturated fatty acids.

Table 10: Dietary sources of omega-3, omega-6 and long-chain omega-3 polyunsaturated fatty acids

Type of fat	Abbreviation	Structure	Sources
Linoleic acid	LA	18:2n-6	Plant oils: sunflower, soybean, safflower, cottonseed, corn
α-linolenic acid	ALA	18:3n-3	Flaxseed (also known as linseed) oil and products canola oil and margarines, soy, legumes, walnuts
Eicosapentaenoic acid	EPA	20:5n-3	Fish and fish oils Meat, poultry, pork, game and eggs
Docosapentaenoic acid	DPA	22:5n-3	Fish and fish oils Meat, poultry, pork, game and eggs
Docosahexaenoic acid	DHA	22:6n-3	Fish and fish oils Meat, poultry, pork, game and eggs

Source: Meyer et al (2003); Howe et al (2006); NHMRC (2006); Mann and Truswell (2007)

Health effects

Dietary fats circulate in the blood bound to lipoproteins. Low-density lipoprotein (LDL) cholesterol is the predominant form of circulating cholesterol, followed by high-density lipoprotein (HDL) cholesterol. These lipoproteins have different implications for cardiovascular disease: LDL cholesterol increases the risk of cardiovascular disease, whereas HDL cholesterol is protective. In general, saturated fatty acids and trans fatty acids increase total and LDL cholesterol; monounsaturated fatty acids are neutral; and polyunsaturated fatty acids decrease total and LDL cholesterol (Mann and Truswell 2007). Because of these attributes, monounsaturated and polyunsaturated fats are often referred to as 'good' fats, while saturated fat and trans fat are considered 'bad'. Although the message is to decrease intake of saturated fats and increase that of unsaturated fats, all three types of fat contain the same high level of concentrated energy. The proportions of the types of fat in the diet are important, but the intake of total fat still needs to be limited.

Deficiencies resulting from inadequate fatty acid intakes are rare, suggesting the minimum requirements are low. In countries such as New Zealand, the major health issues concerning dietary fat are related to excess consumption, especially saturated fat, and/or an imbalance of fatty acids. Cardiovascular disease (mainly ischaemic heart disease) is the leading cause of death in New Zealand and most of this disease burden is attributable to high blood cholesterol (Ministry of Health and University of Auckland 2003; Turley et al 2006). Although cardiovascular disease is rare in children and young people, the disease process (eg, atherosclerosis) begins in childhood so appropriate amounts and types of dietary fat are important for children and young people (Daniels and Greer 2008).

Inadequate intakes of the essential fatty acids (linoleic acid and α-linolenic acid) are also considered rare (Mann and Truswell 2007). These fatty acids are required for the structural integrity of all cell membranes but they are also precursors of the longer-chain polyunsaturated acids, such as arachidonic acid (AA), EPA and DHA. EPA in particular has been linked to a number of positive effects on health, including improved cardiovascular risk and lower inflammatory response (Mann and Truswell 2007). The intake of these essential fatty acids, as part of a balanced diet, should be encouraged.

Recommended intake

No RDI or AI has been set for saturated fatty acids and monounsaturated fatty acids because they can be synthesised in the body (NHMRC 2006). An AI was established for the following fatty acids: linoleic acid, α-linolenic acid and total long-chain omega-3 fatty acids (EPA, DPA and DHA)(Table 11). It was not possible to set a UL for linoleic acid or α-linolenic acid, but the UL for total long-chain omega-3 fatty acids for children and young people is 3000 mg per day. There is some evidence to suggest that high levels of these fatty acids may impair immune response and prolong bleeding time, although these effects are not confirmed (NHMRC 2006).

Table 11: Adequate intake for fatty acids for children and young people

Age group (years)	Linoleic acid (g)		α-linolenic acid (g)		Long-chain omega-3 fatty acids (mg)	
	Male	Female	Male	Female	Male	Female
2–3	5.0	5.0	0.5	0.5	40.0	40.0
4–8	8.0	8.0	0.8	0.8	55.0	55.0
9–13	10.0	8.0	1.0	0.8	70.0	70.0
14–18	12.0	8.0	1.2	0.8	125.0	85.0

Source: NHMRC (2006)

It was not possible to set an RDI or AI for total fat, but the AMDRs/SDTs for those aged 14 years and over are:

- total fat: 20–35 percent of total energy.
- saturated + trans fats: 10 percent or less of total energy
- linoleic acid: 4–10 percent of dietary energy
- α-linolenic acid: 0.4–1 percent of dietary energy
- long-chain polyunsaturated fatty acids (LCPFAs – DHA, EPA, DPA): males 610 mg, females 430 mg (NHMRC 2006).

Current levels of intake

Table 12: Mean daily total fat and saturated fat intake for children and young people (as a percentage of total energy intake)

Age group (years)	Total fat intake (% energy)		Saturated fat intake (% energy)	
	Male	Female	Male	Female
5–6	32	31	14	14
7–10	33	33	15	15
11–14	34	34	15	15
15–18	35	34	14	14

Source: 2002 National Children's Nutrition Survey (5–14 years) (Ministry of Health 2003b) and 2008/09 NZ Adult Nutrition Survey (15–18 years) (University of Otago and Ministry of Health 2011)

Total fat provides 31–35 percent of energy and saturated fat provides 14–15 percent of energy in the diets of children and young people (Ministry of Health 2003b; University of Otago and Ministry of Health 2011). Although total fat intakes are just within the AMDR, saturated fat intakes are too high.

Trans fat intake was not measured in national nutrition surveys due to incomplete New Zealand food composition data. However, based on dietary modelling it is estimated that trans fat provides 0.7 percent of energy in the diets of New Zealanders aged 15 years and over (FSANZ 2006), which is consistent with the WHO nutrient intake goal of less than 1 percent of energy (WHO 2003a). Due to a high saturated fat intake, New Zealand young people (14 years and over) exceed the AMDR recommendation to limit the combined intake of saturated and trans fats to no more than 10 percent of total energy (NHMRC 2006).

Intakes of linoleic acid, α-linolenic acid and long-chain omega-3 fatty acids were not measured in national nutrition surveys or research studies due to incomplete New Zealand food composition data for these fatty acids. Therefore, it is not possible to know if New Zealand children and young people are meeting their requirements for these essential fatty acids. Vegetarians need an adequate intake not only because they need to meet requirements for these nutrients but also because linoleic and α-linolenic acid are precursors for the longer-chain polyunsaturated fatty acids (EPA, DPA, DHA) that are only available from animal sources.

Blood lipids and lipoproteins

There are no guidelines for blood lipid and lipoprotein levels in children and young people. In adults, the relationship of blood lipids and lipoproteins to ischaemic heart disease mortality is continuous and graded, with the risk of mortality increasing from a total cholesterol to HDL cholesterol ratio of approximately 3.5 (Prospective Studies Collaboration 2007). Elevated blood lipid and lipoprotein levels in childhood track into adulthood (Nicklas et al 2002; Srinivasan et al 2006) and are associated with subsequent cardiovascular disease (Daniels and Greer 2008). Therefore, establishing healthy dietary patterns early in life is important to reduce future risk of cardiovascular disease. For New Zealanders, establishing these patterns includes choosing foods higher in monounsaturated and polyunsaturated fats (including omega-3 fatty acids) and reducing intake of foods high in saturated fats or choosing lower-fat options available for the same kind of food (see 'Sources in the diet' below).

Total and HDL cholesterol concentrations in children and young people aged 5–14 years were on average 4.4 and 1.4 mmol/L respectively, giving a total cholesterol to HDL cholesterol ratio of 3.2 (Ministry of Health 2003b). In young people aged 15–18 years, total and HDL cholesterol concentrations average 4.0 and 4.4, and 1.2 and 1.3 mmol/L respectively (males and females), giving a total cholesterol to HDL cholesterol ratio of 3.4 for both groups. (University of Otago and Ministry of Health 2011). This ratio value is lower than the ratio value of 3.5 given above as the starting point for increasing risk of mortality in adults.

Sources in the diet

Table 10 (see above in this section) shows the dietary sources of fatty acids for which an AI has been established. Plant oils are the major source of linoleic and α-linolenic acid, whereas fish and fish oils are the major source of long-chain omega-3 fatty acids. Vegetarians need to include a good source of α-linolenic acid in their diet, as this can be converted to the long-chain omega-3 fatty acids EPA and DHA. Good plant sources of α-linolenic acid (ALA) are flaxseed (also known as linseed) and flaxseed oil and, to a lesser extent, canola oil, soybean oil, walnuts and walnut oil. Key sources of these fatty acids in the diets of New Zealanders have not been determined.

Table 13: Dietary sources of fats^

Saturated fat	Polyunsaturated fat	Monounsaturated fat	Trans fatty acids*
Butter	Sunflower oil	Olives	Margarine and table spreads
Cream	Safflower oil	Peanuts	Manufactured foods eg, pies, biscuits, cakes, pastries and snack foods
Cheese	Soybean oil	Almonds	
Milk	Corn oil	Avocados	
Meat	Margarine and table spread (check label)	Macadamia	
Poultry		Olive oil	
Coconut cream		Canola oil	
Coconut milk	See Table 10 for foods that are sources of the omega fats and their derivatives.	Peanut oil	
Coconut oil		Almond oil	
Ghee		Avocado oil	
Palm oil and manufactured foods containing it eg, pies, biscuits, cakes and pastries		Macadamia oil	
		Meat from grass-fed animals in NZ	
		Margarine and table spread (check label)	

^ Foods contain a mixture of different types of fat; however, many have a predominant type as indicated in this table.

* Trans fatty acid levels in New Zealand foods are relatively low compared with countries like the United States, and levels in food have declined in the last 10 years (Lake et al 1996; Saunders et al 2008).

Key sources of total fat in the diets of New Zealand children and young people (5–14 years) are potatoes, kūmara and taro[2] (9%); milk (8%); biscuits (7%); butter and margarine (6%); pies and pastries (6%); and poultry[3] (6%) (Ministry of Health 2003b). Key sources of saturated fat for 5–14 year olds are: milk (11%); potatoes, kūmara and taro (9%); biscuits (9%); pies and pastries (7%); dairy products (6%); and cheese (5%).

Key sources of total fat for New Zealand 15–18 year olds are: bread-based dishes (12%); potato and kūmara and taro[4] (10%); poultry This includes poultry[5] cooked in fat or poultry based dishes that have high fat ingredients added. (7%); butter and margarine; and pies and pastries (each 6%); as well as beef and veal; grains and pasta; and milk (each 5%). Key sources of saturated fat are bread-based dishes (13%); potatoes, kūmara and taro (10%); milk (8%); poultry and pies and pastries (each 6%): as well as dairy products; butter and margarine; cheese; and grains and pastries (each 5%) (University of Otago and Ministry of Health 2011).

2 Potatoes, kūmara and taro are naturally very low in fat, however this category (used in the national nutrition surveys) also includes foods and dishes made from potatoes, kūmara and taro, including food cooked in fat or those with fat added for example, hot chips, french fries, taro in coconut cream.

3 This includes poultry cooked in fat or poultry based dishes that have high fat ingredients added.

4 Potatoes, kūmara and taro are naturally very low in fat, however this category (used in the national nutrition surveys) also includes foods and dishes made from potatoes, kūmara and taro, including food cooked in fat or those with fat added for example, hot chips, french fries, taro in coconut cream.

5 This includes poultry cooked in fat or poultry based dishes that have high fat ingredients added.

4.6 Protein

Summary

- Proteins have structural and functional roles in every cell and are essential for growth.
- Protein requirements are closely linked to body size and age. The AMDR for young people aged 14 years and over is 15–25 percent of energy from protein.
- New Zealand children and young people have adequate protein intakes.
- Good sources of protein include lean meat, poultry, seafood, eggs, milk, milk products, legumes, tofu, nuts and seeds.
- Protein requirements can be met from a vegetarian or vegan diet when a range of plant foods is consumed and energy needs are met (see section 12.1: Vegetarian eating).

Background

Protein is necessary to build, maintain and repair tissue. Proteins are the second most abundant compounds in the body after water. They form structural and functional components within every cell. Protein is also necessary to synthesise hormones, enzymes and antibodies. It can be used as a source of energy like the other macronutrients (fat and carbohydrate), although most protein is used for other functions. Proteins are constantly being broken down and resynthesised in a process called protein turnover. During growth, protein synthesis exceeds protein degradation.

Proteins are made up of 20 amino acids. The body can synthesise some of these amino acids, but others must be obtained from food and these are referred to as **indispensable** (or essential) **amino acids**. In most populations with an abundant and varied food supply, protein intakes are adequate. However, protein deficiency can occur when energy intakes are low, when the quality of amino acids is low or during illness (as a result of increased requirements for nutrients). Protein is particularly important during childhood and adolescence to ensure adequate growth.

Recommended intake

Protein requirements are closely linked to body size and age. The RDI for protein is expressed both as grams per day and as grams per kilogram of body weight in Table 14. There is no UL of intake for protein, but the AMDR for adults and young people aged 14 years and over is 15–25 percent of energy from protein (NHMRC 2006).

Table 14: Recommended dietary intake for protein for children and young people

Age group (years)	g/day		g/kg body weight	
	Male	Female	Male	Female
2–3	14	14	1.08	1.08
4–8	20	20	0.91	0.91
9–13	40	35	0.94	0.87
14–18	65	45	0.99	0.77

Source: NHMRC (2006)

Current levels of intake

Given that usual median protein intakes are well above the RDI, current protein intakes (g/day) are likely to be adequate (Table 15). When expressed as a percentage of total energy, protein provides 13–16 percent of total energy. The lower level of intake is slightly outside the AMDR for protein (15–25% of total energy); however, this is not a concern as the median actual intakes for all age groups are well within the recommended gram per day levels. Percentage of total energy intake figures are useful to give a broad indication of the distribution of energy sources in the diet and are most useful when applied on a population basis.

Table 15: Median daily protein intake for children and young people

Age group (years)	g/day		% energy	
	Male	Female	Male	Female
5–6	62	52	14	13
7–10	71	61	13	13
11–14	88	66	14	13
15–18	107	67	16	15

Source: 2002 National Children's Nutrition Survey (5–14 years) (Ministry of Health 2003b) and 2008/09 NZ Adult Nutrition Survey (15–18 years) (University of Otago and Ministry of Health 2011)

Sources in the diet

Protein is found in both animal and plant foods. Good sources of protein are meat, poultry, fish, milk, milk products, eggs, legumes, tofu, nuts and seeds. Sources of protein vary in their nutritional value, with proteins from animal sources tending to be higher quality because they contain all the essential amino acids. Although proteins from plant-based sources may be limited in one or more essential amino acid, protein requirements can easily be met on a vegetarian (including vegan) diet when a variety of plant foods is consumed and energy requirements are met (American Dietetic Association and Dietitians of Canada 2003). Legumes, nuts and seeds in general contain significantly less total protein per serving size than meat. For those choosing more of those foods than meat foods or those following a vegetarian diet, the minimum number of servings of those foods is higher. See section 1.3: Summary of food groups, serving sizes and recommended intake, for more details.

Key sources of protein in the diet of New Zealand children aged 5–14 years are: bread (13%); milk (11%); poultry (9%); beef and veal (8%); and bread-based dishes (5%) (Ministry of Health 2003b). For 15–18 year olds, key sources of protein are: bread-based dishes (14%); poultry (11%); bread (10%); as well as milk; grains and pasta; and beef and veal (each 7%).

4.7 Vitamin A

Summary

Vitamin A is required for vision, immune function, regulation of cell growth and normal reproduction.

Most New Zealand children and young people get enough vitamin A. Low vitamin A intake is more prevalent amongst Pacific children and young people.

Vitamin A intakes can be met by eating a range of foods from all four food groups, especially colourful vegetables and fruit, small quantities of liver, and milk and milk products.

Encourage children and young people to eat vegetables of many different colours, including carrots, kūmara, pumpkin, spinach and silverbeet.

Background

Vitamin A is a fat-soluble vitamin that is required for vision, immune function, regulation of cell growth and normal reproduction. The term vitamin A includes retinol and carotenoids (dietary precursors of retinol). Vitamin A requirements are generally expressed in terms of retinol equivalents (RE). One RE is defined as the biological activity associated with 1 µg of retinol. For information on carotenoid conversion factors, refer to the *Nutrient Reference Values for Australia and New Zealand (*NHMRC 2006).

In severe cases, vitamin A deficiency can cause a series of changes to the eye that can lead to blindness (Mann and Truswell 2007). Vitamin A deficiency reduces the ability to see in dim light, which is sometimes referred to as night blindness. Vitamin A deficiency is also associated with impaired immunity and increased risk of infection.

High levels of vitamin A can be very harmful. The most serious consequences of vitamin A toxicity occur during pregnancy, where fetal abnormalities and miscarriage may result. As a fat-soluble vitamin, vitamin A can build up in the body; however, it is rare for vitamin A toxicity to occur from ingestion of foods. The usual causes of vitamin A toxicity are retinoid therapy or high intakes of dietary supplements (Mann and Truswell 2007).

Recommended intake

The RDI and UL for vitamin A in children and young people are summarised in Table 16.

Table 16: Recommended dietary intake and upper level of intake for vitamin A for children and young people

Age group (years)	RDI (RE)		UL (RE)
	Male	Female	All
2–3	300	300	600
4–8	400	400	900
9–13	600	600	1700
14–18	900	700	2800

Source: NHMRC (2006)

Current levels of intake

The median usual daily vitamin A intakes in children and young people aged between 5 and 18 years are outlined in Table 17. The prevalence of inadequate vitamin A intake^ in children and young people aged 5–14 years was estimated to be 10 percent overall, but was considerably higher for Pacific children and young people (22% of males, 34% of females).

The prevalence of inadequate vitamin A intake for 15–18 years olds (University of Otago and Ministry of Health 2011) is relatively high (38% of males and 27% of females). However, a lack of biochemical data (serum vitamin A) precludes an in-depth assessment of the vitamin A status of both age groups of 5–14 years and 15–18 years.

Table 17: Median daily vitamin A intake for children and young people

Age group (years)	Median daily vitamin A intake (RE)	
	Male	Female
5–6	527	485
7–10	631	561
11–14	736	633
15–18	732	599

Source: 2002 National Children's Nutrition Survey (5–14 years) (Ministry of Health 2003b) and 2008/09 NZ Adult Nutrition Survey (15–18 years) (University of Otago and Ministry of Health 2011)

Sources in the diet

Good sources of vitamin A as retinol include meat (especially liver), eggs (especially the yolk), milk, milk products and oily fish. Liver contains large amounts of vitamin A and as such is a good source but its consumption in children needs to be limited to prevent excess build-up of vitamin A.

Good sources of beta-carotene, a precursor for vitamin A, include carrots, pumpkin, kūmara and dark-green leafy vegetables such as spinach and silverbeet.

Key sources of retinol in the diets of New Zealand children and young people aged 5–14 years are: milk (23%); butter and margarine (12%); dairy products (9%); and eggs and egg products (6%) (Ministry of Health 2003b). For 15–18 year olds key sources of retinol are bread-based dishes (13%); milk (13%); butter and margarine (12%); egg and egg dishes (8%); poultry (7%); as well as dairy products and cheese; and (6%) (University of Otago and Ministry of Health 2011).

Key sources of beta-carotene for 5–14 year olds are: vegetables (23%); fruit (12%); soups and stocks (4%); grains and pasta (3%); and bread-based dishes (2%) (Ministry of Health 2003b). For 15–18 year olds key sources are: vegetables (23%); bread-based dishes (15%); fruit; and grains and pasta (each 8%); as well as milk; and savoury sauces and condiments (each 5%) (University of Otago and Ministry of Health 2011).

^ Prevalence of inadequate intake from the 2002 National Children's Nutrition Survey was recalculated using Australian and New Zealand NRVs and total response ethnicity for Pacific peoples.

4.8 Folate

Summary

Folate requirements are high during growth, so folate is important for the unborn baby, children and young people.

Good dietary sources of folate are dark-green leafy vegetables, fruit (especially citrus), and breads and breakfast cereals fortified with folic acid. Check the food label for folic acid.

Folate is sensitive to light, air and heat so store vegetables in covered containers in the dark, cook and eat them while they are still fresh or (in the case of frozen or canned vegetables) still within their 'use-by' date. Boil lightly in a minimum of water, steam or microwave.

Adequate folate intake is important for children and young people, in particular young women of childbearing age. Maximise their folate intake by including foods that are good sources of folate.

The folate requirement for women is higher during preconception and the early stages of pregnancy. Therefore women planning a pregnancy (or who find themselves pregnant) should take a subsidised folic acid tablet as recommended in section 12.6: Pregnancy and breastfeeding.

Background

Folate is a generic term applied to dietary sources of related compounds that are involved in the metabolism of nucleic and amino acids, and hence the synthesis of DNA, RNA and proteins. The requirement for folate is highest during growth. Inadequate folate intakes are associated with impaired immune function and macrocytic anaemia (ie, anaemia where the red blood cells are larger than normal).

Folate status is difficult to measure through dietary intake assessment because the bioavailability of different forms of folate varies. The bioavailability of folate that occurs naturally in food is about 50–60 percent, whereas the bioavailability of folic acid used to fortify foods and in folic acid supplements is about 85 percent when consumed with food. Folic acid supplements are almost 100 percent bioavailable on an empty stomach (NHMRC 2006).

Recommended intake

Recommended folate intake is expressed as dietary folate equivalents (DFEs) to account for differences in the bioavailability of food folate and synthetic folic acid. One microgram (1 µg) of DFEs equals:

- 1 µg of folate from food
- 0.5 µg of a folic acid tablet taken on an empty stomach
- 0.6 µg of folic acid from fortified food or taken as a tablet with meals.

Recommended folate intakes for children and young people are summarised in Table 18.

Table 18: Recommended dietary intake and upper level of intake for folate for children and young people (per day)

Age group (years)	RDI (µg DFE)		UL* (µg DFE)
	Male	Female	All
2–3	150	150	300
4–8	200	200	400
9–13	300	300	600
14–18	400	400	800

Source: NHMRC (2006)

* The UL is for dietary folate equivalents from foods fortified with folic acid and from supplements.

It is important that all young women of childbearing age eat foods that are good sources of folate, given that a large proportion (40–60%) of pregnancies in New Zealand are unplanned (Schader and Corwin 1999; Ferguson et al 2000; Paterson et al 2004; Dobson et al 2006; Gao et al 2008).

Current levels of intake

Median usual daily folate intakes in children and young people (5–14 years) range from 226 to 283 µg for males and from 201 to 216 µg for females, as summarised in Table 19. The prevalence of inadequate folate^ intake in children and young people aged 5–14 years was estimated to be 37 percent overall, but was considerably higher for females aged 9–14 years (64%). Dietary folate intake levels were not reported in the 2008/09 NZ Adult Nutrition Survey, as the available food tables data used in the survey had not incorporated the increase in foods fortified with folic acid. As a result any estimates of dietary folate intake levels would not be accurate.

Table 19: Daily median folate intake for children and young people

Age group (years)	Daily median folate intake (µg)	
	Male	Female
5–6	226	201
7–10	250	211
11–14	283	216

Source: 2002 National Children's Nutrition Survey (5–14 years) (Ministry of Health 2003b)

Nutrient status

Red blood cell folate is considered less sensitive to recent intake and is a more reliable measure of folate status (University of Otago and Ministry of Health 2011). As identified in the 2008/09 NZ Adult Nutrition Survey, mean levels for New Zealanders aged 15–18 years are 784 nmol/L for males and 758 nmol/L for females. In this age group, 1 percent of males and 3.3 percent of females had values below 317 nmol/L which is considered low.

^ Prevalence of inadequate intake from the 2002 National Children's Nutrition Survey was recalculated using Australian and New Zealand NRVs and total response ethnicity for Pacific peoples.

Sources in the diet

Good sources of naturally occurring folate are dark-green leafy vegetables, such as broccoli, cabbage, spinach, lettuce and brussels sprouts. Fruit, especially citrus fruit, is another good source. Folate is sensitive to light, air and heat, so vegetables and fruit should be cooked and stored carefully to minimise these conditions, with the aim of maximising the folate content of the vegetables. For example, cook vegetables and fruit lightly in a minimum of water. Ideally do not eat vegetables and fruit if they are past their best or (in the case of frozen or canned vegetables and fruit) past their 'use-by' date.

Since 1996 voluntary fortification of selected foods (eg, breakfast cereals, flour and breads) with folic acid has been permitted under the Australia New Zealand Food Standards Code (FSANZ 2010). Mandatory fortification of bread with folic acid has been deferred in New Zealand until 2012. In the interim, the voluntary permissions to fortify selected foods, including bread, with folic acid are maintained. New Zealand bakers have indicated they will widen the range of breads that they currently fortify with folic acid on a voluntary basis. Check the ingredients on the food label to establish whether folic acid has been added to a particular product.

Key sources of folate in the diets of New Zealand children and young people aged 5–14 years are: bread (22%); breakfast cereals (21%); vegetables (9%); as well as potatoes, kūmara and taro; fruit; and savoury sauces (each 6%) (Ministry of Health 2003b).

4.9 Vitamin D

Summary

Vitamin D enhances calcium absorption and has an important role in bone health.

Vitamin D deficiency can cause rickets in children.

There are few dietary sources of vitamin D, so adequate vitamin D status is unlikely to be achieved through dietary intake alone.

Exposure to sunlight or ultraviolet radiation is the main source of vitamin D. Sun protection behaviour is recommended when the ultraviolet index (UVI) is 3 or higher to avoid skin and eye damage.

From September to April it should be possible for most people to meet vitamin D requirements through incidental sunlight exposure outside peak UVI times (ie, before 10 am and after 4 pm).

From May to August it is difficult for most people to meet their vitamin D requirements through incidental exposure.

Risk of vitamin D deficiency is highest in people with dark pigmented skin (eg, Indian, Middle Eastern and African peoples), those with limited sun exposure, and (in winter) those who live in the South Island.

Under medical supervision, supplementation with 10 µg (400 IU) vitamin D per day (or equivalent dose given weekly or monthly) may be appropriate for children and young people at risk of vitamin D deficiency or insufficiency.

Please note: The Ministry of Health and the Cancer Society have made recommendations on vitamin D and sun exposure. Go to: www.health.govt.nz

Background

Vitamin D is a group of fat-soluble pro-hormones that have an essential role in calcium and phosphorus homeostasis. Vitamin D enhances calcium absorption and has an important role in the formation and mineralisation of bone (see section 4.10: Calcium).

There are two forms of vitamin D.

- Vitamin D_2 (ergocalciferol) is found in a limited number of foods.
- Vitamin D_3 (cholecalciferol) is synthesised in the skin in response to sunlight.

Under normal conditions vitamin D is supplied mainly by the skin, so it is not a nutrient in the traditional sense. Vitamin D is hydroxylated to 25-hydroxyvitamin D in the liver and circulates in the blood in this form. In the kidneys, 25-hydroxyvitamin D gets converted to 1,25-dihydroxyvitamin D (calcitriol), which is the biologically active form that binds to vitamin D receptors throughout the body, resulting in its physiological actions.

Severe vitamin D deficiency causes rickets in children, which is characterised by the poor mineralisation of newly formed bone tissue. Rickets is rare in most developed countries. However, a small number of cases has been reported in New Zealand children younger than five years, of whom most are of Indian origin but some are of Pacific or Māori ethnicity (Blok et al 2000; Judkins and Eagleton 2006).

Vitamin D insufficiency has been associated with some cancers, cardiovascular disease, auto-immune disease, chronic infections and all-cause mortality. However, evidence is not sufficient at this stage to be confident of the role of vitamin D in any of these areas.

For most people, sunlight is the major source of vitamin D. Therefore, dietary intake is not a very good indicator of vitamin D status. The best indicator of vitamin D status is the concentration of serum 25-hydroxyvitamin D. Although there is no universally accepted definition of vitamin D deficiency, an acceptable serum 25-hydroxyvitamin D level appears to be 50 nmol/L, with moderate–severe deficiency defined as less than 25 nmol/L (Ministry of Health and Cancer Society of New Zealand 2012; Institute of Medicine 2011). Severe vitamin D deficiency, resulting in rickets and osteomalacia, is associated with serum 25-hydroxyvitamin D concentrations of below 12.5 nmol/L (Working Group of the Australian and New Zealand Bone and Mineral Society et al 2005). Serum 25-hydroxyvitamin D concentrations of below 50 nmol/L are associated with increased parathyroid hormone secretion, increased bone turnover and reduced bone density (Working Group of the Australian and New Zealand Bone and Mineral Society et al 2005).

Recommended intake

It was not possible to set an RDI for vitamin D, but the AI for children and young people aged 2–18 years is 5 µg (NHMRC 2006). The UL for vitamin D for children and young people is 80 µg. The recommendations assume little or no exposure to sunlight. Therefore, depending on environmental and personal factors related to sunlight exposure (see 'Sources of vitamin D' below), this requirement may be reduced.

Current levels of intake

Vitamin D intake was not assessed in recent national nutrition surveys due to a lack of up-to-date data for New Zealand foods rich in vitamin D in the New Zealand food composition database.

Nutrient status

Until recently it was assumed that sunlight exposure in New Zealand would result in sufficient vitamin D synthesis to ensure adequate vitamin D status. However, there is now considerable evidence that some New Zealand children and young people have sub-optimal vitamin D status (Chiu 2005; Rockell et al 2005; Judkins and Eagleton 2006; Wishart et al 2007; CC Grant et al 2009).

In the 2002 National Children's Nutrition Survey, the prevalence of vitamin D less than 37.5 nmol/L in children aged 5–14 years was 31 percent, including 4 percent who had vitamin D levels below 17.5 nmol/L (Rockell et al 2005). Multivariate analyses showed the main determinants of 25-hydroxyvitamin D were ethnicity and season. Adjusted serum 25-hydroxyvitamin D concentrations were highest in European/Other children (53 nmol/L), intermediate in Māori children (44 nmol/L) and lowest in Pacific children (37 nmol/L) (Rockell et al 2005). The prevalence of vitamin D deficiency was significantly higher in winter than in summer (Rockell et al 2005). The clinical implications of these findings are unclear, but the prevalence of vitamin D less than 37.5 nmol/L found in New Zealanders during winter is associated with higher parathyroid hormone levels, which may have adverse effects on bone health (Rockell et al 2008).

There are no national data on vitamin D status in Asian children, but they are likely to be at risk of vitamin D deficiency. In a study of 18 infants and toddlers diagnosed with rickets at an Auckland hospital in 1998, two-thirds were Indian, with the remainder being Māori, Pacific, African or Asian (Blok et al 2000). Other studies suggest ethnic groups at risk of vitamin D deficiency are Asian, Middle Eastern and African (Wishart et al 2007; CC Grant et al 2009).

Sources of vitamin D

Dietary intake

In New Zealand, adequate vitamin D status is unlikely to be achieved through dietary intake alone (Shrapnel and Truswell 2006). Vitamin D is found in only a small number of foods. Moderate sources include oily fish (eg, wild salmon and sardines), liver, eggs and fortified foods.

The joint Australia New Zealand Food Standards Code (FSANZ 2010) permits selected foods to be voluntarily fortified with vitamin D (eg, margarine, butter and low-fat spreads, some milks and milk products such as yoghurt, and soy beverages). However, not all of these foods are currently fortified and the level of fortification permitted is low, so these foods will make only a small contribution to dietary vitamin D intake (Shrapnel and Truswell 2006).

Sunlight

For most people in New Zealand, exposure to sunlight or ultraviolet (UV) radiation is the main source of vitamin D. However, it is difficult to make recommendations regarding how much sun exposure is required for maintenance of adequate vitamin D status for two reasons.

1. Sun exposure is the main cause of skin cancer in New Zealand, accounting for over 90 percent of cases (Working Group of the Australian and New Zealand Bone and Mineral Society et al 2005). Therefore, advice regarding sun exposure to maintain adequate vitamin D status must be balanced with the need to minimise the risk of skin cancer.
2. Environmental and individual factors influence the amount of vitamin D synthesised in the skin, so universal recommendations are difficult.

    > The ultraviolet index (UVI) is a measure of the intensity of UV radiation. The higher the UVI, the greater the risk of skin and eye damage. When the UVI is low (< 3), no sun protection is required. When the UVI is 3 or higher, sun protection behaviour is recommended. SunSmart advice includes wearing a broad-brimmed legionnaire-style or bucket hat (brim at least 5 cm), sun protective clothing and a broad spectrum sunscreen with a sun protection factor of at least 30. For more information, refer to the SunSmart website (www.sunsmart.org.nz) and the Cancer Society of New Zealand's SunSmart advice (www.cancernz.org.nz/reducing-your-cancer-risk/sunsmart).

- Environmental factors influencing UV exposure include latitude, season, time of day and other environmental conditions. Latitude is a major determinant of UV, with peak summer UVI levels ranging from 8 in Invercargill to 13 in Auckland (Cancer Society of New Zealand 2008). In the winter, UVI levels range from 1 to 2 in all locations (Cancer Society of New Zealand 2008). Other determinants of UVI levels include time of day and environmental conditions (eg, cloud cover and pollution) (Prentice 2008).
- Individual factors influencing UV exposure and vitamin D synthesis include skin colour and age. Dark-pigmented skin reduces UV absorption, so people with darker skins need more sun exposure than people with fairer skins to synthesise the same amount of vitamin D. Other individual factors include time spent outdoors, sunscreen use and the amount of skin exposed (Prentice 2008).
- Between September and April sun protection is recommended, especially between 10 am and 4 pm. Outdoor physical activity in the early morning or late afternoon is recommended. Between May and August some sun exposure is important. Outdoor physical activity in the hours around noon with face, arms and hands exposed, is recommended (Ministry of Health and Cancer Society of New Zealand 2012).

Vitamin D supplementation

At risk groups (as identified below) may benefit from vitamin D supplementation. Supplementation with 10 µg (400 IU) of vitamin D per day may be necessary for children and young people at risk of vitamin D deficiency, as described below. Vitamin D should only be taken under the supervision of a health practitioner (Munns et al 2006).

High intakes of some supplements can have serious adverse effects when they either exceed the upper level of intake or interact with other nutrients. As a fat-soluble vitamin, vitamin D can also build up in the body. Alternatively an equivalent dose can be taken weekly or monthly. There is no known risk of adverse effects with supplementation at the recommended dose of 10 µg per day or equivalent weekly or monthly dose.

Risk factors for vitamin D deficiency

For children and young people, the main risk factors for deficiency are those that reduce vitamin D production or intake. Individuals at higher risk for vitamin D deficiency are:

- people with naturally very dark skin, includes many people from Africa, the Indian subcontinent, and the Middle East, especially if they are covered by veils and full-body coverage clothing
- people who completely avoid sun exposure because they have had skin cancer, skin damage or are on photosensitising medication, for example, some acne medications
- have liver or renal disease, have malabsorption or are taking medications that are contraindicative to vitamin D metabolism.

4.10 Calcium

Summary

Calcium is essential for healthy bones and teeth.

Calcium requirements are highest in young people aged 12–18 years.

Approximately one-third of young people (12–18 years) in New Zealand have inadequate calcium intakes.

The risk of inadequate calcium intake is highest in young women from all ethnic groups (especially Pacific) and in young Pacific males. However, there is some evidence that Pacific peoples may have a reduced risk of developing osteoporosis, so lower calcium levels may be less problematic for them than for other ethnic groups.

Milk and some milk products (eg, yoghurt and cheese) are good sources of calcium.

Children and young people require two to three servings of milk and milk products each day to meet their calcium requirements.

Reduced- or low-fat milk and milk products provide calcium at a level that is as much as, or more than, that in homogenised or whole milk varieties and are recommended for children from the age of two years. Low fat milk with extra calcium added is also available.

Calcium-fortified milk alternatives (eg, soy milk) are recommended for children and young people who do not consume cow's milk.

Non-dairy sources of calcium include canned fish with bones, green leafy vegetables, legumes, nuts and seeds (especially sesame seeds, including the sesame seed paste tahini), and breakfast cereals fortified with calcium.

If milk, milk products and/or calcium-fortified milk alternatives are not part of the diet, meeting calcium requirements via non-dairy sources alone is very difficult. In such situations a calcium supplement should be considered.

Background

Calcium is essential for healthy bones and teeth. The skeleton contains 99 percent of the body's calcium, which is used to store or provide calcium depending on physiological need. Calcium also plays an essential role in regulating muscle contraction, nerve conductivity, blood clotting and many other important bodily functions. Vitamin D plays an important role in the absorption of dietary calcium and bone health (Sanders et al 2009), so it is also important to have adequate vitamin D status for optimal bone health (see section 4.9: Vitamin D).

Calcium is particularly important in children and young people because their bones are growing rapidly. Adequate calcium intake is essential for the attainment of peak bone mass, which is the best protection against age-related bone loss and osteoporosis (Greer et al 2006). Peak bone mass is attained between 10 and 20 years of age, with bone mass acquisition peaking at about 12.5 years in girls and 14 years in boys (Greer et al 2006). In addition to dietary calcium, high-impact weight-bearing physical activity (eg, jumping or running) is an important determinant of peak bone mass (Greer et al 2006).

Although osteoporosis generally appears later in life, low calcium intakes throughout childhood and adolescence can lead to low bone mineral density and increased risk of fracture. A New Zealand study found that New Zealand European children aged 3–13 years who avoided milk had low calcium intakes, low bone mineral density and significantly

more fractures than expected (Black et al 2002; Goulding et al 2004). There is evidence that people from some ethnic groups may not have the same association between low calcium intakes and bone density or fracture risk. Specifically, Pacific children and young people have lower mean calcium intakes than New Zealand European children (Ministry of Health 2003b), but the bone area and bone mineral content of the two groups are similar (when adjusted for body weight) (Grant et al 2005). Of note is that osteoporosis rates in Pacific peoples living in New Zealand are lower than those among New Zealand Europeans (Norton et al 1995). Further investigation is needed in this area.

Foods that reduce the bioavailability (and thus absorption) of calcium include foods containing high levels of phytates (found in wholegrain cereals, legumes, nuts and seeds) and oxalate (found in spinach, rhubarb and walnuts) (Sanders et al 2009). It is possible for children and young people following a carefully planned vegetarian, including vegan, diet to meet their calcium requirements by eating a wide range of plant foods, including calcium-fortified products (American Dietetic Association and Dietitians of Canada 2003).

Recommended intake

The RDI and UL for calcium in children and young people are set out in Table 20.

Table 20: Recommended dietary intake and upper level of intake for calcium for children and young people

Age group (years)	RDI (mg)	UL (mg)
	All (males and females)	All (males and females)[1]
2–3	500	2500
4–8	700	2500
9–11	1000	2500
12–13	1300	2500
14–18	1300	2500

Source: NHMRC (2006)

Current levels of intake

Median usual daily calcium intakes in children and young people are set out in Table 21. The prevalence of inadequate calcium intake* in children and young people aged 5–14 years was estimated to be very high, at 65 percent overall. The estimated prevalence of inadequate intake for calcium for New Zealanders aged 15–18 years (University of Otago and Ministry of Health 2011) is also high (males 58% and females 88%), with higher values for Māori and Pacific aged 15–18 years. Interpretation of these data requires a cautious approach as the EAR values have been augmented by 320 mg to take into account 'unspecified low absorption that occurs at about 500 mg/day' (NHMRC 2006).

* Prevalence of inadequate intake from the 2002 National Children's Nutrition Survey was recalculated using Australian and New Zealand NRVs and total response ethnicity for Pacific peoples.

Table 21: Median calcium intake for children and young people

Age group (years)	Median calcium intake (mg)	
	Male	Female
5–6	677	616
7–10	788	628
11–14	888	733
15–18	980	682

Source: 2002 National Children's Nutrition Survey (5–14 years) (Ministry of Health 2003b) and 2008/09 NZ Adult Nutrition Survey (15–18 years) (University of Otago and Ministry of Health 2011)

Sources in the diet

As calcium is not widely distributed across food groups, ensuring adequate intake can be more difficult than for other nutrients. Milk and some milk products (eg, yoghurt and cheese) are the predominant sources of calcium. Reduced- and low-fat milk, which are suitable for children from two years of age, usually provide more calcium than whole or homogenised milk (Athar et al 2006). Low-fat milk with extra calcium added is also available. Milk products such as cream, butter, sour cream, cream cheese and cottage cheese are not good sources of calcium.

Non-dairy sources of calcium include canned fish (with bones), green leafy vegetables, legumes, nuts and seeds* (especially sesame seeds, including the sesame seed paste tahini). Most breads and cereals are not high in calcium, but as they are consumed in large quantities they can be a key source in the diet (especially breads containing whole grains and seeds). The Australia New Zealand Food Standards Code (FSANZ 2010) permits some foods to be fortified with calcium, including milk alternatives (eg, soy and rice milk), milk and milk products, and some breakfast cereals.

Key sources of calcium in the diets of New Zealand children and young people aged 5–14 years are milk (34%); bread (11%); dairy products (9%); cheese (8%); and beverages (5%) (Ministry of Health 2003b). For 15–18 year olds sources are milk (23%); bread-based dishes (13%); bread (10%); non-alcoholic beverages (8%); and cheese (7%) (University of Otago and Ministry of Health 2011).

If a child does not drink milk because they do not like the taste, consumption of other milk products and non-dairy sources of calcium should be encouraged. Milk can be added to other foods, such as mashed potatoes and low-fat milk puddings. Milk powder can be also added to other foods, such as minced meat and mashed legumes. If a child does not consume milk or milk products for other reasons (ie, because they have an allergy or are vegan), calcium-fortified milk alternatives (eg, soy and rice milk) are recommended as they provide similar amounts of calcium to milk (see Part 5: Fluids). Most children who are lactose intolerant can tolerate small amounts of milk and milk products in which the lactose has been fermented (eg, hard cheese and yoghurt), especially when accompanied by other foods (Greer et al 2006).

If milk, milk products and/or calcium-fortified milk alternatives are not part of the diet, meeting calcium requirements via non-dairy sources alone is very difficult. In such situations a calcium supplement should be considered.

Decisions about use of calcium tablets should be made on an individual basis, in consultation with a doctor. Evidence shows that supplementation when calcium dietary intake is moderate to high has little or no benefit for bone health (Gibbons et al 2004; Winzenberg et al 2006).

* Do not give small, hard foods such as whole nuts and large seeds until children are at least five years old to reduce the risk of choking (see section 1.3: Summary of food groups, serving sizes and recommended intake).

4.11 Iodine

Summary

Iodine is an essential component of thyroid hormones, which play a critical role in maintaining the body's metabolic rate, as well as in normal growth and development.

Mild to moderate iodine deficiency causes goitre and impairs brain development.

Since the 1990s evidence of iodine deficiency has re-emerged in New Zealand, where more than one-quarter of children and young people are moderately iodine deficient.

Mandatory fortification, since September 2009, via iodised salt in commercially prepared bread is expected to increase daily iodine intakes among the population by 20–70 µg per day (if a person consumes two to three slices each day).

Good sources of iodine are fish, shellfish, seaweed (eg, sushi), milk, milk products and commercially prepared bread. If using salt, use iodised salt.

It is recommended that healthy pregnant and breastfeeding women take one subsidised daily iodine-only tablet of 150 µg per day. For more information, see section 12.6: Pregnancy and breastfeeding.

For more information on iodine, view the Ministry of Health webpage: www.health.govt.nz

Background

Iodine is an essential component of thyroid hormones, which play a critical role in maintaining the body's metabolic rate and in normal growth and development. There is a wide spectrum of iodine deficiency disorders affecting all life cycle groups from the fetus to adult (Hetzel 1983; WHO et al 2007). Mild to moderate iodine deficiency can cause a range of disorders in children and young people, including goitre (enlarged thyroid gland), hypothyroidism and impaired mental and physical development. Severe iodine deficiency during fetal development causes cretinism and is the leading cause of preventable mental impairment in children worldwide. Iodine deficiency can impair mental performance of schoolchildren and lower the intelligence quotient (IQ) (Mann and Truswell 2007). A recent randomised controlled trial in Dunedin children aged 10–13 years showed that correcting mild iodine deficiency improves aspects of cognitive performance (Gordon et al 2009).

The main cause of iodine deficiency is inadequate dietary intake. The iodine content of foods reflects the iodine content of the soil, which is deficient in New Zealand (and many other countries) (C Thomson 2002; Zimmerman 2009). Goitre was common in New Zealand in the early part of last century, which led to the initial iodisation of salt in 1924, with levels of iodisation increased in 1938. Goitre had virtually disappeared in New Zealand by the 1950s and iodine status in New Zealand was adequate until the 1990s (Mann and Aitken 2003) when evidence of mild deficiency in some population groups in New Zealand was identified (Skeaff et al 2002; Mann and Aitken 2003). Re-emerging iodine deficiency is due to a combination of factors including the:

- decline in the use of iodophors as sanitisers in the dairy industry
- decline in the use of iodised salt in the home, due to reduced discretionary salt use in response to recommendations to reduce salt intake and/or increased use of non-iodised salt (eg, sea salt and rock salt)
- greater reliance on convenience and manufactured foods, most of which are made with non-iodised salt.

To address the re-emergence of iodine deficiency in New Zealand and Australia, in September 2009 it became mandatory for bread manufacturers to replace salt with iodised salt in all commercially prepared bread (except organic and unleavened bread). The salt iodisation level is in the range of 25–65 mg per kg of salt, which is the same as the range currently used for iodised table salt.

Estimated iodine intakes for all children, 5–14 years of age have increased by 52 µg following the fortification of bread. Mandatory fortification is expected to increase daily iodine intakes by around 20–70 µg per day if a person eats two to three slices of bread (depending on thickness) each day (MAF 2012).

Recommended intake

The daily RDI and UL for iodine in children and young people are shown in Table 22.

Table 22: Recommended dietary intake and upper level of intake for iodine for children and young people per day

Age group (years)	RDI (µg)		UL (µg)
	Male	Female	All
2–3	90	90	200
4–8	90	90	300
9–13	120	120	600
14–18	150	150	900

Source: NHMRC (2006)

It is recommended that pregnant and breastfeeding young women take one subsidised daily iodine-only tablet of 150 µg per day. For more information, see section 2.6: Pregnancy and breastfeeding.

Current estimated levels of intake from simulated diets

Iodine intake has not been assessed in national nutrition surveys because of difficulties with quantifying discretionary salt intake, and because intakes are not a good measure of iodine status. Urinary iodine is the best measure for assessing iodine status.

Iodine intake has been estimated through simulated typical model diets in the New Zealand Total Diet Survey (NZTDS),[6] which does not include discretionary salt use. Since 1982 NZTDS data have suggested iodine intakes in all age–sex groups were decreasing, however the 2009 NZTDS estimated intakes show a levelling off (Vannoort and Thomson 2009). In 2009 estimated mean iodine intakes were: 48 µg in toddlers aged 1–3 years; 43 µg in children aged 5–6 years; 61 µg in males aged 11–14 years; and 50 µg females aged 11–14 years (Vannoort and Thomson 2009). These data suggest children may be at risk of iodine deficiency.

Nutrient status

More than 90 percent of iodine is excreted in the urine, so urinary iodine is a good indicator of recent iodine status (Zimmerman 2009). For school-aged children, a population-based median urinary iodine of lower than 50 µg/L is indicative of moderate iodine deficiency, and of lower than 20 µg/L is indicative of severe iodine deficiency (WHO et al 2007; Zimmerman 2009).

6 Now called the New Zealand Total Diet Study.

Iodine status is most reliably assessed by biochemical measures, such as levels of urinary iodine and of thyroid hormone. In the 2002 National Children's Nutrition Survey the median urinary iodine concentration (UIC) was assessed for the first time. Results showed the concentration to be 66 µg/L in children and young people aged 5–14 years, with little variation by gender and age group (Ministry of Health 2003b). This result indicates that this population is mildly iodine deficient. More than one in four (28%) children and young people aged 5–14 years had a UIC of under 50 ug/L. Results from the 2008/09 NZ Adult Nutrition Survey, which pre-dates mandatory fortification, show the median UIC to be 52 for males and 53 for females aged 15–18 years, also indicating this population is mildly iodine deficient. In this population, 46 percent of males and 45 percent of females have a UIC lower than 50 ug/L. For iodine status by age group, see Table 23.

Table 23: Iodine status for children and young people

Age group (years)	Median urinary iodine (µg/L)		Percentage of population (< 50 µg/L)	
	Male	Female	Male	Female
5–6	71	60	28	33
7–10	66	61	27	30
11–14	70	66	22	33
15-18	52	53	46	45

Source: Ministry of Health (2003b), University of Otago and Ministry of Health (2011)

In addition to urinary iodine concentrations, levels of thyroid hormones in blood can be measured to assess iodine status. Thyroid stimulating hormone, thyroglobulin, tri-iodothyronine (T_3) and thyroxine (T_4) were measured in blood samples collected during the 2002 National Children's Nutrition Survey. Results indicated that New Zealand children and young people aged 5–14 years are at risk of mild iodine deficiency (Skeaff et al 2005).

Iodine status has been assessed in other regional studies in New Zealand. A study of schoolchildren aged 8–10 years from Dunedin and Wellington found similar results to the 2002 National Children's Nutrition Survey. Specifically, median urinary iodine was 66 µg/L, with 31 percent of these children having a UIC lower than 50 µg/L and 3.6 percent having a UIC of lower than 20 µg/L (Skeaff et al 2002). This study also measured thyroid volume and found the prevalence of goitre was 11 percent in these children (Skeaff et al 2002). A regional study of 150 children 8 to 10 years done post introduction of mandatory fortification show a median urinary iodine of 113 µg/L, and 40 percent of children with UIC less than 100 µg/L and 12 percent less than 50 µg (Skeaff, Lonsdale and Cooper 2011).

Sources in the diet

Prior to fortification as stated above, the iodine content of foods reflected the iodine content of the soil, which is low in New Zealand along with many other countries. As marine animals and plants are able to concentrate iodine from seawater, seafoods such as fish, shellfish and seaweed are good sources of iodine. Milk and milk products are useful sources of iodine (due to the volume typically consumed). Eggs, meat and cereals are also useful sources of iodine. If using salt, use iodised salt.

Following fortification commercially prepared bread has gone from providing 1 percent (11th highest contributor) of dietary iodine to New Zealanders aged 5–14 years to 47 percent, making it the highest contributor (MAF 2012).

4.12 Iron

Summary

Iron needs are highest during periods of rapid growth, such as early childhood and the time of the adolescent growth spurt. Iron needs are higher in young women who are menstruating.

Prolonged iron deficiency can lead to anaemia, which is associated with impaired immune function, fatigue and some specific cognitive learning effects.

Haem iron (in animal foods) is more bioavailable than non-haem iron (in plant foods). The absorption of non-haem iron is enhanced by vitamin C and inhibited by tannins and phytates.

In New Zealand adolescent girls, especially those of Māori or Pacific ethnicity, are greatest at risk of iron-deficiency anaemia. Young children (2–4 years) may also be at risk.

Encourage the inclusion of the following foods as part of a healthy diet.

- Animal foods such as meat, poultry, fish and seafood, and eggs are sources of haem iron. The good sources are lean red meat and shellfish (eg, mussels).
- Plant foods such as breads, cereals, vegetables, legumes, nuts and fruit are good sources of non-haem iron.
- Eating foods rich in vitamin C (eg, kiwifruit, cauliflower, broccoli, citrus fruits, strawberries and tomatoes) together with good sources of non-haem iron foods enhances absorption of iron.
- Children and young people should avoid drinking tea with meals.

Vegetarians, including vegans, are able to meet their iron requirements provided their diet contains a wide range of plant foods.

Background

Iron is an essential component of haemoglobin, the component of red blood cells that transports oxygen. Iron also has an important role in cognitive development. Iron needs are greatest during periods of rapid growth, including early childhood and the time of the adolescent growth spurt. Iron needs are also high in women of childbearing age (to replace iron lost during menstruation) and during pregnancy (due to increased blood volume). The risk of iron deficiency is higher in children and young people who follow restricted diets (eg, vegetarian or vegan), young women with high menstrual losses, pregnant teens and some athletes.

Dietary iron is available in two forms: haem and non-haem. Haem iron is found in foods of animal origin, whereas non-haem iron is found in non-animal sources such as plant foods (vegetables, fruit and cereals), eggs, iron medication and iron used in fortification. Haem iron is more bioavailable than non-haem iron. It is conservatively estimated that 25 percent of haem iron is absorbed, compared with around 17 percent of non-haem iron (Institute of Medicine 2001) and the absorption of non-haem iron is also influenced by other components in the diet (see 'Sources in the diet' below).

The absorption of dietary iron is dependent on a number of factors, including iron status, individual requirements, the bioavailability of iron in food (haem or non-haem iron), and dietary enhancers and inhibitors of iron absorption. These factors make it difficult to assess iron status through dietary intake, so biochemical measures are recommended.

There are three stages of iron deficiency: low iron stores, iron deficiency and iron-deficiency anaemia. A combination of biochemical measures is recommended to assess iron status. Reference ranges for biochemical measures vary with age. There are few symptoms associated with low iron stores, but iron deficiency and iron-deficiency anaemia are associated with impaired immune function, fatigue and some specific cognitive learning effects.

Recommended intake

The daily RDI and UL for iron in children and young people are listed in Table 24.

Table 24: Recommended dietary intake and upper level of intake for iron for children and young people

Age group (years)	RDI (mg)		UL (mg)
	Male	Female	All
2–3	9	9	20
4–8	10	10	40
9–13	8	8	40
14–18	11	15	45

Source: NHMRC (2006)

Current levels of intake

Median usual daily iron intakes in children and young people are shown in Table 25. The prevalence of inadequate iron intake^ in children and young people aged 5–14 years was estimated to be 1.3 percent overall, but was higher in females aged 9–14 years (4.2%).

Females aged 15–18 years also had a high estimated prevalence of inadequate iron intake (34%). Within this group, Māori females had a 49 percent estimated prevalence and Pacific females had 40 percent (University of Otago and Ministry of Health 2011).

Table 25: Median iron intake for children and young people

Age group (years)	Median iron intake (mg)	
	Male	Female
5–6	10.0	8.4
7–10	11.9	9.7
11–14	14.1	9.9
15–18	13.5	9.1

Source: 2002 National Children's Nutrition Survey (5–14 years) (Ministry of Health 2003b) and 2008/09 NZ Adult Nutrition Survey (15–18 years) (University of Otago and Ministry of Health 2011)

Nutrient status

Based on analysis of blood samples from national nutrition surveys, it appears that the prevalence of iron-deficiency anaemia in New Zealand children and young people is relatively low (Table 26). Adolescents, particularly girls, are at greatest risk of iron-deficiency anaemia within this group (Ministry of Health 2003b; University of Otago and Ministry of Health 2011).

^ Prevalence of inadequate intake from the 2002 National Children's Nutrition Survey was recalculated using Australian and New Zealand NRVs and total response ethnicity for Pacific peoples.

Table 26: Prevalence of iron deficiency and iron-deficiency anaemia for children and young people

Age group (years)	Iron deficiency with and without anaemia (%)		Iron-deficiency with anaemia (%)	
	Male	Female	Male	Female
5–6	0.1	0.0	0.0	0.0
7–10	0.7	0.7	0.2	0.1
11–14	0.7	5.5	0.1	1.2
15–18	0.0	10.5	0.0	4.9

Source: 2002 National Children's Nutrition Survey (5–14 years) (Ministry of Health 2003b) and 2008/09 NZ Adult Nutrition Survey (15–18 years) (University of Otago and Ministry of Health 2011)

Other New Zealand studies confirm that adolescent females from non-European ethnic groups are at highest risk of iron deficiency. An Auckland study of secondary school students (mean age 16 years) found the prevalence of iron deficiency with anaemia was 8.7 percent in females and 0.7 percent in males (Schaaf et al 2000). The prevalence of iron deficiency with anaemia was higher in Māori (10.4%), Pacific (10.0%) and Asian (8.7%) females than it was in European (3.5%) females (Schaaf et al 2000).

There are no national data on iron status in children aged 2–4 years, but regional studies show that iron-deficiency anaemia is present in 4–14 percent of infants and toddlers (Heath et al 2002; Soh et al 2004; CC Grant et al 2007). These findings indicate that preschoolers may also be at risk of iron deficiency.

Sources in the diet

Haem iron is found in foods of animal origin such as meat, poultry, fish and seafood, and eggs; the good sources are lean red meat and shellfish (eg, mussels). Non-haem iron is found in plant foods such as breads and cereals, vegetables, legumes, nuts and fruit. It is also the form of iron used in iron supplements and iron fortificants. Absorption of non-haem iron can be enhanced by eating foods high in vitamin C – namely vegetables and fruit, especially citrus fruits and kiwifruit – at the same time. Vitamin C, like folate, is water soluble. It is sensitive to light, air and heat, so vegetables should be cooked and stored carefully to minimise exposure to these conditions. For example, cook vegetables lightly in a minimum of water. Ideally do not eat vegetables if they are past their best or (in the case of frozen and canned vegetables) past their 'use-by' date.

The absorption of non-haem iron is also enhanced if someone eats foods that contain it along with sources of haem iron; for example, they might eat meat and vegetables at the same meal. Absorption of non-haem iron is inhibited by tannins and polyphenols (found in tea and coffee) and by phytates and oxalates (found in wholegrain cereals, legumes, nuts* and seeds) (Schlemmer et al 2009). Although non-haem iron is less bioavailable than haem iron, it is possible for children and young people following a vegetarian, including vegan, diet to meet their iron requirements if they consume a wide range of plant foods (American Dietetic Association and Dietitians of Canada 2003) (see section 12.1: Vegetarian eating). The Australia New Zealand Food Standards Code (FSANZ 2010) permits selected foods, including breakfast cereals, breads and flour, to be voluntarily fortified with iron.

Key sources of iron in the diets of New Zealand children and young people aged 5–14 years are: breakfast cereals (18%); bread (12%); beef and veal (7%); potatoes, kūmara and taro (7%); and beverages (6%) (Ministry of Health 2003b). For 15–18 year olds, key sources are: breakfast cereals (12%); bread-based dishes (12%); bread (10%); potatoes, kūmara and taro (7%); as well as grains and pasta; and beef and veal (each 7%) (University of Otago and Ministry of Health 2011). It is unknown what proportion of iron from breakfast cereals and breads is naturally occurring and what comes from fortification.

Supplemental iron may be necessary in some situations, but should only be used when prescribed by a doctor. As with all medications, iron supplements should be stored well out of the reach of children because they are toxic to small children in high doses.

4.13 Selenium

Summary

Selenium is involved in thyroid hormone metabolism and antioxidant defence.

New Zealand soils (and thus foods) are low in selenium.

Consuming a variety of foods from the four food groups, especially fish, shellfish and a limited intake of Brazil nuts* (one to two per day, less for young children), will help ensure adequate selenium intake.

* Do not give small, hard foods such as whole nuts until children are at least five years old to reduce the risk of choking (see section 1.3: Summary of food groups, serving sizes and recommended intake).

Background

Selenium is a component of several important enzymes and selenoproteins, which have three main roles: antioxidant defence, thyroid hormone metabolism, and reactions involving oxygen. Severe selenium deficiency is associated with Keshan disease, a cardiomyopathy that can lead to heart failure and death. Although low selenium intake is associated with lower levels of selenium and selenoproteins in the blood, there is currently no evidence that mild selenium deficiency has clinically significant effects (Mann and Truswell 2007).

New Zealand soils are low in selenium and thus locally produced foods, especially plant foods, are likewise low in selenium. The low selenium intake and status of New Zealanders were first recognised in the 1950s and continue to be a concern, although Keshan disease (severe deficiency) has not been reported in New Zealand (Thomson 2004). Further work is required before any health impact of the lower intake and status in New Zealanders can be established.

Recommended intake

The daily RDI and UL for selenium in children and young people are listed in Table 27.

Table 27: Recommended dietary intake and upper level of intake for selenium for children and young people

Age group (years)	RDI (µg)		UL (µg)
	Male	Female	All
2–3	25	25	90
4–8	30	30	150
9–13	50	50	280
14–18	70	60	400

Source: NHMRC (2006)

Current levels of intake

Median usual daily selenium intakes in children and young people are listed in Table 28. Median usual daily selenium intakes are below the RDI for those aged 11–18 years.

Table 28: Median selenium intake for children and young people

Age group (years)	Median selenium intake (µg)	
	Male	Female
5–6	30	25
7–10	35	30
11–14	44	35
15–18	64	39

Source: 2002 National Children's Nutrition Survey (5–14 years) (Ministry of Health 2003b) and 2008/09 NZ Adult Nutrition Survey (15–18 years) (University of Otago and Ministry of Health 2011)

The prevalence of inadequate selenium intakes^ for 5–14 year olds was 48 percent. For 15–18 year olds, estimates of the likelihood of having an inadequate intake are also high, with an estimated likelihood of 40 percent for males and 78 percent for females (University of Otago and Ministry of Health 2011).

Nutrient status

Biochemical indicators of selenium status are more reliable than estimates of dietary intake, given the wide variation in the selenium content of soil (and thus food) and the variation in selenium bioavailability. In the 2002 National Children's Nutrition Survey, mean serum selenium concentrations in children and young people aged 5–14 years were 0.96 µmol/L (Thomson et al 2007). Serum selenium concentrations have not been analysed in the 2008/09 NZ Adult Nutrition Survey.

There is considerable regional variation in selenium status. Children and young people from the South Island have a poorer selenium status than those from the North Island (Thomson et al 2007). This difference is thought to be largely due to the type of bread eaten in the South Island which tends to come from locally grown wheat and thus to have low selenium levels. Although there are no established international reference ranges for serum selenium, selenium status for New Zealand children fall into the middle of the

^ Prevalence of inadequate intake from the 2002 National Children's Nutrition Survey was recalculated using Australian and New Zealand NRVs and total response ethnicity for Pacific peoples.

international range for serum selenium. However, children from the South Island have among the lowest levels reported internationally (Thomson et al 2007).

Sources in the diet

Good sources of selenium in New Zealand are fish, shellfish and nuts, especially Brazil nuts* (Thomson et al 2008). Because New Zealand soils are low in selenium, imported wheat, which is commonly used in New Zealand (predominantly North Island) bread-making, is higher in selenium than locally grown wheat. Meat, poultry, cereals and milk contain only moderate amounts of selenium but because these foods are commonly consumed they are key sources of selenium intake.

Brazil nuts* are an excellent source of selenium. Research has shown that an intake of just two nuts per day had the response equivalent to taking 100 ug selenium through a supplement (Thomson et al 2008). However, there is concern that a recommendation to regularly include Brazil nuts in the diet needs to be made with caution. Consumption of Brazil nuts needs to be limited to just a few nuts* per day (for adults, less for children) to avoid accumulation of selenium in the tissue. There is also concern regarding the presence and variable concentration of barium and radium found in Brazil nuts. There is uncertainty about what biological effects these elements might have on humans who consume them.

Key sources of selenium in the diets of New Zealand children and young people are: fish and seafood (22%); poultry (12%); bread (10%); grains and pasta (7%); as well as pork; and milk (each 5%) (Ministry of Health 2003b). Key sources for 15–18 year olds are: bread (14%); bread-based dishes (14%); poultry (12%); fish and seafood (7%); as well as eggs and egg dishes; and grains and pulses (6%) (University of Otago and Ministry of Health 2011). Fish is a key source of selenium in the diets of Pacific children and young people (Thomson et al 2007).

4.14 Sodium

Summary

Although sodium is an essential nutrient, requirements for it are low.

Current sodium intakes far exceed recommendations.

Salt (sodium chloride) from processed food is the main source of sodium in the diet.

High salt intake increases blood pressure, a significant risk factor in cardiovascular disease.

Decreasing salt intake in children can reduce blood pressure in childhood and could reduce the subsequent rise in blood pressure that occurs with age.

To decrease salt intake:

- choose whole or minimally processed foods instead of highly processed convenience and fast foods
- choose products with low (< 120 mg of sodium per 100 g) or medium (120–600 mg of sodium per 100 g) levels of sodium where possible
- use little or no salt in cooking and at the table (but if using salt, use iodised salt)
- limit intake of foods high in salt (sodium), such as savoury snacks and biscuits, fast food and takeaways, and processed meats and cheese.

Useful websites:

www.stroke.org.nz – 'Slash the salt' (to access this free pamphlet, click Resources then Free Resources)

www.foodsmart.govt.nz – 'Food additives and nutrients' (for access, click What's in our food? then Chemicals, nutrients, additives & toxins).

* Do not give small, hard foods such as whole nuts and large seeds until children are at least five years old to reduce the risk of choking (see section 1.3: Summary of food groups, serving sizes and recommended intake).

Background

Sodium is an essential nutrient required to maintain the volume of fluids outside cells and the number of solute particles in serum, as well as for active transport of molecules across cell membranes. However, sodium requirements are low.

In developed countries, sodium intakes greatly exceed requirements. High sodium intakes increase blood pressure, which is a major risk factor for cardiovascular disease.

There is considerable evidence that reducing sodium intake lowers diastolic and systolic blood pressure in individuals with normal or high blood pressure (Cutler et al 1997; Sacks et al 2001; He and MacGregor 2004) and decreases the risk of cardiovascular disease (Strazzullo et al 2009). In children, halving salt (sodium) intake results in an immediate decrease in both diastolic and systolic blood pressure (He and MacGregor 2006). If sustained, this decrease could lessen the subsequent rise in blood pressure that occurs with age, which in turn would reduce cardiovascular disease significantly (He and MacGregor 2006).

Recommended intake

Recommended sodium intakes for children and young people are summarised in Table 29. The range of intakes reflects the uncertainty in setting the AI. Recommended sodium intakes are expressed both as mg and mmol per day (1 mmol sodium equals 23 mg of sodium). To convert sodium to salt (sodium chloride), multiply the sodium value by 2.5. For example, 400 mg of sodium is equivalent to 1000 mg (or 1 g or one-sixth of a teaspoon) of salt.

Table 29: Adequate intake and upper level of intake for sodium for children and young people

Age group (years)	AI		UL
	Male	Female	All
2–3	200–400 mg (9–17 mmol)	200–400 mg (9–17 mmol)	1000 (43 mmol)
4–8	300–600 mg (13–26 mmol)	300–600 mg (13–26 mmol)	1400 mg (60 mmol)
9–13	400–800 mg (17–37 mmol)	400–800 mg (17–34 mmol)	2000 mg (86 mmol)
14–18	460–920 mg (20–40 mmol)	460–920 mg (20–40 mmol)	2300 mg (100 mmol)

Source: NHMRC (2006)

Current levels of intake

Sodium intake is difficult to measure because discretionary salt use (ie, salt added to food during cooking and at the table) is difficult to quantify. Furthermore, there is considerable variation in the sodium content of processed foods, even within the same category. For example, the sodium content of bread in New Zealand varies from approximately 350 mg to 650 mg per 100 g (Athar et al 2006). Approximately 90 percent of sodium is excreted in the urine, so measurement of urinary sodium is a more reliable indicator of sodium intake than dietary assessment. As sodium excretion fluctuates during the day, a 24-hour urine sample is usually required to accurately estimate sodium intake.

A comprehensive measure of sodium intake has not been done in recent national nutrition surveys because of the difficulty of quantifying discretionary salt use and the impracticality of collecting 24-hour urine samples. However, several regional studies have measured 24-hour urinary sodium to estimate sodium intake in adults (Simpson et al 1978, 1982;

Thomson and Colls 1998). Based on these studies, daily sodium intake is estimated to be approximately 150 mmol in adults (Ministry of Health and University of Auckland 2003). This intake is equivalent to 3450 mg of sodium per day, which far exceeds recommendations. There are no national data available to estimate sodium intake in children.

With regard to dietary habits, the 2002 National Children's Nutrition Survey found most children and young people aged 5–14 years 'usually' (37%) or 'sometimes' (28%) had salt added to their meals during preparation (Ministry of Health 2003b). The majority (52%) of children and young people did not add salt at the table, while the remainder added salt 'sometimes' (35%) or 'usually' (13%) (Ministry of Health 2003b). The 2008/09 NZ Adult Nutrition Survey identified that 48 percent of males and 57 percent of females aged 15–18 years 'never' or 'rarely' added salt to food after it had been cooked or prepared (University of Otago and Ministry of Health 2011).

Sources in the diet

Most dietary sodium comes from salt (sodium chloride), with small amounts coming from food additives such as sodium bicarbonate and monosodium glutamate. The vast majority of dietary salt comes from processed foods, while discretionary salt (eg, salt added during or after cooking) accounts for another 10–20 percent of intake. Foods that are high in sodium include savoury snacks (eg, chippies/chips/crisps), processed meat (eg, sausages, bacon, ham, salami, luncheon sausage), cheese, sauces (eg, tomato and soy sauce), some breakfast cereals (eg, cornflakes) and most fast foods and takeaways (Athar et al 2006). Bread contains moderate amounts of sodium but because bread is frequently consumed, it is a significant source of sodium in the diet.

Key sources of sodium in the diet of New Zealand adults are: breads and bread-based dishes (approximately 30%); processed meats (10%); sauces (7%); and breakfast cereals (6%) (Ministry of Health and University of Auckland 2003). There are no data on sources of sodium in the diets of New Zealand children and young people, but key sources of sodium are likely to be similar to those for adults.

Given the current food supply, it is difficult to reduce sodium intake to meet recommendations. Salt is added as an ingredient to most processed and pre-prepared foods for technological reasons and/or flavouring. Technological purposes include inhibiting microbial growth (eg, in processed meats) and improving quality and volume of bread (eg, strengthening the gluten in bread). However, salt is added to many processed foods at levels in excess of those required for quality and safety. The wide variation in the sodium content of breads (350–640 mg per 100 g) and breakfast cereals (2–1130 mg per 100 g) (Athar et al 2006) suggests that sodium levels could be substantially reduced without reducing product quality. See section 7.3: The wider food environment, for information on reformulation initiatives that the food industry is taking in this area.

Whole or minimally processed foods, including fresh vegetables, fruit, meat, fish and poultry, are low in sodium. Most frozen and canned vegetables are also low in sodium, unless they are canned in brine. Choosing whole or minimally processed foods instead of highly processed convenience and fast foods, or preparing meals from scratch with minimal added salt will help to reduce sodium intake. In addition, when choosing processed foods be familiar with what are low-salt foods (< 120 mg of sodium per 100 g of food), medium-salt foods (120–600 mg of sodium per 100g) and high-salt foods (> 600 mg of sodium per 100 g) (Stroke Foundation 2010).

When looking for lower-salt options in common foods, look for varieties that contain the quantities of sodium set out in Table 30.

Table 30: Lower-salt options for common foods

Food type	Preferred quantity of sodium
Bread	Less than 450 mg of sodium per 100 g
Breakfast cereals	Less than 400 mg of sodium per 100 g
Table spreads	Less than 400 mg of sodium per 100 g
Crackers	Less than 350 mg of sodium per 100 g
Source: Stroke Foundation of New Zealand (2010)	

For information on the use of herbs and spices as flavour alternatives to salt in cooking, see Part 2: Meal Patterns of New Zealand Children and Young People. In addition, reducing added salt gradually rather than rapidly may be more successful in promoting a long-term reduction in salt use.

4.15 Zinc

Summary

Zinc is important for growth and development as well as optimal immune and cognitive function.

In those aged 5–14 years, the prevalence of low zinc status is 16 percent. These results are being further investigated.

Lean meat, poultry, fish and shellfish are good bioavailable sources of zinc.

Other good sources of zinc include wholegrain breads and cereals, legumes and nuts.

Background

Zinc is required for protein synthesis and is, therefore, essential for growth and development. Zinc deficiency is associated with impaired growth, as well as poor immune and cognitive function.

Recommended intake

Table 31 sets out the daily RDI and UL for zinc in children and young people

Table 31: Recommended dietary intake and upper level of intake for zinc for children and young people

Age group (years)	RDI (mg)		UL (mg)
	Male	Female	All
2–3	3	3	7
4–8	4	4	12
9–13	6	6	25
14–18	13	7	35
Source: NHMRC (2006)			

Current levels of intake

Median daily usual zinc intakes in New Zealand children and young people are identified in Table 32. The prevalence of inadequate intake for zinc, based on the 2002 National Children's Nutrition Survey, is low. However, data on zinc status (see below) suggest some children and young people may have inadequate zinc intakes. The data collected for 15–18 year olds as part of the 2008/09 NZ Adult Nutrition Survey are considered unreliable so no conclusion regarding dietary adequacy for this group has been made (University of Otago and Ministry of Health 2011).

Table 32: Median zinc intakes for children and young people

Age group (years)	Median zinc intakes (mg)	
	Male	Female
5–6	8.7	7.2
7–10	10.0	8.4
11–14	12.0	9.1
15–18	13.5	8.7

Source: 2002 National Children's Nutrition Survey (5–14 years) (Ministry of Health 2003b) and 2008/09 NZ Adult Nutrition Survey (15–18 years) (University of Otago and Ministry of Health 2011).

Nutrient status

Serum zinc is often used as an indicator of zinc status and was measured in a subset of children from the 2002 National Children's Nutrition Survey. Mean zinc concentrations were 12 µmol/L and the prevalence of low zinc status was 16 percent (Ministry of Health 2003b). Further investigation of these results, including to establish whether low serum zinc levels in New Zealand children have any clinical implications, is ongoing.

Sources in the diet

Zinc is found in many foods, but its bioavailability is variable. Good bioavailable sources of zinc are meat, poultry and fish. Wholegrain breads and cereals, legumes and nuts are also good sources, although these foods also contain inhibitors of zinc absorption so zinc is less bioavailable.

Key sources of zinc in the diets of New Zealand children and young people aged 5–14 years are: beef and veal (12%); bread (11%); milk (9%); as well as grains and pasta; and breakfast cereals (each 6%) (Ministry of Health 2003b). Key sources for young people aged 15–18 years are bread-based dishes (14%); grains and pasta (11%); beef and veal (9%); bread (8%); and poultry (7%) (University of Otago and Ministry of Health 2011).

Part 5: Fluids

Summary

Water and low-fat milk are the best sources of fluid for children and young people.

- Offer water at meal times and provide children and young people with a reusable water bottle to take to school.
- Serve milk after or between meals.
- As very high milk intake can displace other foods in the diet, limit preschoolers to around 500 ml of milk per day.
- Standard homogenised milk (dark-blue top) is recommended for toddlers between the ages of one and two years. From two years of age, and as long as they are growing well, young children can transition from homogenised (dark-blue top) to low-fat (green or yellow top) milk.
- Toddler milk is not necessary for most toddlers in New Zealand.
- Some milk alternatives, such as soy milk, that are fortified with calcium and other micronutrients are suitable alternatives to cow's milk.
- Flavoured milks are not recommended as a main source of milk for children and young people as they are high in sugar. If they are consumed, have them only occasionally, in small serving sizes. Choose low-fat flavoured milks and for younger children dilute flavoured milks with unflavoured low-fat milk.
- Encourage children and young people to drink water and milk, and to eat fresh fruit rather than drink fruit juice. If providing fruit juice, limit intake to one glass per day and always dilute at least 50:50 with water (dilute more for young children). If consumed, fruit juice should be served with meals rather than between meals, to maintain good oral health.

Sugary drinks (including fruit drinks, fizzy/soft drinks, cordial, powdered drinks, and energy and sports drinks) are high in sugar and energy but provide few beneficial nutrients. Many are associated with dental caries and increased body weight.

- Limit intake of sugary drinks. If they are consumed, have them only occasionally (less than once a week), and offer small servings (ie, half a glass for children aged under five years, one glass for older children and young people). Consume with meals rather than between meals, to maintain good oral health.
- Encourage parents and caregivers to avoid keeping sugary drinks in the house. Parents and caregivers are important role models and, therefore, should limit their own consumption of these drinks too.
- Sports drinks are not necessary for most children and young people. Plain water is the best source of fluid replacement if exercising for less than 60–90 minutes.
- Energy drinks and energy shots contain large amounts of caffeine, a psychoactive stimulant drug, and often large amounts of sugar. They are not recommended for children and young people.

Diet drinks (drinks containing intense sweeteners) provide less or no energy compared with regular drinks, but are not recommended for children and young people because they can be acidic (causing tooth erosion) and maintain a taste for sweetness.

If consumed, diet drinks should be consumed only occasionally (less than once a week), in small quantities, and with food rather than between meals.

Coffee and tea are not recommended for children less than 13 years. If drinking tea and coffee, it is recommended young people (13–18 years) limit their intake to one to two cups per day.

Alcohol is not recommended for children and young people (see section 13.3: Alcohol).

5.1 Introduction

Water is considered an essential nutrient because it is required in amounts that exceed the body's ability to produce it. Water accounts for 50–80 percent of body weight, depending on the proportion of lean mass. It fills the spaces in and between cells and helps form the structure of large molecules such as protein (NHMRC 2006).

Water has many important functions in the body, including the digestion, absorption and transportation of nutrients and elimination of waste products. Water is also required for temperature control and fluid balance. Water losses from the lung and skin account for approximately half of water turnover, although the exact amount lost depends on environmental conditions. Fluid balance is tightly regulated as even a small degree of dehydration (eg, 2% of body weight) can impair physiological responses and performance (NHMRC 2006).

5.2 Recommended intake

Recommended fluid intakes for children and young people are summarised in Table 33. There was insufficient information to set an RDI and UL for daily fluid intake, but an AI was set. Fluid requirements from drinks range from 1.0–1.9 L per day (see Table 33). Note that fluid requirements may be higher in very active children and young people (NHMRC 2006).

Table 33: Adequate intakes for fluids for children and young people

Age group (years)	Fluids from drinks (L/day)	
	Male	Female
2–3	1.0	1.0
4–8	1.2	1.2
9–13	1.6	1.4
14–18	1.9	1.6

Source: NHMRC (2006)

High fluid intake can reduce diet quality by displacing other foods and nutrients. For example, preschoolers who drink large volumes of milk may have less room for solid foods. For this reason it is recommended that preschoolers consume no more than around 500 ml of milk per day (Ministry of Health 2008a).

5.3 Current levels of intake

Fluid intake has not been quantified in national nutrition surveys, but frequency of consumption of drinks has been assessed in several surveys. In the 2007 New Zealand Children's Food and Drinks Survey, tap water was the most commonly consumed beverage by children aged 5–16 years, followed by fruit juice, milk, full-sugar carbonated drinks, other fruit drinks (eg, powdered drinks and cordial), bottled water, diet carbonated drinks and flavoured water (National Research Bureau 2008).

Only 26 percent of 5–19 year olds drank unflavoured milk seven or more times a week. The majority of children and young people consumed sugary drinks, including fizzy or soft drinks (51%) and fruit juice and fruit drinks (73%), at least once per week (Clinical Trials Research Unit and Synovate 2010a). Diet fizzy or soft drinks were consumed at least once per week by 15 percent (Clinical Trials Research Unit and Synovate 2010a).

In general, New Zealand surveys show that younger children drink more milk than older children and young people, and the reverse is true for sugary drinks. Pacific and Māori children and young people tend to be less frequent consumers of milk and more frequent consumers of sugary drinks than children and young people from other ethnic groups (Ministry of Health 2003b, 2008g).

There are no data on how beverage consumption patterns in New Zealand children and young people have changed over time, although trends are likely to be similar to those seen in other economically developed countries, such as the United States. Data from national nutrition surveys in the United States show that consumption of sugary drinks among children and young people has increased, whereas consumption of milk has decreased (Harnack et al 1999; Nielsen and Popkin 2004). From 1977 to 2001 the proportion of energy provided by sweetened drinks has doubled from 4.8 to 8.5 percent in children and young people, due to increases in both the number of servings (from 2.0 to 2.6) and the size of servings (from 390 to 560 ml) (Nielsen and Popkin 2004). These trends in fluid intake are a concern because milk is a good source of protein, calcium and riboflavin, whereas sugary drinks are high in energy and very low in key nutrients (nutrient-poor).

5.4 Sources of fluid in the diet

Water

Plain water is an excellent source of fluid for children and young people. Water is the best fluid for meeting hydration needs (ie, quenching thirst) (Manz 2007). Water also contains no energy (kilojoules) or sugars that can damage teeth. Where possible, fluoridated water is recommended (see section 13.2: Oral health). In New Zealand, most water from the tap is safe to drink. For more information on water supplies in your area, refer to the local Public Health Unit.

Milk

Unflavoured milk

Unflavoured milk is another important source of fluid for children and young people. In addition to providing fluid, it provides key nutrients such as protein, calcium, riboflavin and vitamin B12. Most of the milk derived from animals that is available in New Zealand comes from cows, although goat's milk is also available. Reduced-fat (light-blue top) or low-fat (green or yellow top) milk is the best choice because it is lower in total and saturated fat, and usually higher in protein and calcium (Athar et al 2006). Reduced- and low-fat milk is suitable for children aged two years and over, as long as growth is occurring normally. Therefore, it is recommended that children transition from standard homogenised (dark-blue) milk to low-fat (green or yellow) milk from two years of age. The 2002 National Children's Nutrition Survey identified milk as the greatest source of saturated fat in

the diets of New Zealanders aged 5–14 years. Dark-blue milk has 4 g of saturated fat per 200 ml cup, while light-blue milk has 1.6 g and yellow and green milks have 0.1 g or less (Lesperance et al 2009). Choosing a lower-fat milk has the potential to significantly reduce saturated fat intakes in children, while maintaining intake of key nutrients.

Anecdotal reports indicate two major barriers to families/whānau changing to lower-fat milks. The first is the perception that the green and yellow milks cost more than dark-blue milk. Although this is true in some parts of New Zealand, in other parts the cost of green and dark-blue are the same or very similar. The second barrier is lack of acceptance of lower-fat milks within the family/whānau. A transitional change to light-blue milk may be acceptable to family/whānau members while still halving the amount of saturated fat consumed from milk in the household.

Milk and milk products should be pasteurised because there is a risk of contracting an infectious disease, such as campylobacteriosis or tuberculosis, from unpasteurised milk (Ministry of Health 2008a).

Children and young people who do not drink milk should be encouraged to drink milk alternatives that have been fortified with calcium and B12, such as calcium- and B12-fortified soy milk or rice milk.

Milk alternatives

Milk alternatives are beverages derived from plants such as legumes (eg, soy) and cereals (eg, rice, oats). The Australia New Zealand Food Standards Code (FSANZ 2010) permits a range of micronutrients, including calcium, riboflavin and vitamin B12, to be voluntarily added to milks derived from legumes and cereals.

Regular soy milk contains similar levels of energy, fat and protein to standard homogenised cow's milk (dark-blue top), although most of the fat in soy milk is unsaturated. Reduced-fat soy milk is also available. Rice and other cereal-based milks contain lower levels of energy and protein than cow's milk, so are not recommended as the sole milk replacement for children under five years of age. Where possible, a milk alternative fortified with calcium, riboflavin and, for vegans, vitamin B12 should be chosen.

'Toddler milk'

Toddler milk is a drink based on cow's milk with extra vitamins, minerals and other nutrient-based ingredients. It is often produced by infant formula companies and is marketed as a drink for toddlers (ie, over one year of age). Toddler milk is not necessary for most toddlers in New Zealand. Adequate nutrient intakes are achieved by eating a range of foods from the four food groups as well as a daily intake of around 500 ml of milk per day (see above). Toddler milk may be a useful short-term option for a small number of toddlers for whom there is significant concern about the variety of food in their diet. Where parents and caregivers are providing toddler milk (up to around 500ml per day) as an alternative to cow's milk, it is important that they continue offering and encouraging a range of food options as well. Picky eating is a normal stage of development for most toddlers, and for most children it is relatively short term. See information and suggestions related to the family/whānau eating environment in Part 6: The Home Environment and picky eating in Part 12.2: Picky eating in children.

In cases of serious concern about a toddler's dietary intake, especially when normal growth and weight gain are not occurring, a referral to a paediatrician and paediatric dietitian is warranted.

Flavoured milk

Although flavoured milks include the beneficial nutrients contained in milk, they tend to have large amounts of added sugar. For this reason, they are not recommended as a main source of milk for children and young people. If they are consumed, it should be only occasionally and in small serving sizes. For younger children, it is recommended that, if used, flavoured milks are diluted with unflavoured milk.

Sugary drinks

If consumed, sugary drinks should be consumed only occasionally (less than once a week), in small quantities (one glass or less) and with food rather than between meals. Sugary drinks include fruit drinks,[7] powdered drinks, cordial (eg, blackcurrant, lemon barley), carbonated or fizzy drinks (eg, lemonade, cola and orange), energy drinks and flavoured waters. Sugary drinks are high in sugar and energy (see Table 34) but are nutrient-poor. Sports drinks are also high in sugar and energy and contain electrolytes (eg, sodium and potassium). Given their relatively low cost, sugary drinks have displaced milk in the diets of many children, resulting in a lower intake of many essential nutrients (Vartanian et al 2007).

Table 34: Average sugar and energy levels in fruit juice, flavoured milk, sugary drinks and sports drinks

Type of drink	Serve	Sugar			Energy (kJ)	
		g per 100 ml	g per serve	tsp per serve*	Per 100 ml	Per serve
Fruit juice	Glass (250 ml)	10	25	6	180	400
Flavoured milk	Glass (250 ml)	10	25	6	313	783
Powdered fruit drink^	Glass (250 ml)	8	20	5	140	350
Cordial^	Glass (250 ml)	8	20	5	140	350
Fizzy drink	Can (355 ml)	11	39	10	180	640
	Bottle (600 ml)	11	66	17	180	1080
Energy drink	Can (250 ml)	10	25	6	190	480
	Bottle (600 ml)	10	60	15	190	1140
Sports drink	Bottle (750 ml)	8	60	15	140	1050
Flavoured waters	Bottle (700 ml)	3	21	5	50	350

Source: Various (supermarket visit, New Zealand Food Composition Tables, websites)

* 1 teaspoon of sugar = 4 grams (Athar et al 2006)

^ Made according to instructions on label.

Sugary drinks provide a lot of energy, particularly if the whole bottle or can is consumed (see Table 34). For example, a 600 ml bottle of fizzy or energy drink or a 750 ml bottle of sports drink contains around 15 teaspoons of sugar and provides 10 percent of the daily energy requirements for a moderately active boy aged 11 years or girl aged 13 years. It would take nearly one hour of brisk walking to burn off this amount of energy.

7 'Fruit drink' is a broad term but it must contain no less than 50 ml/L of fruit (except for passionfruit drink which must contain no less than 35 ml/L passionfruit (FSANZ 2011). In this document the term 'fruit drink' refers to a sugar-containing drink.

There is now convincing evidence that sugary drinks are associated with increased body weight and increased risk of obesity and type 2 diabetes mellitus (Malik et al 2006; Vartanian et al 2007; Gibson 2008). Furthermore, experimental studies show that reducing intakes of sugary drinks improves these health outcomes (Vartanian et al 2007). The World Cancer Research Fund also concluded that there is convincing evidence that sugary drinks are associated with weight gain and obesity, both of which are risk factors for many cancers (World Cancer Research Fund and American Institute for Cancer Research 2007). The main reason sugary drinks contribute to weight gain is thought to be that they do not induce satiety to the same extent as solid food (Wolf et al 2007). As a result, people do not reduce their intake of solid food to compensate for the extra energy (kJ) consumed as sugary drinks, which can lead to weight gain (Bellisle and Drewnowski 2007). Sugary drinks may also be consumed in higher volumes compared with water, because less fluid is absorbed from sugary drinks (Manz 2007).

Another concern about all types of sugary drinks is that they contribute to dental caries by providing a sugar substrate that is fermented by bacteria to produce acid, which in turn promotes tooth erosion. In addition, many sugary drinks are acidic, which causes tooth erosion independently of dental caries (for more information on both these issues, see section 13.2: Oral health). Many sugary drinks also contain artificial food colours (see section 13.6: Food additives) and some contain caffeine (see section 13.8: Caffeine). A kola-type drink contains around 33 mg caffeine per 355 ml can, compared with 55 mg of caffeine in 250 ml of instant coffee/tea.

Fruit juice[8]

Under most circumstances, children and young people do not need fruit juice to meet their fluid and nutrient requirements. Fruit juice is high in sugar, even if the label says it contains no added sugar (see Table 34 above). The high sugar and acid content of fruit juice contributes to dental caries and tooth erosion (Touger-Decker and van Loveren 2003; American Dietetic Association 2007). Excessive intakes of juice in young children can cause gastrointestinal symptoms such as abdominal pain, bloating, flatulence and chronic diarrhoea (American Academy of Pediatrics: Committee on Nutrition 2001). In older children and young people, excessive intakes of juice can increase energy intake and the risk of obesity (American Academy of Pediatrics: Committee on Nutrition 2001).

Children and young people should be encouraged to get their fluid from water and milk, and to eat fresh fruit because it provides dietary fibre, vitamins and minerals. If choosing juice, limit intake to no more than one diluted glass per day, equating to a maximum of 250 ml after the juice has been diluted (at least half water, more dilute for younger children). To protect teeth, juice should be consumed with meals rather than between meals (see section 13.2: Oral health).

Energy drinks and energy shots

Energy drinks and energy shots are not recommended for children or young people. Energy drinks are usually high in sugar (see Table 34 above), which contributes to dental caries and excess intake of energy (kJ). A 600 ml bottle of energy drink provides approximately 15 teaspoons of sugar. Sugar free energy drinks are available in New Zealand. All energy drinks and energy shots contain caffeine, a psychoactive stimulant drug that acts on the central nervous system. (For more information on caffeine, energy drinks and energy shots, see section 13.8: Caffeine.)

8 Fruit juice is defined as the liquid portion with or without pulp, obtained from fruit, and in the case of citrus fruit other than lime, the endocarp only of the fruit. It includes products that have been concentrated and later reconstituted with water to a concentration consistent with that of undiluted juice (FSANZ 2011).

Energy drinks should not be used for fluid replacement (to quench thirst or replace fluid after activity) because caffeine and guarana (a source of caffeine also in some energy drinks) are diuretics, which increase urine output (Meadows-Oliver and Ryan-Krause 2007; New Zealand Dietetic Association 2008). Energy drinks also tend to have too high a concentration of carbohydrate to be effective for fluid replacement during or after activity.

Sports drinks

Sports drinks are not necessary for most children and young people. These drinks contain sugar and electrolytes (eg, sodium, potassium and magnesium) and are designed for fluid replacement during endurance activities, which generally means more than 90 minutes of continuous moderate to vigorous activity. Plain water is the best source of fluid replacement for active children and most young athletes exercising for less than 90 minutes in normal climatic conditions. Electrolytes lost during activity are generally replaced by food.

Sports drinks are generally available in large containers, so contribute significant amounts of sugar and energy to the diet of children and young people who drink them. For example, a 750 ml bottle contains 15 teaspoons of sugar and would provide around 10 percent of the total energy requirements needed by a moderately active 11-year-old boy or 13-year-old girl. Like all sugary drinks, sports drinks are associated with dental caries (American Dietetic Association 2007). To be effective for fluid replacement during or after activity for young athletes exercising for 90 minutes or more, sports drinks should contain 0.5–0.7 g/L sodium and 4–8 percent of glucose or glucose-containing carbohydrates (New Zealand Dietetic Association 2008) (see section 8.9: Nutrition requirements and physical activity).

Flavoured waters

Although plain water is the best choice of fluid, flavoured waters are a better choice than other sugary drinks. Flavoured waters have less sugar and energy per 100 ml than other sugary drinks, but as they are sold in large serving sizes they still contain a lot of sugar and energy per serving (see Table 34 above). For example, one 700 ml bottle of flavoured water contains 21 grams (5 teaspoons) of sugar.

Diet drinks

Diet drinks are not recommended for children and young people. However, in recognition that New Zealanders do drink fizzy/soft drinks, a diet fizzy/soft drink would be a better choice than a sugary fizzy/soft drink because it provides less energy (kJ) and does not contribute directly to dental caries. Note that diet drinks tend to be acidic, and can contribute to tooth erosion. If consumed, diet drinks should be consumed only occasionally, in small quantities, and with food rather than between meals.

Diet drinks are sweetened with intense sweeteners so provide little or no energy (kJ) (see section 13.7: Intense sweeteners). Theoretically the use of diet drinks should assist with weight control, but there is limited evidence to support this outcome. A small number of diet drinks contain the intense sweetener cyclamate. A dietary modelling study showed that children and young people who consume these drinks in high amounts were at risk of exceeding the acceptable daily intake (ADI) for cyclamate (FSANZ 2004). However, the maximum level of cyclamate permitted in drinks has been lowered since this study was undertaken, making it less likely for consumers to exceed the ADI (see section 13.7: Intense sweeteners).

Another concern about diet drinks is that they maintain a taste for sweetness, so consumers of diet drinks may find healthy foods that are less sweet unpalatable, which could reduce diet quality (Ludwig 2009). Many diet drinks also contain artificial food colours (see section 13.6: Food additives) and some contain caffeine (see section 13.8: Caffeine). A diet kola-type drink contains around 49 mg of caffeine per 350 ml glass, compared with 55 mg of caffeine in 250 ml of instant coffee/tea.

Hot drinks

Coffee, tea and drinking chocolate contribute very few nutrients to the diet, unless made with milk. They also contain caffeine, which is a psychoactive stimulant drug that acts on the central nervous system. For more information on hot drinks and caffeine, see section 13.8: Caffeine.

Coffee and tea are not recommended for children younger than 13 years. If young people aged 13 years or older drink tea or coffee, it is recommended they limit their intake to one to two cups per day. They should avoid drinking tea at meal times, as this drink contains tannins and polyphenols, which can inhibit the absorption of nutrients, such as iron.

Part 6: The home environment and its influence on what children and young people eat

Summary

The home environment of family or whānau strongly influences the diet of children and young people. Physical, sociocultural and economic factors are all important influences.

Parental attitudes and behaviours are central to the development of children's eating habits.

To encourage healthy eating in the home environment, where appropriate provide parents and caregivers with up-to-date information and education on:

- how parents or caregivers influence their children's eating habits
- how genetic and developmental factors contribute to children's food choices and behaviour
- appropriate responses to problematic eating behaviours
- the current challenges to children and young people's health such as childhood obesity.

In addition, provide parents and caregivers with advice to encourage a healthy and positive home food environment, as follows.

Physical environment

- Provide a suitable eating environment away from distractions like television and toys.
- Buy and offer a variety of nutritious foods from all four food groups for children and young people to select from.
- Offer age-appropriate portions to children; that is, portions smaller than adult portions.
- Limit the offer of high fat, sugar and salt (HFSS) foods and drinks. Keep them for occasional use only, rather than every day.

Sociocultural environment

- Behave the way you want the children and young people to behave, such as by eating a range of the foods on offer at meal times to provide a good example.
- Create a happy and positive atmosphere at meal times and foster a 'healthy' attitude to food and eating.
- Have a regular eating routine and have meals together as a family/whānau where possible.
- Involve the children in meal preparation from an early age, expanding their role as they grow older.
- Be responsive to children's hunger and satiety cues.
- Be clear on roles and responsibilities around food and eating in the household.
- Avoid restrictive and coercive child-feeding practices.
- Parents and caregivers can act as 'gatekeepers' to social influences on children's eating, including through controlling access to media.

Economic environment

Food security is the ready availability of sufficient nutritionally adequate and safe foods as well as the ability to acquire such foods in a socially acceptable way.

Health practitioners need to become familiar with the issue of food security, what factors impact it and how it influences the families/whānau they are working with.

6.1 Introduction

Dietary preferences and patterns are influenced by a complex mix of personal, social, cultural, economic and environmental factors. Although humans have innate preferences for certain tastes – for example, those that are sweet, salty and energy-rich – they also learn through experience. Sociocultural and environmental factors are important determinants of eating patterns (Savage et al 2007).

Ultimately, parents and caregivers have the greatest influence on dietary habits in children, as children are dependent on them for food (Ventura and Birch 2008). During the first five years of life children learn when to eat, what to eat and how much to eat. This learning primarily occurs through the transmission of familial and cultural beliefs, attitudes and practices around food and eating (Savage et al 2007).

The family/whānau unit itself is, in turn, greatly influenced by the wider physical, sociocultural, economic and political environment around it. As children grow older, influences outside the family/whānau begin to affect eating habits. Young people become increasingly independent, and have more say in when, where and what they eat (Birch and Fisher 1998). They often have more money of their own and can purchase their own foods (See section 6.3: The dietary habits of young people). The influence of their peers, food marketing and the media becomes stronger (Marshall et al 2004; Savage et al 2007). Aspects of these influences are discussed in section 7.3: The wider food environment.

6.2 Physical, sociocultural and economic factors within the home environment

Family/whānau characteristics and behaviours have an important influence on food preferences and dietary patterns in children and young people (Birch and Fisher 1998). Two systematic reviews highlight the importance of the home environment in promoting healthy eating behaviours, such as regular breakfast consumption and high intakes of vegetables and fruit (Pearson et al 2009a, 2009b). Important factors related to the home environment include:

- physical factors (items that are physically present), such as healthy foods, a suitable environment for eating, and facilities for storing and cooking food
- sociocultural factors, such as parental modelling (including parental intake), family/whānau rules about eating, parental encouragement, parental attitudes to food and healthy eating, frequency of family/whānau dinners, religion and ethnicity
- economic factors, such as household income and expenses.

These factors interact with and impact heavily on each other. For example, economic factors like household income could dictate whether the family/whānau can afford to purchase a freezer for storing food. The availability of a freezer will, in turn, influence the type of food purchased (Pearson et al 2009a, 2009b). Each of these factors is described in more detail below.

Physical factors of the home environment

The presence or absence of the following items in the home environment has a strong influence on food preferences and dietary patterns in children and young people.

The type of food available

The food preferences and dietary patterns of children and young people are ultimately shaped by the foods that are available and accessible to them in the home (Birch and Fisher 1998; Savage et al 2007). The availability of healthy foods, such as vegetables, fruit, breakfast foods and low-fat milk products, is strongly linked to the development of healthy eating patterns in children (Birch and Fisher 1998; van der Horst et al 2007; Pearson et al 2009a, 2009b).

In the 2007 New Zealand Children's Food and Drinks Survey, all parents and caregivers who participated said fresh fruit and vegetables were available in their home (National Research Bureau 2008). This survey found that many less healthy foods were also commonly available in most homes. For example, potato chips and other salty snacks were found in 93 percent of homes; other foods commonly available included lollies and chocolates (93%), burgers and sausages (92%), pies and pastries (79%), and fried chicken or nuggets (67%) (National Research Bureau 2008).

Foods available in the home are likely to reflect a combination of factors, such as parental food preferences, nutrition knowledge and skills, time available for purchasing and preparing food, kitchen facilities and food price. These factors need to be taken into consideration when providing advice about the home food environment.

The size of portions

Although young children usually have an innate ability to self-regulate their energy intake (Savage et al 2007; Scaglioni et al 2008), the extent to which they use and maintain this ability is determined by environmental conditions. Offering large food portions can promote greater intake by children as young as two years of age (Savage et al 2007). Portion size[9] can be defined as the amount of food served at a single eating occasion.

9 Portion size is different to serving size, as discussed in section 1.2: Food groups and recommended serving sizes.

Portion sizes should be age-appropriate (Benton 2004), meaning that they should be smaller for children than for young people and adults. Children and young people's ability to eat appropriate amounts and self-regulate their energy intake can be enhanced by encouraging them to recognise satiety cues (ie, feelings of hunger and fullness) (Savage et al 2007; Scaglioni et al 2008) (also see Sociocultural factors of the home environment, below).

The physical eating environment

Providing an organised eating environment is another important physical factor of the home food environment (Scaglioni et al 2008). An appropriate eating environment is a place where the family/whānau can sit and eat together, in a place with a comfortable temperature, lighting and few distractions such as television and toys. The inclusion of a table and chairs encourages eating together but it is not a necessary component for some cultures who, for example, sit on the floor together to eat.

Visual and auditory distractions, particularly television, can impair people's ability to monitor their food intake by distracting them from satiety cues (JM Smith and Ditschun 2009). In the 2007 New Zealand Children's Food and Drinks Survey, over half (53%) of parents and caregivers said their child sometimes had his/her main meal in front of the television, a computer or video game player (National Research Bureau 2008). Research has shown frequent watching of television during meals is associated with increased consumption of unhealthy foods and decreased consumption of healthier foods (Benton 2004). In the Dunedin Multidisciplinary Study, television viewing in childhood and adolescence was strongly associated with obesity in young adulthood (Hancox et al 2004; Landhuis et al 2008a, 2008b).

Providing eating utensils appropriate to the age of the children and type of food being offered may also be important, although some cultures eat with their hands and do not need them.

Sociocultural factors of the home environment

Sociocultural factors present in the home environment are important determinants of children's eating patterns (Birch and Fisher 1998).

Parental modelling

Parental modelling influences food consumption in children and young people (McClain et al 2009) in that positive modelling of a healthy diet is associated with better diet patterns. Maternal consumption of milk predicts milk intake in young girls (Greer et al 2006). A New Zealand study of Auckland students aged 13–16 years found that parental modelling was positively associated with eating breakfast and healthy foods, to a statistically significant level (Moore and Harre 2007). In the 2007 New Zealand Children's Food and Drinks Survey, just over half (55%) of parents and caregivers said they tried to set a good example at home in terms of what they eat or drink all of the time (National Research Bureau 2008).

Eating together

Eating together as a family/whānau also influences intake. It provides an opportunity for parents to role-model and support healthy eating. Family/whānau meals are associated with improved dietary intake – for example, a higher intake of vegetables and fruit (Pearson et al 2009b); and higher academic performance and improved psychosocial health (Story and Neumark-Sztainer 2005). Parents' connectedness and involvement with their children are important components of healthy youth development. Family/whānau meals provide an important opportunity to communicate, learn, transmit cultural heritage and develop family/whānau rituals (Story and Neumark-Sztainer 2005). For older children and young people, family/whānau meals appear to provide a 'protective factor' in their lives. Regular family/whānau meals can help prevent risky behaviours, such as smoking, drug use, getting into fights and early sexual activity (Story and Neumark-Sztainer 2005).

Plan to have meals together as a family/whānau where possible. If evening meals together are difficult to achieve, alternatives could include breakfast, brunch or lunch on the weekend.

Eating routine

A regular household eating routine provides a structure that could help regulate appetite and coordinate attempts to eat together as a family/whānau. Provide routine by having set times for meals and snacks. Offer children and young people three meals and two to three small snacks during the day to meet their energy and nutrient requirements for growth. If they don't eat much at one meal, maintain the routine as their hunger should adjust to it in time.

Placing a limit around eating time, especially if picky eating is a problem, can also be useful. If the food has not been eaten, remove the plate without comment and do not offer anything else until the next meal or snack time.

Parenting style

The parenting style of key caregivers is another important influence on dietary intake. Many parenting practices related to children and eating have evolved from parental perception of environmental threats to their children's wellbeing and often pass from generation to generation. Some 'traditional' practices developed in a time of food scarcity (Savage et al 2007), whereas food for most New Zealanders is now relatively plentiful and current threats to wellbeing involve the abundance of energy-rich, nutrient-poor foods and the increasing risk of obesity. However, some parents and caregivers still use 'clear your plate' messages in relation to their own and their children's eating.

Putting pressure on children to eat healthy foods and to eat more in general can be counterproductive. Research has linked pressure to eat a certain food with a decreased preference or liking for that food (Savage et al 2007; Scaglioni et al 2008). Pressure to eat more food or 'clear your plate' may prevent children from learning to regulate their own intake (Benton 2004). It is important to let children (and encourage them to) identify their own physical feelings of hunger and fullness and to allow them to use those signals as a guide for if and how much to eat during meal and snack times (Satter 2011). Exerting excessive control over what and how much children eat may contribute to overweight (Scaglioni et al 2008).

In relation to parenting style, research has shown that neither strongly restrictive nor permissive approaches are successful in encouraging good eating habits (Benton 2004; Savage et al 2007). With a restrictive parenting style, the parent tends to be less responsive to the needs of the child (eg, their appetite) and sets strong rules and expectations. A parent with a permissive parenting style, on the other hand, is highly responsive to the needs of the child but has few consistent or firm limits, rules and expectations (Bowne 2009). Some specific research has linked both parenting styles to an increased risk of children being overweight (Rhee et al 2006).

Children and young people need some guidance and control but excessive control is not helpful. Parents and caregivers need to find a balance between providing guidance and having expectations of children, on the one hand, and being responsive to their needs, on the other. For example, parents and caregivers exhibit guidance and control by providing children with a range of foods to choose from that is, for the most part, of low to moderate energy density and of high nutrient density. At the same time, by allowing the children to choose what and how much of the food to have, parents and caregivers are being responsive to the needs of their children. Such a balance has been found to promote good nutrition and growth (Savage et al 2007). An understanding and use of the division of roles and responsibilities between caregivers and children or young people can help achieve this balance (see 'Roles and responsibilities' below).

Having a 'healthy attitude' to food and eating is very important for parents and caregivers. A healthy attitude could be described as recognising food and eating as one of life's many pleasures (Satter 2011). Although the body needs the right type of food most of the time, there are no forbidden or 'bad' foods. Making a point of offering high fat, sugar and/or salt (HFSS) foods on occasion and enjoying them is an important part of a healthy food and eating attitude (Satter 2011). Heavy restriction of HFSS foods has been linked to an increasing preference for them among children and young people (Savage et al 2007).

Roles and responsibilities

Parents and caregivers are also responsible for ensuring that meal times are enjoyable for the family/whānau. Having clear roles and responsibilities within the family/whānau around food and eating can help to create a positive atmosphere. Parents and caregivers are responsible for what food is offered at meals and snacks and the time of day of these events (what and when), while the children are responsible for what and how much of this food they eat (Satter 2011). This approach requires parents and caregivers to trust children's ability to know what they need. This knowledge, along with positive parental modelling and a focus on internal cues of hunger and fullness, will contribute to enjoyable meal times. For information on picky eating see section 12.2: Picky eating in children.

Involving children and young people in preparing food

Involving younger family/whānau members in the preparation of food has been linked to improvements in the nutritional quality of their dietary intake (Larson et al 2006). Involve the children in meal preparation from an early age. As they get older, consider giving them responsibility for preparing a meal once a week.

Other research has shown that nearly all children and young people who are involved in growing vegetables at home or school, also eat them (Clinical Trials Research Unit and Synovate 2010a), and also increase their consumption of vegetables and fruit in general (Moss et al 2011).

Economic factors in the home environment

Household economic factors impact significantly on the diet of the whole family/whānau.

Household income and expenditure

Household income and expenditure directly affect the amount of money available to purchase food. The 2009/10 Household Economic Survey shows that the average New Zealand household spends $177.70 on food each week, representing 18 percent of its total net household expenditure (Statistics New Zealand 2011a).

For those on incomes below the average, the impact of food costs is greater. An analysis of data from the 2003/04 Household Economic Survey showed that although low-income households spend less money on food than high-income households, they do spend a greater proportion of their income on food (Ministry of Health 2006d). As a result, low-income families/whānau are more sensitive to changes in food prices and often cite food price as a barrier to healthy eating.

The cost of food required to meet the nutritional needs of most healthy individuals or families/whānau is measured annually in the Food Cost Survey. In 2010 food costs did not vary across the five main urban centres of Auckland, Hamilton, Wellington, Christchurch and Dunedin (Department of Human Nutrition 2010). Estimated weekly food costs for three types of diet are shown in Table 35.

Table 35: Estimated weekly family food costs for children and young people, 2010

Age	Estimated cost of type of diet per child/young person ($)		
	Basic diet^	Moderate diet^	Liberal diet^
4 years	32–34	42–44	50–52
5 years	34–36	44–47	53–56
10 years	51–54	67–70	80–84
Adolescent girl	65–68	85–88	102–106
Adolescent boy	78–81	102–106	122–127

Source: Department of Human Nutrition (2010)
^ For a definition of each diet type, see the website of the yearly Food Cost Survey, http://nutrition.otago.ac.nz/consultancy/foodcostsurvey

This information was used to calculate whether New Zealanders on low incomes, via either the minimum wage or income support benefit entitlements, could afford in theory to eat a basic diet (Robinson 2010). The findings suggest that many families/whānau on low incomes could experience 'food stress' – that is, they would need to spend 25–30 percent or more of their income on food in order to eat a basic diet.

Aspects of food price are also discussed in section 7.3: The wider food environment.

Household food security and insecurity

Factors such as income, number of people living in the household and location of the household also contribute to household food security. Food security is defined as the ready availability of sufficient, nutritionally adequate and safe foods, as well as the ability to acquire such foods in a socially acceptable way (Parnell et al 2001). In contrast, food insecurity occurs when the availability of nutritionally adequate and safe foods, or the ability to acquire such foods, is limited or uncertain.

Food insecurity is an issue to varying degrees for 20–30 percent of New Zealand households with 5–18 year olds. For more information see *NZ Food NZ Children: Key results of the 2002 National Children's Nutrition Survey* (Ministry of Health 2003b) and *A Focus on Nutrition: Key findings of the 2008/09 New Zealand Adult Nutrition Survey.* (University of Otago and Ministry of Health 2011).

In most developed countries the diets of people who are food insecure provide enough energy to meet or exceed requirements, but do not provide enough nutrients to optimise health and prevent chronic disease (Tanumihardjo et al 2007). Therefore, food insecurity is associated with both under-nutrition and over-nutrition (ie, obesity). Food insecurity during childhood has many adverse effects on physical, mental and emotional health, including problems with growth, iron-deficiency anaemia, poor academic performance and psychosocial problems (American Dietetic Association 2003; Kursmark and Weitzman 2009).

Health practitioners need to be familiar with the issue of food insecurity, what factors impact it and how it influences the families/whānau they are working with. Food security needs to be considered when education and advising families/whānau on diet and lifestyle change (American Dietetic Association 2010).

For further discussion of food security see: Part 7: The wider environment; Part 9: Considerations for tamariki and rangatahi Māori and their Whānau; Part 10: Considerations for Pacific children, young people and their families; and Part 11: Considerations for Asian and other populations.

6.3 The dietary habits of young people

Summary

Age is a strong predictor of dietary behaviours for children and young people.

With increasing independence, young people become less focused on family/whānau life and more on the wider world. Peers and the media often exert more influence in relation to diet and lifestyle.

Parents and caregivers can help young people develop attitudes and skills that may encourage continued healthier eating as they become more independent, by:

- acting in the ways discussed in section 6.2: Physical, sociocultural and economic factors within the home environment, such as being a positive parental role model and providing healthy food for the household
- encouraging young people to help with preparing meals, growing food (if this is possible), designing menus and food shopping; and providing information about food safety and budgeting
- regulating advertisement viewing and enabling media literacy skills among themselves and family/whānau members.

According to the 2008/09 NZ Adult Nutrition Survey, 'bread-based dishes', including sandwiches, burgers and pizzas, significantly contribute to the nutrient intakes of 15–18 year olds.

- Encourage healthy, tasty takeaway choices over high fat, sugar and salt ones. For examples, see the summary for Part 2: Meal Patterns of New Zealand Children and Young People.
- Encourage the food industry to contribute positively by reformulating the recipes for takeaway foods and introducing new healthy and tasty menu alternatives.

Age is a strong predictor of dietary behaviours for children and young people. The trends associated with increasing age and what and how this group eat and drink include the following (Clinical Trials Research Unit and Synovate 2010b).

Diet-related behaviours that increase with age include:

- consuming high fat, sugar and/or salty foods such as takeaways
- consuming high-sugar fizzy/soft drinks
- having meals in front of the television
- consuming alcohol.

Diet-related behaviours that decrease with age include:

- consuming water and milk
- having breakfast
- meeting the recommendation to have at least two or more servings of fruit a day
- consuming sandwiches and filled rolls
- eating the evening meal with other members of the household.

The lifestyles of many young people become less healthy as they age. Dynamics within the family/whānau change and influences outside the family/whānau begin to affect eating habits more. Young people become increasingly independent, and have more say in when, where and what they eat (Birch and Fisher 1998). They have more money of their own and can purchase their own foods. The influence of their peers, food marketing and the media becomes stronger (Marshall et al 2004; Savage et al 2007) as young people become focused less on family/whānau life and more on the wider world. Some of the dietary changes

listed above occur for practical reasons. Young people may be involved in more activities away from the home – for example, playing sport, going out with friends, longer school days, after-school activities and part-time jobs – and they are old enough to get to them independently. Such activities mean they are more likely to be away from home at meal times and so need to access food from other sources.

Children can also become more concerned about their own body size and shape as they grow older, which can influence eating patterns. For more information, see section 13.1: Body image, disordered eating and eating disorders.

Preparing young people for independent living in practical ways has been associated with better dietary habits after leaving home (Satter 2011). Encourage children and young people to help with preparing meals, growing food (if this is possible), designing menus and food shopping; and provide information about food safety and budgeting. If parents and caregivers do not consider their own skills are strong enough in these areas, perhaps another family/whānau member or friend could help.

Within the household there are a number of ways parents and caregivers can help children and young people develop attitudes and skills that may encourage them to continue with healthier eating as they become more independent. Role modelling of healthy attitudes and practices related to food and eating is important. This can include having a clear division of roles and responsibilities around food, and encouraging children and young people to identify their own feelings of physical hunger and satiety.

In regard to powerful food marketing including advertising, parents could limit exposure to it by having the television off during peak advertising periods or muting the sound during advertisement breaks. Developing skills like media literacy can also be useful for families/whānau. Parents have been identified as important enablers of media literacy for children and young people (Buckingham et al 2004). A useful part of their enabling role could be for parents or caregivers to watch television or other forms of media with children and young people and initiate discussion about what messages are being sent and to whom. Aspects of these influences are also discussed in section 7.3: The wider food environment.

The 2008/09 NZ Adult Nutrition Survey found that the food group of 'bread-based dishes' contributes significantly to the nutrient intakes of 15–18 year olds. It features as one of the top five key food sources of a number of macro- and micronutrients. This survey-defined 'food group' includes: sandwiches, filled rolls, hamburgers, hotdogs, pizza, nachos, doner kebabs, wontons, spring rolls and stuffings. A breakdown of the contribution of these foods to the overall intake of this 'food group' for the total population surveyed in the 2008/09 NZ Adult Nutrition Survey (15–75+ years) shows that about half of the 'bread-based dishes' consumed (49%) were sandwiches and filled rolls, a quarter (25%) were burgers and hotdogs and 15 percent comprised pizza (University of Otago and Ministry of Health 2011). No specific analysis for 15–18 year olds has been done, but given other research that shows the popularity of takeaway-style food with young people, it is possible that burgers, pizza and other takeaways contribute significantly to nutrient intakes in this age group.

This behaviour provides an opportunity for widespread dietary improvement by recommending healthy, tasty takeaway choices over high fat, sugar and salt ones. Examples are provided in the summary of Part 2: Meal patterns of New Zealand children and young people. There is also potential for the food industry to contribute positively by reformulating the recipes for takeaway foods and introducing new healthy and tasty menu alternatives, as some are already doing.

Useful resources and tools

Parenting support

Further advice and support in regard to parenting issues are available from evidence-based parenting programmes such as 'Triple P' and 'Incredible Years' (Turner et al 1994; Promising Practices Network 2006; MR Sanders and Morawska 2006). Parents, family and whānau can access these programmes via the Ministry of Education Special Education Services as well as through Child and Adolescent Mental Health Services (CAMHS, based in district health boards). Further information (including background, resources and details on courses) on Triple P and Incredible Years is available from the following websites:

- www.incredibleyears.com
- www.werrycentre.org.nz/509/Incredible_Years_Programmes
- www.education.auckland.ac.nz/uoa/triple-p#
- www33.triplep.net

Useful reports and websites

The following three papers are detailed literature reviews that also include practical suggestions for parents. These documents can be found on the Agencies for Nutrition Action website (www.ana.org.nz).

- Scragg R, Quigley R, Taylor R. 2006. Does watching TV contribute to increased body weight and obesity in children? A report prepared by the Scientific Committee of the Agencies for Nutrition Action.
- Quigley R, Taylor R, Scragg R. 2007. Is consuming breakfast important for academic performance, maintaining a healthy body weight, and improving nutrient intake and lifestyle habits in children? A report prepared by the Scientific Committee of the Agencies for Nutrition Action.
- Brown R, Scragg R, Quigley R. 2008. Does the family environment contribute to food habits or behaviours and physical activity in children? A report prepared by the Scientific Committee of the Agencies for Nutrition Action.

Websites for teachers, parents, children and young people on cooking in the home are:

- www.teachkidstocook.com
- www.itsmyturntocooktonight.com

Part 7: The wider environment and its influence on what families and individuals eat

Summary

Income, education, occupation, housing, culture, ethnicity, social cohesion, and the availability and quality of population-based services and facilities are considered the most important determinants of health.

These determinants influence the nutrition (and food security) of households via their influence on dietary choices and eating patterns.

- Health practitioners need to consider the influence of the wider environment on the food and lifestyle choices of the people they are working with or advising on diet.

The determinants of food security are food supply and access to food. Food supply and access are significantly affected by the number, type, location and accessibility of food outlets.

The profile of food outlets in New Zealand is changing with an increase in restaurants and 'takeaway' shops and a decrease in fresh produce outlets.

Meals made commercially tend to be high in energy, fat, salt and refined carbohydrates, and low in dietary fibre and micronutrients.

Price is an important determinant of food choice.

In some food categories (eg, meat, cheese and spreads) healthy choices are more expensive, whereas in other categories (eg, canned fish) they are not.

Large portion sizes are linked to higher energy intake and weight gain.

Food marketing influences food choices among children and young people and tends to promote unhealthy foods.

School and early childhood education (ECE) food environments are important settings for promoting healthy eating.

- Encourage schools and ECE settings to use available supports and resources to improve their food and physical activity environment. (See the Ministry of Health's website (www.health.govt.nz) for information on the Food and Beverage Classification System (now called Fuelled 4 life) and the Heart Foundation's website www.heartfoundation.org.nz for its Healthy Heart Awards.)

7.1 Introduction

Although the family/whānau plays a significant role in what children and young people eat, the wider physical, sociocultural and economic environment to which each household belongs plays an even bigger role.

Sociocultural, economic and environmental conditions impact significantly on what families/whānau and individuals eat (Ministry of Health 2002a). Families and whānau often have little control over their wider environment.

7.2 The broader determinants of health and their influence on family/whānau dietary choices

Social, cultural and economic factors such as income, education, occupation, housing, culture, ethnicity, social cohesion and population-based services and facilities are known as the most important determinants of good health (National Advisory Committee on Health and Disability 1998). These factors influence dietary choices both directly and indirectly. Income affects the type, quantity and quality of food that is purchased for a household. It also influences the cooking and storage facilities available in a household, which in turn influence food choice. Although employment is generally considered positive as it increases the household income, low-income working mothers have reported it means they have less time to shop and cook food so may opt for more 'ready-made' meals for their families/whānau (Dubowitz et al 2007).

Many of the key determinants of health are unevenly distributed within society according to socioeconomic status. This uneven distribution is considered the primary cause of differences in health status within New Zealand (Ministry of Health 2002a). International (Darmon and Drewnowski 2008) and New Zealand (Metcalf et al 2006) research has shown that, in general, diets higher in nutrient quality are consumed by more affluent and educated sections of the population.

Conversely, lower-quality diets tend to be consumed by those who are more socioeconomically deprived. The 2002 National Children's Nutrition Survey provided evidence that socioeconomic deprivation, diet and eating patterns are linked. For example, females in NZDep01 Group 1 (least socioeconomically deprived) had a lower proportion of energy from total fat than those from Groups 4 and 5 (most socioeconomically deprived). More participants from the most socioeconomically deprived group reported they added fat to cooked vegetables at least weekly, compared with those from the less deprived groups (Ministry of Health 2003b).

Food security

Food security is a determinant of health that is unequally distributed. Research from the three recent national nutrition surveys (Parnell et al 2001; Ministry of Health 2003b; University of Otago and Ministry of Health 2011) found that food insecurity was more common for socioeconomically deprived households and for Māori and Pacific peoples.

In New Zealand, between 1997 and 2008/09 food security worsened. The proportion of households 'fully/almost food secure' category fell, while the proportion of households in the 'moderately food secure' and 'low food security' categories rose.

For information on food security see *NZ Food NZ Children: Key results of the 2002 National Children's Nutrition Survey* (Ministry of Health 2003b) and *A Focus on Nutrition: Key findings of the 2008/09 New Zealand Adult Nutrition Survey* (University of Otago and Ministry of Health 2011).

7.3 The wider food environment

In the last 20 to 30 years, there have been widespread changes in the food environment in New Zealand, including where we obtain food, the type of foods available, and factors that influence how we purchase and consume foods (Holsten 2009). The current environment is considered to promote obesity because of the many ways it promotes over-consumption of less healthy foods and limits opportunities for physical activity (Egger and Swinburn 1997; Swinburn et al 1999). The current food environment is characterised by a growing range of readily available, relatively inexpensive, highly palatable foods and drinks that are high in energy (energy-dense) and low in beneficial nutrients (nutrient-poor). Many of these foods and drinks are available in large portion sizes and are strongly promoted via a range of marketing techniques, including advertising, sponsorship and sales promotions.

This section gives a brief overview of some aspects of the wider food environment that influence what people eat.

Food supply, access and availability

The food outlet environment

Food supply, access and availability are largely determined by the number, type, location and accessibility of food outlets (Glanz 2009). Food outlets include supermarkets, other grocery stores, cafes, restaurants, and takeaway and fast food outlets. New Zealanders buy the majority (up to 70%) of their food at the supermarket (Statistics New Zealand 2008b).

Access to food outlets in New Zealand, both those selling healthy and those selling less healthy foods, is socially patterned (Pearce et al 2007b). Access to supermarkets, other shops selling healthy food and fast food outlets is generally better in more socioeconomically deprived neighbourhoods. Possible explanations for this trend are that consumer demand is greater in more socioeconomically deprived suburbs and/or that population density is associated with neighbourhood deprivation. The draw of lower rent and land prices in more deprived suburbs could also be a factor. Pearce et al (2007b) make the point that, in many urban areas, suburbs rated higher and lower on the socioeconomic deprivation scale are located near each other. As a result, having food outlets in more deprived areas does not necessarily preclude access for highly mobile and affluent people from nearby suburbs. Resistance to the impacts (including aesthetics) of commercial food outlets being located in less deprived suburbs may also have some influence on their location (Pearce et al 2007b).

The recent growth of farmers' markets, where food producers sell directly to consumers, provides an opportunity to purchase lower-priced produce. However, as for any food outlet, the farmers' market option is not always practical for those without access to a car. In New Zealand, approximately 10 percent of households do not have access to a car (Statistics New Zealand 2007f), a situation associated with higher socioeconomic deprivation (Pearce et al 2007a). Grocery shopping for a family/whānau group without the use of a car is difficult and can become a barrier to obtaining more affordable healthy food.

The food outlet environment and patterns of food spending

The number and type of food outlets found in New Zealand appear to be changing. An analysis of data from the Retail Trade Survey showed that there were nearly 20,000 food outlets in New Zealand in 2005, 18 percent more than in 2000 (Ministry of Health 2006d). While the number of retail outlets selling vegetables, fruit, fresh meat, fish and poultry declined during this period, the number of outlets providing meals away from home increased substantially (Ministry of Health 2006d). For example, the number of pizza takeaway outlets increased by 57 percent.

In 2006/07 the average New Zealand household spent 24 percent of its weekly food budget on meals away from home (eg, restaurant meals, fish and chips, meat pies, pizzas, burgers and ethnic food) (Statistics New Zealand 2007b). In 1997/98 and 2000/01 this figure was

23 percent. Meals away from home are typically high in energy, refined carbohydrates, fats and/or salt and relatively low in beneficial nutrients such as fibre, vitamins and minerals (Athar et al 2006). Therefore meals away from home are associated with lower micronutrient intake, higher energy intake, weight gain and obesity (Popkin et al 2005).

Food price

Price is an important determinant of food choice. In a New Zealand study investigating options for improving food security among low-income, Māori and Pacific families, participants reported that high food prices were a major determinant of their food purchases (Bowers et al 2009). A recent randomised controlled trial involving New Zealand supermarkets found that price discounts on healthy foods significantly increased purchases of those foods (Ni Mhurchu et al 2010).

International trends show that global food prices are increasing. From 2006 to 2009 food price increased by 26 percent (Lock et al 2009). Reasons for rising food prices are thought to include changing diets in emerging markets, changing agricultural trade, rising costs of fuel, climate change and speculative investment in agricultural markets (Lock et al 2009).

Overall figures on food price increases disguise differential increases across different types of foods, with some foods becoming more affordable relative to others. In New Zealand, the price of 'meat and poultry' and 'breads and cereals' increased by more than the average increase for food prices as a whole, while the price of 'soft drinks, waters and juices' and 'restaurant meals' increased by less than the average (Statistics New Zealand 2009b).

A New Zealand study found that although healthier choices within certain food categories (eg, canned fish) were not more expensive than less healthy choices, healthy choices within other categories (eg, meat and poultry, cheese and spreads) were more expensive (Ni Mhurchu and Ogra 2007). A New Zealand pilot study compared prices of high-saturated fat and lower-saturated fat options for spreads, dairy products, biscuits, crackers and chocolate sold in two supermarkets. The study found that foods with lower-saturated fat equivalents (< 20% saturated fat) were between 8 and 109 percent more expensive than the high-saturated fat foods (> 20% saturated fat) (Wilson and Mansoor 2005).

For more information on the impact of food price on households, see section 6.2: Physical, sociocultural and economic factors within the home environment.

Portion size

Food portion sizes are one of the environmental factors that contribute to obesity (Swinburn et al 1999). Portion sizes are positively associated with body mass index (BMI) and body weight in children (McConahy et al 2002) and adults (Ledikwe et al 2006). Studies show that if children or adults are served larger portions they tend to consume more food or drink, resulting in increased energy intake (Kral and Rolls 2004; Fisher and Kral 2008; Steenhuis and Vermeer 2009).

'Portion distortion' and 'value for money' are two main reasons why people purchase and consume larger portion sizes (Steenhuis and Vermeer 2009). 'Portion distortion' is the acceptance of increased portion sizes as normal. Although there are no data on trends in portion sizes in New Zealand, data from the United States show that portion sizes for some foods and drinks have increased since the late 1970s, with particularly large increases in portion sizes for fizzy/soft drinks and fast foods (French et al 2003; Nielsen and Popkin 2003, 2004; Young and Nestle 2007; Fisher and Kral 2008).

Larger portion sizes also often have a lower price per unit, so appear to be better 'value for money'. For example, at fast food outlets consumers can substantially increase the size of the portion or meal for relatively little extra cost (Close and Schoeller 2006). At supermarkets and convenience stores, foods and drinks in larger package sizes or multi-packs are often cheaper per unit, so are perceived as better 'value for money'.

Portion sizes are generally determined by the person who serves the food or the manufacturer who determines the package size, so purchasing individuals may have little control over portion sizes. People often perceive a single package size to be the appropriate amount for a single serving, but the package may actually contain multiple servings (Geier et al 2006).

Making families/whānau aware of the importance of portion sizes when serving meals is important, as is information about choosing the portion size to eat or drink from bought food rather than considering the whole package size as a single serve.

Food marketing

Marketing is a common tool used by food producers/manufacturers to increase sales of their products. Marketing traditionally focuses on four key components of the product: the product itself (eg, its benefits to the purchasers); the price of the product; placement (ie, the product's distribution channel); and promotion of the product (eg, advertising).

Sales promotions are another common form of food marketing for unhealthy foods and drinks (B Allen 2007; Pollock et al 2009). Sales promotions can include price reductions, loyalty card discounts and/or points, coupon discounts, multi-buys (eg, three for the price of two), quantity deals (eg, 25% extra free) and competitions (Hawkes 2009). Sales promotions are highly effective, increasing sales volume by an average of 200 percent (Competition Commission 2000) and they are likely to increase consumption of some foods (Hawkes 2009).

Advertising of products is a powerful tool which can influence consumer buying decisions. In New Zealand, foods advertised on television during children's viewing times are predominantly unhealthy foods (Hammond et al 1999; Wilson et al 1999, 2006a, 2006b). Similarly outdoor food advertisements close to schools are predominantly for unhealthy foods (Maher et al 2005). An analysis of advertising expenditure in New Zealand provides further evidence that non-essential foods (eg, chocolate, confectionery and fizzy/soft drinks) are much more likely to be promoted than core foods (eg, vegetables and fruit, bread, meat, fish and poultry) (Ministry of Health 2006d). A related finding is that New Zealand children and young people who watch two or more hours of television each day are more likely to consume commonly advertised foods, such as fizzy/soft drinks, salty snacks and fast foods (Utter et al 2006a).

New Zealand currently has a self-regulatory system related to advertising standards which is administered by the Advertising Standards Authority. For more information on the Code for Advertising of Food and the recently developed Children's Code for Advertising Food 2010 (Advertising Standards Authority 2010) see:

- www.asa.co.nz/code_food.php
- www.asa.co.nz/code_children_food.php

Encouraging media literacy among families/whānau could be helpful in building their discernment around food-related advertising and promotion (Hindin et al 2004).

Food labelling

Front-of-pack nutrition labels have the potential to support consumers in choosing healthier foods and drinks and so could be a useful tool in helping people improve their diets (Ni Mhurchu and Gorton 2007). Food standards, including labelling in New Zealand, are controlled by the mandatory Australia New Zealand Food Standards Code (FSANZ 2010). Nutrition information about the product is presented in the Nutrition Information Panel. These food labels present technical information giving the amount of macro- and micronutrients in the food per serving and per 100 grams. In general it seems consumer understanding of this information is poor which limits the value of nutrition labels as a tool for making healthy choices (Ni Mhurchu and Gorton 2007). Signal et al (2007) found Māori, Pacific and low-income New Zealanders rarely use nutrition labels to inform

their food purchasing. Lack of time to read labels, lack of understanding and the relative absence of simple nutrition labels on lower-cost foods they purchase were some reasons given. Food labelling law and policy in Australia and New Zealand are currently under review (Food Labelling Law & Policy Review Committee 2011).

Food industry reformulation initiatives

Health-focused reformulation of recipes used in food manufacturing, if applied to high-volume, low-cost foods, has the potential to generate substantial health gains for New Zealand. Sections of the New Zealand food industry have been making progress in sodium reduction in manufactured foods for some years (Gorton et al 2010). More recently, in collaboration with the Heart Foundation, some major bread manufacturers have reduced the salt in white bread by up to 18 percent, resulting in the removal of 150 tonnes of salt from the food supply annually (Heart Foundation 2011).

Following on from this work has been the establishment of HeartSAFE, a voluntary collaboration between the food sector, industry bodies and government, facilitated by the Heart Foundation. This industry-led initiative encourages collaborators to share their knowledge and experience with each other and aims for simultaneous stepwise salt reduction across food categories. To date, best practice guidelines have been developed for salt reduction in breakfast cereals and processed meats (Heart Foundation 2011). These types of initiatives have potential benefits for both consumers and the food industry. They use a voluntary and self-regulatory approach which is favoured by the food industry (Gorton et al 2010) as well as providing an avenue for industry to work with the health sector.

School and early childhood education food environments

School and early childhood education (ECE) environments have long been recognised as important settings for promoting healthy eating. The nutrition environment in New Zealand schools has been the subject of several research studies. The majority of studies found most foods sold in school tuckshops or through fundraising activities were high in fat, sugar and/or salt (MA Carter and Swinburn 2004; Richards et al 2005). There is also evidence that the physical environment surrounding schools promotes obesity. For example, most outdoor food advertisements and foods available in the vicinity of 10 schools in Wellington were inconsistent with the Ministry of Health's Food and Nutrition Guidelines for Healthy Adolescents (Maher et al 2005).

The National Administration Guidelines (NAGs) set out principles of conduct or administration for schools. As part of the NAGs, the Boards of Trustees are required to promote healthy food and nutrition for all students (Ministry of Education 2010). Similarly ECE settings are required to provide food that meets the nutritional needs of the children attending.

The Food and Beverage Classification System (FBCS) was developed in 2007 by the Ministry of Health to support schools and ECE services in providing healthy food and beverages for students and attendees. The FBCS is now called Fuelled 4 Life. More information on it is available at the Ministry of Health's website: www.health.govt.nz

The Ministry of Health funds the Heart Foundation to administer the Healthy Heart Awards for both schools and ECE settings. The school award supports primary and secondary schools to develop environments that promote healthy nutrition and lifestyles for the whole school community. The programme provides resources, guidance and support to develop a heart-healthy environment and assist in identifying and addressing a variety of nutritional needs, resulting in a whole-school approach to healthy eating. The award for ECE settings encourages them to promote healthy eating and active movement to the under fives and their families/whānau. The programme provides ECE staff with information on nutrition and active movement, planning tools and curriculum guides, with the aim of assisting with the implementation of healthier food choices and active movement. For more information, visit the following webpage: www.heartfoundation.org.nz/programmes-resources/schools-and-eces

Part 8: Physical activity

Summary

Along with good nutrition, physical activity is important for maintaining a healthy lifestyle.

Physical activity is not just sport; it also includes active recreation, incidental activities, transportation and physical work.

Regular physical activity in children and young people promotes health and wellbeing in many ways, including through:

- helping to build healthy bones, muscles and joints
- promoting mental wellbeing
- assisting weight management
- developing a healthy cardiovascular system
- developing coordination and movement control.

Establishing good physical activity habits during childhood and maintaining these during adolescence have many long-term health benefits and reduce the risk of chronic disease, including depression.

Sedentary behaviours, such as watching television and playing computer games, are associated with adverse health outcomes.

- Children and young people should:
- do at least 60 minutes of moderate to vigorous physical activity every day
- spend less than two hours a day (out of school time) in front of television, computers and gaming consoles
- be active in as many ways as possible, for example through play, cultural activities, dance, sport and recreation, jobs and going from place to place
- be active with friends and family/whānau, at home, at school and in their community.

Physical activity declines during adolescence so this is a key time to promote continued physical activity.

To increase levels of physical activity, promote activities that are fun and appropriate for different ages and ethnic groups.

Culture is an effective vehicle for describing and encouraging physical activity.

Physical activities can be split into three types: aerobic; resistance (strengthening of muscles and bones); and flexibility. Each type provides different health benefits.

Most physically active children and young people do not have specific nutrition-related requirements beyond the need to follow general age-related nutrition advice and to have an adequate fluid intake to replace what is lost through physical activity.

8.1 Introduction

Along with good nutrition, physical activity is an important lifestyle behaviour that benefits health and wellbeing. It is important to establish good physical activity patterns in childhood and maintain these throughout adolescence, as physical activity during adolescence is a good predictor of adult physical activity patterns (Hallal et al 2006).

Physical activity refers to all movement produced by skeletal muscles that increases energy expenditure (Caspersen et al 1985). Physical activity is not only organised sport (eg, netball); it also includes active recreation (eg, playing in the park), active transport (eg, walking to and from school, work or the shops), everyday or incidental activities (eg, walking up stairs or household chores) and physically active jobs (eg, manual labour).

Physical activity is often described by the following dimensions:

- type (eg, aerobic, muscle-strengthening, bone-strengthening, flexibility)
- frequency (eg, number of times)
- duration (eg, amount of time)
- intensity (eg, light, moderate or vigorous).

Intensity refers to how hard your body is working when you are being physically active. It is graded according to the following three categories.

1. Light-intensity physical activity is movement that does not require much effort (eg, walking slowly).
2. Moderate-intensity physical activity will cause a slight but noticeable increase in breathing and heart rate, which still allows you to carry on a conversation.
3. Vigorous-intensity physical activity will cause a significant increase in heart and breathing rate to the extent that you will be unable to hold a conversation.

8.2 Health effects of physical activity

Regular physical activity in children and young people has many benefits for physical development and health including:

- building and maintaining healthy bones, muscles and joints
- promoting mental wellbeing
- controlling weight and reducing the risk of overweight and obesity – physical activity levels in early childhood have been shown to predict fat mass in adolescence independently of ongoing physical activity patterns (Janz et al 2009)
- developing a healthy cardiovascular system
- developing coordination and movement control
- assisting social development through providing opportunities for self-expression, developing self-confidence, relieving tension, and enabling social interaction and integration (WHO 2003b)
- improving self-esteem in the short term (Ekeland et al 2005).

Students who are well nourished and engage in regular physical activity are also in a better position to benefit from opportunities to learn (Clinton et al 2006). Children who are more physically active demonstrate higher levels of academic achievement (Shephard 1997; Linder 1999; Dwyer et al 2001).

The benefits of regular physical activity are well established. Ongoing regular physical activity can reduce the risk of and improve outcomes for many conditions and diseases in adults such as:

- cardiovascular disease
- diabetes

- osteoporosis
- obesity
- depression
- certain cancers (especially colorectal and breast)
- falls among older people (WHO 2003a).

Several researchers have suggested chronic disease prevention begins in childhood (Epstein et al 1984; Strong et al 2005).

8.3 Sedentary behaviour

Sedentary behaviours are a distinct class of activity characterised by low energy expenditure (Biddle 2007). These activities do not increase energy expenditure substantially above the resting level.[10] Examples of sedentary behaviours include sitting watching television and other screen-based activities, such as playing video games and working on computers. Some people can be very active, but also spend a lot of time doing sedentary activities (Biddle 2007). Time spent on sedentary behaviour is independent of physical activity as a risk factor for cardiovascular disease mortality (Dunstan et al 2010).

Sedentary behaviour in childhood and adolescence is associated with poor health outcomes in adulthood (Hallal et al 2006). The Dunedin Multidisciplinary Study has examined the impact of television watching in childhood and adolescence on short- and long-term health outcomes. Television viewing in childhood and adolescence was a strong predictor for higher body mass index (BMI), poor fitness and higher serum cholesterol at 26 and 32 years of age (Hancox et al 2004; Landhuis et al 2008b). The current recommendation related to limiting sedentary behaviour is to spend less than two hours a day (out of school time) in front of television, computers and gaming consoles.

8.4 Physical activity recommendations

New Zealand has physical activity guidelines for children and young people aged 5–18 years, developed by Sport and Recreation New Zealand (SPARC), the Ministry of Health and the Ministry of Education, in consultation with the Ministry of Youth Development. These guidelines state that children and young people (5–18 years) should:

- over the course of each day, do 60 minutes or more of moderate to vigorous physical activity
- be active in as many ways as possible, for example through play, cultural activity, dance, sport and recreation, jobs and going from place to place
- be active with friends and whānau, at home, school and in their community
- spend less than two hours a day (out of school time) in front of television, computers and gaming consoles.

Although there are no specific physical activity guidelines for children aged under five years, movement is important for all preschool children for brain and motor skill development. For a series of active movement resources with ideas on how to incorporate physical activity into the lives of children under five years, including through balancing, walking, tummy time and climbing, visit SportNZ's website: www.sportnz.org.nz

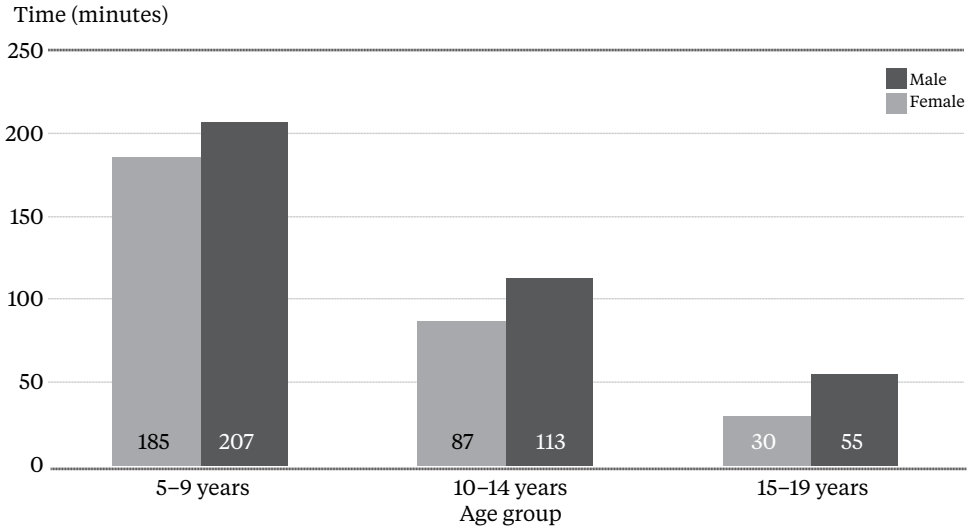
10 The energy expenditure for an activity such as lying or sitting is at the level of 1.0–1.5 metabolic equivalents (METs), which is considered resting level.

8.5 Physical activity and sedentary behaviour levels in children and young people

According to accelerometry data, in 2008/09 almost all 5–9 year olds met the current recommendation of 60 minutes of moderate to vigorous physical activity each day. However, the proportion meeting this recommendation dropped to 81 percent in 10–14 year olds and 41 percent in 15–19 year olds (Clinical Trials Research Unit and Synovate 2010a).

Figure 5 shows how time spent in moderate- to vigorous-intensity physical activity declines with increasing age (Clinical Trials Research Unit and Synovate 2010a).

Figure 5: Time (mean minutes per day) children and young people spend each day in moderate- to vigorous-intensity physical activity, by age group and gender



Source: Clinical Trials Research Unit and Synovate (2010a)

As Table 36 shows, physical activity patterns vary with age:

- 5–9 year olds spent the most time of any age group in free play
- 10–14 year olds spent more time on organised sport than other age groups, but they spent twice as much time in free play as in organised sport
- 15–19 year olds spent the most time of any age group on active transport (Clinical Trials Research Unit and Synovate 2010a).

According to the New Zealand Health Survey, just under half of children aged 5–14 years usually used active transport (eg, walk, bike, skate or scooter) to get to and from school (Ministry of Health 2008g).

Screentime refers to time spent watching television, working on computers and playing video games. The proportion of children and young people meeting the screentime guideline of less than two hours per day (out of school time) declines with age:

- 60 percent in 5–9 year olds
- 33 percent in 10–14 year olds
- 30 percent in 15–19 year olds.

Overall females (44%) are more likely to meet the guideline than males (35%) among 5–24 year olds (Clinical Trials Research Unit and Synovate 2010a).

Table 36: Average time children and young people spend each day on selected activities

Group	Average daily time (mean minutes per day)*			
	Organised sport^	Free play+	Active transport#	Passive transport**
Overall (5–24 year olds)	29.3	77.6	43.0	45.6
Females	20.2	77.4	35.6	45.5
Males	37.8	77.7	49.9	45.8
5–9 year olds	23.0	**141.2**	30.4	40.2
10–14 year olds	**42.3**	86.5	44.4	38.2
15–19 year olds	28.8	29.7	**52.2**	**53.7**

Source: Clinical Trials Research Unit and Synovate (2010a)

* The highest value in each column is highlighted in bold.

^ Sport, games or activities (eg, aerobics) that were structured in nature.

\+ Playing for fun and not in an organised or structured way.

Transportation from one location to another using non-motorised transport, eg, walking, cycling, skateboarding.

** Motorised transport from one location to another, eg, car, bus, train.

8.6 Increasing physical activity levels

Children and young people should be encouraged to do activities that are fun, and appropriate for their age and interests. For young children, physical activity is likely to be less structured, involving everyday activities and play. As children get older, they have more opportunities to get involved in sport and transport-related physical activity.

The best ways to get children and young people active is to incorporate physical activity into their daily routine and to find activities they enjoy and feel successful doing. When choosing an activity, consider the interests, abilities, temperament and body type of the child or young person, together with available opportunities, access, available time and affordability.

Some physical activity is better suited to older children or young people. For example, children do not need formal muscle-strengthening programmes, such as lifting weights. Instead they can get muscle-strengthening from everyday activities and play using their own body weight, such as through jumping, skipping and climbing. As young people mature, they may start structured weight programmes as part of specific sport training.

8.7 Culture and physical activity

Culture has been identified as an effective vehicle for describing and encouraging physical activity. Although currently there is little evidence available to support its use, it is being encouraged within the health promotion sector as a useful and appropriate medium for change and learning (Henwood 2007; Bowers et al 2009). Tikanga-based health promotion, including physical activity, is discussed in section 9.5: Working with tamariki and rangatahi Māori and their whānau.

8.8 Types of physical activity

Physical activities for children and young people can be split into three types: aerobic; resistance (strengthening of the muscles and bones); and flexibility. Each type provide different health benefits.

- **Aerobic** physical activities raise the heart rate and help to keep the heart and lungs healthy.
- Muscle-strengthening activities use **resistance** to build strength, anaerobic endurance and size of skeletal muscles. This type of activity can provide additional benefits not found with aerobic activity, including increased bone, muscle, tendon and ligament strength, improved joint function and reduced potential for injury. Children and young people can participate in muscle-strengthening activities through unstructured activities that involve lifting or moving their body weight or working against resistance, for example, climbing on the 'monkey bars'. Bone-strengthening activities produce a force on the bone that promotes bone growth and strength. This force is produced most commonly by impact with the ground, for example, through skipping with a rope, hopping and running.
- **Flexibility** activities involve reaching, bending and stretching the major muscle groups and help you keep your muscles relaxed and joints mobile. Flexibility can help prevent muscle soreness and joint injuries. Lack of joint flexibility may affect quality of life and can lead to disability.

Table 37 sets out examples of appropriate activities for children and young people that fall under each of these activity types.

Table 37: Some beneficial physical activities for children and young people

Type of activity	Children's activities	Young people's activities
Moderate-intensity* aerobic	Brisk walking	Brisk walking
	Bicycle riding	Bicycle riding
	Dancing	Dancing
	Games that require catching and throwing (eg, softball)	Games that require catching and throwing (eg, softball)
	Kapa haka	Kapa haka
	Rollerblading or skateboarding	Rollerblading or skateboarding
	Skipping with a rope	House and yard work
Vigorous-intensity^ aerobic	Active games such as running and chasing (eg, tag)	Active games such as ultimate frisbee
	Bouncing on a trampoline	Bouncing on a trampoline
	Fast bicycle riding	Fast bicycle riding
	Fast skipping with a rope	Fast skipping with a rope
	Martial arts, such as karate	Martial arts, such as karate
	Running	Running
	Sports such as soccer, netball, hockey, rugby, touch rugby, swimming	Sports such as soccer, netball, hockey, rugby, touch rugby, swimming
	Ki-o-rahi	Ki-o-rahi
	Vigorous dancing	Vigorous dancing
	Waka ama	Waka ama

Type of activity	Children's activities	Young people's activities
Muscle-strengthening	Climbing, pulling using body weight or resistance Games such as tug-of-war Modified push-ups Rope or tree climbing Sit-ups Swinging on playground equipment/bars	Chin-ups Climbing wall Games such as tug-of-war Push-ups and pull-ups Resistance exercises with exercise bands, weight machines^ and hand-held weights Sit-ups
Bone-strengthening	Bouncing on a trampoline Games such as hopscotch Hopping, jumping, skipping Running Skipping with a rope Sports such as gymnastics, basketball or volleyball	Bouncing on a trampoline Hopping, jumping, skipping Running Skipping with a rope Sports such as gymnastics, basketball or volleyball

Source: Adapted from Ministry of Health and Clinical Trials Research Unit (2009b)

* Activities such as bicycle riding can be moderate- or vigorous-intensity depending on the effort level.

^ The Ministry of Health recommends that young people only undertake weight training under supervision and when it is developmentally appropriate.

8.9 Nutrition requirements and physical activity

Most children and young people who are moderately to vigorously physically active do not have specific nutrition-related requirements beyond following the nutrition guidelines for their age and ensuring an adequate fluid intake to replace what is lost through physical activity. Having a high-carbohydrate, moderate-protein, nutrient-rich diet which includes snacks between meals should meet the body's requirements for growth and activity. Some very active children and young people may need to eat more food than those who are less active. Prior to, during and following physical activity, water is the best fluid unless the moderate to intense activity extends beyond 90 minutes' duration. In these situations a sports drink may be suitable (see section 5.4: Sources of fluid in the diet).

For children and young people involved in sport at an elite level, which requires frequent and intense training and competition, there are specific dietary considerations. The diet needs to be based on the nutrition guidelines as with all children and young people but those involved in elite sport have increased nutritional needs, specifically in regard to energy, protein, calcium, fluid and potentially iron (New Zealand Dietetic Association 2008). Exact requirements vary based on gender, stage of growth, level of training and type of sport. Any child or young person involved in elite sport should see a registered sports nutritionist for advice specific to their individual needs. For a list of registered and intern sports nutritionists, visit Sport and Exercise Science New Zealand's website (www.sesnz.org.nz), click on Membership Directory and then from the 'Expertise required' dropdown menu select 'Sports Nutrition'.

On this topic, the *Position of the New Zealand Dietetic Association: Nutrition for Exercise and Sport in New Zealand,* published by Dietitians New Zealand (formerly New Zealand Dietetic Association) in 2008, provides relevant information and includes sections on young athletes; vegetarian athletes and eating disorders among athletes.

8.10 Motivators for and barriers to physical activity

The key motivators for young people to be active are the opportunities to have fun, improve skills, improve body image, socialise with friends, gain a sense of achievement and enhance sport performance (Leslie et al 1999; O'Dea 2003). Perceived barriers are a lack of transport and/or family/whānau support, perceived low levels of ability, lack of energy and motivation, and time constraints as well as the expanding range of sedentary alternatives on offer (O'Dea 2003; SPARC 2005).

Individual, social and environmental factors are important influences on whether children and young people participate in physical activity. Individual factors that may provide motivation for participating in physical activity are listed above.

Among the influential social factors, parental support is likely to be an important determinant of physical activity. Children tend to be more physically active if their parents are active themselves and/or are supportive. In the Obesity Prevention in Communities study,[11] approximately half of all secondary school students reported that their parents provided 'a lot' of support for physical activity (Utter et al 2008a). Māori and Pacific students reported higher levels of parental support than Asian and European students.

Changes in our environment over the last few years have reduced the opportunities for physical activity. For example, the increased use of cars and concerns about safety mean children and young people are much less likely to walk or bike to school. As described in Part 7: The wider environment, the current physical environment is considered to promote obesity because of the many ways in which it promotes over-consumption of foods and limits opportunities for physical activity (Egger and Swinburn 1997; Swinburn et al 1999).

An international study of 11 countries including New Zealand identified several environmental or neighbourhood characteristics that were significantly associated with meeting physical activity recommendations. These characteristics were the presence and close proximity of footpaths, public transport stops, shops, facilities to bike and low-cost recreational facilities near home (Sallis et al 2009).

Cost can be another barrier to participation in physical activity by children and young people. A regional survey identified that nearly 10 percent of parents could not afford to support their school-aged children to take part in regular sporting activities due to financial issues. Specific barriers included the payment of fees and subscriptions, and the purchase of uniforms, footwear and equipment (Sport Otago 2009).

8.11 Safety considerations

For most children and young people, the benefits of physical activity outweigh any negative outcomes. There are, however, some potential harms associated with physical activity in childhood and adolescence. In a systematic review of literature, Hallal et al (2006) identified the following potentially adverse effects of physical activity for this age group.

- Being forced to exercise has been associated with inactivity in adulthood.
- Excessive physical activity in female adolescents can harm their reproductive system and lead to 'athletic amenorrhoea'. It may also be linked to eating disorders (see section 13.1: Body image, disordered eating and eating disorders).

11 The Obesity Prevention in Communities study used a non-representative sample of 12–18 year olds.

Hallal et al (2006) also noted that weight-lifting during puberty can cause musculoskeletal injuries and constrain growth. However, others (Faigenbaum et al 2009) assert that resistance and weight training can be safe for young people if age-appropriate training and supervision are provided. The Ministry of Health recommends that young people only undertake weight training under supervision and when it is developmentally appropriate.

Part 9: Considerations for tamariki and rangatahi Māori and their whānau

Summary

In 2006, 35 percent of Māori were aged less than 15 years, compared with 22 percent of the total population in this age group.

Nutritional concerns for tamariki and rangatahi Māori (although they are not limited to Māori only) include:

- low vegetable and fruit intake
- frequent consumption of sugary drinks and fast foods
- skipping breakfast especially among rangatahi
- low intakes of some nutrients (low vitamin A, folate, calcium, selenium, iron and zinc)
- sub-optimal nutritional status (increased risk of iron and vitamin D deficiency, and sub-optimal iodine and zinc status)
- increased risk of obesity
- food insecurity, which is more common among Māori than among the total population.

Access to safe and healthy food will influence nutrient intakes.

Socioeconomic determinants shape the range of real options open to tamariki, rangatahi and their whānau in terms of addressing healthy lifestyle choices.

- Consider and, where possible, address nutrition-related issues in the context of the broader social, cultural and economic factors that affect people's lives and health.
- The Māori philosophy of health and wellbeing is holistic, encompassing wellbeing at physical, spiritual, psychological and social levels. A number of Māori models of health that encompass this holistic approach are being used in New Zealand .
- Where Māori responses and interventions are necessary, involve Māori providers. They play a pivotal role in improving access to health and disability services, and in enhancing the effectiveness and appropriateness of these services for Māori. Ensure programmes and services:
  - are culturally appropriate and engage with whānau
  - consider socioeconomic factors that could be influencing decisions
  - are located within a Māori world view
  - are responsive to feedback from whānau about delivery
  - are conveniently located and available to whānau
  - build on what works for whānau, hapū and/or iwi.

Ensure Māori whānau and communities receive the right information and tools in a culturally appropriate mode to make informed choices and build whānau capability to meet their own development needs and take responsibility for their own lives. This approach includes having Māori-specific resources available.

- Use a whānau-centred approach,as the basis of a quality interpersonal interaction between health practitioner and the whānau.

Kai (food) has an important role in both traditional and contemporary Māori life. Its cultivation, harvesting, preparation and eating hold spiritual, social and physical significance.

- If appropriate, incorporate the broader role of kai into food- and nutrition-related messages.
- Support the use of cultural foods that are healthier food choices and talk about the amount of food that might be appropriate.

9.1 Introduction

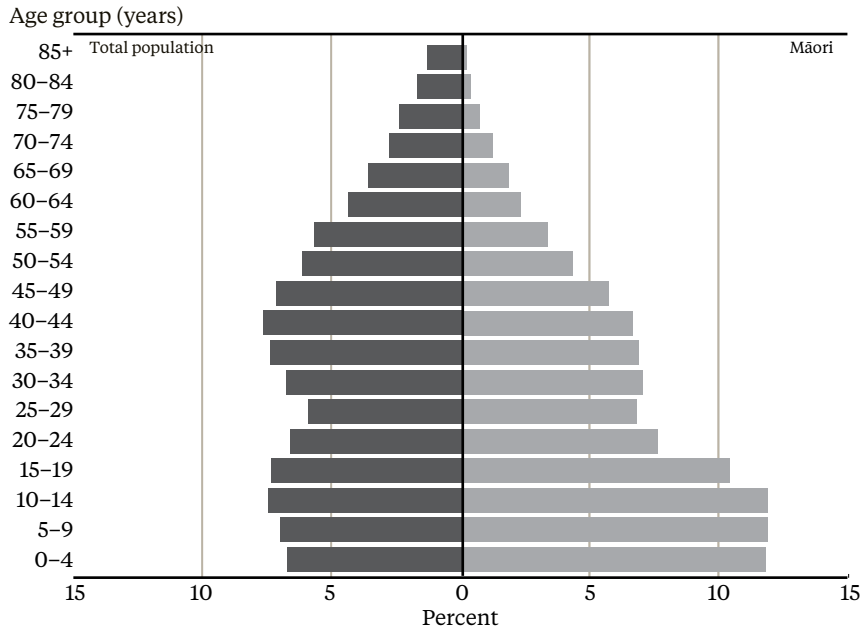
This part identifies key issues related to nutrition and physical activity for tamariki Māori (Māori children) and rangatahi Māori (Māori young people). It also provides some background and context, including information on a Māori world view of health, wellbeing and kai (food), with the aim of enhancing the cultural competence of those working with Māori. However, as Māori are a heterogeneous group, there are diverse Māori realities and some people's realities will of course differ from what is presented here.

Also note that this part is not intended to provide stand-alone food and nutrition advice for Māori; it sits within the broader context of recommendations provided in these *Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2–18 Years)*. Other parts, including Part 6: The home environment and Part 7: The wider environment, also provide information that will be useful when considering nutrition issues for Māori.

Demographics

At the 2006 Census, there were 565,329 Māori living in New Zealand, representing 14.6 percent of the total population (Statistics New Zealand 2007a). The Māori population differs demographically from the general population by being more youthful and is expected to grow at a faster rate. In 2006 the median age of Māori was 22.7 years, compared with the median age of 35.9 years overall. As Figure 6 shows, 35 percent of Māori were aged under 15 years, compared with 22 percent of the total population in this age group (Statistics New Zealand 2007d).

Figure 6: Population age structure for the total population and Māori, 2006



Source: 2006 Census of Population and Dwellings

The proportion of Māori in the New Zealand population is growing. By 2026 it is forecast that Māori will represent 16 percent of the total population, with 28 percent (up from 24 percent in 2006) of children under 15 years identifying as Māori (Statistics New Zealand 2011).

Māori health status and factors that contribute to it

At present in today's society Māori have poorer health status than non-Māori. For example, Māori have lower life expectancy, greater exposure to health risks and higher rates of chronic disease (Ministry of Health 2006d).

The factors that lead to poor health status are complex and many are linked to the uneven distribution of the key determinants of health such as income, housing, education and employment. Socioeconomic deprivation is an issue for many Māori whānau; for example, more than 50 percent of Māori live in areas of highest deprivation (NZDep06 Groups 8, 9 and 10) (White 2008). This issue impacts directly and indirectly on food security, food choices and ultimately nutrition status. See section 6.2: Physical, sociocultural and economic factors within the home environment; section 7.2: The broader determinants of health; and section 7.3: The wider food environment.

However, socioeconomic factors account for only one-third to one-half of the disparity in mortality between Māori and the European/Other ethnic group (Blakely et al 2007).

Across New Zealand, people with lower incomes suffer more ill health, but Māori at all educational, occupational and income levels continue to experience poorer health status than non-Māori. Other factors thought to contribute to the health disparity, include disparities in access to health care and lifestyle factors (eg, smoking) (Ellison-Loschmann and Pearce 2006; Blakely et al 2007). Compounding poor health outcomes are the small number of Māori health professionals (De Souza 2008).

Four major nutrition-related risk factors contribute to 47 percent of mortality in adult Māori, compared with 39 percent in adult non-Māori (Lawes et al 2006). The four risk factors are high body mass index (BMI), high blood pressure, high blood cholesterol, and inadequate vegetable and fruit intake.

Initiatives are in place regionally and nationally to address some of these issues to improve the health status of Māori. In addition, Māori have a number of strengths that positively contribute to improving health status. Brough et al (2004) identified the following specific strengths of indigenous communities (the examples in brackets come from te ao Māori – the Māori world):

- the extended family (eg, whānau and hapū)
- a strong sense of community which included a commitment to community; neighbourhood and community networks; community organisations and community events (eg, marae, kōhanga reo, sports clubs, kapa haka events)
- cultural identity
- cultural knowledge and skills (eg, tikanga)
- organisational involvement
- volunteerism.

9.2 Nutrition and health indicators

Data on the dietary and physical activity habits of tamariki and rangatahi Māori came from the:

- 2002 National Children's Nutrition Survey (Ministry of Health 2003b)
- 2006/07 New Zealand Health Survey (Ministry of Health 2008g)
- National Survey of Children and Young People's Physical Activity and Dietary Behaviours in New Zealand: 2008/09 (Clinical Trials Research Unit and Synovate 2010a, 2010b)
- 2008/09 NZ Adult Nutrition Survey (University of Otago and Ministry of Health 2011).

Data indicate that there are issues for some tamariki and rangatahi Māori related to improving their dietary habits, including the need to increase their intake of the key food groups and decrease their intake of high fat, sugar and salt foods. These changes would improve nutrient intakes and eventually nutrition status. Related to these dietary intake issues, tamariki and rangatahi Māori are at increased risk of obesity and of food insecurity relative to the total population.

Dietary habits

Vegetables and fruit intake

Data on intake of vegetables and fruit (Ministry of Health 2003b; University of Otago and Ministry of Health 2011) indicate the following percentages for those meeting the recommendation for:

- three or more servings of vegetables per day:
- tamariki Māori (5–14 years) – 54 percent of males and 53 percent of females
- rangatahi Māori (15–18 years) – 30 percent of males and 57 percent of females
- two or more servings of fruit per day:
- tamariki Māori (5–14 years) – 40 percent of males and 43 percent of females
- rangatahi Māori (15–18 years) – 53 percent of males and 53 percent of females.

Milk intake

In regard to milk intake, data (Ministry of Health 2003b; University of Otago and Ministry of Health 2011) indicate that among:

- tamariki Māori (5–14 years), 39 percent of males and 33 percent of females drank milk every day
- rangatahi Māori (15–18 years), 22 percent of males and 33 percent of females used reduced-fat, skim or trim milk most of the time.

Breakfast

Data (Ministry of Health 2008g; University of Otago and Ministry of Health 2011) indicate the following proportions ate breakfast every day:

- tamariki Māori (2–14 years) – 84 percent of both males and females
- rangatahi Māori (15–18 years) – 44 percent of males, 25 percent of females.

High fat, sugar and salt (HFSS) foods and drinks

Data (Ministry of Health 2008g; University of Otago and Ministry of Health 2011) indicate that tamariki and rangatahi Māori consume HFSS foods three or more times per week in the following proportions:

- fast food by:
  - tamariki Māori (2–14 years) – 10 percent of both males and females
  - rangatahi Māori (15–18 years) – 11 percent of males and 30 percent of females
- hot chips by:
  - rangatahi Māori (15–18 years) – 26 percent of males and 39 percent of females
- fizzy/soft drinks by:
  - tamariki Māori (2–14 years) – 25 percent of both males and females
- fizzy/soft drinks or energy drinks by:
  - rangatahi Māori (15–18 years) – 61 percent of males and 56 percent of females.

Household food security

Māori experience lower levels of household food security than the total population, which is likely to contribute to nutritional inequalities (Parnell et al 2001). Sixty-four percent of households with tamariki Māori (5–14 years) reported always being able to afford to eat properly, compared with 78 percent of households overall (Ministry of Health 2003b). Among households with male rangatahi aged 15–18 years, 20 percent had low food security,[12] as did 16 percent of Māori households with female rangatahi in this age group (University of Otago and Ministry of Health 2011).

For more information on food security see *NZ Food NZ Children: Key results of the 2002 National Children's Nutrition Survey* (Ministry of Health 2003b) and *A Focus on Nutrition: Key findings of the 2008/09 New Zealand Adult Nutrition Survey.*(University of Otago and Ministry of Health 2011).

Nutrient intake and nutritional status

Nutrients of concern for tamariki and rangatahi Māori, as identified in the 2002 National Children's Nutrition Survey (Ministry of Health 2003b) and 2008/09 NZ Adult Nutrition Survey (University of Otago and Ministry of Health 2011), are summarised below.

Nutrient intake[13]

As with all New Zealand children and young people, intakes of saturated fat in Māori are higher than the recommended intake of less than 10 percent of energy intake.

Saturated fat provides approximately 14.9 percent of energy intake in Māori 5–14 year olds. Among those Māori aged 15–18 years, it provides 14.8 percent of energy intake in females and 13.9 percent in males.

12 As classified using the Rasch analysis – see Appendix 6.

13 Dietary intake that appears inadequate may not necessarily translate into inadequate nutritional status or have any clinical implication.

Tamariki Māori (5–14 years) are at risk of inadequate intakes of the following nutrients: calcium, folate and selenium.[14]

Rangatahi Māori (15–18 years) are at risk of inadequate intakes of the following nutrients: vitamin A, calcium, zinc and selenium, and (for females) iron (University of Otago and Ministry of Health 2011).

Nutritional status

- The prevalence of iron-deficiency anaemia among Māori females was:
  - 4 percent among 11–14 year olds
  - 10 percent among 15–18 year olds.
- Approximately 40 percent of tamariki Māori were vitamin D insufficient, including 5 percent who were vitamin D deficient (Rockell et al 2005) (see section 4.9: Vitamin D).
- Serum zinc concentrations were not assessed in 15–18 year olds (University of Otago and Ministry of Health 2011). Among tamariki Māori (5–14 years), concentrations were low in:
  - 22 percent of males
  - 9 percent of females.
- Iodine deficiency (low urinary iodine concentrations of < 50 ug/L)[15] was found in:
  - 24 percent of male and 29 percent of female tamariki Māori (5–14 years) (Ministry of Health 2003b)
  - 52 percent of male and 49 percent of female rangatahi Māori (15–18 years). Concentrations of less than 100 ug/L were found in 83 percent of males and 80 percent of females in this age group (University of Otago and Ministry of Health 2011).

Body size

- Sixty percent of tamariki Māori aged 2–14 years were in the normal range for BMI; a quarter (26%) were overweight, an additional one-eighth (12%) were obese and very few (2%) were underweight (Ministry of Health 2008g).
- Among those aged 15–24 years,[16] 49 percent of Māori males and 44 percent of Māori females were in the normal range for BMI; 27 percent of males and 29 percent of females were overweight; and an additional 23 percent of males and 27 percent of females were obese. Also in this age group, 1 percent of Māori males and less than 1 percent of females were in the underweight category (Ministry of Health 2008g).
- Data on body size from 2002 to 2006/07 show no change in the prevalence of overweight and a small (but not statistically significant) decline in the prevalence of obesity in tamariki Māori aged 5–14 years (Ministry of Health 2008h).
- Most (89% of male and 72% of female) Māori secondary school students (12–18 years) were satisfied with their body weight. However, over half (54%) had tried to lose weight in the previous year (Clark et al 2008).

14 Prevalance of inadequate intake from the 2002 National Children's Nutrition Survey was recalculated using Australia and New Zealand NRVs and total response ethnicity for Pacific peoples.

15 These data were collected prior to the 2009 introduction of mandatory iodine fortification of salt used in bread production.

16 This information is provided for those aged 15–24 years as the sample size was too small to output data for those aged 15–19 years, as given for the total population in Part 3: Growth and body size.

Physical activity and sedentary behaviours

- Data on physical activity levels among Māori secondary school students (12–18 years) (Clark et al 2008) indicate the following.
  - Two-thirds (66%) of Māori secondary school students took part in at least 20 minutes of moderate- or vigorous-intensity physical activity at least three times in the past week.
  - Twelve percent obtained the recommended 60 minutes of physical activity each day.
  - Over half (54%) participated in a school sports team.
- Half of tamariki Māori (5–14 years) usually used active transport to get to and from school (males 56% and females 44%).
- Three-quarters (76%) of tamariki Māori (2–14 years) watched two or more hours of television each day (Ministry of Health 2008h).

9.3 Concepts of health

The Māori philosophy of health and wellbeing is holistic, encompassing wellbeing at physical, spiritual, psychological and social levels. A number of Māori models of health are being used in New Zealand, all of which encompass a holistic approach.

For more information on Māori models of health, visit the Ministry of Health's website: www.health.govt.nz

9.4 Traditional foods and cultural practices: kai from a historical perspective[17]

The diet of Māori has changed dramatically over the past 200 years. Before the arrival of Europeans, kai (food) – including birds, seafood, wild herbs, roots and berries – was gathered from the bush, sea and rivers. Kai moana (seafood) was a significant part of the Māori diet in coastal areas. It included kina (sea urchins), pāua, pipi, kōura (crayfish), ngaeti (periwinkles), tuna (eel), pātiki (flounder), inanga (whitebait), kuku (mussels) and parengo (a type of seaweed).

Māori also have a strong tradition of gardening. Traditionally their diet included a number of cultivated foods such as kūmara, taro, uwhi (yams) and hue (gourds). Other vegetables grown or gathered include kamokamo (marrow), pūhā and watercress (green leafy vegetables) and pikopiko (fern shoots). Ensuring there was a year-round supply of food required a lot of time and energy.

Kai was also a significant trading commodity so gardens and food gathering areas were highly valued by iwi. Kai was accepted as coming from the atua (gods). As a result, a number of customs developed around collecting, cultivating, storing, preparing and cooking foods.

A number of traditional and semi-traditional foods continue to be an important part of the diet for many Māori. These foods are generally compatible with the Food and Nutrition Guidelines, provided they are prepared with minimal added fat, salt and sugar.

Kai remains for many a highly prized taonga (treasure) that is valued for its spiritual origins, numerous healing properties, and potential to sustain physical, mental, spiritual and social wellbeing. Kai is critical to the lives of all people, as it provides sustenance for physical wellbeing of te tinana (the body). Understanding this holistic view of kai for Māori is central to encouraging change in relation to it.

17 Information for this section comes primarily from McKercher (2003).

Kai has very important social and cultural significance. Mahikai or mahinga kai (the gathering of kai) is an important practice. The collective ability of the whānau, hapū or iwi to provide kai for the marae is highly regarded. This ability is particularly important when there are manuhiri (visitors) to the marae, and providing well for them earns respect from other whānau, hapū and iwi. When they are hosts, tāngata whenua (the people of the land – the whānau, hapū and iwi of an area) have obligations to help with the provision of food and labour, strengthening social connections. The success of the hosts is measured by the abundance and type of kai given to manuhiri. Demonstrating manaakitanga (the acts of caring well for guests) is indicative of mana (prestige) in tāngata whenua.

9.5 Working with tamariki and rangatahi Māori and their whānau

The following initiatives and practices can assist health practitioners in working effectively with tamariki and rangatahi Māori and their whānau.

Whānau Ora

Whānau Ora is a Government initiative based on a Māori world view in which the whānau is the central component. It is a joint initiative involving Te Puni Kōkiri and the Ministries of Social Development and Health. Whānau Ora provides a framework for whānau and families across New Zealand to work towards their own perceived broad health and wellbeing goals in a way they have determined themselves.

Whānau Ora also provides governmental and non-governmental organisations and agencies with an integrated way to work with whānau and families to support them to achieve their own goals. Specifically, through the use of single, outcomes-focused contracts that deliver holistic services to a specific group, Whānau Ora providers will be able to streamline and optimise this support to whānau and families.

The Whānau Ora approach will provide the basis of health and wellbeing service provision for Māori and other whānau/family groups. More information is available at: www.health.govt.nz

Cultural competency

For practitioners, clinical and professional competence cannot be separated from cultural competence. Culture influences how behaviours and symptoms are perceived, understood and responded to by whānau and the health workforce, and how outcomes are defined and measured (Durie 2001). Therefore, to improve the quality and effectiveness of services for Māori it is important to strengthen the clinical and cultural competence of the sector (Robson 2004).

The cultural competence of practitioners is key to working with tamariki and rangatahi Māori and their whānau. Cultural competence involves having the awareness, knowledge and skill to work with people from different cultures. This includes recognising how one's own and others' cultural backgrounds shape personal world views. Recognising and understanding different world views is essential for developing effective health policy, programmes and services.

High-quality service is more likely to be achieved through reorienting practice to a more people-centred approach. Such an approach recognises the values, beliefs and realities of the people as the basis of a quality interpersonal interaction between practitioner and people (Ryan 2009, cited in Kiro 2009).

Māori health providers

Currently (2011) there are 312 Māori providers nationwide who offer a range of services to Māori and their whānau. These vary from smaller providers offering one kind of health service, such as smoking cessation, to integrated providers who have a range of health and social services.

Where Māori responses and interventions are necessary, involve Māori providers. They play a pivotal role in improving access to health and disability services, and in enhancing the effectiveness and appropriateness of these services for Māori. A list of providers can be found at: www.health.govt.nz

Traditional Māori approaches to food, nutrition and physical activity

One way to capture and use the strengths of culture (see section 9.1: Introduction) has been the growing use of Māori traditional knowledge and skills as the basis of health promotion initiatives. 'Culture is slowly being recognised as an effective medium for change, learning and wellness in the health sector' (Henwood 2007). Such strategies are not new or unique to Māori. Traditional Māori games and activities required physical fitness, stamina and coordination. Participating in them provided opportunities to develop skills needed in a wide range of areas including hunting, warfare, gardening and leadership (Henwood 2007).

Tikanga-based approaches for encouraging physical activity and good nutrition, although currently lacking in quantitative evidence, are being encouraged within the health promotion sector (Henwood 2007; Bowers et al 2009). Tikanga, in this context, has been defined as a 'Māori way of approaching things based on acting in the most appropriate way for any given situation' (Bowers et al 2009). Potential benefits identified for a tikanga-based approach are:

- increased engagement with the target group as the approach may be perceived more relevant, for example, because the approach is underpinned by a Māori world view (Henwood 2007)
- an excellent way to transfer cultural knowledge and skills
- a validation of Māori approaches and ways of doing things
- a broader understanding that the knowledge was always there. As Raphael (2000) (as cited in Henwood 2007) says, it is of benefit 'to recognise what is known …'

The following are examples of tikanga-based programmes.

- Mana Tane – Mana Māori was developed at Ngāti Porou Hauora and promotes self-sufficiency among tāne (men) and their whānau by encouraging a return to traditional principles and practices of food and food gathering. Physical activity, the sharing of knowledge and skills, and positive male role modelling are some of the many outcomes that have been identified by programme attendees.
- Toiora – Toi Tangata was developed by Te Hotu Manawa Māori (THMM). This programme teaches good nutrition and physical activity skills with the use of traditional Māori concepts, stories and practices.

For more information on health promoting programmes focused on tikanga-based nutrition and physical activity, see the THMM website: www.tehotumanawa.org.nz

Useful resources and tools

The cultural competence of organisations can be enhanced at a number of levels, ranging from high-level strategy to operational day-to-day interactions between health practitioners and Māori. Tools to help integrate cultural competence at all levels as well as resources for the practitioner are identified below.

1. *He Korowai Oranga: Māori Health Strategy* (Minister of Health and Associate Minister of Health 2002) provides a framework for improving Māori health. Therefore it is a valuable framework for informing the development and implementation of these nutrition guidelines.

   He Korowai Oranga works towards improved Māori health by promoting a vision of whānau ora, in which whānau are supported to achieve maximum health and wellbeing. The key pathways to achieving whānau ora are:

   - whānau, hapū, iwi and community development
   - Māori participation
   - effective service delivery
   - working across sectors.

   If actions to promote and support nutrition and physical activity are to be implemented in a meaningful and sustainable way for Māori, it is important that outcomes, actions, interventions, programmes and services are aligned with these four pathways.

   To view or download *He Korowai Oranga: Māori Health Strategy*, visit the Māori Health website: www.maorihealth.govt.nz.

2. *Whānau Ora: Transforming our futures* is the Government initiative described on page 112.

3. The Ministry of Health has developed a range of other resources which may be useful.
   - The *Health Equity Assessment Tool: A user's guide* has been developed by the University of Otago (Wellington) to help facilitate the use of the Health Equity Assessment Tool (HEAT). The user's guide gives a brief overview of inequalities in health, introduces the HEAT and its use, looks in depth at each of the HEAT questions and provides case examples of the tool's use (Signal et al 2008). To access this resource, visit the Ministry of Health website: www.health.govt.nz
   - The *Whānau Ora Health Impact Assessment* tool is a formal approach used to predict the potential health effects of policy on Māori and their whānau (Ministry of Health 2007). To access this resource, visit the Ministry of Health's website: www.health.govt.nz
   - The *Whānau Ora Tool* is a practical guide to developing health programmes where whānau, hapū, iwi and Māori communities play a leading role in achieving whānau ora (Ministry of Health 2008i). To order this resource, email moh@wickliffe.co.nz or call (04) 496 2277 quoting HP number 4589.
   - The Ministry of Health's health education resources, both Māori-specific and for a general audience, are available from: www.healthed.govt.nz

4. Te Hotu Manawa Māori is an independent national health organisation working in the areas of Kai Tōtika me te Whakapakari Tinana (Nutrition and Physical Activity); and Tupeka Kore (Tobacco Control).
   - The Kai Tōtika me te Whakapakari Tinana (Nutrition and Physical Activity) service works to empower Māori communities to improve their health through good nutrition and participation in regular physical activity. The service achieves this by:
     - providing innovative training and development opportunities for the health workforce in Aotearoa
     - mobilising nutrition and physical activity resources to improve knowledge exchange and community partnerships
     - developing and promoting credible Māori nutrition and physical activity messages.
   - For more information, visit the THMM website: www.tehotumanawa.org.nz

Part 10: Considerations for Pacific children, young people and their families

Summary

The term 'Pacific peoples' is used to describe the diverse cultures of peoples from Polynesia, Melanesia and Micronesia.

In 2006, 38 percent of Pacific peoples in New Zealand were aged less than 15 years compared with 22 percent of the total population in this age group.

Nutritional concerns for Pacific children and young people (although they are not limited to Pacific peoples only) include:

- frequent consumption of sugary drinks and fast foods
- skipping breakfast
- risk of inadequate dietary intake (vitamin A, folate, calcium, selenium and iron)
- sub-optimal nutritional status (increased risk of iron and vitamin D deficiency, and sub-optimal iodine and zinc status)
- increased risk of obesity
- food insecurity, with Pacific peoples reporting less food security than the total population and the least food security of any ethnic group.

Social and cultural attitudes and behaviours around the role of food, and access to safe and healthy food will influence nutrient intakes.

Cultural practices relating to food may vary greatly between cultures and individuals, and may depend on whether people were born in the Pacific Islands region or in New Zealand.

Pacific peoples have a holistic view of health. Health is also a family concern rather than an individual matter. Involve the whole family if possible, preferably during a home visit.

Where possible and if appropriate, involve Pacific health providers. They play a pivotal role in improving access to health and disability services, and in enhancing the effectiveness and appropriateness of these services for Pacific peoples.

Successful health initiatives:

- are community based
- have multiple interventions
- are specifically designed for Pacific peoples and delivered by Pacific peoples within the context of cultural values, beliefs and the social environment.

10.1 Introduction

This part provides background and context on Pacific children, young people and their families living in New Zealand that is relevant to the issues of health, food and nutrition. Specific information on nutrition-related indicators and traditional food and cultural practices is also included. In addition, as recognising and understanding different world views is essential for developing effective policy, programmes and services, this part discusses aspects of a Pacific world view of health and food. At the same time, it is recognised that Pacific peoples are a heterogeneous group and do not all share the same cultural understandings. It is important to recognise this diversity when providing nutrition education and dietary management (Muimuiheata 2009).

Other parts, including Part 6: The home environment and Part 7: The wider environment, also provide information that is useful when considering nutrition issues for Pacific peoples.

Pacific peoples in New Zealand

The term 'Pacific peoples' is used to describe the diverse cultures of peoples from Polynesia, Melanesia and Micronesia (Ministry of Health 2008b). There are more than 22 different Pacific communities in New Zealand, each with its own distinctive culture, language and history. Within these communities, there is further diversity between those born in the Pacific Islands region and those born in New Zealand.

Demographics

At the 2006 Census, there were 265,974 Pacific peoples living in New Zealand, representing 6.9 percent of the total population (Statistics New Zealand 2007e). This total includes people who identify with one or more Pacific ethnic groups, either solely or in combination with other ethnic groups.

Samoans are the largest Pacific group in New Zealand, accounting for around half (49%) of the total Pacific population (see Table 41). Other Pacific nations represented under the term 'Pacific peoples' living in New Zealand include those from French Polynesia, Kiribati, Papua New Guinea and Solomon Islands.

The proportion of Pacific peoples in the total population is projected to increase to 9.5 percent by 2026, and the proportion of Pacific children and young people up to 15 years to increase from 12 percent to 18 percent (Statistics New Zealand 2011). Most Pacific peoples live in the Auckland (67 percent) or Wellington (13 percent) region (Statistics New Zealand 2007e).

Table 38: Demographic information for the seven Pacific ethnic groups with the largest population size in New Zealand

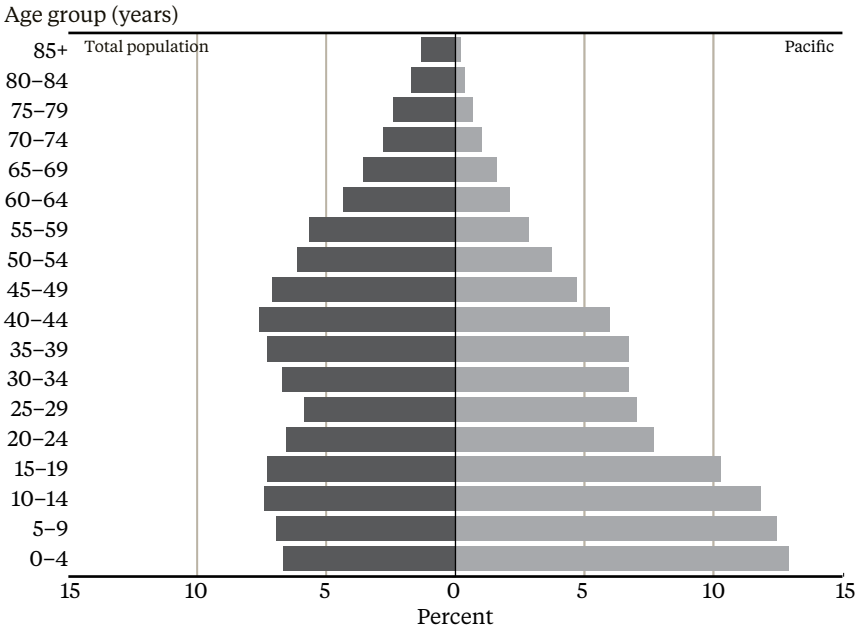
Ethnic group	Population count 2006	% increase 2001–2006	% New Zealand–born 2006	% English-speaking 2006
Samoan	131,103	14	62	85
Cook Islands	58,008	10	73	92
Tongan	50,481	24	56	84
Niuean	22,476	12	73	91
Fijian	9864	40	42	93
Tokelauan	6819	10	69	88
Tuvaluan	2628	34	32	79
Total*	265,974	Average: 15	Average: 61	Average: 87

Source: Statistics New Zealand (2007e)

* Figures for individual groups may not sum to the total because people can choose to identify with more than one ethnic group.

The Pacific population in New Zealand is young (see Figure 7). The median age of Pacific peoples was 21.1 years, compared with 35.9 for the total population (Statistics New Zealand 2007e). In 2006, 38 percent of Pacific peoples were aged under 15 years, compared with 22 percent of the total population (Statistics New Zealand 2007e).

Figure 7: Population age structure for the total population and Pacific peoples, 2006



Source: 2006 Census of Population and Dwellings

Pacific health status and factors that contribute to it

Compared with the total New Zealand population, Pacific peoples have poorer health status, are more exposed to risk factors for poor health, and experience barriers to accessing health services (Minister of Health and Minister of Pacific Island Affairs 2010).

Socioeconomic factors contribute to poor health status. In 2006 Pacific adults had a lower annual income than adults overall, were less likely to have a post-school qualification and were more likely to be unemployed (Statistics New Zealand 2007e, 2007f). Pacific peoples are considerably more likely to live in socioeconomically deprived neighbourhoods (White et al 2008). As discussed in section 7.2: The broader determinants of health, lower socioeconomic status impacts both directly and indirectly on food choices and ultimately on nutrition.

The dietary pattern of Pacific communities is influenced by the interplay of many social, economic and cultural factors. These factors include income, occupation (often involving long working hours), living arrangements, and obligations and commitments to family, community and church (Muimuiheata 2009). Recent research (Teevale et al 2010) has identified that healthy eating and higher levels of physical activity among Pacific adolescents were positively related to parental presence at home and parental occupation type (ie, non-shift work). There has been an increase in the proportion of Pacific households working more than 48 hours per week between 1981 and 2006 (Cotterell et al 2009). In addition there has been an increase in the proportion of Pacific households paying more than 25 percent[18] of their weekly income in rent. Pacific household spending prioritises extended family, community and church obligations, sometimes ahead of immediate household need (Cowley et al 2004).

In a review of Pacific child and youth health, the Ministry of Health identified three priority areas for action, one of which was to reduce overweight and obesity through improvements in nutrition and physical activity (Ministry of Health 2008c, 2008f). Key nutrition and health indicators for Pacific children and young people are summarised in the following sections.

The strengths of Pacific communities can contribute to health and wellbeing. A key strength for many Pacific peoples is their family bonds. For most Pacific peoples, family is the centre of their way of life. Family provides identity, status, honour, prescribed roles and support (Minister of Health and Minister of Pacific Island Affairs 2010). Strong social connections established through consistent participation in church and other community activities are another feature of Pacific communities. A number of recent specific health initiatives have been built around these strengths (Minister of Health and Minister of Pacific Island Affairs 2010).

10.2 Nutrition and health indicators

Data providing information on the dietary and physical activity habits of Pacific children and young people came from the:

- 2002 National Children's Nutrition Survey[19] (Ministry of Health 2003b)
- 2006/07 New Zealand Health Survey (Ministry of Health 2008g)
- National Survey of Children and Young People's Physical Activity and Dietary Behaviours in New Zealand: 2008/09 (Clinical Trials Research Unit and Synovate 2010a and 2010b)
- 2008/09 NZ Adult Nutrition Survey (University of Otago and Ministry of Health 2011).

18 Weekly rent at 25 percent of the weekly gross equalised household income is one of the wellbeing indicators used by Cotterell et al (2009).

19 Some (where indicated) of the data used from the 2002 National Children's Nutrition Survey has been recalculated for total response ethnicity for Pacific peoples.

Dietary habits

Vegetable and fruit intake

Data on intake of vegetables and fruit[20] (University of Otago and Ministry of Health 2011) indicate the following percentages for those meeting the recommendation for:

- three or more servings of vegetables per day:
  - Pacific children (5–14 years) – 58 percent
  - Pacific young people (15–18 years) – 57 percent of males and 45 percent of females
- two or more servings of fruit per day:
  - Pacific children (5–14 years) – 46 percent[21]
  - Pacific young people (15–18 years) – 74 percent of males and 67 percent of females.

Milk intake

In regard to milk intake, data[22], (University of Otago and Ministry of Health 2011) indicate that among:

- Pacific children (5–14 years),[23] 29 percent drank milk every day
- Pacific young people (15–18 years), 23 percent of males and 28 percent of females used reduced-fat, skim or trim milk most of the time.

Breakfast

Data (Ministry of Health 2008g; University of Otago and Ministry of Health 2011) indicate the following proportions ate breakfast every day:

- Pacific children (2–14 years) – 80 percent of both males and females
- Pacific young people (15–18 years) – 41 percent of males and 25 percent of females.

Among Pacific young people (15–18 years), the proportions who ate breakfast five or more times per week (University of Otago and Ministry of Health 2011) were:

- 62 percent of males
- 42 percent of females.

Eating at school

Data (Utter et al 2006b) indicate that among Pacific children (5–14 years):

- 10 percent sometimes or always skipped lunch
- 78 percent bought most/some food for the school day from the tuckshop
- 52 percent bought food for the school day from a dairy
- 12 percent brought food for the school day from home.

High fat, sugar and salt (HFSS) foods and drinks

Data (Ministry of Health 2008g; University of Otago and Ministry of Health 2011) indicate that Pacific children and young people consume HFSS foods three or more times per week in the following proportions:

- fast food by:
  - Pacific children (2–14 years) – 14 percent of both males and females
  - Pacific young people (15–18 years) – 37 percent of males and 28 percent of females
- hot chips by:
  - Pacific young people (15-18 years) – 48 percent of males and 26 percent of females

21, 22, 23, 24 These data from the 2002 National Children's Nutrtion Survey were recalculated for total response ethnicity for Pacific peoples.

- fizzy/soft drinks by:
  - Pacific children (2–14 years) – 24 percent of both males and females
- fizzy/soft drinks or energy drinks by:
  - Pacific young people (15–18 years) – 77 percent of males and 60 percent of females.

Traditional Pacific foods

Just over half of Pacific children aged 5–14 years had consumed some traditional foods (taro and fish) at least once in the last week (Ministry of Health 2003b).

Household food security

Pacific households reported the least household food security compared with European/Other and Māori (Parnell et al 2001). Fifty percent of Pacific households[24] with children reported always being able to afford to eat properly, compared with 78 percent of households overall (Ministry of Health 2003b). Among Pacific households with males aged 15-18 years, 12 percent had low food security, as did 9 percent with females in this age group[25] (University of Otago and Ministry of Health 2011).

For more information on food security see *NZ Food NZ Children: Key results of the 2002 National Children's Nutrition Survey* (Ministry of Health 2003b) and *A Focus on Nutrition: Key findings of the 2008/09 New Zealand Adult Nutrition Survey.*(University of Otago and Ministry of Health 2011).

Nutrient intake and nutritional status

Nutrients of concern for Pacific children and young people as identified in the 2002 National Children's Nutrition Survey[26] and 2008/09 NZ Adult Nutrition Survey (University of Otago and Ministry of Health 2011) are summarised below.

Nutrient intake[27]

As with all New Zealand children and young people, intakes of saturated fat in Pacific children and young people (14.5% of energy intake in 5–14 year olds; 13.3% and 13.9% of energy intake in 15–18 year old females and males respectively) are higher than the recommended intake of less than 10 percent of energy intake.

Pacific children (particularly those aged 11–14 years) are at risk of inadequate intakes of the following nutrients: vitamin A, folate, calcium and selenium.

Pacific young people (15–18 years) are at risk of inadequate intakes of the following nutrients: vitamin A, calcium, selenium and iron (females).

Nutritional status

- The prevalence of iron-deficiency anaemia in Pacific females was:
  - 9 percent of those aged 11–14 years (Ministry of Health 2003b)
  - not possible to establish reliably among those aged 15–18 years because the number of subjects was too small to draw conclusions (University of Otago and Ministry of Health 2011).

24 These data from the 2002 National Children's Nutrtion Survey were recalculated for total response ethnicity for Pacific peoples.

25 As classified using the Rasch analysis – see Appendix 6

26 Prevalance of inadequate intake from the 2002 National Children's Nutrition Survey was recalculated using Australia and New Zealand NRVs and total response ethnicity for Pacific peoples.

27 Detary intake that appears inadequate may not necessarily translate into inadequate nutritional status or have any clinical implication.

- Serum zinc concentrations were not assessed in 15–18 year olds (University of Otago and Ministry of Health 2011). Among Pacific children (5–14 years), (Ministry of Health 2003b) concentrations were low in:
  - 23 percent of males
  - 16 percent of females.
- Evidence of iodine deficiency (low urinary iodine concentrations)[28] was found in:
  - Pacific children (5–14 years), with 22 percent of males and 24 percent of females having low urinary iodine concentrations (< 50 ug/L) (Ministry of Health 2003b)
  - Pacific young people (15-18 years), as in the total population of this age group (University of Otago and Ministry of Health 2011).

Three out of five (59%) Pacific children were vitamin D insufficient, including 8 percent who were vitamin D deficient (Rockell et al 2005) (see section 4.9: Vitamin D).

Body size

- Just under half (44%) of Pacific children and young people aged 2–14 years had a body mass index (BMI) in the healthy range; almost one-third (31%) were overweight, almost a quarter (23%) were obese and very few (1%) were underweight (Ministry of Health 2008h).
- Among Pacific young people aged 15–24 years,[29] 17 percent of males and 29 percent of females were in the normal range for BMI; 37 percent of males and 26 percent of females were overweight; and an additional 46 percent of males and 44 percent of females were obese. One percent of Pacific females in this age group were underweight; there was an inadequate number of males in this age group and category to provide reliable data (Ministry of Health 2008g).
- Four out of 10 Pacific youth (40% of males, 44% of females) perceived themselves to be overweight, but more than half (53% of males, 61% of females) were trying to lose weight (Utter et al 2008a).

Physical activity and sedentary behaviours

Physical activity levels and sedentary behaviours in young Pacific peoples are similar to those for other children and young people.

- The Youth2000 study[30] found 68 percent of Pacific secondary school students reporting exercising three to four times in the last week (Mila-Schaaf et al 2008).
- In the 2006/07 New Zealand Health Survey, 54 percent of Pacific children (5–14 years) usually used active transport to get to and from school (Ministry of Health 2008g).
- Sixty-six percent of Pacific children (5–14 years) watched two or more hours of television per day (Ministry of Health 2008g).

10.3 Concepts of health

There are two well-documented health fundamentals that Pacific peoples share: a holistic notion of health, and health as a family concern rather than an individual matter (Ministry of Health 2008b). Family, culture and spirituality are very important to Pacific peoples.

Furthermore, understanding Pacific peoples both as New Zealand–born and as migrant people is important because of the contact and interaction between the two groups, with

28 These data were collected prior to the 2009 introduction of mandatory iodine fortification of salt used in bread production.

29 This information is provided for those aged 15–24 years as the sample size was too small to output data for those aged 15–19 years as given for the total population in Part 3: Growth and Body Size.

30 For a summary of the studies mentioned in this section, refer to Appendix 7.

each contributing to the life and health of the other. The two groups often live together in the same household (Ministry of Health 2008b). Views may vary widely between these two broad Pacific groups. The majority (60%) of Pacific peoples are born in New Zealand and so have been more exposed to New Zealand systems and ways (Ministry of Health 2008b).

Pacific models of health care that recognise Pacific world views and beliefs about health have been developed. The Fonofale model was created for use in the New Zealand context (by Polotu-Enderman). Other Pacific models of health include: the Samoan Fa'afetui model (created by Tamasese et al in 2005); the Cook Islands Tivaevae model (by Maua-Hodges 2000); the Tongan Kakala model (by Helu-Thaman 1999); and the Tokelauan Vaka Atafaga (by Kupa Kupa 2008).[31]

Perceptions of health and illness

Within Pacific communities, there are diverse perceptions of health and illness, and how they come about (Ministry of Health 2008b). Some community members continue to link illness to beliefs about God and punishment, while some hold beliefs about a much wider range of misfortunes (including accidents, interpersonal conflicts, natural disasters and supernatural insult), of which ill health may be a manifestation. Still others regard any such perceptions as ancient and now outmoded beliefs (Ministry of Health 2008b).

The perception of beauty and body size among Pacific peoples has tended to differ from that held by Europeans, with some Pacific peoples preferring a larger body size and/or not perceiving overweight to be unhealthy (Brewis et al 1998; Metcalf et al 2000). Although obesity was uncommon in traditional Pacific communities up until the 1960s, Pacific peoples now have one of the highest rates of obesity in the world (WHO 2009a). Among younger people, aged approximately 12–18 years, Pacific perceptions of body size and beauty are changing. As noted above, the Obesity Prevention in Pacific Communities study (Utter et al 2008a) found that while one in four Pacific youth perceived themselves to be overweight, more than half were trying to lose weight. For some Pacific peoples, however, the preference for larger body sizes persists (Ministry of Health 2008b).

Pacific peoples tend to consider food as something to be enjoyed rather than controlled or rationed for health reasons (Muimuiheata 2009). This view may have contributed to the response of some Tongan participants in a study on diabetes, where they did not understand the role of diet in the management of diabetes and concluded the disease must not be serious if no medication was given (Moata'ane et al 1996).

10.4 Traditional foods and cultural practices

The traditional diet of many Pacific peoples comprises: coconuts, starchy root vegetables and other staples (taro, cassava, kūmara, yams, pandanus and sago); fruit when in season (bananas, pawpaw, mangoes, breadfruit and plantain); fresh fish or shellfish; and occasionally pork and chicken. These foods are supplemented by leaves and other green vegetables, such as taro leaves, pele (edible hibiscus leaves), kūmara leaves and fern shoots, and are often cooked with coconut cream in an umu (earth oven) (WHO Regional Office for the Western Pacific 2003). Although many of these foods are eaten widely across the Pacific Islands region, each of the Pacific nations has its own specific traditional food and customs (Muimuiheata 2009) so there is also diversity related to favoured foods and preparation methods. In general, traditionally Pacific cultures emphasised the starchy foods, but a meal without animal protein was seen as less desirable or kai kovi (a Tongan term meaning 'unhealthy and lacking substance').

31 The names in the brackets represent the creators of the models; they are not referring to a specific publication.

Giving and receiving food is important to Pacific peoples. When it is shared, it demonstrates respect, love and appreciation, and it expresses hospitality and brings people together. Food is also used to show kinship and identity; it is a standard of wealth and a barometer of social status; and it is a significant part of feasting and celebration (Moataʻane et al 1996). The provision of food helps to fulfil family and community commitments as well as church obligations. For migrants and their families, food may be seen as a symbol for helping Pacific peoples maintain their identity (Ministry of Health 2008b).

Health does not necessarily determine food choice. Pacific peoples tend to value food through the amount and status of the food and as something to enjoy, rather than as a source of nutrients needed to keep them healthy. Individuals generally choose food based on what is available, affordable, tasty and convenient, as well as being guided by habits and traditions.

Some foods are associated with wealth and prestige, such as taro, yams, pork, fish and povi or pulu masima (salted brisket). Feasting is an important cultural ritual in Pacific communities, serving as a focus and a venue for family, community and social exchange. Foods such as cassava, kūmara, bananas, mangoes, other seasonal fruits and green leafy vegetables are not generally considered prestige foods.

Finally, cultural practices relating to food may vary greatly between Pacific communities and individuals, and may depend on whether people are born in the Pacific Islands region or in New Zealand.

10.5 Working with Pacific peoples

Cultural views, language and length of time in New Zealand influence the way in which Pacific peoples perceive, access and continue to use health care services in New Zealand (Ministry of Health 2008g). If health practitioners acknowledge and integrate Pacific values, principles, attitudes and practices in the care and delivery of service to Pacific clients, their families and communities, they will provide culturally competent care. The provision of such health care is one of the strategies advocated for reducing or eliminating racial and ethnic health disparities (Tiatia 2008).

Culturally appropriate health services (including those of mainstream providers) that build on the strengths of Pacific peoples and communities may include:

- targeted health promotion activities
- support from key leaders in the community
- formal partnerships and consultations with organisations or groups representing ethnic minorities
- the availability of a multilingual and culturally competent health workforce
- provision of information in a variety of media and languages
- provision of services in locations that are readily accessed by people from different communities, such as churches, community centres, schools or shopping centres
- provision of services and facilities that welcome the participation and support of families.

Where possible and if appropriate, involve Pacific health providers. They play a pivotal role in improving access to health and disability services, and in enhancing the effectiveness and appropriateness of these services for Pacific peoples.

Successful initiatives were community-based, incorporated multiple interventions, and were specifically designed for Pacific peoples and delivered by Pacific peoples within the context of cultural values, beliefs and the social environment (Tiatia 2008).

Useful resources and tools

1. *Ala Mo'ui: Pathways to Pacific Health and Wellbeing 2010–2014* sets out the priority outcomes and actions that will contribute to better health outcomes for Pacific peoples, families and communities (Minister of Health and Minister of Pacific Island Affairs 2010). It seeks to achieve six priority outcomes to improve health services and health outcomes for Pacific peoples.
   - Pacific workforce supply meets service demand.
   - Systems and services meet the needs of Pacific peoples.
   - Every dollar is spent in the best way to improve health outcomes.
   - More services are delivered locally in the community and primary care.
   - Pacific peoples are better supported to be healthy.
   - Pacific peoples experience improved broader determinants of health.
   - Alongside each priority outcome there are specific actions to be undertaken by the Ministry of Health, district health boards, Ministry of Pacific Island Affairs and other relevant agencies. *'Ala Mo'ui* is available on the Ministry of Health's website: www.health.govt.nz

2. For further information on Pacific peoples, refer to the following background papers that were prepared to inform *'Ala Mo'ui*:
   - *Pacific Cultural Competencies: A literature review* (Tiatia 2008)
   - *Pacific Child Health: A paper for the Pacific Health and Disability Action Plan review* (Ministry of Health 2008c)
   - *Pacific Youth Health: A paper for the Pacific Health and Disability Action Plan review* (Ministry of Health 2008f)
   - *Pacific Peoples' Experience of Disability: A paper for the Pacific Health and Disability Action Plan review* (Ministry of Health 2008d)
   - *Pacific Peoples and Mental Health: A paper for the Pacific Health and Disability Action Plan review* (Ministry of Health 2008e)
   - *Improving Quality of Care for Pacific Peoples: A paper for the Pacific Health and Disability Action Plan review* (Ministry of Health 2008b).

3. The Ministry of Health's Pacific webpage is at: www.health.govt.nz
4. Health education resources specific to Pacific peoples are available from:
   - Ministry of Health at: www.healthed.govt.nz
   - Pacific Heartbeat at: www.pacificheart.org.nz
   - Agencies for Nutrition Action at: www.ana.org.nz/respacific.php

5. The Pacific Island Heartbeat Programme aims to reduce the high rates of heart disease in Pacific communities, by encouraging and supporting Pacific peoples and communities to make positive lifestyle changes. The Pacific Heartbeat national team, based in Auckland and Wellington, offers Pacific heart health advice that is appropriate and relevant to the cultures, customs and lifestyles of Pacific peoples living in New Zealand. The Programme has components on nutrition, physical activity and being smokefree. It offers nutrition training courses, including a specific one for community health workers. For more information see: www.pacificheart.org.nz

Part 11: Considerations for Asian and Other populations

Summary

The term 'Asian' is used to describe peoples primarily from China, Korea, Cambodia, the Philippines, Japan, India, Sri Lanka, Pakistan and Afghanistan.

The term 'Other' populations includes peoples from the Middle East, Latin America and Africa.

Cultural practices relating to food may vary greatly among population subgroups and individuals; such differences will influence food and nutrient intakes.

There is evidence of a 'healthy migrant'* effect in Asian populations, although this disappears as the length of time in New Zealand increases.

There are limited data on the nutritional and health status of children and young people from Asian and 'Other' ethnic groups, but potential problems include iron-deficiency anaemia (girls) and vitamin D deficiency.

Refugees differ from other migrants in many ways and have specific health needs.

- Consider and, where possible, address nutrition-related issues in the context of the broader social, cultural and economic factors that affect people's lives and health.
- Ensure programmes and services are culturally appropriate, and recognise the different cultural practices and beliefs in relation to food and health.
- Recognise that the health needs of children and young people who are recent migrants are likely to differ from the needs of those born in New Zealand.

* Migrants are typically healthier than those in their native country because good health is typically a requirement of being allowed to emigrate. In addition many migrants have high socioeconomic status in their country of origin, which also contributes to their good health.

11.1 Introduction

This part provides background information relevant to food and nutrition issues for those health practitioners working with children and young people from Asian and 'Other' population groups, including refugees living in New Zealand.

Other parts, including Part 6: The home environment and Part 7: The wider environment, also provide information that is useful when considering nutrition issues for these groups of children and young people.

Asian New Zealanders

In New Zealand, the term 'Asian' is used to describe the diverse cultures of peoples from the Asian continent, including peoples from China, Korea, Cambodia, the Philippines, Japan, India, Sri Lanka, Pakistan and Afghanistan. The 'Asian' ethnic group is very diverse and each subgroup has its own distinctive culture, language, history and health status. Within each subgroup, there is further diversity according to country of birth (ie, those born overseas and those born in New Zealand), length of time in New Zealand, English language ability and socioeconomic status (Ministry of Health 2006b; Rasanathan et al

2006b). Whether individuals or families arrive in New Zealand as migrants or as refugees also has a significant impact on health status (see 'Refugees', page 128).

The 'Asian' ethnic group, as defined by Statistics New Zealand, is now the third largest ethnic group in New Zealand, after New Zealand European and Māori (Statistics New Zealand 2011). At the 2006 Census, there were 354,552 Asian people living in New Zealand, representing around 10 percent of the total population. The Chinese and Indian ethnic groups are the largest Asian ethnic groups, accounting for 42 and 30 percent of the Asian population respectively (see Table 39).

Further, the Asian population is the fastest-growing population in New Zealand, with the number of Asian New Zealanders increasing by 49 percent from 2001 to 2006 (see Table 39). The proportion of Asian people in the total population is expected to continue increasing, reaching 16 percent by 2026 (Statistics New Zealand 2011).

Four out of five (79%) Asian New Zealanders were born overseas (see Table 39). The majority (66%) of Asian New Zealanders live in the Auckland region, with the next-highest proportions living in the Wellington (11%) and Canterbury (8%) regions.

Table 39: Demographic information for the seven Asian ethnic groups with the largest population size in New Zealand

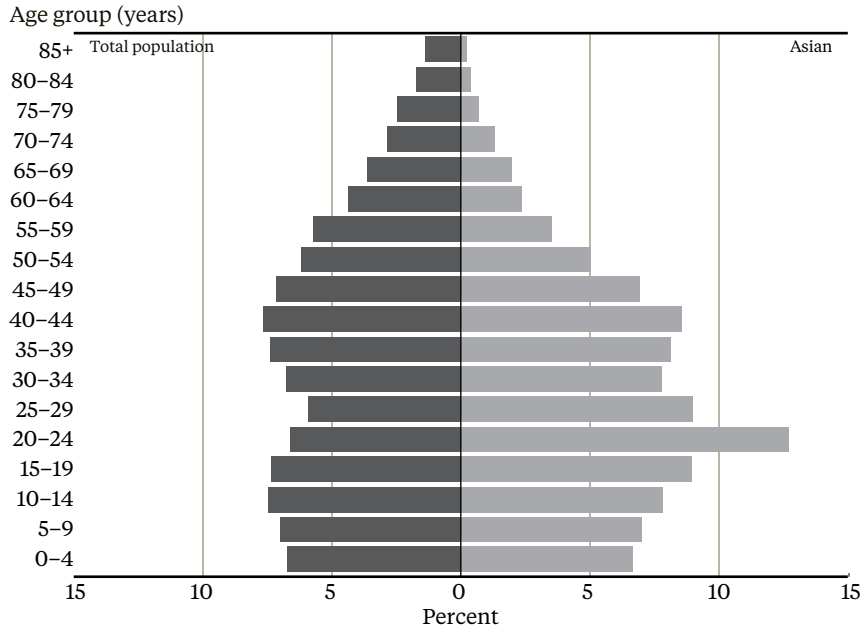
Ethnic group	Population count 2006	% increase 2001–2006	% born overseas 2006	% English-speaking 2006
Chinese	147,570	40	77	79
Indian	104,583	68	76	88
Korean	30,792	62	93	68
Filipino	16,938	53	82	95
Japanese	11,910	19	79	79
Sri Lankan	8310	19	87	92
Cambodian	6918	31	76	73
Total*	354,552	Average: 49	Average: 79	Average: 82

Source: Statistics New Zealand (2007c)

* Figures for individual groups may not sum to the total because people can choose to identify with more than one ethnic group.

The Asian population is also a young population (although not as young as Māori and Pacific populations). The 20–24 years age group contains the highest proportion of the Asian population (see Figure 8).

Figure 8: Population age structure for the total population and Asian people, 2006



Source: 2006 Census of Population and Dwellings

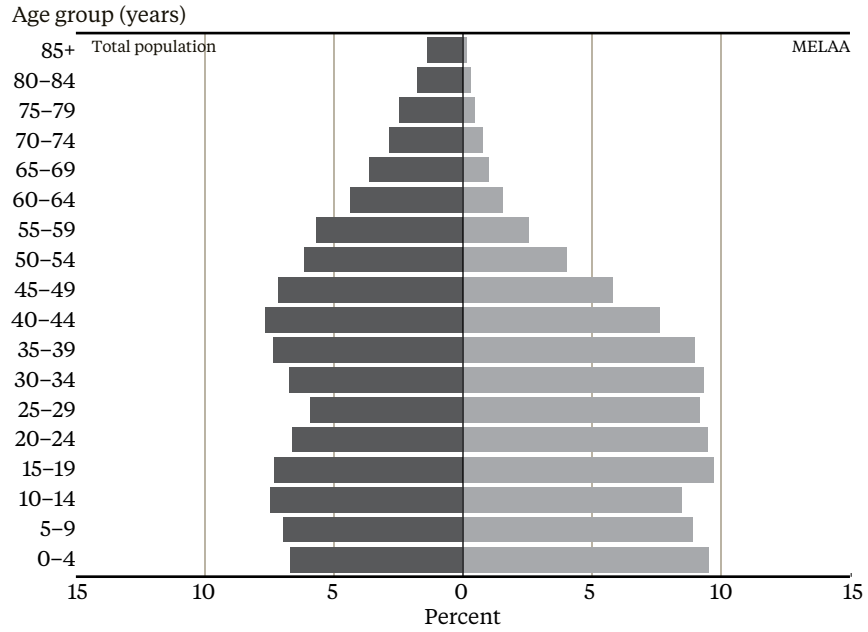
In 2006 Asian children and young people made up 10 percent of New Zealand's total population for 0–17 years, but this figure is predicted to increase to 17 percent by 2026 (Ministry of Social Development 2010).

'Other' ethnic groups

After the New Zealand European, Māori, Pacific and Asian ethnic groups, the Middle Eastern, Latin American and African group (MELAA) is the next-largest ethnic group with 34,746 people in 2006 (0.9% of the total population) (Statistics New Zealand 2007c). Within this group, 50 percent were Middle Eastern, 31 percent were African and 19 percent were Latin American. This ethnic grouping is obviously very heterogeneous and subgroups within this broader ethnic group represent an extremely diverse range of cultures. In addition, some from the MELAA ethnic group came to New Zealand under refugee status (see page 128).

The MELAA ethnic group population increased by 44 percent between 2001 and 2006 (Statistics New Zealand 2007c). It has a younger age structure than the New Zealand population overall (Figure 9). In 2006, 27 percent of the MELAA ethnic group was aged under 15 years, compared with 22 percent of the total population (Statistics New Zealand 2007c).

Figure 9: Population age structure for the total population and Middle Eastern, Latin American and African people, 2006



Source: 2006 Census of Population and Dwellings

Refugees

A refugee is defined as any person who, owing to a well-founded fear of being persecuted for reasons of race, religion, nationality, membership of a particular social group or political opinion, is outside the country of their nationality and is unable, owing to such fear, or unwilling to avail themselves of the protection of that country (UNHCR 2007). In New Zealand, individuals with refugee status, applicants for refugee status and people appealing against refusal of refugee status are eligible for publicly funded health and disability services (Ministry of Health 2008j).

Each year, New Zealand accepts approximately 750 people under the Refugee Quota Programme. In addition, New Zealand accepts up to 1800 applications annually from asylum seekers for refugee status, of whom 20–30 percent will gain residency as refugees.

Refugees spend six weeks at the Mangere Refugee Resettlement Centre where they receive health screening, health care, English lessons and basic orientation to New Zealand before starting new lives in cities and towns throughout New Zealand. Children and young people make up a large proportion of the refugee group (Wishart et al 2007). The screening process includes investigations related to nutrition status, such as weight and height measurements, and blood tests including tests for iron, liver function, vitamin D and calcium levels (Mangere Refugee Reception Centre 2009).

Nutrition-related health problems are not uncommon among refugee populations (see section 11.3: Nutrition and health indicators, page 163). A history of nutritionally inadequate diets along with a high risk of parasitic infestations can result in failure to thrive and a number of micronutrients deficiencies. In addition, in a new country refugees (and migrants) have to deal with unfamiliar foods and lack of local knowledge about shopping and food preparations, which can contribute to poor diet. Similarly they may be disadvantaged by a lack of awareness of the potentially harmful effects of some foods, for example, the link between dental caries and sugar, or high-fat foods and obesity (Ministry of Health 2001).

For refugee populations, it is important to monitor height, weight and body mass index (BMI) to ensure adequate growth and nutritional status (see Part 3: Growth and Body Size). If a refugee has recently lost weight, consider the possibility of an illness, an eating disorder associated with traumatic experiences, or household food insecurity (Ministry of Health 2001).

11.2 Health status

For newcomers to New Zealand, the migration experience and duration of residence affect their health status. For Asian New Zealanders, there is evidence of health selection: migrants are typically healthier than those in their native country (once acute stresses related to the migration process have passed) (Ministry of Health 2006b). This trend is referred to as the 'healthy migrant' effect and occurs because good health is typically a requirement of being allowed to emigrate. Many migrants also have high socioeconomic status in their country of origin, which further contributes to their good health status.

The healthy migrant effect declines the longer the migrant stays in their new country. It then disappears in future generations as New Zealand–born children move towards a health status similar to that of the total population.

Asian population

Overall, Asian New Zealanders have a longer life expectancy than the total New Zealand population, and Asian adults have better health status and are exposed to fewer risk factors for poor health (eg, smoking). There is concern that this better health status is mainly due to the 'healthy migrant' effect as described above. In the future, as this effect wanes, Asian health status and risk for major chronic disease may begin to resemble those of other New Zealanders (Rasanathan et al 2006b).

However, health status varies considerably among Asian subgroups and by duration of residence in New Zealand. For example, Chinese adults living in New Zealand tend to have better health status than Indian adults living in New Zealand (Ministry of Health 2006b). Chinese people also tend to have better health status than the total New Zealand population, including a longer life expectancy and lower cardiovascular disease mortality. Indian people have a slightly longer life expectancy than the total population, but are three times more likely to have diabetes and have a significantly increased risk of cardiovascular disease mortality.

The Youth2000 study showed that Asian secondary school students have a similar level of overall health to New Zealand Europeans, which again may reflect the better health status of recent migrants (Ameratunga et al 2008). Youth2000 also showed there were no significant differences in self-reported health status between either Chinese or Indian secondary schools students and their New Zealand European counterparts (Rasanathan et al 2006a).

Data from the 2006/07 New Zealand Health Survey suggest that Asian children and young people aged 2–14 years are healthier than children and young people in the total population. For example, Asian children and young people were significantly less likely to have been diagnosed with a chronic health condition than children and young people overall (26% vs 36%) (Ministry of Health 2008g).

Social, cultural and economic factors can also impact negatively on Asian New Zealanders, especially new migrants. Difficulties in settling into new host communities and finding employment can negatively impact on people and their health (Rasanathan et al 2006b).

11.3 Nutrition and health indicators

Data from the 2002 National Children's Nutrition Survey and 2008/09 NZ Adult Nutrition Survey are not included in this section as the sample size was not large enough to allow results to be reported separately for Asian and other ethnic groups. A small selection of national data has been included below, supplemented with data from regional studies to offer more information on nutrition and health indicators for Asian and refugee children and young people. The Youth'07 report used in this section (Parackal et al 2011) also contains further analysis of results for 'Asian' into 'Chinese' and 'Indian'.

Dietary habits

Vegetables and fruit intake

Among Asian young people (12–18 years), 26 percent reported eating the recommended number of servings of vegetables and fruit (Parackal et al 2011).

Breakfast, lunch and dinner

Ninety percent of Asian children and young people (2–14 years) had breakfast at home every day (Ministry of Health 2008g).

Among Asian young people (12–18 years):

- 64 percent 'always' ate breakfast (Parackal et al 2011)
- students born in New Zealand, or those who had been in New Zealand for more than five years were even less likely to have breakfast than those who had been in New Zealand for five or fewer years (Rasanathan et al 2006a)
- 83 percent 'always' ate lunch (78% of females and 87% of males)
- 61 percent 'sometimes' brought lunch from home and 33 percent 'sometimes' bought their lunch from shops and takeaways
- 93 percent 'always' ate dinner
- 53 percent 'sometimes' bought dinner from shops or takeaways
- 64 percent reported that their family had eaten a meal together at least five times in the previous week (Parackal et al 2011).

High fat, sugar and salt foods and drink:

Among Asian children young people (2–14 years):

- 21 percent had fizzy/soft drinks three or more times a week
- 7 percent had fast food three or more times in the past week (Ministry of Health 2008g).

Among Asian young people (12–18 years):

- 26 percent reported they had consumed four or more fizzy/soft drinks in the previous week
- 9 percent said they had eaten food from fast food outlets, takeaways, dairies or petrol stations at least four times in the previous week (Parackal et al 2011).

Nutrient intake and nutritional status

Asian populations

Regional studies suggest Asian populations are at risk of sub-optimal iron and vitamin D status.

- An Auckland study of secondary school students (mean age 16 years) found the prevalence of iron-deficiency anaemia was 8.7 percent in Asian females, compared with 3.5 percent in European females (Schaaf et al 2000).
- Children and young people from Asian, African and Middle Eastern ethnic groups are at risk of vitamin D deficiency (Blok et al 2000; Judkins and Eagleton 2006) (see section 4.9: Vitamin D).

Refugee populations

The following data are relevant to young refugees.

- Iron-deficiency anaemia has been found in a small proportion of refugees and asylum seekers undergoing health screening checks in New Zealand (Hobbs et al 2002; McLeod and Reeve 2005).
- Malnutrition can be associated with intestinal parasites.
- Other micronutrient deficiencies such as vitamin A, vitamin C, folate and vitamin B12 can exist (Ministry of Health 2001). Vitamin D deficiency is common in refugees arriving in New Zealand, with 22 percent of those aged 16 years or younger being vitamin D deficient (serum 25-hydroxyvitamin D concentrations 25–49 nmol/L) (Wishart et al 2007).

Body size

- Most (71%) Asian children aged 2–14 years were in the normal range for BMI, 15 percent were overweight, a further 6 percent were obese and 8 percent were underweight (Ministry of Health 2008h).
- Among Asian young people aged 15–24 years,[32] 63 percent of males and 75 percent of females were in the normal range for BMI; 26 percent of males and 14 percent of females were overweight; and a further 4 percent of males and 5 percent of females were obese. Also in this age group, 8 percent of Asian males and 6 percent of Asian females were in underweight (Ministry of Health 2008g).
- Among Asian secondary school students, 36 percent of females and 42 percent of males were happy or very happy with their body weight (Utter et al 2008a).

Physical activity and sedentary behaviours

- Nearly half (47%) of Asian children and young people aged 2–14 years reported using active transport to get to and from school (Ministry of Health 2008h).
- In a New Zealand study of physical activity patterns in a multiethnic sample of female children and young people, South and East Asian girls were less active than girls from other ethnic groups, with lower step counts both on weekdays and weekends (EK Duncan et al 2008).
- Among Asian students (12–18 years), 15 percent reported engaging in 20 minutes or more of vigorous activity on three or more occasions in the previous week, while 9 percent met the current recommendation for 60 minutes of physical activity every day (Parackal et al 2011).
- Asian males were more active than Asian females in that 63 percent of males and 39 percent females were active for at least 20 minutes three times a week (Parackal et al 2011).
- Sixty-one percent of Asian children watched two or more hours of television a day (Ministry of Health 2008h).
- During leisure hours, 32 percent of Asian students (12–18 years) reported using the internet, 29 percent watching TV, 19 percent playing computer games and 18 percent texting for three or more hours per day (Parackal et al 2011).
- Asian students (12–18 years) who were born in New Zealand or had lived in New Zealand for more than five years were twice as likely to watch television for more than five hours daily as students who had been in New Zealand for five or fewer years (Rasanathan et al 2006a).

32 This information is provided for those aged 15–24 years as the sample size was too small to output data for those aged 15–19 years as given for the total population in Part 3: Growth with body size.

11.4 Traditional foods and cultural practices

Each Asian and 'Other' group has its own traditional foods and cultural practices. The importance of traditional foods may depend on place of birth, length of time in New Zealand, age, food availability, personal preference and cultural adherence. Access to traditional foods for many Asian groups has increased in recent years.

As there are many different Asian and 'Other' ethnic groups living in New Zealand, outlining traditional foods and cultural practices for each one is beyond the scope of this document. In general, however, there are some key factors for practitioners working with Asian and 'Other' populations to consider.

First, for many Asian children and young people, there is evidence that traditional foods are being replaced with western foods, particularly highly processed foods high in sugar and/or fat. For example, anecdotal reports suggest Asian children and young people feel ashamed to take traditional food to school for lunch because it is so different to what others bring for lunch. Instead, many prefer to buy food at the school tuckshop. There are also anecdotal reports that Asian parents and caregivers do not consider reduced- and low-fat milk to be healthy for children and young people.

Religion also can influence the food intake. For example, most adherents to Islam (Muslims) do not consume pork or alcohol products. Foods derived from animal sources must be halal, meaning they must come from a herbivorous animal slaughtered under specific circumstances, with the exception of game that has been hunted or fished for oneself. This halal requirement also applies to rennet used in the production of yoghurt and a number of dairy products now indicate whether the rennet used is halal. Some people following the Hindi faith avoid beef and many follow a vegetarian diet.

11.5 Access to health care

Cultural views, language and length of time in New Zealand influence the ways Asian and 'Other' populations perceive access and continue to use health care services in New Zealand. Asian children and young people in New Zealand access a wide range of health care services, although there are some services they are less likely to access.

- Asian children and young people aged up to 15 years were significantly less likely to have a health practitioner or service they usually consult first when unwell or injured, relative to all children and young people (92.5% vs 97.9%) (Ministry of Health 2008h). However, the proportion of Asian children and young people who had seen a general practitioner in the last 12 months did not differ from that for children and young people overall.
- Asian children and young people were significantly less likely than all children and young people to have seen an oral health care worker (71% vs 80%) or medical specialist (13% vs 21%) (Ministry of Health 2008h).
- In Youth'07 (Parackal et al 2011), when health care was needed many Asian students faced barriers to accessing it, including a lack of knowledge of the health care system, cost of care and lack of transport to attend.

11.6 Working with Asian and 'Other' populations

Health practitioners will benefit from recognising and understanding different cultural practices and beliefs in relation to health, food and nutrition. Supporting, valuing and celebrating diverse cultural practices and traditions is recommended for organisations that deal with Asian (Parackal et al 2011) and 'Other' groups.

The needs of children and young people who are recent migrants are likely to differ from the needs of those born in New Zealand to migrant families. Barriers to receiving nutrition information or participating in healthy lifestyle behaviours in New Zealand may include language, income, cultural beliefs and knowledge of foods. As with all other population groups, using strengths of people and communities as a starting point for health promotion can be useful. Identifying sources of resilience and protective factors is important.

The nutrition-related health of children and young people from Asian and 'Other' populations in New Zealand may be affected by:

- changes in the amount and types of foods available, as well as changes in climate, language, housing and living arrangements
- language barriers, particularly for parents or caregivers, which limit access to health care and community resources
- social and cultural attitudes and behaviours around the role of food
- access (physical and economic) to food that is safe, nutritious and culturally and socially acceptable
- the role of children and young people within the family.

Useful resources, tools and organisations – Asian health

For useful information on Asian health in New Zealand visit these websites:

- Asian health as part of the Ministry of Health's website: www.health.govt.nz
- Asian health as established by the Auckland Regional Public Health Service, with a website that includes useful links: www.asianhealth.govt.nz
- The Asian Network Incorporated (TANI), a pan-Asian community organisation that supports Asian New Zealanders to enjoy optimal quality of life and wellbeing and develop strong and healthy Asian communities in New Zealand: www.asiannetwork.org.nz

The Agencies for Nutrition Action website has some useful information and links in regard to Asian health: www.ana.org.nz

Useful resources and tools – refugee health

A refugee handbook has been developed for health practitioners working with refugee people. It provides insights into the cultural and ethnic backgrounds of the main refugee populations in New Zealand, as well as guidance to health practitioners on conducting culturally sensitive consultations and the effective use of interpreters. For more information, refer to refugee health on the Ministry of Health's website: www.health.govt.nz

The refugee service of the Auckland Regional Public Health Service provides useful information on refugee health in New Zealand, along with resources and links, at: www.refugeehealth.govt.nz

The Ministry of Health produces a number of nutrition-focused health education resources specifically for migrant and refugee groups. View them online under the 'New Immigrants' Health' section at: www.healthed.govt.nz

Part 12: Special dietary considerations

This part summarises special dietary considerations and, where relevant, background information related to vegetarian (including vegan) diets; picky eaters; food-related choking in young children; allergy in children and young people; coeliac disease; and young women who are pregnant or breastfeeding.

12.1 Vegetarian eating

Summary

It is possible for children and young people to obtain all essential nutrients from a carefully planned vegetarian (including vegan) diet.

Include a variety of foods from the four food groups.

Eat a range of vegetables and fruit. Include vegetables and fruit high in vitamin C (eg, tomatoes and oranges) with breads and cereals or legumes to help increase iron absorption.

Breads and cereals are an important source of energy and nutrients. Where possible consume whole grains, as these contain more nutrients (including iron, zinc and calcium). Some vegetarian children might need to eat more refined grains to help them eat enough to meet their energy requirements, as many vegetarian foods are filling for small stomachs.

For children and young people who do not consume milk and/or milk products, encourage them to consume milk alternatives fortified with calcium and vitamin B12, such as fortified soy milk. Rice milk is lower in energy, protein and fat, and is not recommended as a sole milk replacement for children under five years.

Eat a variety of protein-rich foods, such as legumes (eg, dried beans, peas, lentils and soy products), nuts,* seeds and eggs.

Key nutrients to consider if reviewing diet of vegetarian and vegan children and young people include energy, protein, calcium, iron, zinc, vitamin B12 and omega-3 fatty acids.

If there is concern about nutrient intakes in vegetarian and vegan children and young people, a referral to a dietitian for that individual and their family/whānau would be useful.

* Do not give small, hard foods such as whole nuts and large seeds until children are at least five years old to reduce the risk of choking (see section 1.3: Summary of food groups, serving sizes and recommended intake).

Background

The term vegetarian encompasses a wide range of diets, which have the common characteristic of excluding meat and vary regarding the other animal products excluded. Common reasons for choosing a vegetarian diet include concern for animal welfare and/or the environment, health considerations, religious beliefs and economic factors (American Dietetic Association 2009b). Some young people may adopt a vegetarian diet as a weight control method because it is a socially acceptable method to avoid eating certain foods (American Dietetic Association and Dietitians of Canada 2003).

Within the broad category, vegetarians can be classified as follows.

- **Lacto-ovo-vegetarians** exclude meat, fish and poultry, but include other animal products such as eggs, milk and milk products.
- **Lacto-vegetarians** exclude meat, fish, poultry and eggs, but include milk and milk products.
- **Vegans** exclude all animal-related foods, including meat, fish, poultry, eggs, milk and milk products.

Well-balanced vegetarian diets have many nutritional benefits. They align more closely with recommended dietary guidelines, with higher intakes of wholegrain cereals, vegetables, fruit and legumes and lower intakes of saturated fat and sodium. Vegetarian diets are less energy-dense and associated with better dietary intake and weight outcomes in adolescents and young people (Robinson-O'Brien et al 2009). In adults, following a vegetarian diet is associated with reduced risk of obesity, cardiovascular disease, diabetes and some cancers independent of other healthy lifestyle behaviours such as being physically active and not smoking (American Dietetic Association 2009b). Vegetarian diets also have many benefits unrelated to health. For example, they are better for the environment, requiring less water, energy, fertiliser and pesticides to produce than a non-vegetarian diet (Marlow et al 2009). There is also evidence that a plant-based diet may help mitigate the effects of climate change (Carlsson-Kanyama and Gonzalez 2009).

Based on data from national nutrition surveys, very few New Zealand children and young people are vegetarian. In the 2002 National Children's Nutrition Survey, around 1 percent of children aged 5–14 years followed a vegetarian diet (0.7% lacto-ovo-vegetarian, 0.3% lacto-vegetarian, 0.1% vegan) (Ministry of Health 2003b). In the 2008/09 NZ Adult Nutrition Survey, 0.2 percent males and 1.7 percent of females aged 15–18 years had not had meat, chicken or seafood in the past four weeks (University of Otago and Ministry of Health 2011).

Key nutrients

It is possible for children and young people to obtain all essential nutrients for growth and development from a carefully planned vegetarian (including vegan) diet (American Dietetic Association 2009b). It is crucial that vegetarians, particularly those living in an omnivore household, have support from parents to ensure their diets provide adequate energy and nutrients for growth. Although all nutrients are important, the following have a higher potential for inadequate intake in an unbalanced or inadequate vegetarian or vegan diet.

Energy

Energy requirements can usually be met on a vegetarian diet when a wide variety of plant foods is consumed. Children following a lacto-ovo-vegetarian diet grow at a similar rate to their non-vegetarian peers, suggesting energy requirements are met (American Dietetic Association 2009b). It may be more difficult for children following a strict vegan diet to meet their energy requirements, so growth should be closely monitored. If a child is not growing at an expected rate, intakes of energy-dense foods such as vegetable oils, margarine, avocado, soy products, nuts and seeds should be increased.

Although the emphasis should be on wholegrains due to their higher nutrient content, some refined grains may help young vegan and vegetarian children meet their energy requirements by reducing the bulk that accompanies a high-fibre diet (Messina and Mangels 2001).

Protein

Protein requirements can be met when diets contain a variety of plant foods and energy needs are met (American Dietetic Association 2009b). Milk, milk products and eggs are good sources of protein for lacto-ovo-vegetarians. Good sources of plant protein include grains/cereals, legumes (eg, dried peas and beans, lentils, tofu), soy products, nuts* and seeds.

For children and young people consuming regular meals and a variety of foods (including a range of protein-containing plant foods), it is not necessary to combine complementary proteins at each meal (Messina and Mangels 2001).

Complementary proteins are a range of plant-based foods that separately do not contain all indispensable (or essential) amino acids, but when eaten together in certain combinations 'complement' each other and so provide all the indispensable (or essential) amino acids in one meal. Indispensable (or essential) amino acids are the amino acids that cannot be synthesised by the body (see section 4.6: Protein). Vegetarian children and young people should eat at least one to three servings of plant-based protein foods each day, depending on their age and individual requirements (see 'Recommended number of servings').

Vitamin B12

Animal products are the only natural sources of vitamin B12, so having an adequate intake of B12 can be an issue for vegetarians, especially vegans. Sources of vitamin B12 for lacto-ovo-vegetarians include eggs, milk and milk products. Some milk alternatives are fortified with vitamin B12; check the label to identify products that contain vitamin B12 (see Part 5: Fluids). Fermented soy products, algae and spirulina have been proposed as sources of vitamin B12 and may contain vitamin B12 analogues (compounds that are biologically, structurally or chemically similar to vitamin B12). However, fermented soy products are not a reliable source of active vitamin B12 and no unfortified plant food (eg, algae and spirulina) contains any significant amount of active vitamin B12 (American Dietetic Association 2009b). Given there are few dietary sources of vitamin B12 for vegans, a supplement may be required.

Iron

Plant sources of iron include wholegrain and fortified cereals, legumes, nuts, seeds, dark-green leafy vegetables and dried fruit. Vegetarians may require more dietary iron than non-vegetarians because the iron found in plant foods (non-haem iron) is less bioavailable than the haem iron found in meat.

Enhancers of iron absorption include vitamin C and other organic aids, so foods rich in vitamin C (eg, vegetables and fruit) should be included in meals along with foods containing iron. Diets based on plant foods tend to be high in phytate, which can inhibit absorption of iron. However, some food preparation techniques such as soaking and sprouting beans, grains and seeds, and the leavening (rising) of grains (as in bread) can reduce phytate levels. There is evidence that the body gradually adapts to low iron intakes by increasing iron absorption and minimising losses (American Dietetic Association 2009b).

Zinc

Plant sources of zinc include legumes, wholegrain cereals, nuts and soy products. Zinc absorption is also inhibited by phytate, found mainly in wholegrain cereals and legumes. Protein is a promoter of zinc absorption, so emphasising foods that are good sources of both zinc and protein (eg, legumes and nuts) can increase the intake and absorption of zinc.

Calcium

Milk and milk products provide sufficient calcium for lacto-ovo-vegetarians, but vegans will have to rely on calcium from plant foods or calcium-fortified milk alternatives, such as soy milk (see Part 5: Fluids). Note that rice milks (and potentially other 'grain' milks) are lower in energy, protein and fat and are not recommended as a sole milk replacement for children under five years.

Plant foods with high calcium bioavailability include broccoli, bok choy, Chinese cabbage, nuts and seeds (including tahini from sesame seeds). Calcium-fortified foods (eg, some breakfast cereals) are other good sources of calcium for vegans.

Omega-3 fatty acids

Long-chain omega-3 fatty acids are found in fish and fish oils, seafood, eggs, lean red meat and omega-3 enriched foods. Vegetarians who eat none or little of these foods need to include a good source of α-linolenic acid in their diet as this can be converted to the long-chain omega-3 fatty acids eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA). The best plant sources of α-linolenic acid are flaxseed and flaxseed oil and, to a lesser extent, canola oil, margarine and canola-based spread, soybean oil, walnuts and walnut oil.

Recommended number of servings

The recommended number of servings per food group for those following a vegetarian diet is the same as those following an omnivorous diet (see section 1.2: Food groups and recommended serving sizes) with the exception of the 'lean meat, poultry, seafood, eggs, legumes, nuts and seeds' group. Although legumes, nuts and seeds provide many important vitamins and minerals, in general they contain less protein per serving size (as defined in section 1.2: Food groups and recommended serving sizes) than meat. For those following a vegetarian diet, more servings of those foods are required as described below.

For those following a vegetarian diet, it is recommended that:

- preschool children (2–5 years) eat at least one to two servings of legumes, nuts and seeds each day
- schoolchildren (6–12 years) eat at least two servings of legumes, nuts and seeds each day
- young people (13–18 years) eat at least three servings of legumes, nuts and seeds each day.

Support for vegetarian and vegan families

All parents want to ensure their child's diet is optimal for growth and development. Parents who are vegetarian or vegan themselves are usually very knowledgeable about this diet and aware of the dietary requirements of vegetarian or vegan children and young people. However, if parents are not knowledgeable about the nutritional needs of their vegetarian or vegan child or young person, they should be encouraged to seek specialist advice from a dietitian. Specialist advice is particularly important if other household members do not follow a vegetarian or vegan diet. Ensure that parents are aware of the resources and support provided by the New Zealand Vegetarian Society: www.vegetarian.org.nz

Relationship with health practitioner

The decision for a person to be vegetarian or vegan is usually based on strong beliefs and should be respected by others. Some vegetarian or vegan parents who choose this dietary pattern for their child have experienced some negativity from their health practitioner, which can affect the relationship with the family/whānau and the quality of advice provided. These problems may arise because health practitioners are not aware that carefully planned vegetarian and vegan diets are now considered appropriate for all stages of the life cycle, including children and young people. The American Dietetic Association (2009b) position paper on vegetarian diets may be a useful basis for discussion.

12.2 Picky eating in children

Picky or fussy eating is defined as the rejection of a large proportion of foods, both familiar and new. It is a common occurrence among toddlers (Carruth et al 2004; Gilmore 2006) and often includes food neophobia, which is the rejection of new or unknown foods. Food neophobia is most common in young children, usually starting at 18–24 months (Birch and Fisher 1998). Many children who have been good eaters start to reject food at this age (Benton 2004). Picky eating can last only a few days or weeks or, in a more extreme form, can persist for a number of years.

It is thought that genetic, environmental and developmental factors play a role in food neophobia and picky eating. For example, food neophobia is thought to be an adaptive behaviour that serves to protect the young from unknown and potentially toxic foods (Kelly 2009). Similarly children are born with a preference for certain tastes (eg, sweet) and aversion to other tastes (eg, bitter), which may also be adaptive and protective (Savage et al 2007). For example, naturally occurring sweeter foods are often calorie-dense (eg, potato and kūmara), whereas foods with bitter tastes can be either low in calories (eg, leafy greens) or, in some cases, toxic. Multiple attempts (up to 15) may be required to get a child to accept a new food (Ventura and Birch 2008). However, if the new food is offered too frequently or the food is widely disliked, persisting with these attempts may not be effective.

Environmental factors also play a role in food choices, behaviour and preferences because children are predisposed to learn through experience and observing others (Birch and Fisher 1998). Consequently repeated exposure to a wide variety of flavours can increase the chance of children accepting new foods. Parental modelling and social facilitation are very important when trying to get children to eat new foods (Birch and Fisher 1998). Children are much more likely to eat a food if others are eating it at the same time.

In addition, during the period from infancy to childhood children's sense of self and independence are increasing. These factors, along with a growing awareness of the outside world, help to reduce young children's interest in eating and increase their interest in asserting independence and engaging in the world beyond their immediate environment.

Although picky eating appears to be a normative stage in the development of many young children, it has been linked to an increased risk of being underweight (Ekstein et al 2010). A sensible precaution seems to be for health practitioners to monitor growth to identify any significant growth faltering, as a secondary effect of picky eating (Kelly 2009). In most cases a healthy child will eat when he or she is hungry. Most young children have erratic appetites, eating very little one day and more the next. This pattern of eating is normal and not of concern when the child is growing normally. Whether picky eating behaviours are predictive of later eating problems to some degree may depend on how parents and caregivers respond to the behaviours (Gilmore 2006).

'Picky' or poor eating can have a medical or more serious developmental cause. If the poor eating occurs for a prolonged period or is a distinct change from previous eating patterns, medical causes need to be investigated.

Further guidance on appropriate responses to picky eating can be obtained through evidence-based parenting programmes such as Incredible Years and Triple P, as described in Part 6 under Useful resources and tools. It is important to reassure parents and caregivers of young children that most eating problems are part of the normal development of many children (Gilmore 2006).

To encourage healthy eating in children with specific feeding problems such as food neophobia, follow these practices in addition to the recommendations above.

- Make sure the child is not drinking excessive amounts of milk or other fluids and avoid sugary drinks. Too much fluid can fill up small stomachs and decrease appetite. The recommended amount of milk intake for toddlers and young children is around 500 ml per day.
- Introduce one new food at a time alongside other accepted foods or flavours.
- Multiple attempts (up to 15) may be required to get a child to accept a new food.
- Avoid using preferred foods (eg, dessert) as a reward for eating other foods (eg, vegetables). This strategy can be effective in the short term but could increase the child's preference for the reward food (Birch and Fisher 1998; Benton 2004; Savage et al 2007).

Part 12.3 Food-related choking in young children aged 2–5 years

People can choke on food at any age but children are at higher risk of choking until approximately five years, with children up to three years of age at greatest risk. Approximately 70–90 percent of all choking incidents reported are in children under three years, with foods being the most common cause of choking (Altkorn et al 2008, Altmann and Ozanne-Smith 1997, Despres et al 2006 and Goren et al 2005).

Sixteen children and young people (aged 0–24 years) died from foreign body inhalation (involving choking) in New Zealand during 2002–2009 (Hayman and Dalziel 2010). Thirteen deaths were in children under six years of age and nine of the deaths involved the inhalation of food namely meat/sausage, peanuts, apple and grapes.

European data found that for every child that dies from foreign body inhalation, another ten are hospitalised (Zigon G et al 2006). Non-fatal choking incidents can cause severe acute and chronic health problems such as aspiration pneumonia, perforation to the airway or brain damage due to lack of oxygen.

The US Center for Disease Control (CDC 2002) suggests that because complete removal of all choking hazards is unlikely, parents and caregivers should:

- be aware of the types of foods and objects that pose a choking risk for children
- become familiar with methods to reduce risk
- be able to treat choking in children.

Ozdemir et al (2005) also suggest parents must be educated about the importance of age and stage of development in relation to eating solid food.

While people of any age can choke on food, young children choke on food more easily for a number of reasons (Byard et al 1996, Committee on Injury, Violence, and Poison Prevention 2010), including:

- the small diameter of their air and food passages (similar to the diameter of their little finger) which can be easily blocked by small objects
- their inexperience with moving food around in the mouth
- biting and chewing skills that are not fully developed
- a less effective cough mechanism to dislodge foreign bodies.

Byard et al (1996) suggest that although some young children are able to bite off food they may, due to age, lack the second molars that enable them to successfully grind the food prior to swallowing. Children don't normally have these second molars fully erupted into the mouth and functioning until they are over 30 months (two and a half years) of age. There are also significant individual behavioural and anatomical differences among healthy children of the same age (Carruth and Skinner 2002). As a result using age alone as a guide to judge eating competency can be problematic.

There are a number of high risk foods that are often associated with young children choking and most of these share common characteristics (see Table 40). Making carers aware of them and how to make changes to reduce their risk is recommended.

Table 40: Characteristics and examples of foods that pose a high choking risk for children under five years

Food characteristics	Food examples	Choking risk	Changes to reduce risk
Hard foods	Nuts Hard dried fruit Pieces of raw carrot, celery or apple. Food that break into hard sharp pieces eg, crisps, corn chips and rice crackers. Unpopped popcorn husks	Difficult for children to bite through and break down enough to swallow safely. Pieces can become stuck in children's airways.	Avoid giving whole nuts or hard dried fruit to children under the age of five. Use thinly spread smooth peanut butter instead of whole or chopped nuts. Carrot, apple and celery can be either cooked until soft or grated.
Small round or oval foods	Grapes, berries, cherry tomatoes	Foods with these qualities can lodge in children's airways.	Grapes, berries and cherry tomatoes can be halved, quartered or chopped smaller.
	Raisins/sultanas		Soak raisins/sultanas to soften and cut in half
	Fruit with stones and large seeds or pips, eg, watermelon, small stone fruits		Remove stones from fruits
	Peas		Peas can be squashed with a fork
	Lollies/sweets	Children do not have the ability to chew small round hard, chewy or sticky lollies/sweets.	Small round hard or chewy and sticky lollies/ sweets should not be given to children under the age of three years.

Food characteristics	Food examples	Choking risk	Changes to reduce risk
Foods with skin or leaves	Chicken sausages, saveloys, 'cherrios', frankfurters etc	Food skins are difficult to chew and can completely seal children's airways	Remove or peel skins before serving Chop up (to at least size of child's small fingernail and add to mashed food
	Stone fruits (eg, plums, peaches, nectarines)		Remove stones from fruit
	Apples and pears		Finely chop salad leaves
	Tomatoes		Cook spinach and cabbage until soft and chop finely
	Lettuce and other raw salad leaves		
	Spinach, cabbage		
Compressible foods	Sausages, saveloys, 'cherrios', frankfurters, hotdogs etc	Can conform to the airway shape and get wedged tightly	As above, remove skins before serving Cook meat until very tender
	Pieces of cooked meat		Chop finely (to at least size of child's small finger nail) and add to mashed food
	Marshmallow Popcorn Chewing or bubble gum		Marshmallows and popcorn should not be given to children under three Do not give chewing or bubble gum
Thick pastes	Chocolate spreads Peanut butter	Can form to the shape of a child's airway and stick to the side	Use thick pastes sparingly and spread evenly onto bread
Fibrous or stringy foods	Celery Rhubarb Raw pineapple	Fibres make it difficult for children to break up the food into smaller pieces	Peel the skin/strong fibres off celery and rhubarb Slice these foods thinly across the grain of fibres

Source: Based on information from Altkorn et al 2008, Altmann and Ozanne-Smith 1997, Byard et al 1996, Committee on Injury, Violence, and Poison Prevention 2010, Goren et al 2005, Hayman and Dalziel 2010, Karatzanis et al 2006, Morley et al 2004, Ozdemir et al 2005)

One of the most important choking prevention measures is for carers to stay with and supervise young children while they are eating. Young children should learn not to play or run around while eating (Hayman and Dalziel 2010). Establishing a routine where young children sit while eating is recommended.

Parents and caregivers should never resort to forcing children to eat and should request a feeding assessment through their general practitioner for a child who repeatedly gags or chokes on age appropriate foods. An oral health assessment via the community oral health service may be needed if there is the child has discomfort with eating.

Although all care can be taken to prevent food related choking incidents they may still occur. Due to young children's greater vulnerability to accidental injuries it is recommended people caring for children, including parents, teachers and child care providers should learn cardiopulmonary resuscitation (CPR) and choking first aid for children (Ozdemir et al 2005, Committee on Injury, Violence, and Poison Prevention 2010).

For the key messages on minimising the risk of food-related choking in young children see section 1.3.

For more information on food-related choking see the Ministry of Health website www.health.govt.nz

12.4 Food allergy

The following section is intended to provide an overview of food allergies in children and young people. It is not intended as a guide to dietary management. For further information and resources related to managing allergies, see 'Useful resources and tools' at the end of this section.

Summary

Cow's milk, egg, and peanut account for about 75 percent of childhood food allergy, with allergy to tree nuts, sesame, soybean, wheat, kiwifruit, fish and shellfish being other common causes.

Although most other food allergy develops in very early childhood (around 6–24 months of age), fish and shellfish allergy may develop in adolescence or adulthood.

Many children will outgrow their allergy to cow's milk, egg, soy or wheat by five to seven years of age, with most having outgrown the allergy by late adolescence. Although 10–20 percent of peanut and tree nut allergies resolve, most persist into adulthood.

Food allergy may affect 4–8 percent of children and 2–3 percent of adults.

The prevalence of food allergy appears to be increasing in economically developed countries. The reasons for the increase are not yet clear.

Accurate diagnosis of a food allergy is important. Allergy testing should be undertaken by a registered medical practitioner.

Food allergy should be managed jointly by the registered medical practitioner and dietitian with the family/whānau.

There is no cure for food allergy, so management focuses on preventing symptoms by avoiding the food allergen.

A comprehensive management plan is required for children at risk of anaphylaxis.

Background

An **adverse food reaction**, often referred to as a food hypersensitivity, includes any abnormal reaction resulting from the ingestion of food (Sampson 2004). There are two main types of adverse food reactions.

1. **Food intolerance** is an adverse reaction to food that is non-immunological and caused by some unique physiological characteristic of the person, such as lactose intolerance as a result of lactase enzyme deficiency.
2. **Food allergy** is an adverse health effect arising from a specific immune response that occurs reproducibly on exposure to a given food (NIAID 2010). Most food allergy reactions are mediated by immunoglobulin E (IgE) antibodies, but others are non-IgE-mediated cellular reactions or a combination of both. The most common symptoms involve the skin (eg, rash, hives, swelling and eczema), gastrointestinal tract (eg, vomiting, abdominal pain, cramping and diarrhoea) and respiratory tract (eg, rhinitis and wheeze). The most severe reaction is anaphylaxis (see the Glossary), which can cause death (Lack 2008b).

Most food allergy presents in early childhood, usually between 6 and 24 months of age, although fish and shellfish allergy may develop in later childhood or adulthood (see Table 41). Cow's milk, egg and peanut are the most common food allergies, while allergy to tree nuts, soy, wheat, sesame, kiwifruit, fish and shellfish are also frequently seen (Lack 2008b).

There is no evidence that restricting any specific food from a child's diet or delaying food introduction will prevent the development of food allergy. Some data indicate that avoiding commonly allergenic foods in early childhood may even increase the chance of specific food allergy (Koplin et al 2010). This relationship applies for children at high risk of allergy such as those with parents or siblings with food allergy, asthma or atopy (Sampson 2004; Prescott and Tang 2005; Greer et al 2007; Prescott et al 2007).

Table 41: National history of food allergy and cross-reactivity between common food allergies

Food	Usual age of onset	Cross-reactivity	Usual age at resolution
Hen's egg white	6–24 months	Other avian egg	7 years (75% of cases resolve)*
Cow's milk	6–12 months	Goat's milk, sheep's milk, buffalo milk	5 years (76% of cases resolve)*
Peanut**	6–24 months	Other legumes, peas, lentils and coreactivity with tree nuts	Persistent (20% of cases resolve by 5 years old)
Tree nuts**	1–7 years; in adults, onset occurs after cross-reactivity to birch pollen	Other tree nuts and coreactivity with peanuts	Persistent (9% of cases resolve after 5 years)
Sesame seeds	6–36 months	None known; coreactivity with peanuts and tree nuts	Persistent (20% of cases resolve by 7 years)

Food	Usual age of onset	Cross-reactivity	Usual age at resolution
Fish^	Late childhood and adulthood	Other fish (low cross-reactivity with tuna and swordfish)	Persistent
Wheat	6–24 months	Other grains containing gluten	5 years (80% of cases resolve)
Soybeans+	6–24 months	Other legumes	2 years (67% of cases resolve)
Kiwifruit	Any age	Banana, avocado and latex	Unknown
Apples, carrots, and peaches#	Late childhood and adulthood	Birch pollen, other fruits and nuts	Unknown

Source: Lack (2008b)

* Recent studies suggest that resolution may occur at a later age.

** Do not give small, hard foods such as whole nuts until children are at least five years old to reduce the risk of choking (see section 1.2: Food groups and recommended serving sizes).

^ Fish allergy that is acquired in childhood can resolve.

+ Although IgE-mediated allergies to wheat and soybeans are frequently suspected food allergies, in practice these diagnoses are rarely confirmed after evaluation by a specialist.

Allergy to apples, carrots, and peaches (oral allergy syndrome) is commonly caused by heat-labile proteins. Fresh fruit causes oral pruritus, but cooked fruit is tolerated. There is generally no risk of anaphylaxis, although in rare cases, allergies to cross-reactive lipid transfer protein can cause anaphylaxis after ingestion of fruits and vegetables.

Accurate diagnosis of food allergy is important. The gold standard for diagnosis of food allergy is a double-blind, placebo-controlled food challenge. However, this method is time consuming and not practical in most settings. The diagnosis of a food allergy involves a medical review, physical examination and a comprehensive dietary history. The type of information collected in the history includes the type/s of food thought to cause an adverse reaction, the amount of food required to produce symptoms, the length of time between food exposure and symptoms, details of the symptoms, and reproducibility of symptoms in response to the same food (Lee and Burks 2006; Lack 2008b).

Allergy testing must be carried out under the guidance of a medical practitioner. Skin prick tests and specific IgE tests (blood tests for allergen specific IgE, often referred to as RAST or EAST) are used to detect the presence of food-specific IgE antibodies, and indicate the likelihood of an IgE-mediated food allergy. For food allergy that is not IgE-mediated these tests are expected to be negative. The history is generally key to recognition, an oral food challenge may be required to confirm a diagnosis.

Prevalence

The true prevalence of food allergy is difficult to determine. When clinical tests are used to diagnose food allergy, prevalence estimates tend to be lower than those produced through self-report (Rona et al 2007). Research indicates food allergy may affect 4–8 percent of children and 2–3 percent of adults (Sampson 2003; Lee and Burks 2006; Lack 2008b). The prevalence of food allergy tends to be higher in children with atopic disorders such as eczema (Sampson 2003). An Australian population-based study has recently suggested even higher rates of challenge proven food allergy, affecting up to more than 10 percent of one year old infants (Osborne et al 2010).

There are no reliable data on the prevalence of food allergy in New Zealand children and young people (Crooks et al 2008). However, the prevalence of food allergy appears to be

increasing in economically developed countries (Lack 2008a). The reasons for the increase are not entirely clear, but several theories have been proposed including change in dietary composition, the hygiene hypothesis (Lack 2008a) and epigenetic changes, (whereby gene expression may be influenced by environmental exposures) (Prescott 2011). The hygiene hypothesis proposes that reduced exposure to infections during early childhood leads to an inappropriate immune response and increased risk of allergy (Allen et al 2006; Lack 2008a).

Management

There is no cure for food allergy, so management focuses on preventing symptoms by avoidance of the food allergen(s) (Sampson 2004; Lee and Burks 2006). It is very important that food allergy is managed in consultation with a registered medical practitioner and dietitian.

Nutrition review with a dietitian is recommended for most children with food allergy, especially those with cow's milk, soy or wheat allergy, to review food and nutrient intake, and provide advice on suitable food and beverage alternatives.

Parents, caregivers and family members need to be educated about allergen avoidance including reading food labels, eating away from home (eg,parties, shared lunches, restaurant meals, 'sleep overs' etc), recognising symptoms and managing severe reactions (Sampson 2004)

A medical treatment plan needs to be given for management of acute reactions and for those at risk of anaphylaxis (For more information see). Predicting who is at risk of a severe food allergic reaction is difficult. While in some cases there is clearly risk as there has been a previous severe reaction, other children will also be at risk of severe reaction on accidental exposure depending on the allergen in question, allergen 'dose', presence of asthma, and other modifying factors such as exercise. All caregivers need to able to recognise signs and symptoms suggestive of a severe reaction and understand the importance of seeking urgent medical attention. It is important to remember that while some foods are more commonly thought of as potentially causing severe allergic reactions (eg, peanut, other nut or shellfish), any food causing IgE mediated food allergy has the potential to cause a severe allergic reaction.

Standard 1.2.3 of the Australian New Zealand Food Standards Code (FSANZ 2010) requires most common food allergens ie, shellfish (crustacea), egg, fish, cow's milk, peanut, soy, tree nuts and sesame seeds, along with sulphites (in concentrations of 10 mg/kg or more), to be declared on food labels. The allergen must be declared when it is an ingredient, food additive, processing aid or a component of any of these.

Cow's milk allergy

Dairy products (eg, milk, yoghurt and cheese) will need to be avoided. Some children and young people may tolerate dairy as an ingredient in well cooked foods, but this will need to be discussed with the child's doctor/dietitian. There is cross-reactivity between milk proteins from different animal species, so some children with cow's milk allergy will also react to other types of milk, such as goat or sheep milk (Restani et al 1999). In cow's milk allergic children a 92 percent cross reactivity rate to goat milk was observed (Bellioni-Businco et al 1999). Avoidance of all animal milks – goat, sheep and buffalo is recommended for children with IgE mediated cow's milk allergy.

Milk is an important source of many nutrients, including protein, calcium, riboflavin, vitamin A and vitamin B12. It is also important for bone health and growth. In a 2002 New Zealand study of 3–10 year old Dunedin children, milk avoiders with low calcium intakes were shorter, had smaller skeletons and lower total bone mineral content (Black et al 2002).

A calcium and vitamin B12 fortified soy milk is recommended as a cow's milk alternative for children over one year of age. A calcium, vitamin and mineral fortified rice milk may be as appropriate as a cow's milk and soy milk replacement for children over one year of age with an adequate energy and protein intake from a variety of foods.

Egg allergy

Egg from all poultry eg, hen, duck, quail should be avoided. Many children will tolerate egg as an ingredient in foods that have been well cooked (eg, cake, biscuit and muffin) and in this case these foods may be permitted in the child's diet while still avoiding foods containing raw or lightly cooked egg. Other children will need to avoid all egg, including as an ingredient.

Peanut and tree nut allergy

Thirty-five to fifty percent of people with a peanut allergy will react to at least one type of tree nut (Sampson 2003). Therefore, many people with peanut allergy are advised to avoid all tree nuts. Tree nuts include almond, Brazil nut, cashew, hazelnut, macadamia, pecan, pine nut, pistachio and walnut.

It is important to avoid peanut and/or tree nut, as well as any foods with peanut and/or tree nuts as an ingredient. The need to avoid foods with precautionary labelling such as 'may contain traces' should be discussed with the medical practitioner or dietitian.

Peanuts are legumes so there is a small risk (around 5%) that someone with a peanut allergy will also react to other legumes (eg, peas, beans and lentils). Other legumes do not need to be routinely avoided in peanut allergic children, as most children will tolerate other legumes. While 10–20 percent of peanut and tree nut allergies resolve, most persist into adulthood.

Wheat allergy

Most (80%) children will outgrow a wheat allergy by the age of five years. Wheat is an ingredient in many staple foods, such as bread, cereals and pasta.

Cereals and the cereal food group are an important source of energy, carbohydrate, fibre and vitamins. A nutrition review with a dietitian is recommended for advice about age appropriate wheat free alternatives and recipe information.

Fish and shellfish allergy

Allergy to fish and shellfish are not uncommon. There is considerable cross reactivity between various fish and also between various shellfish. Some people are allergic to either fish and shellfish, but many will need to avoid both fish or shellfish, being careful in situations where they could be confused or contaminated.

Soy allergy

All soy products eg soy milk and tofu and all foods containing soy must be avoided. Soy is used as an ingredient in many processed foods including breads.

Sesame seed allergy

In Australia it is the fourth most common cause of food allergy in children and the third in Israel (Stutius et al 2010). Avoidance of sesame seeds and products containing them is required eg tahini, hummus and sesame oil.

Resources

Allergy New Zealand provides information on food allergy including how to substitute foods, read food labels and identify foods which may contain allergens.
Website: www.allergy.org.nz

Australasian Society of Clinical Immunology and Allergy (ASCIA) provides patient and health practioner information on food allergies. Website: www.allergy.org.au

For information and resources on anaphylaxis, visit ASCIA website: www.allergy.org.au and Allergy New Zealand website: www.allergy.org.nz. allergy help/a-z allergies/anaphylaxis

Food manufacturers' websites and 0800 consumer information phone lines may provide ingredient and allergen information.

The Ministry for Primary Industries booklet *Eating Safely When You Have Food Allergies*, and other allergy-related information can be viewed at: www.foodsmart.govt.nz

12.5 Coeliac disease

Background

Coeliac disease (CD) is a permanent, autoimmune disorder caused by intolerance to gluten which is found in wheat, barley, oats and rye. This intolerance to gluten causes the body to produce antibodies which damage the lining of the small bowel and make it difficult for the body to absorb vitamins, minerals and other nutrients from food (Coeliac Society (NZ) 2011). It occurs in those who have a genetic sensitivity (Mann and Truscott 2007) and is more common in certain ethnic groups, including those of North Indian origin (Steele 2011).

The age of onset of CD for most people is usually between six months and seven years. However, there is often a significant delay between this stage and the age of clinical diagnosis. In many cases this delay can be years (Steele 2011).

Classical presentation of CD can involve failure to thrive; persistent diarrhoea; chronic constipation; recurrent abdominal pain; vomiting; incomplete dental enamel development; short stature without apparent cause; pubertal delay; and/or iron-deficiency anaemia that is not responsive to supplementation (Hill et al 2005, as cited by Steele 2011). People with CD can also present with atypical symptoms or with no symptoms at all.

The involvement of a specialist, such as a gastroenterologist, is important. Specific serology tests can be useful in diagnosis but a confirmed diagnosis or definitive exclusion of CD requires a collection of biopsies from the small intestine. Biopsies should always be done while the individual is on a gluten-containing diet. A gluten-free diet can begin following diagnosis and should be offered to all with CD, including those who are asymptomatic.

Prevalence

CD has an estimated prevalence of one percent in the United States and Europe (Mann and Trowel 2007), although it is believed to be under-diagnosed with only 10–20 percent of those with the disease identified (Steele 2011). The number of children diagnosed with CD is increasing. This may be due to improvements around diagnosis ie, increased awareness of atypical presentations and better serologic tests. It could also be due to a genuine increase in prevalence (Steele 2011).

Management

Management of CD requires a team approach involving the child or young person, their family/whānau, a medical practitioner and dietitian. A nutrition review with a dietitian is recommended to review food and nutrient intake, and provide advice on suitable food and beverage alternatives.

Useful resources and tools

The Coeliac Society of New Zealand produces a range of useful resources about CD and a gluten-free diet. Its website is: www.coeliac.org.nz

Food manufacturers' websites and 0800 consumer information phonelines may provide information on ingredients, including gluten content, in their foods.

12.6 Pregnancy and breastfeeding

Background

In 2007 there were 4373 live births in women younger than 20 years, representing 7.4 percent of all live births (Statistics New Zealand 2008a). Close support and monitoring by a Lead Maternity Carer is important for all pregnant young women.

Recommended intake

The nutritional requirements of pregnant and breastfeeding young women are higher than the requirements for adult pregnant and breastfeeding women because the young woman is still growing (NHMRC 2006). These high nutrient requirements put both the baby and mother at risk of inadequate intake, which could result in poor growth and development in one or both of them. Regular monitoring of the growth and development of both mother and baby is essential.

The nutrient reference values (NRVs) for pregnant and breastfeeding young women (aged 14–18 years and 19–30 years) are presented in Appendix 3.

Folate

Adequate folate intake for women during preconception and the early stages of pregnancy is important to reduce the risk of neural tube defects such as spina bifida in the baby. Therefore, women planning a pregnancy (or who find themselves pregnant) should take a subsidised folic acid tablet of 800 µg per day. Ideally they should start taking these tablets at least 4 weeks before conception and continue to 12 weeks after conception.

Women at high risk of a pregnancy affected by NTDs are recommended to take a 5000 µg (5 mg) folic acid tablet for the same period of time. Women at high risk are those who:

- have previously had an NTD-affected pregnancy
- have a family history of NTD, or whose partner had a family history
- are affected by NTD themselves, or whose partner is affected by NTD
- are on insulin treatment for diabetes
- are taking medications known to affect folate metabolism such as anti-convulsants, infertility treatment, vitamin A analogues used to treat acne and some anti-tumor agents; for example, carbemazepine, clomiphene, valproate, retinoids and etretinate.

For more information on folate, see section 4.8: Folate.

Iodine

Iodine is an essential nutrient that is needed for normal growth and development, including the brain development of unborn babies. As iodine requirements during pregnancy and breastfeeding are higher and New Zealanders, in general, have inadequate iodine intakes, a subsidised iodine-only tablet of 150 µg per day is recommended for all young women who are pregnant or breastfeeding. These low-cost tablets are available at pharmacies, either over the counter or on prescription. Young women who have a history of thyroid disease should discuss this issue with their doctor. For more information on iodine, see section 4.11: Iodine.

Useful resources and tools

For more detailed background information on pregnancy and breastfeeding in young women, refer to the *Food and Nutrition Guidelines for Healthy Pregnant and Breastfeeding Women: A background paper* (Ministry of Health 2006c). For an electronic copy of these guidelines, along with relevant food and nutrition policy updates since 2006, visit: www.moh.govt.nz

Note that the recommended nutrient intakes in the 2006 background paper have recently been revised. Refer to Appendix 3 for the current nutrient reference values for pregnant and breastfeeding young women.

The Ministry of Health produces health education resources on food and nutrition issues during pregnancy and breastfeeding. To access them, visit: www.healthed.govt.nz or www.health.govt.nz

The Ministry for Primary Industries is responsible for food safety in New Zealand. For more information on food safety during pregnancy, refer to the booklet *Food Safety in Pregnancy* at: www.foodsmart.govt.nz

Part 13: Other issues

This part discusses other issues relevant for providing effective food and nutrition guidance to children and young people: body image, disordered eating and eating disorders; oral health; alcohol; dietary supplementation; food safety; food additives; intense sweeteners; and caffeine.

13.1 Body image, disordered eating and eating disorders

Summary

Body image is how people perceive their own body size and shape. This perception is influenced by individual, family/whānau, social and environmental factors.

Body image concerns increase as children get older, and are common in young people, especially females.

In New Zealand, more European young people are dissatisfied with their body weight than Māori, Pacific and Asian young people. However, dissatisfaction and attempts to lose weight are issues for a significant number of young people from all ethnic groups.

Negative body image is a risk factor for disordered eating and eating disorders. Parents and caregivers can promote a healthy body image and be good role models by:

- accepting their own body size and shape
- accepting other people's body size and shape
- being critical of media portrayals of unrealistic body sizes
- eating healthily and not dieting
- exercising regularly, but not excessively.

Disordered eating is a spectrum of irregular and unhealthy eating habits ranging from mild to extreme behaviours.

- Family/whānau support and positive role modelling help protect against eating disorders. Eat together as a family/whānau as often as possible.

Eating disorders are rare and complex psychiatric disorders that can have serious consequences. They usually begin in adolescence or young adulthood, but are increasingly being diagnosed in children.

- Eating disorders should be considered when a child or young person engages in unhealthy weight-control behaviour; is obsessive about food, body weight or exercise; or fails to attain or maintain a healthy body size or stage of development for their gender and age.
- If you are concerned a child or young person has an eating disorder, seek help from a doctor.

Introduction

Adolescence is a period of rapid growth and development, both physical and psychological. Leading up to adolescence, the body lays down fat reserves in preparation for the growth spurt. Puberty is associated with changes in body size and shape. In girls, these changes involve laying down fat on the stomach, hips and thighs, which is essential

for reproductive development. Such changes can also make young people more body conscious and concerned about body image. For more information on adolescent eating patterns, see section 6.3. The dietary habits of young people.

Body image

The concept of body image relates to how people perceive their own body size and shape. Many people do not perceive their body size accurately, rating themselves either bigger or smaller than they really are. For example, in the Youth'07 study, over 60 percent of New Zealand secondary school students were in the normal range for body mass index (BMI), yet 71 percent were worried about gaining weight and two-thirds of female students had tried to lose weight in the last year (Adolescent Health Research Group 2008). In the Obesity Prevention in Communities study, less than half of adolescents (36% of females and 44% of males) were happy or very happy with their body weight (Utter et al 2008a). Nearly half (48%) were trying to lose weight and 14 percent were trying to gain weight (Utter et al 2007c). The nature of these concerns often differs by gender. For example, a higher proportion of females (55%) than males (40%) were trying to lose weight, whereas more males (21%) than females (7%) were trying to gain weight.

There also may be differences in concerns about body weight and size in relation to ethnicity. The Obesity Prevention in Communities study[33] found that significantly more Māori, Pacific and Asian young people were happy or very happy with their body weight, compared with their European counterparts (see Table 42).

Table 42: Perceptions of own body weight among young people, by ethnicity and gender

Ethnic group	Percentage (%) 'happy' or 'very happy' with own body weight	
	Female	Male
Māori	41	46
Pacific	35	43
Asian	36	42
European	15	19

Source: Utter et al (2008a)

Although this finding seems to reinforce ideas that body size dissatisfaction is more of an issue for European New Zealanders, young people from other ethnic groups also have concerns. In Youth'07, most Māori secondary school students (72% of females and 89% of males) reported they were satisfied with their body weight (Clark et al 2008). However, over half (54%) had tried to lose weight in the previous year. Similarly the Obesity Prevention in Communities study found 4 out of 10 Pacific youth (44% of females and 40% of males) perceived themselves to be overweight, but more than half (61% of females and 53% of males) were trying to lose weight (Utter et al 2008a).

Individual, family/whānau, social, cultural and environmental factors influence a person's body image. The promotion of unrealistic body sizes in the mass media (television, movies, magazines and internet) is strongly associated with poor body image and eating disorders (Borzekowski and Bayer 2005; Derenne and Beresin 2006; Hogan and Strasburger 2008). Parents are important gatekeepers to the social influences related to children's eating, including through controlling access to the media and acting as role models (Savage et al 2007). Encouraging healthy attitudes around body size and eating behaviours in the home environment is important.

33 The Obesity Prevention in Communities study used a non-representative sample of 12–18 year olds.

In addition, the widespread attention to and publicity on the 'obesity epidemic' in recent years may have made children, young people and their families/whānau more aware of and concerned about body size. Although strong evidence supports the link between heavy body weight and risk of disease (see section 3.3: Obesity), this message needs to be tempered with realistic and positive messages related to body weight and health.

Negative body image or body image distortion is a strong predictor of disordered eating (see below) (Neumark-Sztainer et al 2004). Information-based programmes that focus on teaching young people about eating disorders and related issues have not been successful in improving body image and disordered eating practices. Although participants' knowledge of eating disorders and problem eating is likely to increase, any beliefs, attitudes, intent and behaviours that influence the development of eating problems are unlikely to change. Such information-based programmes have even been considered potentially harmful, as they may have the unintended outcomes of glamorising and normalising eating disorders (O'Dea and Abraham 2000).

In contrast, interactive educational programmes aimed at improving self-esteem have been shown to improve body image and eating attitudes among young people. These school-based programmes also involved parents and families who provided positive statements about their young people (O'Dea and Abraham 2000). Indeed, family/whānau support and family meals appear to protect against eating disorders (Neumark-Sztainer et al 2004).

Disordered eating

Disordered eating is a term used to describe a wide range of irregular and unhealthy eating habits, often where sensations of physical hunger and satiety (fullness) are ignored. There is a broad spectrum of disordered eating, ranging from mild behaviours to much more extreme behaviours that can be similar to diagnosable eating disorders. Examples of disordered eating and related behaviours (Treasure et al 2010) include:

- chaotic eating (eg, irregular meals and/or skipping meals)
- restrictive behaviours (eg, excessively cutting back on the amount of food eaten, prolonged fasting)
- strict rules about eating and/or limiting variety of foods
- avoidance of social eating
- binge eating and purging (eg, self-induced vomiting)
- excessive exercise
- repeated weighing.

Disordered eating behaviours in young people can develop from their concerns about weight, intense fear of weight gain, and body image dissatisfaction (Neumark-Sztainer et al 2007; Neumark-Sztainer 2009). Disordered eating behaviours can have negative emotional, social and physical outcomes, for example, low energy levels, decreased concentration, malnutrition and an increased risk of obesity (Neumark-Sztainer et al 2006). Extreme disordered eating, while not meeting all criteria for a diagnosable eating disorder, can cause malnutrition and serious complications (Madden et al 2009). Disordered eating is also a risk factor in the development of eating disorders such as anorexia and bulimia (Neumark-Sztainer et al 2006).

The prevalence of disordered eating among New Zealand children and young people is unknown, largely because there is no standard definition and it is possible that people do not always recognise or admit to disordered eating behaviours. A study that looked at disordered eating behaviours among North American young people (aged 12–17 years) found 57 percent of the female subjects reported 'dieting' and 58 percent reported 'unhealthy weight control behaviours'. The equivalent figures for male participants were 25 percent and 31 percent respectively (Neumark-Sztainer et al 2006).

In a review article, Neumark-Sztainer (2009) identifies a number of approaches that may guide health practitioners when dealing with young people who have weight-related issues. In modified form, these approaches include the following.

1. Discuss with young people their weight control measures to date, and the appropriateness and effectiveness of the measures. Encourage positive eating and physical behaviours that are sustainable (ie, can be maintained on a regular basis in the future).
2. Help young people care for their bodies through healthy eating, activity and positive self-talk.
3. Encourage families/whānau to have regular and enjoyable meals together.
4. Encourage families/whānau to talk less about weight and do more to help young people achieve a weight that is healthy for them.
5. Consider issues of stigma associated with weight and ways to deal with it. Discuss these ideas with the young person and their family/whānau.

For general information on adolescent eating patterns, see section 6.3: The dietary habits of young people.

Eating disorders

Eating disorders are complex psychiatric disorders that are at the extreme end of the disordered eating spectrum. Eating disorders are relatively rare. The prevalence in New Zealanders aged 16 years and over was assessed in *Te Rau Hinengaro: The 2003/04 New Zealand Mental Health Survey* (Oakley Browne et al 2006). This survey found that in young people aged 16–24 years the prevalence of anorexia was 0.7 percent, bulimia 1.3 percent and any eating disorder 2.0 percent (Oakley Browne et al 2006).

Eating disorders usually begin in adolescence or young adulthood, although they have been seen in children as young as five years (Madden et al 2009). In adults overall, females were about 10 times more likely than males to have anorexia and four times more likely than males to have bulimia.

Diagnostic criteria are based on psychological, physiological and behavioural characteristics and are detailed in the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV TR). The following are definitions from the DSM-IV. The next version of the manual (DSM-V) is due to be released in May 2013.

Anorexia nervosa is characterised by low body weight and body image distortion. A key feature of anorexia nervosa is deliberate weight loss through severe food restriction and/or other weight controlling behaviours, including purging, using laxatives and excessive or compulsive exercise. Symptoms include refusal to maintain weight above a reasonable level (eg, 85% of expected weight), intense fear of becoming fat, self-worth based on body size or shape, and evidence of an endocrine disorder secondary to low weight (eg, amenorrhoea – the absence of at least three consecutive menstrual cycles).

Bulimia nervosa is characterised by repeated binging on food followed by purging. Purging behaviours include vomiting, abuse of laxatives or diuretics (substances that increase urine output) and excessive exercise.

Eating disorders not otherwise specified is a category that encompasses eating disorders that do not fully meet diagnostic criteria for anorexia nervosa or bulimia nervosa, and other eating disorders, such as binge eating and excessive night eating. Binge eating disorder is characterised by recurrent binge eating and distress after eating. Night eating is characterised by people eating more than half of their energy intake after 7 pm (American Dietetic Association 2006).

Health implications of eating disorders

Eating disorders are associated with many serious physical, psychological and social outcomes. Inadequate energy and nutrient intake (mainly anorexia nervosa) can cause growth and developmental problems such as sub-optimal growth, delayed puberty and failure to obtain peak bone mass (American Academy of Pediatrics: Committee on Adolescence 2003; Golden et al 2003; American Dietetic Association 2006). Both anorexia and bulimia nervosa can lead to micronutrient deficiencies and malnutrition, although the extent of nutritional abnormalities among bulimics depends on the extent of dietary restriction during non-binge episodes. Chronic anorexia and bulimia impact on all body systems, including the endocrine, cardiovascular, gastrointestinal and musculoskeletal systems (American Academy of Pediatrics: Committee on Adolescence 2003; American Dietetic Association 2006). Vomiting, a common method of purging among people with bulimia, can cause dehydration, electrolyte imbalance and erosion of tooth enamel. Eating disorders are also associated with other psychological problems, such as anxiety, depression and suicide.

An Australian study examining early onset eating disorders in children aged 5–13 years reported physical symptoms including weight loss, bradycardia, hypothermia and hypotension. Psychological and behavioural symptoms included food avoidance, preoccupation with food, fear of weight gain/fatness, preoccupation with weight, misperception of body shape and excessive exercise (Madden et al 2009).

Early detection and management of eating disorders is critical. When treated, about half of people with anorexia nervosa will recover, but the rest will continue to have moderate to serious problems (Ebeling et al 2003; American Dietetic Association 2006). Anorexia nervosa has one of the highest mortality rates of any psychiatric disorder, with 5–10 percent dying from their illness. Most people with bulimia nervosa will recover fully, with the remainder having partial syndromes. Mortality from bulimia nervosa is rare (American Dietetic Association 2006). Some people cross over between syndromes (Wentz et al 2009).

Risk factors for eating disorders

Societal norms regarding ideal body size, which are often perpetuated by the media, have been found to play an important role in increasing the risk of eating disorders (Hogan and Strasburger 2008). Other risk factors include being female, being aged 10–25 years, having high socioeconomic status, having a mother with body image concerns and/or who frequently diets, and having low self-esteem. Although females are much more likely to have eating disorders than males, changes in the way the media portrays images of men are thought to have contributed to an increase in eating disorders in males (Harvey and Robinson 2003).

Eating disorders can be difficult to diagnose in children and young people for various reasons related to their physical and mental growth and development. This difficulty has led some experts to suggest that the threshold for intervention should be lower than for adults (Golden et al 2003). Eating disorders should be considered when a child or adolescent engages in unhealthy weight-control behaviour; is obsessive about food, body weight or exercise; or fails to attain or maintain a healthy body size or stage of development for their gender and age (American Academy of Pediatrics: Committee on Adolescence 2003; Golden et al 2003).

Treatment

Early detection and treatment improves outcomes and reduces serious or irreversible consequences (American Academy of Pediatrics: Committee on Adolescence 2003). Eating disorders are psychiatric disorders with multifactorial causes and processes. Therefore, treatment will require the involvement of a team of experts, including a psychiatrist and dietitian with specialist training and experience in this area. If there is concern a child or young person may have an eating disorder, a doctor should be contacted immediately.

Useful resources and tools

For guidelines for the treatment of anorexia nervosa, refer to the Australian and New Zealand clinical practice guidelines (Beumont et al 2004). The guidelines can be found online at: http://focus.psychiatryonline.org/cgi/reprint/3/4/618

13.2 Oral health

Summary

Dental caries is one of the most common childhood diseases in children and young people.

Dental caries is an infectious disease and requires the interaction of three factors: micro-organisms (*Streptococci mutans)*, a substrate (fermentable carbohydrate) and a susceptible tooth surface.

Tooth erosion is the loss of dental hard tissue by extrinsic acids, which impair the integrity of the tooth, making it more susceptible to dental caries.

Regular dental care is essential for good oral health. Children in New Zealand are entitled to free basic oral health services from birth until 18 years of age.

Good oral hygiene and minimising intake of cariogenic foods and drinks are key behaviours in preventing dental caries.

Give the following advice to parents, caregivers, children and young people.

- Practise good oral hygiene, including brushing teeth twice a day using full-strength (1000 parts per million) fluoride toothpaste.
- Use a soft brush with a smear of toothpaste for children under six years and a pea-sized amount for children over six. Children should 'swish' and spit out excess toothpaste, but not rinse it out.
- Eat a combination of foods at each meal, including whole grains, vegetables and fruit.
- If drinking fruit juice or sugary or acid-based drinks, do so with meals rather than between meals.
- Drinks other than water and milk should be served in a glass or cup rather than a bottle or sipper cup to reduce the wash of sugar over the teeth.
- Avoid putting a child to bed with a bottle of milk, juice or other sugar-containing beverage.
- Have no more than six meals (including snacks) per day to allow time for teeth to remineralise between meals.
- Choose snacks such as yoghurt and cheese, which are low in fermentable carbohydrate and promote tooth remineralisation.
- Limit sugary foods and drinks, especially those that remain in the mouth for an extended time or are more likely to stick to teeth, for example, hard or chewy sweets, dried fruit, roll-ups and lollipops.

Background

Poor oral health in children and young people can be painful and expensive to treat, and can cause tooth disease and tooth loss. Diet and nutrition are important components of oral health. Although adequate nutrition in children is required for the overall growth and development of the oral cavity, diet can also contribute to dental caries and tooth erosion. Serious oral health problems can lead to problems with eating, which can affect dietary intake (American Dietetic Association 2007).

Dental caries is one of the most common childhood diseases in children and young people. It is an infectious disease and requires the interaction of three factors: micro-organisms (*Streptococci mutans*), a substrate (fermentable carbohydrate) and a susceptible tooth surface. Most children are infected with *Streptococci mutans* by the age of two years. Bacteria are usually transmitted from the mother and practices such as tasting a child's food and sharing eating utensils increase the risk of transmission (Gussy et al 2006).

Tooth erosion is the progressive loss of dental hard tissue by extrinsic acids. Tooth erosion does not involve micro-organisms or fermentable carbohydrate, but the acids impair the integrity of the tooth, making it more susceptible to dental caries. The acids that cause tooth erosion come from the diet (eg, fruit juice, fizzy/soft drinks, citrus fruit, and other acidic foods and drinks), vomiting, gastrointestinal reflux and regurgitation (Touger-Decker and van Loveren 2003).

Oral health in New Zealand children

The 2009 New Zealand Oral Health Survey (Ministry of Health 2010b) assessed a range of oral health conditions and behaviours in children and young people.[34] As expected, the percentage of children who had never had a filling decreased with age: 78 percent of children aged 2–4 years had never had a filling, compared with 77 percent of children aged 5–11 years, and 45 percent of children aged 12–17 years. When adjusted for age, Māori and Pacific children and Māori young people were significantly more likely to have had a filling. Asian children were significantly less likely to have had a filling than children overall.

Levels of tooth decay among children have improved since 1988, but it remains a significant problem for some children. Across the age group of 2–17 years, Māori children were significantly more likely than non-Māori to have more decay and more severe decay in both primary and permanent teeth, less likely to brush their teeth twice daily with fluoride toothpaste, less likely to have visited a health professional in the last year and more likely to have experienced toothache in the last year.

Pacific children were also more likely than non-Pacific children to have decay in their primary teeth, less likely to have visited a dental professional and more likely to have experienced toothache in the last year.

Children living in the most socioeconomically deprived areas were six times more likely to have had one or more teeth removed due to decay than children living in the least socioeconomically deprived areas. In the most socioeconomically deprived areas, 2–11 year olds had an average of 14 decayed, missing or filled teeth.

Nearly two-thirds (60%) of children aged 2–17 years brush their teeth at least twice a day. However, only 43 percent (two out of five) brushed twice a day with fluoride toothpaste of the right strength (1000 parts per million). Around 30 percent of children and young people surveyed brushed only once a day and 7 percent had not brushed their teeth on the previous day. Boys were significantly less likely than girls to brush their teeth twice a day.

Dietary factors influencing dental caries and tooth erosion

Fermentable carbohydrates such as sugars and starches can be fermented (metabolised) by bacteria. This process produces acids that lower the pH in the mouth and promote demineralisation of tooth services (Gussy et al 2006). Sucrose is of particular concern because when it is metabolised it produces dextrans, which enable bacteria to more easily adhere to the teeth (Gussy et al 2006). Cariogenic foods (food containing fermentable

34 The survey also looked at the oral health of all adults over 18 years of age. It was the first national survey of oral health for over 20 years: *Our Oral Health: Key findings of the 2009 New Zealand Oral Health Survey* (Ministry of Health 2010b).

carbohydrates) include sugary drinks (eg, soft and fizzy drinks, energy drinks and sports drinks) and highly processed starchy or sugar foods (eg, lollies, cakes and biscuits) (American Dietetic Association 2007).

The consistency of the food and how it is eaten are very important. For example, foods that stick to the teeth (eg, roll-ups, chewy lollies, fruit leather and dried fruit) and/or are kept in the mouth for a long time (eg, lollipops and hard lollies) are more cariogenic as they can cause extended periods of acid production and demineralisation. Beverages usually pass through the mouth more quickly than solid foods, but holding sugary drinks in the mouth or constant sipping increases risk of dental caries (Touger-Decker and van Loveren 2003). Frequent eating and drinking is also a risk factor for dental caries, as it results in longer periods of demineralisation and less time for remineralisation.

Anti-cariogenic foods and drinks are those that promote tooth remineralisation. They include foods high in calcium, phosphate and protein, such as milk and milk products (Touger-Decker and van Loveren 2003). Sugar-free gums, particularly those containing polyols, can stimulate saliva production, which may increase clearance of sugars and starches from the mouth.

Do not put children to bed with a bottle of juice or other sugar-containing beverages, as this practice causes long-term exposure to sugar and acid. Another drink to avoid at night time is milk, which contains lactose that can be fermented by bacteria.

Fluoride and tooth brushing

Fluoride protects against dental caries via its role in the mineralisation of teeth. Fluoride has both topical and systemic effects: for example, direct contact with teeth promotes mineralisation; and ingested fluoride is incorporated into developing teeth (Gussy et al 2006). Therefore, fluoride acts both before and after teeth have erupted.

Toothbrushing removes dental plaque, which is the sticky soft layer (a bacterial biofilm) that forms on teeth every day. If left to build up, plaque can cause tooth decay and periodontal disease. Bacteria in plaque react with (metabolise) sugar consumed in the daily diet to produce an acid that dissolves the minerals in teeth, and over time this process can cause cavities (holes). Bacteria in plaque also produce substances that cause inflammation in the periodontal tissues surrounding the teeth. A Cochrane review found that children and adolescents who brush their teeth daily with fluoridated toothpaste have less tooth decay (Marinho et al 2003).

Although fluoride is not an essential nutrient, recommendations for fluoride intake have been set, given its important role in the mineralisation of teeth (NHMRC 2006). The adequate intakes (AIs) for fluoride for children and young people are as follows:

- 0.7 mg for children aged 2–3 years
- 1 mg for children aged 4–8 years
- 2 mg for children aged 9–13 years
- 3 mg for young people aged 14–18 years.

Most water supplies in larger urban areas of New Zealand are fluoridated, so water (and beverages or food made with water) is the main source of fluoride in the diet. Another source of fluoride is toothpaste. Full-strength fluoride toothpaste (1000 parts per million) is recommended for all children and young people, especially those with unfluoridated water supplies. Just a smear of fluoride toothpaste is required for children under six years and a 'pea-size' amount for those aged six years and over. Dentists or other oral health professionals may give further advice about additional fluoride sources.

Dental care in New Zealand

Children in New Zealand are entitled to free oral health services from birth to 18 years of age, including regular assessments and a range of preventive and treatment services.

To receive this entitlement, children and young people need to be enrolled in the publicly funded dental service. For more information, including enrolment details, see the Ministry of Health's website at: www.health.govt.nz

Parents can enrol children, make appointments, find out where the nearest provider is or seek advice on a national freephone service: 0800TALKTEETH (0800 825 583).

Useful resources and tools

For further information on oral health, refer to Oral Health on the Ministry of Health's website: www.health.govt.nz

For information about fluoride and water fluoridation, see: www.health.govt.nz

For information for parents, caregivers, children and young people refer to Let's Talk Teeth on the Ministry of Health's website: www.health.govt.nz

For children up to five years, the New Zealand Dental Association, in conjunction with the Ministry of Health, has produced *Healthy Smile, Healthy Child: Oral health guide for Well Child providers* (New Zealand Dental Association 2008). This document is available on the New Zealand Dental Association's website: www.nzda.org.nz

13.3 Alcohol

Background

Alcohol (ethanol) is produced by fermentation of glucose in fruit juice (eg, grape), cereals (eg, barley) (Mann and Truswell 2007) and lactose . Although alcohol is a concentrated source of energy, providing 29 kJ per gram (compared with 37 kJ for fat and 17 kJ for both carbohydrate and protein) (NHMRC 2006), it contains no other nutrients. Most drinks containing alcohol have few nutrients other than small amounts of carbohydrate from unfermented sugars (Foster and Harriott 2006; Mann and Truswell 2007).

Alcohol is the most commonly used recreational drug in New Zealand. Eighty percent of New Zealanders aged 16–17 years report that they have drunk alcohol in the last year. Although most people drink without harming themselves or others, the misuse of alcohol by some results in considerable health, social and economic costs. These costs are borne by individuals, families/whānau and the wider community. Alcohol-related harms include:

- haemorrhagic stroke, cancers of the mouth, throat, breast and liver, and cirrhosis of the liver
- mental health conditions, such as dependence and depression
- birth defects, including fetal alcohol syndrome and other permanent disabilities
- economic and social harms such as poverty, unemployment, low productivity, family/whānau breakdown and child neglect
- injuries (fatal and non-fatal), either intentional (eg, from violence or self-harm) or unintentional (eg, from road traffic crashes).

Research also suggests that some neurological processes do not finish developing until around the age of 25 years and that heavy alcohol use can interfere with this development. There is merit therefore in advising young people to delay their initiation to alcohol use for as long as possible.

Alcohol can affect food intake (Foster and Harriott 2006; Mann and Truswell 2007) and an increasing alcohol intake is associated with a decline in diet quality (Breslow et al 2010). Consequently it has been linked to both malnutrition and obesity (NHMRC 2006). Alcohol use among young people has been identified as a risk factor for disordered eating (Croll et al 2002). For more on disordered eating, see section 13.1: Body image, disordered eating and eating disorders.

Recommendations

The Alcohol Advisory Council advises that for children and young people under the age of 18 years, not drinking alcohol is the safest option. However, if 15–17 year olds do drink alcohol, they should do so only once a week; they should never exceed recommended adult daily limits and consumption should usually be below such levels; and the drinking should take place in a supervised environment. Those under 15 years of age are at the greatest risk of harm from drinking and not drinking in this age group is especially important.

The Ministry of Health advises that women who are pregnant or planning to become pregnant should not drink alcohol. There is no safe level of alcohol use at any stage during pregnancy. Drinking alcohol increases the risk of children being born with fetal alcohol spectrum disorder. For women who are breastfeeding, not drinking is the safest option.

Useful resources and tools

For trends and statistics related to alcohol intake in New Zealand, refer to the Ministry of Health's *Alcohol Use in New Zealand: Key results of the 2007/08 New Zealand Alcohol and Drug Use Survey* (Ministry of Health 2009).

The above publication and other useful documents are available at: www.ndp.govt.nz

For alcohol policy in New Zealand, refer to the Ministry of Health's *National Drug Policy 2007–2012* (Ministerial Committee on Drug Policy 2007). The goal of the policy is to minimise the social, economic and health harms of tobacco, alcohol and other drugs. It is available from the National Drug Policy New Zealand website at: www.ndp.govt.nz/moh.nsf/indexcm/ndp-publications-nationaldrugpolicy20072012

The Alcohol Advisory Council of New Zealand (ALAC) website (www.alac.org.nz) has guidelines for low-risk drinking and a specific youth action plan. There are also a number of resources available including youth-specific ones, such as *Alcohol, Your Kids and You: A guide for parents* (www.alac.org.nz/sites/default/files/useruploads/Resourcepdfs/AlcoholKidsYou.pdf).

For more information on alcohol in relation to pregnancy and breastfeeding, refer to the *Food and Nutrition Guidelines for Healthy Pregnant and Breastfeeding Women: A background paper* (Ministry of Health 2006c), which can be viewed at the Ministry of Health's website: www.health.govt.nz. See also *Alcohol and Pregnancy: A practical guide for health professionals* (Ministry of Health 2010c).

See also the health education resources at www.healthed.govt.nz

- *When You Drink, So Does Your Baby* (HE4160)
- *Eating for Healthy Pregnant Women* (HE1805)
- *Eating for Healthy Breastfeeding Women* (HE1806)

The Alcohol Drug Association NZ has a website and helpline: www.adanz.org.nz

The phone number for the Alcohol Drug Helpline is 0800 787 797.

13.4 Dietary supplementation

Summary

Unless a particular need is identified, dietary supplementation is not recommended for children and young people.

Dietary supplementation may be required in some circumstances, such as when a child is on a restricted diet due to a food allergy.

Supplementation is not recommended except under medical supervision to ensure it is prescribed and taken in an appropriate and safe way.

Background

Good nutrition primarily depends on making appropriate food choices. For most children and young people, following the Food and Nutrition Guideline Statements, including eating a wide variety of foods from the four food groups in the recommended amounts, will provide all the nutrients they require (see sample meal plans in Appendix 5). Supplementation is not required by most children and young people; exceptions are described in 'When is supplementation appropriate?' below.

Research on dietary supplement use in New Zealand shows that people who take supplements have nutrient intakes from foods that are similar to or higher than the intakes of those who do not take supplements (C Smith et al 2005). This finding suggests that supplement users are those who are least likely to need them.

The Ministry of Health recommends people obtain nutrients from foods rather than supplements, for several reasons.

1. By obtaining nutrients from foods, people can meet nutrient requirements while also minimising the risk of excessive nutrient intake (American Dietetic Association 2005, 2009a). High intakes of some supplements can have serious adverse effects, either by exceeding the upper level of intake or by interacting with other nutrients (Lichenstein and Russell 2005).
2. Foods, particularly plant foods, provide a range of health-promoting substances beyond vitamins and minerals, including carotenoids and polyphenols, such as flavinoids (American Dietetic Association 2009a). Research suggests that positive health outcomes relate to dietary patterns, including the types and amounts of foods consumed, rather than individual nutrients (Lichenstein and Russell 2005).
3. Reliance on supplements may lead to a false sense of security about nutritional adequacy and may therefore promote and justify poor food choices (C Smith et al 2005).
4. Spending money on dietary supplements may reduce money available for food.

When is supplementation appropriate?

If dietary supplementation is deemed necessary, it should only be provided under medical supervision due to the potential for adverse outcomes (eg, excessive intake and/or nutrient interactions). Any supplementation should be based on individual requirements (NHMRC 2006). Doctors, pharmacists and other health practitioners need to be aware of the risks and benefits associated with supplement use in children and young people, and of the most appropriate types and doses of supplements for this group.

The following are examples of some children and young people who may require specific supplementation.

- Children and young people with a doctor-diagnosed milk allergy may require calcium supplementation (see section 12.3: Food allergy).

- Children and young people with a vegan diet may require vitamin B12 supplementation, and possibly iron and calcium supplementation depending on their dietary intake (see section 12.1: Vegetarian eating).
- Children and young people diagnosed with iron-deficiency anaemia will require iron supplementation (see section 4.12: Iron).
- It is recommended that young women who plan to become pregnant take a 800 µg of folic acid subsidised tablet daily for at least four weeks prior to conception and for 12 weeks after conceiving to reduce the risk of neural tube defects. (See sections 4.8: Folate and 12.6: Pregnancy and breastfeeding, for more specific information.)
- It is recommended that young women who are pregnant or breastfeeding take a subsidised 150 µg iodine-only tablet daily. (See sections 4.11: Iodine and 12.6: Pregnancy and breastfeeding, for more specific information.)
- Children and young people who do not obtain regular sun exposure, who wear clothing covering most of their skin (eg, veiling) or who have darker pigmented skin may require supplemental vitamin D (see section 4.9: Vitamin D).

If supplementation is required, it is important to adhere to the dosages prescribed or recommended on the supplement label. The Ministry of Health recommends that only those tablets or fluids that adhere to good manufacturing practice (GMP) are prescribed. GMP is the term used to describe the systems that manufacturers of medicines are required to have in place to ensure their products are consistently safe and effective (including reliability around the stated dose) (Medsafe 2010). Along with all medications, dietary supplements should be stored well out of the reach of children because many are toxic to children in very high doses.

Current levels of intake

Dietary supplement use was assessed in the 2002 National Children's Nutrition Survey. According to a 24-hour diet recall, 5 percent of children aged 5–14 years had used a dietary supplement in the previous 24 hours (Ministry of Health 2003b; Parnell et al 2006). The most commonly used supplements were multivitamins and minerals (2.1%) and vitamin C (2.0%). There was little variation in dietary supplement use by age and gender, but dietary supplement use was considerably higher in European/Other children and young people (8.2% of males and 6.0% of females) than in Māori (1.6% male, 2.5% female) and Pacific (0% male, 0.9% female) children and young people (Ministry of Health 2003b).

In an analysis of a subset of the Auckland Birth Cohort Study (Theodore et al 2006), 24 percent of European preschool children (mean age 3.5 years) were taking vitamin and/or mineral supplements daily and 39 percent were taking them weekly. The higher supplement use in this population may reflect increased popularity of supplements over time and/or the study population (Europeans are more likely to take supplements than other ethnic groups).

The 2008/09 NZ Adult Nutrition Survey found 34 percent of males and 42 percent of females aged 15–18 years had consumed supplements within the previous year. Furthermore, 18 percent of males and 17 percent of females had taken supplements regularly (up to once a week). Type of supplements consumed varied between male and female 15–18 year olds. The top three supplements taken by males were oil-based supplements[35] (11%), multivitamin and mineral (8%) and sports related (6%). For females, the top three were multivitamin and mineral (14%), herbal plus vitamin/mineral (12%) and single vitamin (8%) (University of Otago and Ministry of Health 2011).

35 Includes fish oils, omega 3 products, flaxseed/linseed oil and evening primrose oil.

13.5 Food safety

Background

Food safety refers to the microbiological and chemical safety of food. The Ministry for Primary Industries (MPI) is responsible for food safety in New Zealand.

Food-borne illness

It is estimated that 200,000 New Zealanders suffer a food-borne illness every year. Children younger than five years generally have the highest rates of infection (Williman et al 2009). The most common types of pathogens causing food-borne illnesses in children and young people are: campylobacter, giardia, cryptosporidium and salmonella (Williman et al 2009).

A number of food-borne illnesses are covered by New Zealand's notifiable disease regulations. At least nine of the 50 notifiable diseases are food-related. The most common is camplyobacteriosis, followed by salmonellosis. Others include those caused by bacterial and viral pathogens such as *Listeria* and hepatitis A. Once a test has confirmed a patient has a notifiable disease, their health practitioner is legally required to report the illness to the medical officer of health at the nearest public health unit. For more information, contact the local public health unit. The Institute of Environment Science and Research Ltd (ESR) collects a summary of notifiable disease information; to view these reports, visit its Public Health Surveillance website: www.surv.esr.cri.nz

Food-borne illness is generally preventable. Appropriate food handling and preparation reduce the risk of contracting food-borne illness. Easy-to-remember food safety tips include the 3Cs (clean, cook and chill) and proper hand washing as described below.

The following advice for parents and caregivers is recommended (MAF 2011a).

Clean

- Wash your hands thoroughly with soap and warm water and dry them with a clean, dry towel or paper towel.
- Wash and dry your hands before and after handling food.
- Wash and dry your hands every time after you touch raw meat or chicken.
- Before you start handling food, make sure all tools and all surfaces (that the food will touch) are clean.

Cook

- Defrost frozen foods thoroughly before cooking.
- Pre-cook chicken, meat patties and sausages before barbecuing. Minced meat and sausages should be cooked right through, and pork and poultry juices should run clear – use a meat thermometer to check temperatures.
- Use one set of utensils for raw meat and chicken and another set for cooked food.
- When cooking or eating outdoors, ensure that all food remains covered and cool until ready to cook or eat.
- Reheat leftovers until steaming hot throughout and do not reheat more than once.

Chill

- Ensure your fridge is operating at a temperature of between 2 and 4 degrees Celsius.
- Keep all perishable foods cold until you are ready to use them.
- Use an icepack or chilly-bin to keep food cold outdoors.
- Ensure raw meat and chicken is properly wrapped to stop drips, and keep it away from other foods and below ready-to-eat foods in the refrigerator.

- Cover and refrigerate food as soon as possible after cooking. Throw out perishable foods that you have left at room temperature for more than two hours.

For more information on food safety, refer to the food safety tips on Ministry for Primary Industries (MPI) food safety consumer website: www.foodsmart.govt.nz/food-safety/tips/index.htm

MPI's website also has a specific webpage for people with children, which includes food safety messages for keeping school lunchboxes 'cool'. See: www.foodsmart.govt.nz/information-for/people-with-children

MPI also produces food safety advice specifically for Māori, Pacific and other cultures which can be accessed at: www.foodsmart.govt.nz/information-for/maori-pacific-other-cultures

You can access information on food safety for consumers from the same website: www.foodsmart.govt.nz

Information for industry on food safety can be found at: www.foodsafety.govt.nz

Chemicals in foods

Chemicals in food include:

- nutrients, which can occur naturally or be added
- additives, which are used to preserve food and/or improve the taste or appearance (see section 13.6: Food additives below)
- agricultural compounds, which are chemicals used in the production of plants and animals
- toxins and other contaminants, which can occur naturally or be artificially produced (NZFSA 2009b).

Chemicals in food are managed and monitored in a variety of ways. The New Zealand Total Diet Study[36] is a key means of monitoring chemicals in food. This survey is repeated every three to five years, with the most recent survey beginning in 2009. Results from the 2009 New Zealand total Diet Study (Vannort and Thomson 2011) show that the average New Zealand diet has no safety concerns from chemical residues or contaminants. For more information on the New Zealand Total Diet Study and monitoring of chemicals in food, visit MPI's website: www.foodsafety.govt.nz/science-risk/programmes/total-diet-survey.htm

Where people are concerned about chemicals in food, they can reduce exposure by selecting organic foods. Although organic foods may have some environmental benefits, a recent systematic review found no difference in nutrient quality between organic and conventionally produced foods (Dangour et al 2009).

36 Formerly known as the New Zealand Total Diet Survey.

13.6 Food additives

Summary

Food additives are mainly used to maintain the quality or stability of a food over time and to improve the taste or appearance of processed food.

The use of food additives is regulated by the Australia New Zealand Food Standards Code. All new food additives are subject to a safety assessment before they are approved for use.

The acceptable daily intake (ADI) is a measure of the amount of a food additive in food or drink that can be ingested every day over a lifetime without an appreciable health risk.

Although severe reactions are uncommon, some food additives have been linked to digestive problems, neurological and behavioural disorders, and some cancers. However, there is little conclusive evidence of harmful effects in the general population.

Current evidence indicates additives are safe to use for most people. As it is indicative of a recommended safety level, keeping intake below the ADI is recommended.

For people who are sensitive to food additives or wish to avoid them for other reasons, check the food label as any additive present in the food must be listed.

For the general population, choosing a diet based on less refined or highly processed foods is likely to have many nutritional benefits, including gaining higher levels of fibre and micronutrients and phytonutrients found in 'whole foods' and reducing levels of sugar, fat and salt.

Background

Food additives are mainly used to maintain the quality or stability of a food over time and to improve the taste or appearance of processed food. An advantage of food additives is that they allow food to last longer, making a wider variety of food available throughout the year.

Regulation and labelling

The use of food additives is regulated by the Australia New Zealand Food Standards Code (FSANZ 2010). Approximately 300 food additives are approved for use in New Zealand and Australia.

All new food additives are subject to a safety assessment before they are approved for use. The acceptable daily intake (ADI) is a measure of the amount of a food additive in food or drink that can be ingested daily over a lifetime without an appreciable health risk. ADIs are usually expressed in milligrams per kilogram (mg/kg) of body weight per day. They have a large 'safety margin' built in so intakes over the ADI may not necessarily be harmful. However, it is good practice to keep the intakes of children and young people below the ADI. If new information becomes available about the safety of a food additive that results in a change to an ADI, this change may also affect permissions to use the additive.

All food ingredients, including additives, are required to be listed on the food label. The ingredients are listed in descending order by weight. Usually the food additive class name (eg, thickener) is listed, which is then followed by the additive's specific name or number (eg, ascorbic acid or 300). The numbers are part of an international number system, so are consistent across countries. Some numbers have an 'E' in front, which means the food is labelled for the European Union market.

Comprehensive information on food additives, including a list of the food additive names and numbers that are permitted in New Zealand and Australia, can be found in the booklet *Identifying Food Additives*. To view this booklet or for more information on food additives, visit: www.foodsmart.govt.nz/whats-in-our-food/chemicals-nutrients-additives-toxins/food-additives

Health effects

Debate about the safety of some food additives continues. Some people may have adverse reactions to food additives, just as some people have food allergies or intolerances. Although severe reactions are uncommon, some food additives have been linked to digestive problems, some cancers, and neurological and behavioural disorders. There is little conclusive evidence of harmful effects in the general population. Such reactions are also linked to some foods.

Certain food additives, particularly synthetic food colours, have been linked to hyperactivity or behavioural problems in children. To date there is evidence indicating that for sensitive individuals, some colours may increase hyperactive tendencies (Schab and Trinh 2004). For the general population, based on current research, exposure to colouring does not present a health concern (Committee on Toxicity 2007; European Food Safety Authority 2010; JECFA 2011).

Other food additives that may cause problems for some people include monosodium glutamate (MSG, 621) and the food preservatives: sorbates (200–203), benzoates (210–213), sulphites (220–225, 228) and nitrates (249–252). MSG may cause short-term reactions in some people, including a burning sensation or numbness in the back of the neck, chest or arms, headache, nausea, rapid heartbeat and difficulty breathing (particularly in people with asthma) (NZFSA 2009c). Sulphites may cause asthma-like symptoms in people with asthma (NZFSA 2009a).

Recommendations

Current evidence indicates additives are safe to use for most people. As it is indicative of a recommended safety level, keeping intake below the ADI is recommended.

Where people are sensitive to food additives or wish to avoid them for other reasons, they can reduce exposure by looking for additives (by name or number) in the ingredients list on the product label. Although food additives are common in highly processed foods, some processed foods (eg, some canned and frozen foods) contain no additives.

Choosing a diet based on less refined or highly processed foods is likely to have many nutritional benefits, including gaining higher levels of fibre and micronutrients and phytonutrients found in 'whole foods', and reducing levels of sugar, fat and salt.

Useful resources and tools

Food Standards Australia New Zealand (FSANZ) is an independent statutory agency that works within an integrated food regulatory system involving the governments of Australia and New Zealand. FSANZ sets food standards for the two countries. For further information regarding the Australia New Zealand Food Standards Code (FSANZ 2010) and the work of FSANZ (including food additives), visit: www.foodstandards.govt.nz

The Ministry for Primary Industries (MPI), as part of ensuring a safe and suitable food supply, monitors adherence to the Food Standards Code. For further information on the food safety work of MPI (including food additives), visit:
www.foodsmart.govt.nz for consumer information
www.foodsafety.govt.nz for industry information including the Food Standards Code
www.foodsmart.govt.nz/whats-in-our-food/chemicals/nutrients-additives-toxins/food-additives/synthetic-colours

13.7 Intense sweeteners

Summary

A number of intense sweeteners (previously referred to as artificial sweeteners) are permitted for use in the New Zealand food supply.

Each permitted intense sweetener has undergone safety testing and has an acceptable daily intake (ADI) set for its use.

Data show that intake for intense sweeteners in New Zealand is well below the ADI even among most high users (95th centile).

Current evidence indicates intense sweeteners are safe to use for most people. As it is indicative of a recommended safety level, keeping intake below the ADI is recommended. Limiting the use of intense sweeteners may be warranted as although they provide sweetness with little or no energy, their use may maintain a taste for sweetness while providing no nutritional qualities.

If consumed, drinks with intense sweeteners (ie, diet fizzy/soft drinks) should be consumed only occasionally and with food rather than between meals.

Choosing a diet based on less refined or highly processed foods is likely to have many nutritional benefits, including gaining higher levels of fibre and micronutrients and phytonutrients from whole foods, and reducing levels of sugar, fat and salt.

Background

Intense sweeteners, previously referred to as artificial sweeteners, are a type of food additive (see section 13.6: Food additives). Intense sweeteners are regulated by Standard 1.3.1 of the Australia New Zealand Food Standards Code (FSANZ 2010). A number of intense sweeteners are permitted for use in the New Zealand food supply. At the time of publication these were acesulphame-K (950), alitame (956), aspartame (951), aspartame-acesulphame salt (962), cyclamate (952), neotame (961), saccharin (945), sucralose (955), thaumatin (957), stevia (960) and advantame. Standard 1.3.1 includes permissions regarding the foods that can contain intense sweeteners and the amounts that can be added.

For each sweetener, as for other food additives, an acceptable daily intake (ADI) has been established by the Joint FAO/WHO Expert Committee on Food Additives (JECFA). JECFA is the international body that evaluates the safety of food additives (for more information on ADIs, see section 13.6: Food additives).

For the most up-to-date list of intense sweeteners permitted in New Zealand, see the Australia New Zealand Food Standard Code at: www.foodstandards.govt.nz/foodstandards/foodstandardscode.cfm

Current levels of intake

In 2002/03 Food Standards Australia New Zealand undertook research to estimate the level of consumption of intense sweeteners in Australia and New Zealand and compare this level with the ADI (FSANZ 2004). It found that mean exposure to all intense sweeteners was well below the ADI. A small proportion of young people aged 12–17 years exceeded the ADI for cyclamate due to their high intake of cordials, fruit drinks and fizzy/soft drinks containing intense sweeteners (FSANZ 2004). Other population subgroups with higher exposure to intense sweeteners were people with diabetes or on weight control diets (FSANZ 2004). At the time of the study, the Australia New Zealand Food Standards Code permitted cyclamate to be added to drinks at a maximum level of 600 mg/kg, but this has since been lowered to 350 mg/kg for water-based flavoured drinks and 400 mg/kg for brewed fizzy/soft drinks and low-joule fruit and vegetable juice products (FSANZ 2007).

Health effects

Despite extensive safety testing and a rigorous process for setting the ADI, concerns about the safety of some intense sweeteners remain held by some. Health concerns are usually focused on potentially susceptible populations, such as children and pregnant women. Children and young people are considered at risk because, relative to their body size, they have high intakes of foods and beverages.

Intense sweeteners are well tolerated by most people, but can have side effects. The most common side effects are headaches, dizziness, mood changes, nausea and vomiting (American Dietetic Association 2004). People with phenylketonuria (PKU) cannot safely consume aspartame because they cannot metabolise the amino acid phenylalanine (one of two amino acids in aspartame). PKU is a rare genetic disease and is usually diagnosed shortly after birth by a routine blood test. People with PKU need to follow a strict diet with no foods containing phenylalanine to avoid serious and permanent health effects. All products with aspartame must state on the food label that they contain phenylalanine.

Some intense sweeteners, such as saccharin and cyclamate, have been linked to cancer. However, a review of literature concluded that the possible risk of artificial sweeteners inducing cancer seems to be negligible (Weihrauch and Diehl 2004).

The potential carcinogenic risk of newer-generation intense sweeteners, such as acesulfame-K, sucralose, alitame and neotame, has not yet been the subject of epidemiological studies in the human population. However, as part of any approval process all these products have undergone a pre-market risk assessment. There are no known examples of any food additive that has undergone a pre-market risk assessment by various regulatory agencies around the world, and then was subsequently shown to cause cancer in humans (FSANZ personal communication, 2011).

The main benefit of intense sweeteners is that they provide sweetness with little or no energy (kJ). Although this quality may be of potential benefit for weight control, there is limited evidence showing the use of artificially sweetened foods and drinks actually leads to weight loss (Whitehouse et al 2008). Other potential benefits of non-nutritive intense sweeteners include prevention of dental caries, although this outcome also depends on other factors such as tooth brushing, fluoridation of water, diet and frequency of eating. However, some diet drinks (mainly kola) can be acidic, which can contribute to tooth erosion. It has also been suggested that if intense sweeteners are added to healthy foods, such as fruits, vegetables and wholegrain breads and cereals, they may increase the palatability of those foods (American Dietetic Association 2004). However, by maintaining a taste for sweetness, diet drinks may make these healthy foods less appealing, which could in turn reduce diet quality (Ludwig 2009).

Recommendations

Current evidence indicates intense sweeteners are safe to use for most people. As it is indicative of a recommended safety level, keeping intake below the ADI is recommended. Limiting use of intense sweeteners may be warranted as although they provide sweetness with little or no energy, their use may maintain a taste for sweetness while providing no nutritional qualities.

Choosing a diet based on less refined or highly processed foods is likely to have many nutritional benefits, including gaining higher levels of fibre and micronutrients and phytonutrients found in ‘whole foods’, and reducing levels of sugar, fat and salt.

If consumed, drinks with intense sweeteners (ie, diet fizzy/soft drinks) should be only consumed occasionally and with food rather than between meals.

For more information on intense sweeteners, see the following websites:
the Ministry for Primary Industries (MPI) at: www.foodsmart.govt.nz/whats-in-our-food/chemicals-nutrients-additives-toxins/food-additives/sweetners/
the Australia New Zealand Food Standard Code at: www.foodstandards.govt.nz/foodstandards/foodstandardscode.cfm

13.8 Caffeine

Summary

Caffeine is a psychoactive stimulant drug that acts on the central nervous system, alters brain function, acts as a diuretic, and elevates blood pressure and metabolic rate.

Acute adverse effects from caffeine that have been identified include anxiety, headaches, insomnia, irritation of gastrointestinal tract, nausea and depression.

Long-term adverse effects from caffeine are not clear.

Children may be more sensitive to adverse effects of caffeine than other groups in the population.

An upper exposure of 2.5 mg/kg of body weight per day has been suggested as a cautious toxicological limit on which to base risk assessment for children, on the grounds of limited evidence.

Caffeine intake data based on the 2002 National Children's Nutrition Survey and 1997 National Nutrition Survey show more than 95 percent of children (5–12 years) and most young people (13–18 years) have relatively low intake levels. However, a small proportion of young people (> 5%) have high intake levels (approximately 4.5 mg/kg per day).

Children and young people should limit their intake of foods and drinks containing caffeine. For specific recommendations on drinks, see Part 5: Fluids.

Background

In New Zealand, caffeine occurs naturally in coffee, tea, cocoa, guarana and foods containing these ingredients. Caffeine is a psychoactive stimulant drug that is rapidly absorbed in the stomach and small intestine (Roehrs and Roth 2008).

There is currently no recognised reference standard for caffeine exposure, such as an acceptable daily intake (ADI). An upper exposure of 2.5 mg/kg of body weight per day has been suggested as a cautious toxicological limit on which to base risk assessment for children, on the grounds of limited evidence (B Thomson and Schiess 2010). Although moderate caffeine intake (up to 400 mg/day – 5.7 kg body weight/day) by healthy adults with adequate nutrition is considered unlikely to have adverse effects, a conservative upper level of 3 mg/kg of body weight per day for adults, based on limited evidence of acute anxiety effects, has been suggested (Thomson and Schiess 2010).

Current levels of intake

New Zealand dietary exposure to caffeine has been estimated using the 1997 National Nutrition Survey and 2002 National Children's Nutrition Survey (Thomson 2009, cited in Thomson and Schiess 2010). The analysis showed that 73 percent of children along with 79 percent of young people consumed caffeine in some form.

As Table 43 shows, a small number of young people (13–19 years) had very high intakes, at 4.5 mg/kg per day.

Table 43: Caffeine exposure estimates for New Zealand children and young people

	Estimated exposure (mg/day)	
	Children (5–12 years)	Young people (13–19 years)
Median	7	41
Mean	20 (0.6 mg/kg/day)	82 (1.2 mg/kg/day)
Range	< 1–644	< 1–2664
P5*	1	1
P95^	74 (2.0 mg/kg/day)	294 (4.5 mg/kg/day)

Source: Thomson and Schiess (2010)

* P5 = 5th centile, representing low caffeine consumers.

^ P95 = 95th centile, representing high caffeine consumers.

Health effects

While in small amounts it can increase alertness or ability to concentrate, caffeine can have a range of adverse effects, particularly at high levels of intake. Caffeine acts on the central nervous system and it can alter brain function, elevate blood pressure and metabolic rate, irritate the gastrointestinal tract and act as a diuretic increasing urine output (Nawrot et al 2003). There is evidence that caffeine disrupts sleep and may cause rebound daytime sleepiness (Roehrs and Roth 2008). Reported depression, but not anxiety was found in both children (10–12 years) and young people (15–17 years) who drank coffee (Luebbe and Bell 2009). Most people will experience symptoms like headache, irritability and insomnia, above a certain level of consumption. Caffeine-sensitive consumers will experience them at lower levels (Higdon and Frei 2006).

Caffeine has also been associated with a slight deterioration in calcium balance, particularly if calcium intake is low (Nawrot et al 2003). Other longer-term impacts on health related to caffeine are less clear and no studies have been reported for potential chronic effects of caffeine consumption on children (Thomson and Schiess 2010). However, as the nervous system, including the brain, continues to develop and mature during childhood, it is possible that children may be more sensitive to adverse effects of caffeine than other groups in the population (Nawrot et al 2003).

Sources in the diet

Caffeine in its natural form is found in coffee, tea, cocoa, guarana and products containing them. In its synthetic form it is found in kola drinks, energy drinks and some supplemented foods.

As shown in Table 44, during childhood (5–12 years) fizzy/soft drinks and tea make the biggest contribution to caffeine intake; biscuits, cakes, pastries and coffee make a smaller but still significant contribution. As children grow older, the proportion of foods and beverages that contributes to caffeine intake shifts from food, fizzy/soft drinks and tea to, in particular, coffee consumption. Adults get most of their caffeine from coffee and tea (Nawrot et al 2003; Frary et al 2005).

Table 44: Contributions of caffeine-containing foods to caffeine dietary exposure for New Zealand children and young people

Food	Percentage (%) contribution		
	Children (5–12 years)	Young people (13–15 years)	Young people (15–19 years)
Biscuits, cakes, pastries	**11**	6	1
Cereal	< 1	< 1	< 1
Chocolate desserts	1	< 1	< 1
Chocolate confectionery	6	4	1
Cocoa and chocolate drinks	7	4	1
Coffee	**10**	**23**	**73**
Energy drinks	2	3	<1
Fizzy/soft drinks	**30**	**32**	**13**
Tea	**32**	**29**	**10**

Source: B Thomson and Schiess (2010)

Note: Figures in bold represent those foods contributing 10% or more to total caffeine exposure.

Energy drinks and energy shots

Energy drinks contribute only a small amount of caffeine to the diet according to the data presented in Table 44. These findings, however, are based on data from the 1997 National Nutrition Survey and 2002 National Children's Nutrition Survey as described above, and the availability of energy drinks and shots at the time of these surveys is unknown. In February 2010, 28 energy drinks and 16 energy shots were identified as available on the New Zealand market (B Thomson and Schiess 2010).

The only current specific consumption data on energy drinks for New Zealanders comes from National Survey of Children and Young People's Physical Activity and Dietary Behaviours in New Zealand: 2008/09 (Clinical Trials Research Unit and Synovate 2010a, 2010b). This survey showed that 30 percent of 10–14 year olds consumed energy drinks, including 7 percent who had them once or twice a week and 2 percent three to four times a week. For 15-to 19-year-olds the equivalent figures were respectively 57 percent, 20 percent and 7 percent.

Standard 2.6.4 of the Australia New Zealand Food Standards Code (FSANZ 2010) sets minimum and maximum levels of caffeine that can be added to formulated caffeinated beverages (ie, energy drinks). A formulated caffeinated beverage must contain between 145 and 320 mg of caffeine per litre. Energy drinks range from 250 to 600 ml and contain 75–240 mg caffeine per retail unit. Energy shots range from 30 to 120 ml and contain 10–300 mg caffeine per retail unit (Thomson and Schiess 2010).

Estimations of caffeine exposure from energy drinks and energy shots suggest that approximately 70 percent of children (5–12 years) and 40 percent of young people (13–18 years) after the consumption of a single retail unit of an energy drink or energy shot would exceed an adverse effect level of 3 mg/kg of body weight per day (Thomson and Schiess 2010).

Under the Australia New Zealand Food Standards Code, manufacturers are required to declare the average quantity (mg) of caffeine per 100 ml and per serving size (see Table 45). The label must also state the food contains caffeine and is not recommended for children, pregnant or lactating women, and individuals sensitive to caffeine.

Table 45: Concentration of caffeine in a selection of New Zealand foods and beverages

Food or beverage	Serve (weight of serve in g)	Caffeine concentration mg/serve	Caffeine concentration (mg/10g)
Bakery products			
Biscuit, chocolate coated	1 biscuit (10.5)	1	8
Large biscuit eg, 'Cookie Time original'	1 biscuit (92)	11	12
Cake, chocolate, butter icing	1/8 cake (79)	3	3
Beverages, non-alcoholic			
Milo, made with trim milk	1 cup (280)	1	Trace
Chocolate, drinking, powder	1 tsp (2.5)	1	51
Coffee, café latte, caffeinated	1 cup (272)	269	99
Coffee, espresso, brewed	1 cup (272)	577	212
Coffee, decaffeinated	1 tsp (1.8)	3	160
Coffee, instant powder	1 tsp (1.5)	56	3700
Energy drink eg, 'V Drink'	1 can (250)	72	28
Fizzy/soft drink eg, 'Cola-Diet'	1 can (350)	49	14
Fizzy/soft drink eg, 'Coca-Cola'	1 can (355)	33	9
	1 bottle (500)	46	
Tea, Indian, infused	1 cup (251)	55	22
Chocolate confectionery			
Chocolate bar, milk	1 small bar (50)	10	20

Source: Adapted from Thomson and Schiess (2010)

Note: The data used in this table come from *The Concise New Zealand Food Composition Tables*, 8th edition (Athar et al 2009), which in turn sourced caffeine content data from USDA National Nutrient Database and Nutrients Tables for use in Australia (NUTTAB). Neither of these food composition databases reported the analytical method used for the analysis of caffeine concentration in foods. So it is unknown whether caffeine content alone is being described or whether the concentration figure includes total methylxanthine content in caffeine-equivalent terms.

Recommendations

Children and young people should limit their intake of food and drinks containing caffeine.

For recommendations regarding intake of caffeine-containing drinks, see Part 5: Fluids.

Glossary

Acceptable daily intake (ADI)	A measure of the amount of a specific substance (eg, food additive) in food or drinks that can be ingested over a lifetime without an appreciable health risk. ADIs are usually expressed as milligrams per kilogram of body weight per day.
Accelerometer	A small electronic device that, when placed at the hip, measures the duration, frequency and intensity of movement during different activities.
Acceptable macronutrient distribution range (AMDR)	An estimate of the range of intake for each macronutrient (expressed as percentage contribution to energy) that would allow for an adequate intake of all the other nutrients while maximising good health (applies only to adults and young people aged 14 years and over).
Adequate intake (AI)	Used when an RDI cannot be determined. The average daily nutrient intake level based on observed or experimentally determined approximations or estimates of nutrient intake by a group (or groups) of apparently healthy people that are assumed to be adequate.
Alpha (α)-linolenic acid (ALA)	An omega-3 fatty acid with 18 carbon atoms; found in flaxseed (also known as linseed), flaxseed oil and, to a lesser extent, canola oil, soybean oil, walnuts and walnut oil. Can be converted to the omega-3 long-chain fatty acids EPA and DHA.
Anaemia	Lower levels of haemoglobin than is normal for a person's age and sex. A diagnosis of iron-deficiency anaemia is made when anaemia is accompanied by laboratory evidence of iron deficiency, such as low serum ferritin.
Anaphylaxis	A rapidly evolving, generalised multi-system allergic reaction characterised by one or more symptoms or signs of respiratory and/or cardiovascular involvement and the involvement of other systems such as the skin and/or gastrointestinal tract.
Anorexia nervosa	A psychiatric disorder characterised by low body weight and body image distortion.
Arachidonic acid	An omega-6 fatty acid with 20 carbon atoms, found in egg yolk and meats (particularly organ meat).
Artificial sweeteners	See **intense sweeteners**.
Australia New Zealand Food Standards Code	A set of food labelling and composition standards for both New Zealand and Australia.
Basal metabolic rate (BMR)	The amount of energy expended while at rest in a post-absorptive state for the functioning of vital organs, including the heart, lungs, brain and nervous system.

Bioavailability	The degree to which a drug or nutrient (eg, iron) becomes available for use in the body after administration or ingestion.
Body image	How people perceive their own body size and shape.
Body mass index (BMI)	A measure of weight adjusted for height used to classify people as underweight, normal, overweight or obese. BMI is calculated by dividing weight in kilograms by height in metres squared (kg/m^2).
Bulimia nervosa	A psychiatric disorder characterised by repeated binging and purging.
Caffeine	A substance found naturally in leaves, seeds or fruit from plants such as coffee, tea, cocoa and guarana. Caffeine in its manufactured form is added to some fizzy/soft drinks and energy drinks.
Cariogenic	Producing or promoting tooth decay.
Cereals	Grasses cultivated for their seeds, such as wheat, rice, oats, rye, barley, maize, millet, buckwheat, quinoa and sorghum. The intact cereal (also called grain) is made up of the endosperm, bran and germ. Cereal foods include breads, breakfast cereals, rice and pasta.
Cholesterol	A waxy sterol of fat that is produced by the liver and also can be obtained through the diet. It is used to produce hormones and cell membranes and in circulated in the blood plasma of all mammals.
Cultural competence	The capacity of a health system to improve health and wellbeing of all population groups by integrating cultural practices and concepts into health service delivery.
Dental caries	An infectious disease that arises through the interaction of three factors: micro-organisms (*Streptococci mutans*), a substrate (fermentable carbohydrate) and a susceptible tooth surface. The bacteria metabolise carbohydrate to produce acids, which lowers the pH in the mouth and promotes demineralisation of tooth surfaces.
Deoxyribonucleic acid (DNA)	A nucleic acid that contains the genetic instructions used in the development and functioning of all known living organisms.
Diabetes mellitus	Diabetes is a metabolic condition characterised by raised blood glucose due to insulin deficiency, insulin resistance or both. See **type 1** and **type 2 diabetes mellitus**.
Diet-induced thermogenesis	Energy required to absorb, digest, transport and store food. Accounts for about 10 percent of total energy expenditure.

Dietary folate equivalent (DFE)	The way in which recommended folate intake is expressed to account for differences in the bioavailability of food folate and synthetic folic acid. One microgram (1 µg) of dietary folate equivalents equals: › 1 µg of folate from food › 0.5 µg of a folic acid tablet taken on an empty stomach › 0.6 µg of folic acid from fortified food or taken as a tablet with meals.
Dietary supplements	Products containing vitamins, minerals, herbs or botanicals, amino acids and various other dietary substances that are intended to supplement the diet rather than represent an entire meal or diet.
Disordered eating	Irregular eating habits that do not meet the diagnostic criteria for a specific eating disorder such as anorexia nervosa or bulimia nervosa.
Docosahexaenoic acid (DHA)	An omega-3 fatty acid with 22 carbon atoms. Dietary sources include fish and fish oils.
DNA	See **deoxyribonucleic acid**.
Eicosapentaenoic acid (EPA)	An omega-3 fatty acid with 20 carbon atoms. Dietary sources include fish and fish oils.
Energy density	Energy level of food per unit (eg, kJ per 100 g).
Energy-dense foods	Foods with more than about 1000 kJ per 100 g.
Energy drink	A beverage containing added caffeine, vitamins and other bioactive substances.
Energy shot	A small-volume liquid product containing added caffeine, vitamins and other bioactive substances.
Essential amino acids	See **indispensable amino acids**.
Essential fatty acids	Fatty acids that cannot be formed in the body so are essential in the diet to avoid deficiency symptoms. They include linoleic acid (omega-3) and a-linoleic acid (omega-6).
Estimated average requirement (EAR)	A daily nutrient level estimated to meet the requirements of half of the healthy individuals in a particular life stage and gender group.
Estimated energy requirement (EER)	The average dietary energy intake that is predicted to maintain energy balance in a healthy adult of a defined age, gender, weight and level of physical activity, consistent with good health. For children and for pregnant and lactating women, the EER include needs associated with growth or the secretion of milk at rates consistent with good health.
Fatty acids	A component of fat consisting of a chain of a hydrocarbon with a methyl group at one end and a carboxyl group at the other. The three main types of fatty acids in the diet are saturated, monounsaturated and polyunsaturated.

Folate	A generic term for the various forms of folate found in food. It is involved in the metabolism of nucleic and amino acids, and hence the synthesis of deoxyribonucleic acid (DNA), ribonucleic acid and proteins.
Folic acid	A synthetic form of folate that is found in supplements and fortified foods and beverages. It is more bioavailable and stable than folate in food.
Food additive	A substance added to food to maintain the quality or stability of a food over time and/or to improve the taste or appearance of processed food. Includes preservatives, colours and sweeteners.
Food allergy	An abnormal immunological reaction to a food component, which can range from mild (rash) to severe (anaphylaxis).
Food intolerance	A non-immunological reaction to food caused by characteristics of the host (eg, lactose intolerance due to lactase deficiency).
Food neophobia	Rejection of foods that are new or unknown.
Food insecurity	Limited or uncertain availability of nutritionally adequate and safe foods, or the limited or uncertain ability to acquire such foods in a socially acceptable way.
Food security	The ready availability of sufficient, nutritionally adequate and safe foods, acquired in a socially acceptable way.
Fortification	The addition of nutrients to food. Nutrients can be added to correct a demonstrated deficiency in the population, to replace nutrients lost during processing, storage and handling, or for other reasons.
Fruit drink	Defined in the Food Standards Code as a product prepared from one or more of the following: fruit juice; fruit puree; concentrated fruit juice; concentrated fruit puree; comminuted fruit; orange peel extract; water mineralised water and/or sugar. Fruit drink must contain no less than 50 ml/L of fruit (except for passionfruit drink which must contain no less than 35 ml/l passionfruit (FSANZ 2011). In this document the term 'fruit drink' refers to sugar-containing drink.
Fruit juice	Defined in the Food Standards Code as the liquid portion with or without pulp, obtained from fruit and, in the case of citrus fruit other than lime, the endocarp only of the fruit. It includes products that have been concentrated and later reconstituted with water to a concentration consistent with that of undiluted juice.
Fussy/picky eating	Rejection of a large proportion of foods, both familiar and new. Foods generally rejected based on taste, texture or smell.

Gamma-linolenic acid (GLA)	An omega-6 fatty acid with 18 carbon atoms, found in evening primrose and blackcurrant oils.
Glycaemic index (GI)	Indicator for classifying the physiological effect of dietary carbohydrates. GI describes the blood glucose response after consumption of a carbohydrate-containing food, relative to the response of a carbohydrate-containing reference food such as glucose or white bread. In theory, low GI foods cause a smaller increase in blood glucose that is sustained over a long period, compared with a high GI food.
Glycaemic load (GL)	GL provides a rating similar to that of GI. It takes account of the GI of the food and the amount of the food eaten, whereas the GI rating is based on 100 g of the specific test food.
Good sources of a nutrient	In this document **good** sources of a nutrient are foods that are known to contain high levels of the nutrient, even though these foods may not be consumed very often. Information on good sources is derived from publications listed in the background section of the relevant part.
Good manufacturing practice (GMP)	The systems that manufacturers of medicines are required to have in place to ensure their products are consistently safe and effective (including reliability around the stated dose).
Goitre	An enlargement of the thyroid gland, forming a swelling on the side or front of the neck. It is often associated with iodine deficiency.
Growth	The acquisition of tissue and the subsequent increase in body size (body mass).
Growth chart	A graph with measures of body size plotted against age, with selected centiles marked. It is used to monitor growth for children.
Haem	The iron-containing part of haemoglobin. Haem iron (found in lean meat, poultry and fish) is more bioavailable than non-haem iron (found in plant foods).
Haemoglobin	The protein carrying oxygen in the red blood cells.
Hapū	Sub-tribe.
High fat, sugar and salt (HFSS) foods and drinks	Foods and drinks high in fat (especially saturated fat), sugar and/or salt that provide few vitamins and minerals and are not essential in the diet. HFSS foods and drinks provide very few nutrients relative to their energy content (ie, energy-dense, nutrient-poor).
Hypothyroidism	Decreased activity of the thyroid gland. Symptoms may include weight gain, sluggishness, dry skin, intolerance to cold, and slowing of bodily processes. Treatment includes prescribing oral dosages of the deficient hormone.

Indispensable amino acids	The nine amino acids required for protein synthesis that cannot be synthesised by the body and must be obtained from the diet. Also referred to as essential amino acids.
Insulin resistance	The reduced sensitivity of cells to insulin.
Intense sweeteners	Type of food additive that provides little or no energy (kJ). Previously referred to as artificial sweeteners. Intense sweeteners permitted for use in New Zealand include acesulphame-K, alitame, aspartame, cyclamate, neotame, saccharin, sucralose and thaumatin.
Iwi	Tribe.
Junk food	Foods that are not essential in the diet and provide few nutrients relative to their energy content (ie, energy-dense, nutrient-poor).
Kai	Food.
Kapa haka	Māori performing arts.
Key sources of nutrients	In this document foods listed as **key** sources of a nutrient are the 'food groups' that contributed most to nutrient intake in national nutrition surveys. The foods in these food groups were defined in the national nutrition surveys and are listed in the survey reports. Key sources may include foods that are not listed as good sources because they can be foods that do not contain high levels of the nutrient but are consumed often (eg, daily) so contribute substantially to nutrient intake.
Kina	Sea-eggs/sea-urchin.
Ki-o-rahi	A traditional full-contact tackle game played on a circular pitch with a small round ball. There is also a 'touch' version of Ki-o-rahi.
Kūmara	Sweet potato.
Lacto-vegetarian	A person who eats only plant foods, milk and milk products.
Lacto-ovo vegetarian	A person who eats only plant foods, milk, milk products and eggs.
Legumes	Fruit or seed (produced in a pod) from plants in the Fabaceae family. Common examples include peas, beans, lentils and peanuts.
Linoleic acid	An omega-6 fatty acid with 18 carbon atoms, found in soybean, safflower, sunflower and corn oils, green leafy vegetables, nuts and seeds. It is used to make the long-chain polyunsaturated fatty acids: arachidonic acid (AA) and gamma-linolenic acid (GLA).
Long-chain polyunsaturated fatty acids (LCPFA)	Polyunsaturated fatty acids with 20 or more carbon atoms. LCPFAs include eicosapentaenoic acid (EPA, 20:5n-3) and docosahexaenoic acid (DHA, 22:6n-3). LCPFAs occur in some foods and can be made from precursors.
Mana	Prestige.

Media literacy	The process of understanding and using the media in an assertive and non-passive way. This includes having an informed and critical understanding of the nature of the media, the techniques used by them and the impact of these techniques. Media literacy can also include the ability to access and produce communication in a variety of forms and means.
Meta-analysis	An analysis that combines the results of similar studies (eg, randomised controlled trials) to produce a summary effect size.
Metabolic equivalents (METs)	Multiples of resting metabolic rate. One MET is equivalent to rest. METs are used to classify the intensity of physical activity (low intensity < 3 METs; moderate intensity 3–5.9 METs; vigorous intensity ≥ 6 METs).
Metabolism	The digestion, absorption, transport of food and disposal of waste products.
Monounsaturated fatty acid	A type of unsaturated fatty acid in which there is one double bond. Dietary sources include olives, olive oil, canola oil, peanuts, peanut oil, almonds, avocados, meat from grass-fed animals in New Zealand, and some margarines and spreads.
Neural tube defects	Group of birth defects where the brain, spinal cord or covering of these organs has not developed properly.
Niacin equivalents	The nicotinic acid, nicotinamide and contribution of niacin obtained by conversion from dietary L-tryptophan.
Non-starch polysaccharides (NSP)	Component of dietary fibre. Found in plant foods.
Nutrient-dense foods	Foods with lots of beneficial nutrients per gram (eg, vegetables, fruit and whole grains).
Nutrient-poor foods	Foods with low concentration of beneficial nutrients per gram.
Nutrient reference values (NRVs)	A set of recommendations for intakes of nutrients.
Obesity	Excess weight for height to the extent that health may be affected.
Omega-3 fatty acids	Polyunsaturated fatty acids with their first double bond three carbon atoms from the methyl end of the carbon chain. They are found in oily fish, vegetable oils, nuts and seeds. Common omega-3 fatty acids in the body are alpha (α)-linolenic acid, eicosapentaenoic acid and docosahexaenoic acid.
Omega-6 fatty acids	Polyunsaturated fatty acids with their first double bond six carbon atoms from the methyl end of the carbon chain. They are found in vegetable oils, nuts and seeds. Common omega-6 fatty acids in the body are linoleic acid and arachidonic acid.
Omnivore	A person who eats both animal and plant foods.

Physical activity	All movement produced by skeletal muscle that increases energy expenditure, whether it is incidental, occupational or recreational.
Physical activity level (PAL)	Estimation of energy intake required, based on amount of physical activity.
Phytates	A form of phosphorus found in plant foods, especially wholegrain cereals, legumes, nuts and seeds. Phytates bind with minerals such as iron, zinc and calcium and make them unavailable for absorption.
Polymerisation	A chemical process that combines several small molecules (monomers) to form a large molecule (polymer).
Polyunsaturated fatty acid	An unsaturated fatty acid with two or more double bonds. Dietary sources include most plant oils, particularly sunflower, soybean, safflower and corn, as well as most margarines and spreads.
Portion size	The amount of food typically eaten during one eating occasion.
Prevalence	The proportion of a population with a specific condition. Calculated by dividing the number of participants in the survey with a specific condition by the total number of participants in the survey. Usually expressed as a percentage.
Protective factor	A factor associated with reduced risk of developing a condition. Compare with **risk factor**.
Rangatahi	Youth, the younger generation.
Recommended dietary intake (RDI)	The average daily dietary intake level that is sufficient to meet the needs of nearly all (97–98%) healthy individuals in a particular life stage and gender group, including a margin of safety.
Resistant starch	Starch and starch degradation products not absorbed in the small intestine. Occur naturally in legumes and can be produced during processing in cooking of some cereal and grain products.
Retinol equivalent (RE)	The way that the recommendation for vitamin A intake is expressed (micrograms of retinol equivalents). Retinol equivalents account for the conversion of some beta-carotene to retinol. One microgram (1 µg) of retinol equivalent equals 1 µg of retinol or 6 µg of beta-carotene.
Ribonucleic acid (RNA)	A long chain of nucleotide units transcribed from DNA by enzymes called RNA polymerases. It is essential for protein synthesis and for regulating which genes are expressed.
Rickets	A condition that occurs mainly in children as a result of vitamin D deficiency or malabsorption. It is characterised by abnormal bone growth or softening of bones.

Risk factor	A factor associated with increased risk of developing a condition. Compare with **protective factor**.
Saturated fatty acid	A fatty acid in which there are no double bonds between the carbon atoms of the fatty acid chain. Diets high in saturated fatty acids increase the risk of atherosclerosis and coronary heart disease. Found in animal products such as milk, cream, butter, cheese and meat, but they can also be obtained from palm and coconut oil (used in manufactured foods such as pies, biscuits, cakes and pastries).
Sedentary behaviours	Distinct class of activity characterised by low energy expenditure. Examples include sitting, watching television and doing other screen-based activities, such as playing video games and working on a computer.
Socioeconomic status	Social position, as measured by one or more socioeconomic indicators such as income, occupation and education.
Sugars	Chemical classification used to describe mono- and disaccharides in food.
Sugary drinks	All drinks containing sugars, including fruit drinks, powdered drinks, cordial (eg, blackcurrant and lemon barley), carbonated or fizzy drinks (eg, lemonade, kola and orange), energy drinks, sports drinks, flavoured waters and iced teas.
Suggested dietary target (SDT)	A daily average intake for certain nutrients that may help in the prevention of chronic disease (applies only to adults and young people aged 14 years and over).
Tāngata whenua	People of the land.
Tamariki	Children.
Total Diet Study (TDS)	A periodic survey measuring contaminants and selected nutrients in some commonly eaten New Zealand foods.
Trans fatty acids	Unsaturated fatty acids with one or more double bonds in the *trans* configuration. Occur naturally in some ruminant foods, but are also produced by partial hydrogenation of polyunsaturated fats in food processing. Diets high in trans fatty acids increase the risk of atherosclerosis and coronary heart disease.
Triglycerides (or triacylglycerols)	The most common type of fat in the diet. Consist of one glycerol and three fatty acids.
Type 1 diabetes mellitus	A condition caused by the destruction of insulin-producing cells, resulting in insulin deficiency. It usually develops in childhood and the cause is unknown. Treatment includes daily insulin injections. Previously known as insulin-dependent diabetes mellitus.

Type 2 diabetes mellitus	A condition associated with insulin resistance, leading to a relative insulin deficit. It usually develops in adulthood and is caused by lifestyle factors, including obesity. Treatment includes changes to diet, physical activity, weight loss, tablets and/or insulin injections. Sometimes referred to as adult-onset diabetes mellitus or non-insulin-dependent diabetes mellitus.
Upper level of intake (UL)	The highest average daily nutrient intake level likely to pose no adverse health effects to almost all individuals in the general population. As intake increases above the UL, the potential risk of adverse effects increases.
Vegan	A person who eats only plant foods and nothing of animal origin.
Vegetarian	A person who does not eat lean meat, poultry or fish, but does eat foods derived from animals (eg, milk and/or eggs). See also **lacto-vegetarian** and **lacto-ovo-vegetarian.**
Waka ama	The sport of canoe (waka) racing that originated in New Zealand in the 1980s. The sport uses a single-hulled canoe with an ama (outrigger).
Whānau	Extended family, family group. A familiar term of address to a number of people.
Whole grain	The intact grain (cereal) seed or kernel, including the bran, germ and endosperm. A kernel that has been cracked, crushed, ground, milled or flaked can be called whole grain if it retains the same relative proportions of bran, germ and endosperm found in the original grain (eg, rolled oats, wholemeal flour).
Wholemeal	A product containing milled grain, with the proportion of endosperm, germ and bran similar to the intact grain.

Abbreviations

ADI	Acceptable daily intake
AI	Adequate intake
ALA	Alpha(α)-linolenic acid
AMDR	Acceptable macronutrient distribution range
BMI	Body mass index
BMR	Basal metabolic rate
CD	Coeliac disease
DNA	Deoxyribonucleic acid
EAR	Estimated average requirement
EER	Estimated energy requirement
FSANZ	Food Standards Australia New Zealand
g	gram/s
GI	Glycaemic index
HFSS	high fat, sugar and salt (foods and drinks)
IgE	Immunoglobulin E
IU	International Units
kJ	kilojoule/s
L	litre/s
MPI	Ministry for Primary Industries
µg	microgram/s
ml	millilitre/s
mg	milligram/s
MJ	Megajoule/s
mmol/L	millimole/s per litre
NHMRC	National Health and Medical Research Council
nmol	nanomole/s
NRV	Nutrient reference value
NSP	Non-starch polysaccharide
PAL	Physical activity level
RDI	Recommended dietary intake
RE	Retinol equivalent
SD	Standard deviation
SDT	Suggested dietary target
UL	Upper level of intake
UV	Ultraviolet
UVI	Ultraviolet index
WHO	World Health Organization

Appendix 1: New Zealand policy context

Statement of Intent 2011–2014

The Statement of Intent sets out the Ministry of Health's strategic direction for 2011 to 2014 (Ministry of Health 2011). The Ministry's two health and disability system outcomes are to see that:

- New Zealanders live longer, healthier and more independent lives
- New Zealand's economic growth is supported.

To achieve these two strategic outcomes, the Ministry of Health has identified four intermediate outcomes:

1. a more unified and improved health and disability system
2. people receive better health and disability services
3. good health and independence are protected and promoted
4. the health and disability system and services are trusted and can be used with confidence.

As part of outcome 3, there is an emphasis on prevention and maintaining independence, rather than only treating ill health. As a population-health document aiming to promote health, while also preventing obesity and diet-related chronic diseases, the *Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2–18 years): A background document* contributes to the achievement of this outcome.

To access the Statement of Intent, visit the Ministry's website at: www.health.govt.nz

Good Oral Health for All, for Life

Good Oral Health for All, for Life (Ministry of Health 2006a) is the strategic vision for oral health in New Zealand. The vision is for an environment that promotes oral health through:

- fluoridated water
- healthy diet
- publicly funded services staffed by a multidisciplinary workforce that actively addresses the needs of those at greatest risk of poor oral health.

Oral health is recognised as an important part of general good health.

To access *Good Oral Health for All, for Life*, visit the Ministry's website at: www.health.govt.nz

He Korowai Oranga: Māori Health Strategy

He Korowai Oranga: Māori Health Strategy (Minister of Health and Associate Minister of Health 2002) sets the direction for the health and disability sector's response towards improving Māori health and reducing inequalities for Māori. The strategy provides a framework to help ensure services, programmes and interventions are accessible, effective and appropriate for Māori. The overall aim of *He Korowai Oranga* is whānau ora, a vision in which whānau are supported to achieve their maximum health and wellbeing. The key pathways to achieving whānau ora are:

- whānau, hapū, iwi and community development
- Māori participation
- effective service delivery
- working across sectors.

For nutrition and physical activity initiatives to be implemented in a meaningful and sustainable way for Māori, it is important that actions, interventions, outcomes, programmes and services are aligned with these four pathways.

To access *He Korowai Oranga: Māori Health Strategy*, visit the Ministry's website at: www.health.govt.nz

'Ala Mo'ui: Pathways to Pacific Health and Wellbeing 2010–2014

'Ala Mo'ui is the Ministry of Health's Pacific Health and Disability Action Plan for 2010–2014 (Minister of Health and Minister of Pacific Island Affairs 2010). *'Ala Mo'ui* seeks to achieve six priority outcomes to improve health services and health outcomes for Pacific peoples:

1. Pacific workforce supply meets service demand
2. systems and services meet the needs of Pacific peoples
3. every dollar is spent in the best way to improve health outcomes
4. more services are delivered locally in the community and primary care
5. Pacific peoples are better supported to be healthy
6. Pacific peoples experience improved broader determinants of health.

Alongside each priority outcome there are specific actions to be undertaken by the Ministry of Health, district health boards, Ministry of Pacific Island Affairs and other relevant agencies.

To access *'Ala Mo'ui*, visit the Ministry's website at: www.health.govt.nz

New Zealand Guidelines for Weight Management in Children and Young People

The *New Zealand Guidelines for Weight Management in Children and Young People* (Ministry of Health and Clinical Trials Research Unit 2009b) stand alongside the *New Zealand Guidelines for Weight Management in Adults* (Ministry of Health and Clinical Trials Research Unit 2009a). The aim of the Guidelines is to provide evidence-based advice for the management of overweight and obesity. It is anticipated that these Guidelines will mainly be used in primary care and community-based initiatives.

For more information on the Guidelines, visit the Ministry's website at: www.health.govt.nz

Appendix 2: International policy context

United Nations Convention on the Rights of the Child

New Zealand is a signatory to the United Nations Convention on the Rights of the Child (UNICEF 1990), a key United Nations instrument protecting children's rights. New Zealand ratified the Convention in 1993 and is committed to upholding children's rights embodied in the four principles of the Convention:

1. non-discrimination
2. best interests of the child
3. the right to life, survival and development
4. respect for the views of the child.

New Zealand's obligations under the Convention are met through integrated government policies and programmes in health, education, housing, social support to ensure adequate living standards, and measures to ensure protection and safety.

Diet, Nutrition and the Prevention of Chronic Diseases

In 2003 the World Health Organization (WHO) and Food and Agriculture Organization (FAO) released the report *Diet, Nutrition and the Prevention of Chronic Diseases* (WHO 2003a). The report was based on the work of a Joint WHO/FAO Expert Consultation who reviewed evidence and developed recommendations for diet, nutrition and physical activity in the prevention of chronic disease.

Chronic diseases account for nearly 60 percent of deaths worldwide and 87 percent of deaths in high-income countries (Lopez et al 2006). There is now considerable evidence that chronic disease risks begin in fetal life and continue throughout the life course (WHO 2003a). As adult chronic disease reflects cumulative exposure to damaging environments, early intervention is the best protection against chronic disease.

Global Strategy on Diet, Physical Activity and Health

Ratified in 2004, the *Global Strategy on Diet, Physical Activity and Health* (WHO 2004) addresses two of the main risk factors for non-communicable disease, namely diet and physical activity. The overall goal of the strategy is to promote and protect health through healthy eating and physical activity.

The following are the four main objectives of the strategy.

1. **Reduce risk factors for chronic diseases** that stem from unhealthy diets and physical inactivity, through public health actions.

2. **Increase awareness and understanding** of the influences of diet and physical activity on health and the positive impact of preventive interventions.
3. **Develop, strengthen and implement global, regional and national policies and action plans** to improve diets and increase physical activity that are sustainable and comprehensive and actively engage all sectors.
4. **Monitor science and promote research** on diet and physical activity.

Food, Nutrition, Physical Activity and the Prevention of Cancer

Food, Nutrition, Physical Activity and the Prevention of Cancer: A global perspective (World Cancer Research Fund and American Institute for Cancer Research 2007) is the result of a five-year project, including a review of all studies published since 1960. An Expert Panel graded the evidence and produced recommendations for cancer prevention. The recommendations include both public health goals and personal recommendations, as follows.

1. Be as lean as possible within the normal range of body weight.
2. Be physically active as part of everyday life.
3. Limit consumption of energy-dense foods. Avoid sugary drinks.
4. Eat mostly foods of plant origin.
5. Limit intake of red meat and avoid processed meat.
6. Limit alcoholic drinks.
7. Limit consumption of salt. Avoid mouldy cereals (grains) or pulses (legumes).
8. Aim to meet nutrition needs through diet alone.

Special Recommendation 1:
Mothers to breastfeed; children to be breastfed.

Special Recommendation 2:
Cancer survivors: Follow the recommendations for cancer prevention.

For more detailed information see: www.dietandcancerreport.org

Global Strategy for the Prevention and Control of Non-communicable Diseases and Action Plan

As part of the *2008–2013 Action Plan for the Global Strategy for the Prevention and Control of Non-communicable Diseases* (WHO 2008), New Zealand, along with other members of the WHO, adopted a resolution and set of recommendations on the marketing of foods at the annual World Health Assembly in May 2010.

Interventions on Diet and Physical Activity

Interventions on Diet and Physical Activity: What works – Summary report (WHO 2009b) provides a summary of 'tried and tested' diet and physical activity interventions that aim to reduce the risk of chronic non-communicable disease. The evidence of effective interventions is presented under eight categories:

1. policy and environment
2. mass media
3. school settings
4. the workplace
5. the community
6. primary health care
7. older adults
8. religious settings.

For more detailed information on this report, see: www.who.int/dietphysicalactivity/whatworks/en/index.html

Improving Lifestyles, Tackling Obesity: The Health and Economic Impact of Prevention Strategies

The joint health working paper by the Organisation for Economic Co-operation and Development (OECD) and WHO, *Improving Lifestyles, Tackling Obesity: The Health and Economic Impact of Prevention Strategies*, was published in 2009 (OECD/WHO 2009). This paper presents an economic analysis of the existing evidence base on the efficiency of preventive interventions to tackle unhealthy diets and sedentary lifestyles.

Appendix 3: Nutrient Reference Values for Australia and New Zealand

The *Nutrient Reference Values for Australia and New Zealand* were released in 2006 (NHMRC 2006). The nutrient reference values (NRVs) are presented as a range of recommendations for nutrient and energy intake aimed at avoiding deficiency and excess/toxicity. They also include guidance on dietary intakes needed to reduce the risk of chronic disease. For definitions of estimated average requirement (EAR), recommended dietary intake (RDI), adequate intake (AI), upper level of intake (UL), acceptable macronutrient distribution range (AMDR) and suggested dietary target (SDT), see the Glossary.

The main purpose of the estimated average requirement (EAR), RDI and AI is to ensure adequate physiological or metabolic function and/or to avoid deficiency states. In contrast, the AMDRs and SDTs were established to address the prevention of chronic disease and are restricted to nutrients for which there is sufficient evidence of a protective effect at levels substantially higher than the EAR, RDI or AI (NHMRC 2006). The AMDRs and SDTs apply only to young people aged 14 years and over and adults. However, the range of intakes indicated by the AMDR should be appropriate for most healthy children and young people, provided they are growing normally.

NRVs are estimates of nutrient requirements, based on the best available evidence and expert opinion. Setting NRVs for children and young people is difficult as there are often very few data for these groups. As a consequence, NRVs are often based on data from adults and extrapolated to children and young people.

For more detailed information on how the NRVs were developed and should be interpreted, please refer to the report *Nutrient Reference Values for Australia and New Zealand* (NHMRC 2006).

Nutrient reference values tables

Tables A.1 and A.2 show the estimated energy requirements (EERs) for children and young people by physical activity level (PAL) for males and females respectively. A PAL of 1.2 is equivalent to bed rest, 1.4 is very sedentary, 1.6 is light activity, 1.8 is moderate activity, 2.0 is heavy activity and 2.2 is vigorous activity. It is recommended that children and young people aim for 60 minutes or more of moderate to vigorous activity (PAL 1.8–2.2) each day. Based on a subset of children (n = 39) from the 2002 National Children's Nutrition Survey, the mean PAL was estimated to be 1.57 in girls and 1.67 in boys aged 5–14 years (Rush et al 2003).

The remaining tables then provide the nutrient reference values for four different age groups (2–3 years, Table A.3; 4–8 years, Table A.4; 9–13 years, Table A.5; 14–18 years, Table A.6), as well as for pregnant young women (Table A.7) and lactating young women (Table A.8).

Table A1: Estimated energy requirements for children and young people – males

Age (years)	Weight (kg)	Height (m)	BMR (MJ/d)	PAL 1.2	PAL 1.4	PAL 1.6	PAL 1.8	PAL 2.0	PAL 2.2
3	14.3	0.95	3.4	4.2	4.9	5.6	6.3	6.9	7.6
4	16.2	1.02	3.6	4.4	5.2	5.9	6.6	7.3	8.1
5	18.4	1.09	3.8	4.7	5.5	6.2	7.0	7.8	8.5
6	20.7	1.15	4.1	5.0	5.8	6.6	7.4	8.2	9.0
7	23.1	1.22	4.3	5.2	6.1	7.0	7.8	8.7	9.5
8	25.6	1.28	4.5	5.5	6.4	7.3	8.2	9.2	10.1
9	28.6	1.34	4.8	5.9	6.8	7.8	8.8	9.7	10.7
10	31.9	1.39	5.1	6.3	7.3	8.3	9.3	10.4	11.4
11	35.9	1.44	5.4	6.6	7.7	8.8	9.9	11.0	12.0
12	40.5	1.49	5.8	7.0	8.2	9.3	10.5	11.6	12.8
13	45.6	1.56	6.2	7.5	8.7	10.0	11.2	12.4	13.6
14	51.0	1.64	6.6	8.0	9.3	10.6	11.9	13.2	14.6
15	56.3	1.7	7.0	8.5	9.9	11.2	12.6	14.0	15.4
16	60.9	1.74	7.3	8.9	10.3	11.8	13.2	14.7	16.2
17	64.6	1.75	7.6	9.2	10.7	12.2	13.7	15.2	16.7
18	67.2	1.76	7.7	9.4	10.9	12.5	14.0	15.6	17.1

Source: NHMRC (2006)

Notes: Reference weights and heights are from the CDC Growth Charts for the United States (Kuczmarski et al 2000).

BMR is estimated using Schofield (1985) equations for weight, height and age group (3–10 and 10–18 years).

Table A2: Estimated energy requirements for children and young people – females

Age (years)	Weight (kg)	Height (m)	BMR (MJ/d)	PAL 1.2	PAL 1.4	PAL 1.6	PAL 1.8	PAL 2.0	PAL 2.2
3	13.9	0.94	3.2	3.9	4.5	5.3	5.8	6.4	7.1
4	15.8	1.01	3.4	4.1	4.8	5.5	6.1	6.8	7.5
5	17.9	1.08	3.6	4.4	5.1	5.7	6.5	7.2	7.9
6	20.2	1.15	3.8	4.6	5.4	6.1	6.9	7.6	8.4
7	22.8	1.21	4.0	4.9	5.7	6.5	7.3	8.1	8.9
8	25.6	1.28	4.2	5.2	6.0	6.9	7.7	8.6	9.4
9	29.0	1.33	4.5	5.5	6.4	7.3	8.2	9.1	10.0
10	32.9	1.38	4.7	5.7	6.7	7.6	8.5	9.5	10.4
11	37.2	1.44	4.9	6.0	7.0	8.0	9.0	10.0	11.0
12	41.6	1.51	5.2	6.4	7.4	8.5	9.5	10.6	11.6
13	45.8	1.57	5.5	6.7	7.8	8.9	10.0	11.1	12.2
14	49.4	1.60	5.7	6.9	8.1	9.2	10.3	11.5	12.6
15	52.0	1.62	5.8	7.1	8.2	9.4	10.6	11.7	12.9
16	53.9	1.63	5.9	7.2	8.4	9.5	10.7	11.9	13.1
17	55.1	1.63	5.9	7.2	8.4	9.6	10.8	12.0	13.2
18	56.2	1.63	6.0	7.3	8.5	9.7	10.9	12.1	13.3

Source: NHMRC (2006)

Notes: Reference weights and heights are from the CDC Growth Charts for the United States (Kuczmarski et al 2000).

BMR is estimated using Schofield (1985) equations for weight, height and age group (3–10 and 10–18 years).

Table A3: Nutrient reference values for children aged 2–3 years

Nutrient	EAR	RDI	AI	UL
Protein (g)	12 (0.92 g/kg)	14 (1.08 g/kg)	–	NP[1]
Total fat (g)	No EAR, RDI or AI recommendations for total fat			NP[2]
Linoleic acid (g)	–	–	5.0	NP
α-linolenic acid (g)	–	–	0.5	NP
LC omega-3 (mg)	–	–	40	3000
Carbohydrate (g)	No EAR, RDI or AI recommendations for carbohydrate			NP[3]
Dietary fibre (g)	–	–	14	NP
Water (fluids) (L)	–	–	1.0	NP
Vitamin A (µg RE)	210	300	–	600[4]
Thiamin (mg)	0.4	0.5	–	NP
Riboflavin (mg)	0.4	0.5	–	NP
Niacin (mg NE)	5	6	–	10[5]
Vitamin B6 (mg)	0.4	0.5	–	15[6]
Vitamin B12 (µg)	0.7	0.9	–	NP
Folate (µg DFE)	120	150	–	300[7]
Pantothenic acid (mg)	–	–	3.5	NP
Biotin (µg)	–	–	8	NP
Choline (mg)	–	–	200	1000
Vitamin C (mg)	25	35	–	NP[8]
Vitamin D (µg)	–	–	5	80
Vitamin E (mg α-TE)	–	–	5	70
Vitamin K (µg)	–	–	25	NP
Calcium (mg)	360	500	–	2500
Chromium (µg)	–	–	11	NP
Copper (mg)	–	–	0.7	1
Fluoride (mg)	–	–	0.7	1.3
Iodine (µg)	65	90	–	200
Iron (mg)	4	9	–	20
Magnesium (mg)	65	80	–	65[9]
Manganese (mg)	–	–	2	NP
Molybdenum (µg)	13	17	–	300
Phosphorus (mg)	380	460	–	3000
Potassium (mg)	–	–	2000	NP
Selenium (µg)	20	25	–	90
Sodium (mg)	–	–	200–400	1000
Zinc (mg)	2.5	3.0	–	7

Source: NHMRC (2006)

Notes:

RDI recommended dietary intake; AI = adequate intake; UL = upper levels of intake; – = not established; NP = not possible to establish upper level of intake; LC omega-3 = long-chain omega-3 fatty acids.

1 For protein, a UL of 25% energy from protein is recommended in relation to the balance of macronutrients for chronic disease prevention.

2 For total fat, a UL of 35% energy from protein is recommended in relation to the balance of macronutrients for chronic disease prevention.

3 For carbohydrate, a UL of 65% energy from protein is recommended in relation to the balance of macronutrients for chronic disease prevention.

4 Limit cannot be established for supplemental beta-carotene and is not required for food sources.

5 For niacin, the UL is for nicotinic acid. For nicotinamide supplements, the UL is 150 mg/day.

6 For vitamin B6, the UL is for pyridoxine.

7 For folate, the UL is for dietary folate equivalents from fortified foods and supplements.

8 For vitamin C, a UL of 1000 mg/day would be prudent.

9 For magnesium, the UL is for supplements.

Table A4: Nutrient reference values for children aged 4–8 years

Nutrient	EAR	RDI	AI	UL
Protein (g)	16 (0.73 g/kg)	20 (0.91 g/kg)	–	NP[1]
Total fat (g)	Essentiality relates to type of fat only			NP[2]
Linoleic acid (g)	–	–	8.0	NP
α-linolenic acid (g)	–	–	0.8	NP
LC omega-3 (mg)	–	–	55	3000
Carbohydrate (g)	Limited data re essentiality on which to set EAR/RDI or AI			NP[3]
Dietary fibre (g)	–	–	18	NP
Water (fluids) (L)	–	–	1.2	NP
Vitamin A (µg RE)	275	400	–	900[4]
Thiamin (mg)	0.5	0.6	–	NP
Riboflavin (mg)	0.5	0.6	–	NP
Niacin (mg NE)	6	8	–	15[5]
Vitamin B6 (mg)	0.5	0.6	–	20[6]
Vitamin B12 (µg)	1.0	1.2	–	NP
Folate (µg DFE)	160	200	–	400[7]
Pantothenic acid (mg)	–	–	4	NP
Biotin (µg)	–	–	12	NP
Choline (mg)	–	–	250	1000
Vitamin C (mg)	25	35	–	NP[8]
Vitamin D (µg)	–	–	5	80
Vitamin E (mg -TE)	–	–	6	100
Vitamin K (µg)	–	–	35	NP
Calcium (mg)	520	700	–	2500
Chromium (µg)	–	–	15	NP
Copper (mg)	–	–	1.0	3
Fluoride (mg)	–	–	1.0	2.2
Iodine (µg)	65	90	–	300
Iron (mg)	4	10	–	40
Magnesium (mg)	110	130	–	110[9]
Manganese (mg)	–	–	2.5	NP
Molybdenum (µg)	17	22	–	600
Phosphorus (mg)	405	500	–	3000
Potassium (mg)	–	–	2300	NP
Selenium (µg)	25	30	–	150
Sodium (mg)	–	–	300–600	1400
Zinc (mg)	3	4	–	12

Source: NHMRC (2006)

Notes:

RDI recommended dietary intake; AI = adequate intake; UL = upper levels of intake; – = not established; NP = not possible to establish upper level of intake; LC omega-3 = long-chain omega-3 fatty acids.

1 For protein, a UL of 25% energy from protein is recommended in relation to the balance of macronutrients for chronic disease prevention.

2 For total fat, a UL of 35% energy from protein is recommended in relation to the balance of macronutrients for chronic disease prevention.

3 For carbohydrate, a UL of 65% energy from protein is recommended in relation to the balance of macronutrients for chronic disease prevention.

4 Limit cannot be established for supplemental beta-carotene and is not required for food sources.

5 For niacin, the UL is for nicotinic acid. For nicotinamide supplements, the UL is 150 mg/day.

6 For vitamin B6, the UL is for pyridoxine.

7 For folate, the UL is for dietary folate equivalents from fortified foods and supplements.

8 For vitamin C, a UL of 1000 mg/day would be prudent.

9 For magnesium, the UL is for supplements.

Table A5: Nutrient reference values for children and young people aged 9–13 years

Nutrient	EAR		RDI		AI		UL
	Male	Female	Male	Female	Male	Female	All
Protein (g)	31 (0.78 g/kg)	24 (0.61 g/kg)	40 (0.94 g/kg)	35 (0.87 g/kg)	–	–	NP[1]
Total fat (g)	Essentiality relates to type of fat only						NP[2]
Linoleic acid (g)	–	–	–	–	10	8	NP
-linolenic acid (g)	–	–	–	–	1.0	0.8	NP
LC omega-3 (mg)	-	–	–	–	70	70	3000
Carbohydrate (g)	Limited data re essentiality on which to set EAR/RDI or AI						NP[3]
Dietary fibre (g)	–	–	–	–	24	20	NP
Water (fluids) (L)	–	–	–	–	1.6	1.4	NP
Vitamin A (µg RE)	445	420	600	600	–	–	1700[4]
Thiamin (mg)	0.7	0.7	0.9	0.9	–	–	NP
Riboflavin (mg)	0.8	0.8	0.9	0.9	–	–	NP
Niacin (mg NE)	9	9	12	12	–	–	20[5]
Vitamin B6 (mg)	0.8	0.8	1.0	1.0	–	–	30[6]
Vitamin B12 (µg)	1.5	1.5	1.8	1.8	–	–	NP
Folate (µg DFE)	250	250	300	300	–	–	600[7]
Pantothenic acid (mg)	–	–	–	–	5	4	NP
Biotin (µg)	–	–	–	–	20	20	NP
Choline (mg)	–	–	–	–	375	375	1000
Vitamin C (mg)	28	28	40	40	–	–	NP[8]
Vitamin D (µg)	–	–	–	–	5	5	80
Vitamin E (mg -TE)	–	–	–	–	9	8	180
Vitamin K (µg)	–	–	–	–	45	45	NP
Calcium (mg)	9–11 years 800 12–13 years 1050		9–11 years 1000 12–13 years 1300		–	–	2500
Chromium (µg)	–	–	–	–	25	21	NP
Copper (mg)	–	–	–	–	1.3	1.1	5
Fluoride (mg)	–	–	–	–	2	2	10
Iodine (µg)	75	75	120	120	–	–	600
Iron (mg)	6	6	8	8	–	–	40
Magnesium (mg)	200	200	240	240	–	–	NP[9]
Manganese (mg)	–	–	–	–	3.0	2.5	NP
Molybdenum (µg)	26	26	34	34	–	–	1100
Phosphorus (mg)	1055	1055	1250	1250	–	–	4000
Potassium (mg)	–	–	–	–	3000	2500	NP
Selenium (µg)	40	40	50	50	–	–	280
Sodium (mg)	–	–	–	–	400–800	400–800	2000
Zinc (mg)	5	5	6	6	–	–	25

Source: NHMRC (2006)

Notes:

RDI recommended dietary intake; AI = adequate intake; UL = upper levels of intake; – = not established; NP = not possible to establish upper level of intake; LC omega-3 = long-chain omega-3 fatty acids.

1 For protein, a UL of 25% energy from protein is recommended in relation to the balance of macronutrients for chronic disease prevention.

2 For total fat, a UL of 35% energy from protein is recommended in relation to the balance of macronutrients for chronic disease prevention.

3 For carbohydrate, a UL of 65% energy from protein is recommended in relation to the balance of macronutrients for chronic disease prevention.

4 Limit cannot be established for supplemental beta-carotene and is not required for food sources.

5 For niacin, the UL is for nicotinic acid. For nicotinamide supplements, the UL is 150 mg/day.

6 For vitamin B6, the UL is for pyridoxine.

7 For folate, the UL is for dietary folate equivalents from fortified foods and supplements.

8 For vitamin C, a UL of 1000 mg/day would be prudent.

9 For magnesium, the UL is for supplements.

Table A6: Nutrient reference values for young people aged 14–18 years

Nutrient	EAR		RDI		AI		UL
	Male	Female	Male	Female	Male	Female	All
Protein (g)	49 (0.76 g/kg)	35 (0.62 g/kg)	65 (0.99 g/kg)	45 (0.77 g/kg)	–	–	NP[1]
Total fat (g)	Essentiality relates to type of fat only						NP[2]
Linoleic acid (g)	–	–	–	–	12	8	NP
α-linolenic acid (g)	–	–	–	–	1.2	0.8	NP
LC omega-3 (mg)	–	–	–	–	125	85	3000
Carbohydrate (g)	Limited data re essentiality on which to set EAR/RDI or AI						NP[3]
Dietary fibre (g)	–	–	–	–	28	22	NP
Water (fluids) (L)	–	–	–	–	1.9	1.6	NP
Vitamin A (µg RE)	630	485	900	700	–	–	2800[4]
Thiamin (mg)	1.0	0.9	1.2	1.1	–	–	NP
Riboflavin (mg)	1.1	0.9	1.3	1.1	–	–	NP
Niacin (mg NE)	12	11	16	14	–	–	30[5]
Vitamin B6 (mg)	1.1	1.0	1.3	1.2	–	–	40[6]
Vitamin B12 (µg)	2.0	2.0	2.4	2.4	–	–	NP
Folate (µg DFE)	330	330	400	400	–	–	800[7]
Pantothenic acid(mg)	–	–	–	–	6	4	NP
Biotin (µg)	–	–	–	–	30	25	NP
Choline (mg)	–	–	–	–	550	400	3000
Vitamin C (mg)	28	28	40	40	–	–	NP[8]
Vitamin D (µg)	–	–	–	–	5	5	80
Vitamin E (mg α-TE)	–	–	–	–	10	8	250
Vitamin K (µg)	–	–	–	–	55	55	NP
Calcium (mg)	1050	1050	1300	1300	–	–	2500
Chromium (µg)	–	–	–	–	35	25	NP
Copper (mg)	–	–	–	–	1.5	1.1	8
Fluoride (mg)	–	–	–	–	3	3	10
Iodine (µg)	95	95	150	150	–	–	900
Iron (mg)	8	8	11	15	–	–	45
Magnesium (mg)	340	300	410	360	–	–	NP[9]
Manganese (mg)	–	–	–	–	3.5	3.0	NP
Molybdenum (µg)	33	33	43	43	–	–	1700
Phosphorus (mg)	1055	1055	1250	1250	–	–	4000
Potassium (mg)	–	–	–	–	3600	2600	NP
Selenium (µg)	60	50	70	60	–	–	400
Sodium (mg)	–	–	–	–	460–920	460–920	2300
Zinc (mg)	11	6	13	7	–	–	35

Source: NHMRC (2006)

Notes:

RDI recommended dietary intake; AI = adequate intake; UL = upper levels of intake; – = not established; NP = not possible to establish upper level of intake; LC omega-3 = long-chain omega-3 fatty acids.

1 For protein, a UL of 25% energy from protein is recommended in relation to the balance of macronutrients for chronic disease prevention.

2 For total fat, a UL of 35% energy from protein is recommended in relation to the balance of macronutrients for chronic disease prevention.

3 For carbohydrate, a UL of 65% energy from protein is recommended in relation to the balance of macronutrients for chronic disease prevention.

4 Limit cannot be established for supplemental beta-carotene and is not required for food sources.

5 For niacin, the UL is for nicotinic acid. For nicotinamide supplements, the UL is 150 mg/day.

6 For vitamin B6, the UL is for pyridoxine.

7 For folate, the UL is for dietary folate equivalents from fortified foods and supplements.

8 For vitamin C, a UL of 1000 mg/day would be prudent.

9 For magnesium, the UL is for supplements.

Table A7: Nutrient reference values for pregnancy

Nutrient	EAR		RDI		AI		UL	
	14–18 years	19–50 years	14–18 years	19–50 years	14–18 years	19–50 years	14–18 years	19–50 years
Protein (g)	47 (0.82 g/kg)	49 (0.80 g/kg)	58 (1.02 g/kg)	60 (1.00 g/kg)	–	–	NP[1]	NP[1]
Total fat (g)	Essentiality relates to type of fat only						NP[2]	NP[2]
Linoleic acid (g)	–	–	–	–	10	10	NP	NP
α-linolenic acid (g)	–	–	–	–	1.0	1.0	NP	NP
LC omega-3 (mg)	–	–	–	–	110	115	3000	3000
Carbohydrate (g)	Limited data re essentiality on which to set EAR/RDI or AI						NP[3]	NP[3]
Dietary fibre (g)	–	–	–	–	25	28	NP	NP
Water (fluids) (L)	–	–	–	–	1.8	2.3	NP	NP
Vitamin A (µg RE)	530	550	700	800	–	–	2800[4]	3000[4]
Thiamin (mg)	1.2	1.2	1.4	1.4	–	–	NP	NP
Riboflavin (mg)	1.2	1.2	1.4	1.4	–	–	NP	NP
Niacin (mg NE)	14	14	18	18	–	–	30[5]	35[5]
Vitamin B6 (mg)	1.6	1.6	1.9	1.9	–	–	40[6]	50[6]
Vitamin B12 (µg)	2.2	2.2	2.6	2.6	–	–	NP	NP
Folate (µg DFE)	520	520	600	600	–	–	800[7]	1000[7]
Pantothenic acid (mg)	–	–	–	–	5	5	NP	NP
Biotin (µg)	–	–	–	–	30	30	NP	NP
Choline (mg)	–	–	–	–	415	440	3000	3500
Vitamin C (mg)	38	40	40	60	–	–	NP[8]	NP[8]
Vitamin D (µg)	–	–	–	–	5	5	80	80
Vitamin E (mg α-TE)	–	–	–	–	8	7	250	300
Vitamin K (µg)	–	–	–	–	60	60	NP	NP
Calcium (mg)	1050	840	1300	1000	–	–	2500	2500
Chromium (µg)	–	–	–	–	30	30	NP	NP
Copper (mg)	–	–	–	–	1.2	1.3	8	10
Fluoride (mg)	–	–	–	–	3	3	10	10
Iodine (µg)	160	160	220	220	–	–	900	1100
Iron (mg)	23	22	27	27	–	–	45	45
Magnesium (mg)	335	290 (19–30 years)	400	350 (19–30 years)	–	–	350[9]	350[9]
Manganese (mg)	–	–	–	–	5	5	NP	NP
Molybdenum (µg)	40	40	50	50	–	–	1700	2000
Phosphorus (mg)	1055	580	1250	1000	–	–	4000	3500
Potassium (mg)	–	–	–	–	2800	2800	NP	NP
Selenium (µg)	55	55	65	65	–	–	400	400
Sodium (mg)	–	–	–	–	460–920	460–920	2300	2300
Zinc (mg)	8.5	9	10	11	–	–	35	40

Source: NHMRC (2006)

Notes:

RDI recommended dietary intake; AI = adequate intake; UL = upper levels of intake; – = not established; NP = not possible to establish upper level of intake; LC omega-3 = long-chain omega-3 fatty acids.

1 For protein, a UL of 25% energy from protein is recommended in relation to the balance of macronutrients for chronic disease prevention.

2 For total fat, a UL of 35% energy from protein is recommended in relation to the balance of macronutrients for chronic disease prevention.

3 For carbohydrate, a UL of 65% energy from protein is recommended in relation to the balance of macronutrients for chronic disease prevention.

4 Limit cannot be established for supplemental beta-carotene and is not required for food sources.

5 For niacin, the UL is for nicotinic acid. For nicotinamide supplements, the UL is 150 mg/day.

6 For vitamin B6, the UL is for pyridoxine.

7 For folate, the UL is for dietary folate equivalents from fortified foods and supplements.

8 For vitamin C, a UL of 1000 mg/day would be prudent.

9 For magnesium, the UL is for supplements.

Table A8: Nutrient reference values for lactation

Nutrient	EAR		RDI		AI		UL	
	14–18 years	19–50 years	14–18 years	19–50 years	14–18 years	19–50 years	14–18 years	19–50 years
Protein (g)	51 (0.90 g/kg)	54 (0.88 g/kg)	63 (1.11 g/kg)	67 (1.10 g/kg)	–	–	NP[1]	NP[1]
Total fat (g)	Essentiality relates to type of fat only						NP[2]	NP[2]
Linoleic acid (g)	–	–	–	–	12	12	NP	NP
α-linolenic acid (g)	–	–	–	–	1.2	1.2	NP	NP
LC omega-3 (mg)	–	–	–	–	140	145	3000	3000
Carbohydrate (g)	Limited data re essentiality on which to set EAR/RDI or AI						NP[3]	NP[3]
Dietary fibre (g)	–	–	–	–	27	30	NP	NP
Water (fluids) (L)	–	–	–	–	2.3	2.6	NP	NP
Vitamin A (µg RE)	780	800	1100	1100	–	–	2800[4]	3000[4]
Thiamin (mg)	1.2	1.2	1.4	1.4	–	–	NP	NP
Riboflavin (mg)	1.3	1.3	1.6	1.6	–	–	NP	NP
Niacin (mg NE)	13	13	17	17	–	–	30[5]	35[5]
Vitamin B6 (mg)	1.7	1.7	2.0	2.0	–	–	40[6]	50[6]
Vitamin B12 (mg)	2.4	2.4	2.8	2.8	–	–	NP	NP
Folate (µg DFE)	450	450	500	500	–	–	800[7]	1000[7]
Pantothenic acid (mg)	–	–	–	–	6	6	NP	NP
Biotin (µg)	–	–	–	–	35	35	NP	NP
Choline (mg)	–	–	–	–	525	550	3000	3500
Vitamin C (mg)	58	60	80	85	–	–	NP[8]	NP[8]
Vitamin D (µg)	–	–	–	–	5	5	80	80
Vitamin E (mg α-TE)	–	–	–	–	12	11	250	300
Vitamin K (µg)	–	–	–	–	60	60	NP	NP
Calcium (mg)	1050	840	1300	1000	–	–	2500	2500
Chromium (µg)	–	–	–	–	45	45	NP	NP
Copper (mg)	–	–	–	–	1.4	1.5	8	10
Fluoride (mg)	–	–	–	-	3	3	10	10
Iodine (µg)	190	190	270	270	–	–	900	1100
Iron (mg)	7	6.5	10	9	–	–	45	45
Magnesium (mg)	300	255	360	310	–	–	350[9]	350[9]
Manganese (mg)	–	–	–	–	5	5	NP	NP
Molybdenum (µg)	35	36	50	50	–	–	1700	2000
Phosphorus	1055	580	1250	1000	–	–	4000	4000
Potassium (mg)	–	–	–	–	2800	2800	NP	NP
Selenium (µg)	65	65	75	75	–	–	400	400
Sodium (mg)	–	–	–	–	460–920	460–920	2300	2300
Zinc (mg)	9	10	11	12	–	–	35	40

Source: NHMRC (2006)

Notes:

RDI = recommended dietary intake; AI = adequate intake; UL = upper levels of intake; – = not established; NP = not possible to establish upper level of intake; LC omega-3 = long-chain omega-3 fatty acids.

1 For protein, a UL of 25% energy from protein is recommended in relation to the balance of macronutrients for chronic disease prevention.

2 For total fat, a UL of 35% energy from protein is recommended in relation to the balance of macronutrients for chronic disease prevention.

3 For carbohydrate, a UL of 65% energy from protein is recommended in relation to the balance of macronutrients for chronic disease prevention.

4 Limit cannot be established for supplemental beta-carotene and is not required for food sources.

5 For niacin, the UL is for nicotinic acid. For nicotinamide supplements, the UL is 150 mg/day.

6 For vitamin B6, the UL is for pyridoxine.

7 For folate, the UL is for dietary folate equivalents from fortified foods and supplements.

8 For vitamin C, a UL of 1000 mg/day would be prudent.

9 For magnesium, the UL is for supplements.

Appendix 4: New Zealand–WHO growth charts

The following growth charts are based on the UK–WHO growth charts developed by the Royal College of Paediatrics and Child Health, United Kingdom, © 2009 Department of Health, United Kingdom. The growth charts were adapted by the New Zealand Ministry of Health in July 2010.

Figure A9: Height, weight and head circumference, girls 1–5 years

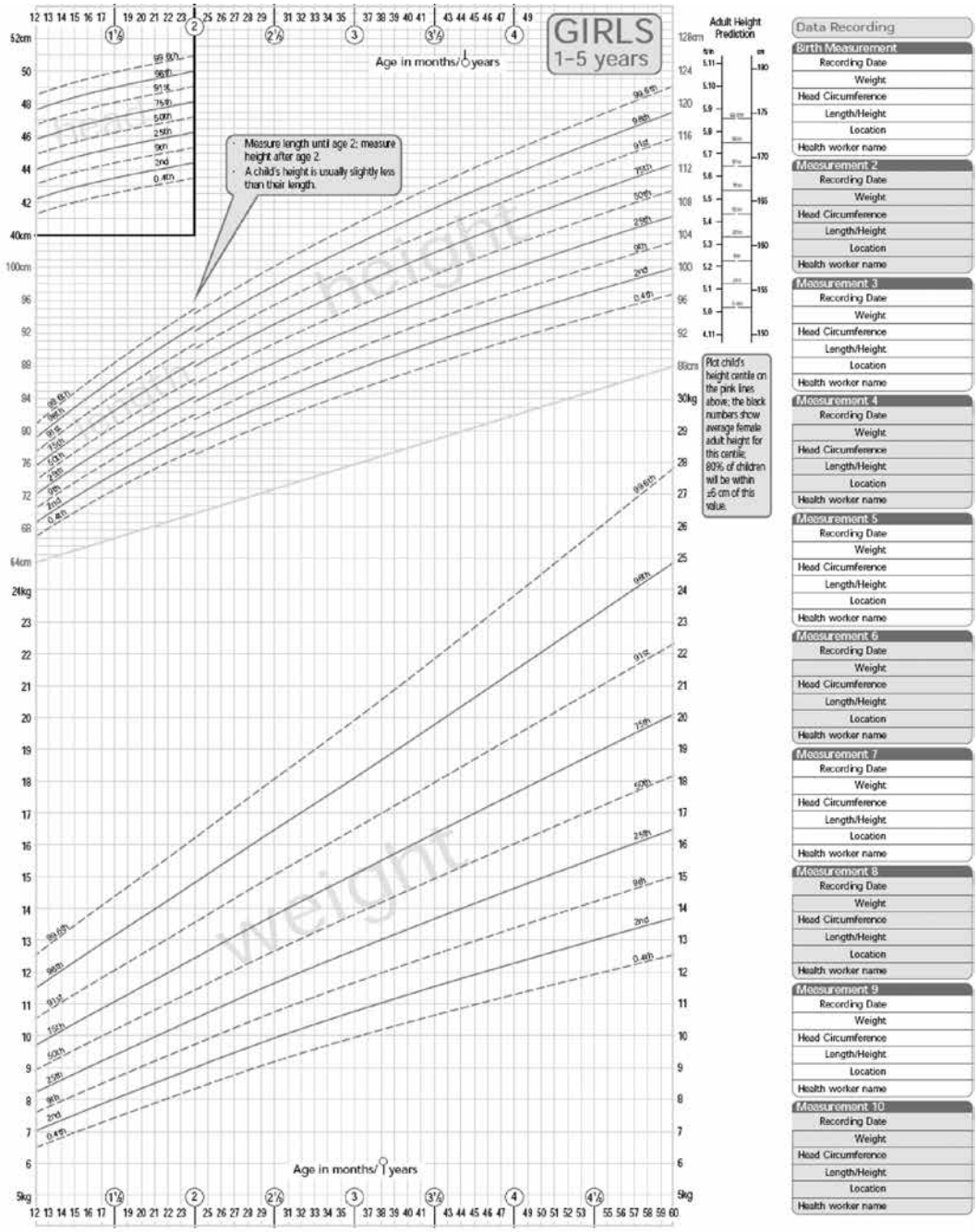


Figure A10: Height, weight and head circumference, boys 1–5 years

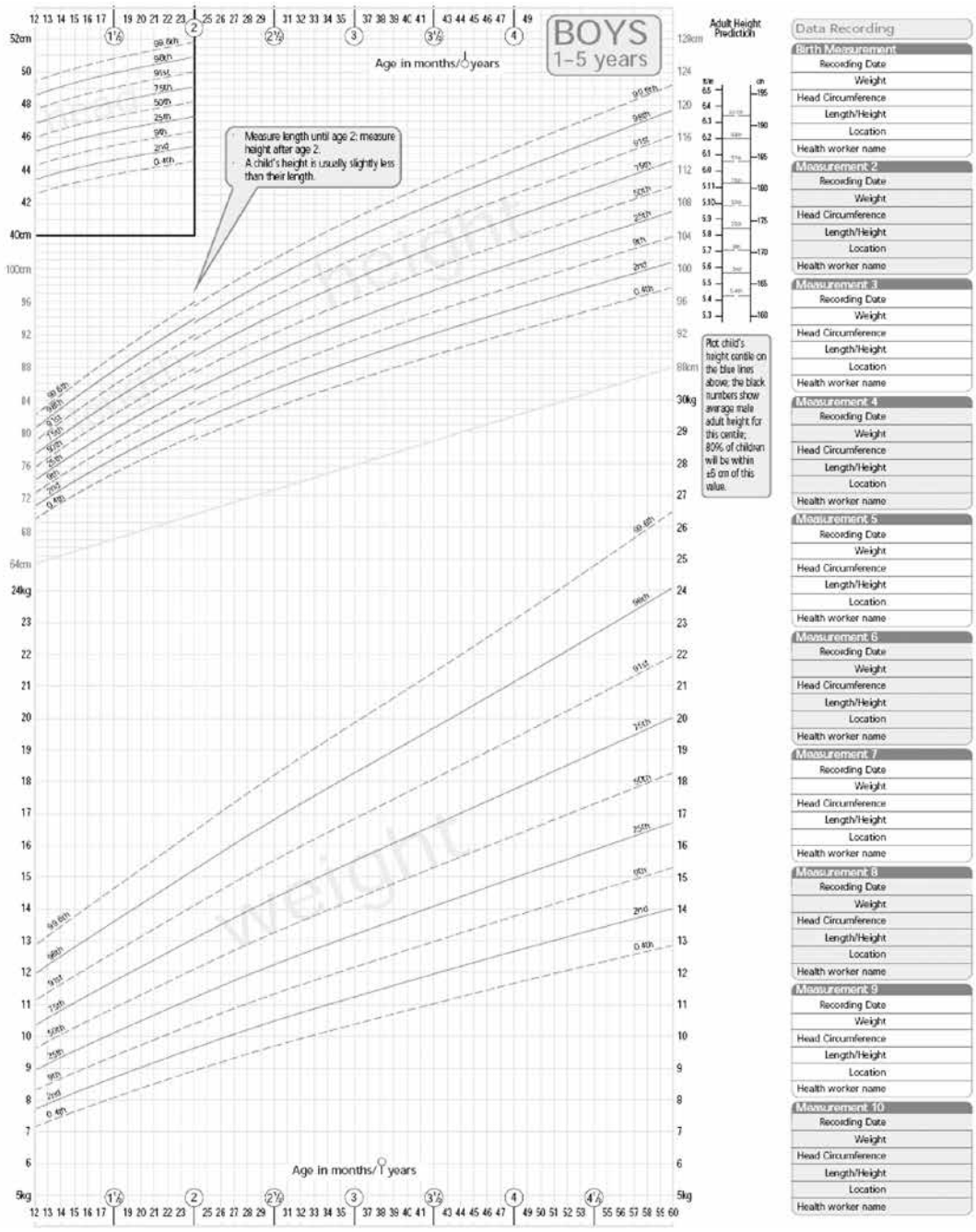
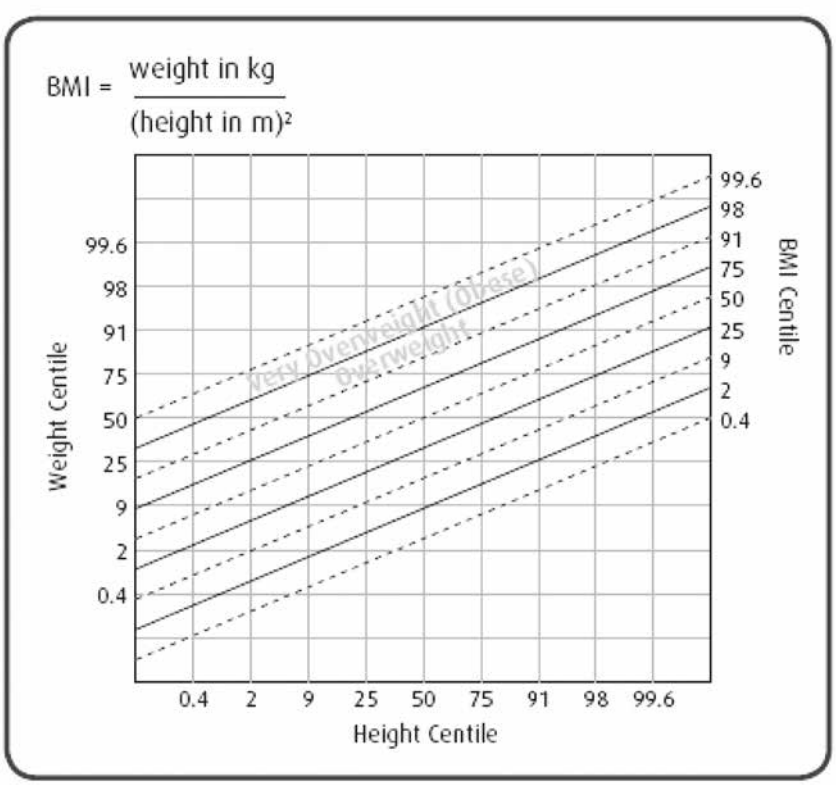


Figure A11: Weight–height to body mass index conversion chart

BMI indicates how heavy a child is relative to his or her height and is the simplest measure of underweight or overweight from the age of 2, when height can be measured fairly accurately. This chart provides an approximate BMI centile, accurate to a quarter of a centile space.



How to calculate and plot BMI using the BMI conversion chart

1. Plot the weight and height using the New Zealand–WHO Growth Charts, identifying the child's weight and height centile.
2. Plot the weight centile (left axis) against the height centile (bottom axis on the BMI conversion chart.
3. Read off the corresponding BMI centile from the slanting lines.
4. Record the centile with the date.

Appendix 5: Three-day sample meal plans

Sample meal plans (Tables A12–A15) have been prepared for children and young people at four different ages at the mid-point of the four age groups for nutrient reference values (NRVs): 2–3 years, 4–8 years, 9–13 years and 14–18 years. The sample meal plans are based on the energy and nutrient requirements of girls with a physical activity level (PAL) of 1.6, which is equivalent to light- to moderate-intensity activity. Because energy requirements are slightly higher for boys, they may need slightly larger portions of some foods.

These sample meal plans are indicative only and are not meant as ideal meal plans for the different age groups. Their purpose is to illustrate how nutrient requirements can be met by diet. Actual diets of children and young people require individualising around many factors such as likes and dislikes, budget, physical activity levels, and cultural, religious and practical considerations.

After the sample meal plans, Table A17 provides a breakdown of the specific nutrients that each of the plans provides.

Plan for three-year-old girl

The sample meal plan is based on the energy and nutrient requirements of a three-year-old girl (EER 5.3 MJ) with a PAL of 1.6 (light-intensity activity). For a three-year-old boy the nutrient requirements are the same but the energy requirements are slightly higher (EER 5.6 MJ).

Table A12: Sample three-day meal plan for three-year-old girl

Day 1	Day 2	Day 3
Breakfast		
> Wheat biscuits: 2 > Trim milk: 125 ml > Banana: ½ > Yoghurt: 2 tbsp > Water: 125 ml	> Porridge with chopped raisins: ½ cup > Banana: ½ > Trim milk: 125 ml	> Wheat biscuits: 1 > Trim milk: 125 ml > Toast: 1 slice > Peanut butter: 1 tsp > Water: 125 ml
Mid-morning snack		
> Mandarin: 1 > Fruit biscuit: 1 > Trim milk: 125 ml	> Crackers: 2 > Cheese: 2 slices > Tomato: 2 slices > Milk, reduced fat (1.5%): 125 ml	> Blueberry muffin: 1 mini (4 x 4 cm) > Margarine: 1 tsp > Kiwifruit: 1 > Water: 125 ml
Lunch		
> Bread: 2 slices > Margarine: 1 tsp > Baked beans: ¼ cup > Milk, reduced fat (1.5%): 125 ml	> Bread roll, small: 1 > Margarine: 1 tsp > Cheese: 1 slice > Pumpkin soup: ½ cup > Apple: ½ > Water: 125 ml	> Bread: 2 slices > Margarine: 1 tsp > Boiled egg: 1 > Tomato: ½ > Water: 125 ml
Mid-afternoon snack		
> Pear: ½ > Cucumber: 3 slices, chopped > Hummus: 2 tbsp > Milk, reduced fat (1.5%): 125 ml	> Apple: ½, grated > Plain biscuit: 2 > Water: 125 ml	> Bread: 1 slice > Margarine: ½ tsp > Cheese: 2 slices > Tomato: 4 slices > Mandarin: ½ > Water: 125 ml
Dinner		
> Mince: 60 g > Pasta shapes: ½ cup > Broccoli: ¼ cup > Carrots, boiled: ¼ cup > Water: 125 ml	> Chicken: 60 g > Kūmara: 1 small > Mixed vegetables: ½ cup > Water: 125 ml	> Fish cake: 1 > Baked potato wedges: 4 > Peas: ¼ cup > Sweetcorn: ¼ cup > Milk: 125 ml
Extras		
> Rice pudding: ¼ cup > Apricots in juice, chopped: ¼ cup	> Fresh fruit salad: ½ cup chopped > Yoghurt: 2 tbsp	> Ice cream: small scoop
Notes: tbsp = tablespoon, tsp = teaspoon		

Plan for six-year-old girl

The sample meal plan is based on the energy and nutrient requirements of a six-year-old girl (EER 6.1 MJ) with a PAL of 1.6 (light-intensity activity). For a six-year-old boy, the nutrient requirements are the same but the energy requirements are slightly higher (EER 6.6 MJ).

Table A13: Sample three-day meal plan for six-year-old girl

Day 1	Day 2	Day 3
Breakfast		
> Breakfast corn flakes: ¼ cup > Milk, trim: 125 ml > Peaches in juice: ¼ cup > Toast: 1 slice > Peanut butter: 1 tsp > Water: 150 ml	> Wheat biscuits: 2 > Milk: 125 ml > Banana: ½ > Toast: 1 slice > Margarine: 1 tsp > Jam: 1 tsp > Water: 150 ml	> Porridge with raisins: ¾ cup > Banana: ½ > Trim milk: 125 ml
Mid-morning snack		
> Mandarin: 1 > Fruit bread: 1 slice > Margarine: 1 tsp	> Kiwifruit: 1 > Fruit muffin: 1 small (4 x 6 cm) > Water: 150 ml	> Plum: 1 > Yoghurt: 1 pottle > Water: 150 ml
Lunch		
> Wholemeal bread: 2 slices > Margarine: 2 tsp > Lean roast lamb: 2 slices > Tomato: 4 slices > Lettuce: 2 leaves > Banana: 1 > Water: 150 ml	> Multigrain bread: 2 slices > Margarine: 1 tsp > Boiled egg: 1 > Tomato: 1 > Apple: 1 small > Water: 150 ml	> Bread roll, small: 1 > Margarine: 1 tsp > Canned tuna: 50 g > Beetroot: 2 slices > Grated carrot: 2 tbsp > Lettuce: 1 leaf > Mayonnaise: 1 tsp > Water: 150 ml
Mid-afternoon snack		
> Crispbread: 2 > Cheese: 2 slices > Tomato: 2 slices > Trim milk: 125 ml	> Raw nuts and seeds: 2 tbsp > Milk, trim: 150 ml > Nutrient enriched chocolate drink powder: 1 tsp	> Wholemeal bread: 1 slice > Cheese: 2 slices > Yeast based spread: ½ tsp > Trim milk: 150 ml
Dinner		
> Fish in sweet and sour sauce: 1 small serving > Potato curry: 1/3 cup > Green beans: ¼ cup > Sweetcorn: ½ cob > Water: 150 ml	> Chapati: 1 > Rice: ½ cup > Dahl: ½ cup > Curried peas and beans: ½ cup > Water: 125 ml	> Chicken: 80 g > Rice: ½ cup > Broccoli: ¼ cup > Mixed vegetables: ¼ cup > Water: 150 ml
Extras		
> Fresh fruit salad: ½ cup > Yoghurt: ½ pottle	> Peaches in juice: ¼ cup > Custard: ½ cup	> Apple crumble: ½ cup > Ice cream: 1 small scoop
Notes: tbsp = tablespoon, tsp = teaspoon		

Plan for 11-year-old girl

The sample meal plan is based on the energy and nutrient requirements of an 11-year-old girl (EER 8.0 MJ) with a PAL of 1.6 (light-intensity activity). For an 11-year-old boy, the nutrient requirements are the same for all nutrients except protein, and the energy requirements are slightly higher (EER 8.8 MJ).

Table A14: Sample three-day meal plan for 11-year-old girl

Day 1	Day 2	Day 3
Breakfast		
> Porridge: ½ cup > Canned pears in juice: 1/3 cup > Low fat calcium enriched milk: ½ cup > Toast: 1 slice > Margarine: 1 tsp > Jam: 1 tsp > Water: 250 ml	> Toast: 2 slices > Banana:1 > Peanut butter: 2 tsp > Nutrient enriched chocolate drink powder: 1 tsp > Low fat calcium enriched milk: 1 cup	> Wheat biscuits: 2 biscuits > Low fat calcium enriched milk: ½ cup > Banana:1 > Toast: 1 slice > Peanut butter: 2 tsp > Water: 250 ml
Mid-morning snack		
> Mandarin: 1 > Rice crackers: 5 > Tomato: ½ > Cheese: 2 slices > Water: 250 ml	> Apple: 1 > Mixed nuts: ¼ cup > Water: 250 ml	> Raw carrot: 1 > Raisins: small box (15 g) > Hummus: 4 tsp (20 g) > Water: 250 ml
Lunch		
> Wholemeal bread: 2 slices > Peanut butter: 2 tsp > Jam: 1 tsp > Banana: 1 > Water: 250 ml	> Bread roll: 1 > Margarine: 1 tsp > Shredded chicken: 50 g > Coleslaw: ½ cup > Fruit yoghurt: 1 pottle (150 g) > Water: 250 ml	> Wholemeal bread: 2 slices > Margarine: 2 tsp > Boiled egg: 1 > Low-fat mayonnaise: 1 tsp > Salad with cheese: ½ cup > Fruit yoghurt: 1 pottle (150 g) > Water: 250 ml
Mid-afternoon snack		
> Plain biscuit: 2 > Low fat calcium enriched milk: 1 cup > Water: 250 ml	> Cheese: 2 slices > Tomato: ½ > Crackers: 4 > Orange: 1 > Water: 250 ml	> Pear: 1 > Beans, baked: 1/3 cup > Margarine: 1 tsp > Toast: 1 slice > Water: 250 ml
Dinner		
> Chicken: 120 g > Black bean sauce: 1 tsp > Garlic: 1 clove > Mixed vegetables: 1 cup > Boiled rice: 1 cup > Water: 250 ml	> Lean lamb chop: 2 (80 g) > Kūmara: 1 > Pumpkin: 1/3 cup > Cabbage: ½ cup > Watercress: ½ cup > Water: 250 ml	> Stewed lean beef mince: ¾ cup > Bolognaise sauce: 1/3 cup > Boiled pasta: 1 cup > Corn kernels: ½ cup > Silverbeet: ½ cup cooked > Water: 250 ml
> Extras > Plain custard: ½ cup > Apple crumble: ½ cup	> Canned fruit salad in juice: 1 cup	> Low fat calcium enriched milk: 1 cup > Nutrient enriched chocolate drink powder: 1 tsp

Notes: tbsp = tablespoon, tsp = teaspoon

Plan for 16-year-old young woman

The sample meal plan is based on the energy and nutrient requirements of a 16-year-old girl (EER 9.5 MJ) with a PAL of 1.6 (light-intensity activity). For a 16-year-old boy, the nutrient requirements are the same for most nutrients but the energy requirements are higher (EER 11.8 MJ).

Table A15: Sample three-day meal plan for 16-year-old girl

Day 1	Day 2	Day 3
Breakfast		
> Wholemeal toast: 3 thick slices > Poached egg: 1 medium > Margarine: 2 tsp > Yeast based spread: 2 tsp > Low fat calcium enriched milk: 250 ml	> Wheat biscuits: 3 > Low fat calcium enriched milk: 150 ml > Yoghurt: 75 g > Wholegrain toast: 1 med slice > Margarine: 1 tsp > Yeast based spread: 1 tsp > Water: 250 ml	> Porridge: 1 cup > Low fat calcium enriched milk: 150 ml > Banana: 1 > Wholegrain toast: 2 med slice > Margarine : 2 tsp > Yeast based spread: 2 tsp > Water: 250 ml
Mid-morning snack		
> Apple: 1 > Yoghurt: 150 g > Water: 250 ml	> Kiwifruit: 2 > Muesli bar: 1 > Water: 250 ml	> Mandarin: 2 > Biscuit: 4 > Water: 250 ml
Lunch		
> Wholemeal bread: 3 med slices > Canned salmon or tuna: 50 g > Salad coleslaw: ½ cup > Mayonnaise: 1 tsp > Orange: 1 > Water: 250 ml	> Bread roll, mixed grain: 1 > Ham: 2 slices > Lettuce : 1 leaf > Tomato: 1 > Mayonnaise: 1 tsp > Apple: 1 > Water: 250 ml	> Wholemeal pita pocket: 1 > Chicken: 60 g > Lettuce: 2 leaves > Tomato: 1 > Mayonnaise: 1 tsp > Pear: 1 > Water: 250 ml
Mid-afternoon snack		
> Smoothie: 300 ml > Rice crackers: 6 > Cottage cheese : 4 tsp > Pear: 1 > Water: 250 ml	> Cream crackers: 4 > Margarine: 4 tsp > Peanut butter: 4 tsp > Pear: 1 > Water: 250 ml	> Wholemeal bread: 2 > Margarine: 2 tsp > Cheese: 2 tsp > Apple: 1 > Water: 250 ml
Dinner		
> Roast chicken: 150gm > Vegetable salad: 1 cup > Potato boiled: 2 > Water: 250 ml	> Fish fillet, grilled: 1 large > Tomato sauce 1 tsp > Vegetable salad: 1 cup > Cooked green banana,and coconut cream (lite): 2 bananas > Water: 250 ml	> Beef chop suey: 1 ¾ cup > Mixed vegetables: 1 cup > Water: 250 ml
Extras		
> Ice cream: 3/4 cup > Popcorn: 1 cup	> Low fat calcium enriched milk: 250 ml > Fruit finger biscuit: 2	> Roasted peanuts: 15g > Low fat calcium enriched milk: 250 ml
Notes: tbsp = tablespoon, tsp = teaspoon		

Table A16: Nutritional analysis[1] of three-day meal plans, average per day

Nutrient	3-year-old girl	6-year-old girl	11-year-old girl	16-year-old young woman
Water (L)	1.3	1.6	2.5	2.7
Energy (kJ)	5349	6081	8048	9423
Protein (g)	62 (20% TE)	71(20% TE)	97 (20% TE)	133 (24% TE)
Carbohydrate (g)	167 (51% TE)	184(50% TE)	228 (48% TE)	276 (48% TE)
Fibre[2] (g)	18	18	25	34
Total fat (g)	42 (29% TE)	49 (30% TE)	71 (32% TE)	70 (28% TE)
Saturated fat (g)	14	16	27	22
Vitamin A (µg RE)	753	738	1399	1227
Riboflavin (mg)	1.8	2.0	2.5	3.2
Total folate[3] (µg)	223	362	300	587
Vitamin B12 (µg)	2.5	2.9	4.2	4.1
Vitamin C (mg)	81	96	144	222
Vitamin D (µg)	0.9	3.9	1.62	6.8
Calcium (mg)	1123	901	1102	1385
Iron (mg)	8.4	9.5	11.6	18
Selenium (µg)	31	45	68	78
Sodium (mg)	1649	1768	1662	2796
Zinc (mg)	7.9	8.8	12.8	13.8

Notes:

% TE = percentage of total energy

1 Analysed in FoodWorks 2007, which excludes the following nutrients of interest: iodine, omega-3 and omega-3 fatty acids.

2 Fibre is calculated using the Englyst method (Englyst and Cummings 1988).

3 Total folate differs slightly from dietary folate equivalents (DFE).

Appendix 6: Categories of household food security

Rasch analyses were performed using BIGSTEPS 2.82 (a DOS-based Rasch measurement program; Linacre and Wright 1998) to generate a measure of the **severity of food insecurity** for each participant. The statement 'I/we can afford to eat properly' was anchored at 0, with values being assigned by Rasch analysis according to the number and severity of the indices the participant responded to positively (Parnell 2005).

Based on the distribution of the respondents' propensities to affirm these statements (ability scores in the Rasch model), and considering the meanings of these scores in terms of item responses (including the item difficulty scores in the Rasch model), households were then assigned to the following three categories.

1. **Fully/almost fully food secure** included households providing no affirmative response to any of the eight statements and households responding positively to only one statement, which is most likely to be 'the variety of food is limited'.
2. **Moderate food security** included households likely to respond positively to the remaining five statements.
3. **Low food security** included households most likely to report 'relying on others for food or money for food' and 'using special food grants or food banks to acquire the food they needed'.

Appendix 7: Summary of New Zealand studies

Where possible, data on current dietary patterns and food and nutrient intake reported in these guidelines were obtained from large, nationally representative surveys. For some population groups, such as children aged under five years and some ethnic groups, data from large regional studies were used. Key surveys and studies are summarised in Table A17 below.

Table A17: Summary of key New Zealand studies

Name of survey or study	Details
2002 National Children's Nutrition Survey	National cross-sectional survey of 3275 children and young people aged 5–14 years (1224 Māori, 1058 Pacific, 993 European/Other). Included 24-hour dietary recall to measure nutrient intake; questionnaires to assess eating patterns, frequency of eating, and physical activity; measurement of body size; and collection of blood and urine samples to assess nutrient status. (www.health.govt.nz)
1997 National Nutrition Survey	National cross-sectional survey of 4636 adults aged 15 years and over, including 246 young people aged 15–18 years. Included 24-hour dietary recall to measure nutrient intake; questionnaires to assess eating patterns, frequency of eating; measurement of body size; and collection of blood samples to assess nutrient status. (www.health.govt.nz)
2006/07 New Zealand Health Survey	National cross-sectional survey of 4921 children aged from birth to 14 years and 12,488 adults aged 15 years and over. Included questionnaires to assess dietary habits, physical activity and sedentary behaviours, health status; and measurement of body size. (www.health.govt.nz)
2008/09 New Zealand Adult Nutrition Survey	National cross-sectional survey of 4721 adults aged 15 years and over, including 700 young people aged 15–18 years. Included 24-hour dietary recall to measure nutrient intake; questionnaires to assess eating patterns and frequency of eating; measurement of body size; and collection of blood samples to assess nutrient status. (www.health.govt.nz)

Name of survey or study	Details
A National Survey of Children and Young People's Physical Activity and Dietary Behaviours in New Zealand: 2008/09 – Key Findings	A national cross-sectional survey of 2503 children and young people aged 5–24 years, undertaken between September 2008 and May 2009. Face-to-face interviews with follow-up telephone calls were conducted, along with objective measurement of height and weight. Accelerometers were used to objectively measure physical activity. The Multi-media Activity Recall for Children and Adolescents (MARCA), a validated, computerised, 24-hour-recall time use questionnaire, was used to collect information on self-reported physical activity and sedentary behaviours. Interview data were collected directly from children and young people aged 10 years and over, while parents provided proxy responses for children aged 9 years and under. (www.health.govt.nz)
Youth2000	National cross-sectional survey of 9699 secondary school students aged 12–18 years (55.3% NZ European, 24.7% Māori, 8.2% Pacific, 7.2% Asian, and 4.6% Other/unspecified). Included questionnaires to assess a range of topics such as general health, nutrition and physical activity. (www.youth2000.ac.nz)
Youth'07: The Health and Wellbeing of Secondary School Students in New Zealand	National cross-sectional survey of 9107 secondary school children aged 12–18 years (6861 European, 1702 Māori, 1178 Pacific, 1310 Asian, 817 Other). Included questionnaires to assess a range of topics such as general health, nutrition and physical activity. (www.youth2000.ac.nz/research-projects-and-surveys-national-survey-2007--/overview-of-youth-07-1130.htm)
2007 New Zealand Children's Food and Drinks Survey	National cross-sectional survey of 1133 parents and caregivers of children aged 5–16 years (n = 424). Included questionnaires to assess dietary habits and behaviours.
Obesity Prevention in Communities (OPIC)	Obesity prevention trial in four countries: New Zealand (Auckland), Australia, Tonga and Fiji. New Zealand sample comprised 4215 adolescents aged 12–18 years (2490 Pacific, 834 Māori, 446 Asian, 445 European) at baseline. Included questionnaires to assess a range of outcomes such as dietary behaviours and body image; and measurement of body size.
Pacific Island Families Study	Longitudinal study of Pacific children born in Auckland in 2000. Sample size 1376 at birth, 1048 at age 4 years. (http://oldwww.aut.ac.nz/about/faculties/health_and_environmental_sciences/research_centres_and_institutes/pacific_islands_families/about_us.htm)
Dunedin Multidisciplinary Health and Development Study (also known as the Dunedin Longitudinal Study)	A prospective cohort study of babies born in Queen Mary hospital in Dunedin from 1 April 1972 to 31 March 1973. The babies were first followed up at the age of 3, and then at 5, 7, 9, 11, 13, 15, 18, 21, 26 years and most recently 32 years. Future assessments are scheduled for 38 and 44 years. (http://dunedinstudy.otago.ac.nz)

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