Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2–18 Years)
A background paper

Draft for Consultation

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Preface

Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2–18 Years): A background paper – Draft for Consultation is one in a series of five 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.

The Draft for Consultation aims to provide up to date, evidence-informed policy advice and technical information for health practitioners working with children and young people (aged 2–18 years). This includes nurses, dietitians, doctors, nutritionists, health promoters and educators.

The Draft for Consultation has 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). In recognition of the many influencing factors on the food choice of children and young people, some topics additional to these previous guidelines 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.

Your comments on this Draft for Consultation (Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2-18 Years: A background paper) are welcome.

How to have your say

Please use the submission booklet to complete your submission. There is a hard copy booklet at the back of this document.

Please note:

- only submissions written in or attached to this booklet, either as electronic or hard copy, will be accepted
- handwritten comments written within the draft background paper for consultation will not be read or accepted.

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Marked: ‘Submission – Food and Nutrition Guidelines for Healthy Children and Young People: A background paper’

Or complete the electronic submission booklet available online at: www.moh.govt.nz and email to: NutritionGuidelinesCYP@moh.govt.nz

All submissions must be received no later than 5 pm on Monday 13 December 2010.
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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. 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. This was followed by further development of the document by the Nutrition and Physical Activity Policy Team at the Ministry of Health, to produce this *Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2–18 Years): A background paper (Draft for Consultation)*.

The following stakeholders provided feedback on the proposed structure and content of the background paper: the New Zealand Dietetic Association, 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.

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## Contents

Preface iii  
Acknowledgements iv  

### Introduction  
Aim 1  
Description of the population 1  
New Zealand policy context 2  
International context 3  
Food and nutrition for children and young people 4  
Structure of this paper 4  

### Part 1: New Zealand Food and Nutrition Guidelines 6  
1.1 The New Zealand Food and Nutrition Guideline Statements, including Physical Activity 6  
1.2 Food groups and recommended serving sizes 7  
1.3 Nutrient reference values for Australia and New Zealand 13  

### Part 2: Growth and Body Size 16  
2.1 Growth 17  
2.2 Body size 22  
2.3 Obesity 24  
2.4 Underweight 28  

### Part 3: Energy and Nutrients 30  
3.1 Introduction 30  
3.2 Energy 31  
3.3 Carbohydrate 34  
3.4 Dietary fibre 37  
3.5 Fat 40  
3.6 Protein 45  
3.7 Vitamin A 47  
3.8 Riboflavin (vitamin B2) 49  
3.9 Folate 50  
3.10 Vitamin D 53  
3.11 Calcium 57  
3.12 Iodine 60  
3.13 Iron 64  
3.14 Selenium 67  
3.15 Sodium 69  
3.16 Zinc 72
<table>
<thead>
<tr>
<th>Part</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Fluids</td>
<td>74</td>
</tr>
<tr>
<td>4.1</td>
<td>Introduction</td>
<td>75</td>
</tr>
<tr>
<td>4.2</td>
<td>Recommended intake</td>
<td>75</td>
</tr>
<tr>
<td>4.3</td>
<td>Current levels of intake</td>
<td>76</td>
</tr>
<tr>
<td>4.4</td>
<td>Sources of fluid in the diet</td>
<td>76</td>
</tr>
<tr>
<td>5</td>
<td>The Home Environment and Its Influence on What Children and Young People Eat</td>
<td>82</td>
</tr>
<tr>
<td>5.1</td>
<td>Introduction</td>
<td>84</td>
</tr>
<tr>
<td>5.2</td>
<td>Physical, economic and sociocultural factors within the home environment</td>
<td>84</td>
</tr>
<tr>
<td>5.3</td>
<td>Meal patterns</td>
<td>91</td>
</tr>
<tr>
<td>6</td>
<td>The Wider Environment and Its Influence on What Families and Individuals Eat</td>
<td>97</td>
</tr>
<tr>
<td>6.1</td>
<td>Introduction</td>
<td>97</td>
</tr>
<tr>
<td>6.2</td>
<td>The broader determinants of health and their influence on family/whānau dietary choices</td>
<td>98</td>
</tr>
<tr>
<td>6.3</td>
<td>The wider food environment</td>
<td>99</td>
</tr>
<tr>
<td>7</td>
<td>Physical Activity</td>
<td>105</td>
</tr>
<tr>
<td>7.1</td>
<td>Introduction</td>
<td>105</td>
</tr>
<tr>
<td>7.2</td>
<td>Health effects of physical activity</td>
<td>106</td>
</tr>
<tr>
<td>7.3</td>
<td>Sedentary behaviour</td>
<td>107</td>
</tr>
<tr>
<td>7.4</td>
<td>Physical activity recommendations</td>
<td>107</td>
</tr>
<tr>
<td>7.5</td>
<td>Physical activity and sedentary behaviour levels in children and young people</td>
<td>108</td>
</tr>
<tr>
<td>7.6</td>
<td>Increasing physical activity levels</td>
<td>109</td>
</tr>
<tr>
<td>7.7</td>
<td>Types of physical activity</td>
<td>110</td>
</tr>
<tr>
<td>7.8</td>
<td>Barriers to and motivators for physical activity</td>
<td>112</td>
</tr>
<tr>
<td>7.9</td>
<td>Safety considerations</td>
<td>113</td>
</tr>
<tr>
<td>8</td>
<td>Considerations for Māori Tamariki, Rangatahi and their Whānau</td>
<td>114</td>
</tr>
<tr>
<td>8.1</td>
<td>Introduction</td>
<td>115</td>
</tr>
<tr>
<td>8.2</td>
<td>Nutrition and health indicators</td>
<td>117</td>
</tr>
<tr>
<td>8.3</td>
<td>A Māori world view of health</td>
<td>119</td>
</tr>
<tr>
<td>8.4</td>
<td>Traditional foods and cultural practices</td>
<td>120</td>
</tr>
<tr>
<td>8.5</td>
<td>Working with Māori tamariki, rangatahi and their whānau</td>
<td>120</td>
</tr>
<tr>
<td>9</td>
<td>Considerations for Pacific Children, Young People and Their Families</td>
<td>123</td>
</tr>
<tr>
<td>9.1</td>
<td>Introduction</td>
<td>124</td>
</tr>
<tr>
<td>9.2</td>
<td>Nutrition and health indicators</td>
<td>126</td>
</tr>
<tr>
<td>9.3</td>
<td>Concepts of health</td>
<td>129</td>
</tr>
<tr>
<td>9.4</td>
<td>Traditional foods and cultural practices</td>
<td>132</td>
</tr>
<tr>
<td>9.5</td>
<td>Working with Pacific peoples</td>
<td>133</td>
</tr>
</tbody>
</table>
Part 10: Considerations for Asian and Other Populations 135
10.1 Introduction 135
10.2 Health status 139
10.3 Nutrition and health indicators 140
10.4 Traditional foods and cultural practices 142
10.5 Access to health care 142
10.6 Working with Asian and other populations 143

Part 11: Special Dietary Considerations 145
11.1 Vegetarian eating 145
11.2 Food allergy 149
11.3 Pregnancy and breastfeeding 154

Part 12: Other Issues 155
12.1 Body image, disordered eating and eating disorders 155
12.2 Oral health 161
12.3 Alcohol 164
12.4 Dietary supplementation 168
12.5 Food safety 170
12.6 Food additives 172
12.7 Intense sweeteners 176
12.8 Caffeine 180

Glossary 185

Abbreviations 195

Appendices
Appendix 1: New Zealand Policy Context 196
Appendix 2: International Policy Context 199
Appendix 3: Nutrient Reference Values 202
Appendix 4: New Zealand–WHO Growth Charts 216
Appendix 5: Three-day Sample Meal Plans 219
Appendix 6: Drinking-water 225
Appendix 7: Summary of New Zealand Studies 226

References 228

Submission Booklet: Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2–18 Years): A background paper 253
List of Tables

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 1</td>
<td>Food groups, specific foods in each group, advice and serving size examples</td>
<td>11</td>
</tr>
<tr>
<td>Table 2</td>
<td>Definitions of nutrient reference values</td>
<td>14</td>
</tr>
<tr>
<td>Table 3</td>
<td>Uses of nutrient reference values</td>
<td>15</td>
</tr>
<tr>
<td>Table 4</td>
<td>Mean height, weight and body mass index for New Zealand children and young people</td>
<td>22</td>
</tr>
<tr>
<td>Table 5</td>
<td>Prevalence of obesity in children and young people</td>
<td>26</td>
</tr>
<tr>
<td>Table 6</td>
<td>Components of energy expenditure</td>
<td>32</td>
</tr>
<tr>
<td>Table 7</td>
<td>Median daily energy intake for children and young people</td>
<td>33</td>
</tr>
<tr>
<td>Table 8</td>
<td>Classification of major dietary carbohydrates</td>
<td>35</td>
</tr>
<tr>
<td>Table 9</td>
<td>Median carbohydrate intake for children and young people</td>
<td>36</td>
</tr>
<tr>
<td>Table 10</td>
<td>Adequate intake for dietary fibre for children and young people</td>
<td>38</td>
</tr>
<tr>
<td>Table 11</td>
<td>Median dietary fibre intake for children and young people</td>
<td>39</td>
</tr>
<tr>
<td>Table 12</td>
<td>Polyunsaturated fatty acids that must be obtained in the diet</td>
<td>42</td>
</tr>
<tr>
<td>Table 13</td>
<td>Adequate intake for fatty acids for children and young people</td>
<td>43</td>
</tr>
<tr>
<td>Table 14</td>
<td>Recommended dietary intake for protein for children and young people</td>
<td>46</td>
</tr>
<tr>
<td>Table 15</td>
<td>Median daily protein intake for children and young people</td>
<td>46</td>
</tr>
<tr>
<td>Table 16</td>
<td>Recommended dietary intake and upper level of intake for vitamin A for children and young people</td>
<td>48</td>
</tr>
<tr>
<td>Table 17</td>
<td>Median daily vitamin A intake for children and young people</td>
<td>48</td>
</tr>
<tr>
<td>Table 18</td>
<td>Recommended dietary intake for riboflavin for children and young people</td>
<td>49</td>
</tr>
<tr>
<td>Table 19</td>
<td>Median riboflavin intake for children and young people</td>
<td>50</td>
</tr>
<tr>
<td>Table 20</td>
<td>Recommended dietary intake and upper level of intake for folate for children and young people (per day)</td>
<td>51</td>
</tr>
<tr>
<td>Table 21</td>
<td>Daily median folate intake for children and young people</td>
<td>52</td>
</tr>
<tr>
<td>Table 22</td>
<td>Recommended dietary intake and upper level of intake for calcium for children and young people</td>
<td>59</td>
</tr>
<tr>
<td>Table 23</td>
<td>Median calcium intake for children and young people</td>
<td>59</td>
</tr>
<tr>
<td>Table 24</td>
<td>Recommended dietary intake and upper level of intake for iodine for children and young people per day</td>
<td>62</td>
</tr>
<tr>
<td>Table 25</td>
<td>Iodine status for children and young people</td>
<td>63</td>
</tr>
<tr>
<td>Table 26</td>
<td>Biochemical measures of iron status</td>
<td>65</td>
</tr>
<tr>
<td>Table 27</td>
<td>Recommended dietary intake and upper level of intake for iron for children and young people</td>
<td>65</td>
</tr>
<tr>
<td>Table 28</td>
<td>Median iron intake for children and young people</td>
<td>66</td>
</tr>
<tr>
<td>Table 29</td>
<td>Prevalence of iron deficiency and iron-deficiency anaemia for children and young people</td>
<td>66</td>
</tr>
<tr>
<td>Table 30</td>
<td>Recommended dietary intake and upper level of intake for selenium for children and young people</td>
<td>66</td>
</tr>
<tr>
<td>Table 31</td>
<td>Median selenium intake for children and young people</td>
<td>68</td>
</tr>
<tr>
<td>Table 32</td>
<td>Adequate intake and upper level of intake for sodium for children and young people</td>
<td>70</td>
</tr>
<tr>
<td>Table 33</td>
<td>Recommended dietary intake and upper level of intake for zinc for children and young people</td>
<td>72</td>
</tr>
<tr>
<td>Table 34</td>
<td>Median zinc intakes for children and young people</td>
<td>73</td>
</tr>
<tr>
<td>Table 35</td>
<td>Adequate intakes for fluids for children and young people</td>
<td>75</td>
</tr>
<tr>
<td>Table 36</td>
<td>Average sugar and energy levels in sugary drinks</td>
<td>78</td>
</tr>
<tr>
<td>Table 37</td>
<td>Food insecurity in households with children and young people aged 5–14 years</td>
<td>87</td>
</tr>
<tr>
<td>Table 38</td>
<td>Estimated weekly family food costs for children and young people, 2010</td>
<td>102</td>
</tr>
</tbody>
</table>
Table 39: Average time children and young people spend each day on selected activities 109
Table 40: Some beneficial physical activities for children and young people 111
Table 41: Food insecurity in Māori households versus households overall with children and young people aged 5–14 years 118
Table 42: Demographic information for the seven Pacific ethnic groups with the largest population size in New Zealand 125
Table 43: Food insecurity in Pacific households with children and young people aged 5–14 years 128
Table 44: Demographic information for the seven Asian ethnic groups with the largest population size in New Zealand 136
Table 45: Common food allergens and natural course of food allergy 150
Table 46: Perceptions of own body weight among young people, by ethnicity and gender 156
Table 47: Types of food additives 173
Table 48: Intense sweeteners permitted for use in the New Zealand food supply 177
Table 49: Estimated exposure to intense sweeteners in consumers, New Zealand 2002/03 178
Table 50: Caffeine exposure estimates for New Zealand children and young people 182
Table 51: Contributions of caffeine-containing foods to caffeine dietary exposure for New Zealand children and young people 183
Table 52: Concentration of caffeine in a selection of New Zealand foods and beverages 184
Table A.1: Estimated energy requirements (EERs) for children and young people – males 202
Table A.2: Estimated energy requirements (EERs) for children and young people – females 203
Table A.3: Nutrient reference values for children and young people, 2–3 years 204
Table A.4: Nutrient reference values for children and young people, 4–8 years 206
Table A.5: Nutrient reference values for children and young people, 9–13 years 208
Table A.6: Nutrient reference values for children and young people, 14–18 years 210
Table A.7: Nutrient reference values for pregnancy 212
Table A.8: Nutrient reference values for lactation 214
Table A.9: Sample three-day meal plan for three-year-old girl 220
Table A.10: Sample three-day meal plan for six-year-old girl 221
Table A.11: Sample three-day meal plan for 11-year-old girl 222
Table A.12: Sample three-day meal plan for 16-year-old girl 223
Table A.13: Nutritional analysis of three-day meal plans, average per day 224
Table A.14: Summary of key New Zealand studies 226

List of Figures
Figure 1: Age and sex structure of the New Zealand population, 2006 Census 2
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 3
Figure 3: Body size for children and young people aged 2–14 years 23
Figure 4: Body size category for young people aged 15–24 years 23
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 108
Figure 6: Population age structure for the total population and Māori, 2006 116
Figure 7: Population age structure for the total population and Pacific peoples, 2006 125
Figure 8: Fonofale health model 130
Figure 9: Population age structure for the total population and Asian peoples, 2006 137
Figure 10: Population age structure for the total population and Middle Eastern, Latin American and African peoples, 2006 138
Figure A.1: Height, weight and head circumference, girls 1–5 years 216
Figure A.2: Height, weight and head circumference, boys 1–5 years 217
Figure A.3: Weight–height to body mass index conversion chart 218
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:

- provides up-to-date policy advice on nutrition and related topics for achieving and maintaining the best possible health for children and young people, and is based on current evidence considered for the New Zealand context
- presents reliable and detailed background information for health practitioners who provide nutrition advice and develop nutrition programmes (including dieticians, nutritionists, doctors, nurses, primary care providers, health promoters and teachers)
- provides the basis for developing education resources for the general public
- provides information on current dietary patterns, nutrient intake, nutritional status, body size and physical activity 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 dietician 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 to under five years.

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 (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. Although the proportion of Māori, Pacific and Asian peoples of all ages is projected to increase by 2026, the ethnic composition of children and young people is not expected to change appreciably during this period (Statistics New Zealand 2009c).

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.
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:

- Diet, Nutrition and the Prevention of Chronic Diseases (WHO 2003a)
- Global Strategy on Diet, Physical Activity and Health (WHO 2004)

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 contribute to good health throughout life because 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 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 physical activity and oral health.

A ‘Summary’ box is included at the beginning of most chapters (Parts), which brings together the key points made in the chapter. 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 and nutrition recommendations for healthy children and young people. This part also outlines the four food groups and recommended servings, and provides an overview of the nutrient reference values (NRVs) for Australia and New Zealand.

Part 2: 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 3: 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 4: Fluids provides information on the function of fluids, recommended intake, current fluid consumption patterns and sources in the diet.

Part 5: The Home Environment and Its Influence on What Children and Young People Eat provides information on how family/whānau and related sociocultural factors influence eating, including food and nutrient intake. Problems with eating such as neophobia and picky eating are also discussed.

Part 6: 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 7: 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 8: Considerations for Māori Tamariki, Rangatahi 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 9: 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 10: Considerations for Asian and Other Populations provides demographic information and a summary of nutrition and health issues for this population group, which includes refugee and migrant populations.

Part 11: Special Dietary Considerations provides information on vegetarian and vegan diets, food allergy and intolerance, and pregnancy and breastfeeding for young women.

Part 12: 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 fortification; 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.
   - Have regular meals, including snacks.

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 fluid each day, preferably water or low-fat milk:
   - Limit use of drinks such as cordial, juice, 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 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. Purchase, prepare, cook and store food in ways to ensure food safety.

8. 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, eg, 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 has 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.

Although standard serving sizes are designed to provide consistency of food and nutrition advice, some examples of standard serving sizes seem large for children. For example, one standard serving of milk and milk products is a 250 ml glass of milk, 150 g pottle of yoghurt, or two slices (40 g) of cheese. However, the total number of servings can be consumed in smaller portions over the day. For example, although it is recommended that children consume two standard servings of milk and milk products each day, they can meet this requirement through consuming 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.

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 often classified as green (eg, broccoli, spinach, kiwifruit), yellow/orange (eg, carrots, pumpkin, mandarins), red (tomatoes, red peppers, strawberries), blue/purple (beetroot, eggplant, plums) or brown/white (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 good choices as recommended by the Ministry of Health. 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 and especially the fruit are high in sugars. If vegetable and 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.

As part of a varied diet, it is recommended that:

- preschool children eat at least four servings of vegetables and fruit each day, comprising at least two servings of vegetables and two servings of fruit
- children and young people aged 5 to 18 years eat at least five servings of vegetables and fruit each day, comprising at least three servings of vegetables and two servings of fruit.

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

What are ‘whole grains’?

There is no widely accepted definition of the term whole grain (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. If the kernel has been cracked, crushed, flaked or milled, then it can only be described as whole grain 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, 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 ‘whole grain’ 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.

As part of a varied diet, it is recommended that:
- preschool children eat at least four servings of breads and cereals each day
- children aged 5 to 12 years eat at least five servings of breads and cereals each day
- young people aged 13 to 18 years eat at least six servings of breads and cereals each day.

Wholegrain breads and cereals are the best choices, as these provide more dietary fibre, vitamins, minerals and other beneficial compounds (eg, phytochemicals). Aim to increase the proportion of breads and cereals that are whole grain as children increase in age.

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). Milk and milk products 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; however, some plant milks contain significantly lower levels of nutrients (eg, energy, protein) than cow’s milk so should not be considered equivalent (see section 4.4: Sources of fluid in the diet). Breast milk is included for children being breastfed.

As part of a varied diet, it is recommended that:

- preschoolers and children aged 2 to 12 years consume at least two servings of milk and milk products each day
- young people aged 13 to 18 years consume at least three servings of milk and milk products each day.

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 (beef, lamb, pork and venison), poultry, fish and shellfish, as well as other protein-rich foods such as eggs, legumes, nuts and seeds. Choose lean and unprocessed meat, poultry and fish where possible. Processed meats (eg, luncheon, salami, ham, bacon and sausages), poultry (eg, chicken nuggets) and fish (eg, fish fingers) are usually high in saturated fat and salt so their use should be limited.

Lean meat, poultry, seafood, eggs, legumes, nuts and seeds provide energy, protein, fats (mostly 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).

As part of a healthy diet, it is recommended that:

- preschoolers and children aged 2 to 12 years eat at least 1–2 servings of lean meat, poultry, seafood, eggs, legumes, nuts and seeds each day
- young people aged 13 to 18 years eat at least two servings of lean meat, poultry, seafood, eggs, legumes, nuts and seeds each day.

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

**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.
<table>
<thead>
<tr>
<th>Food group</th>
<th>Specific foods included</th>
<th>Recommendation (per day)</th>
<th>Serving size examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetables and fruits</td>
<td>All vegetables and fruit, including potatoes, kūmara and taro Vegetables and fruit – fresh, frozen or canned If consumed, only one serving of fruit juice or dried fruit can count as contributing a serving to the recommended dietary intake¹</td>
<td>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</td>
<td>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 tinned fruit (135 g) 1 cup fruit juice (250 ml)¹</td>
</tr>
<tr>
<td>Breads and cereals</td>
<td>All breads, cereals, rice and pasta (increasing wholegrain options as children age)</td>
<td>Preschoolers: at least 4 servings Children: at least 5 servings Young people: at least 6 servings</td>
<td>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</td>
</tr>
<tr>
<td>Milk and milk products</td>
<td>Milk (includes calcium-fortified milk alternatives), cheese and yoghurt (choose low-fat options)</td>
<td>Preschoolers and children: at least 2–3 servings Young people: at least 3 servings</td>
<td>Glass of milk or calcium-fortified milk alternative (250 ml) Pottle of yoghurt (150 g) 2 slices of cheese (40 g)</td>
</tr>
<tr>
<td>Lean meat, poultry, seafood, eggs, legumes, nuts and seeds</td>
<td>Lean meat, poultry, seafood, eggs, legumes (eg, peas, beans, lentils), nuts and seeds (choose unprocessed meats as much as possible)</td>
<td>Preschoolers: and children: at least 1–2 servings Young people: at least 2 servings Vegetarians: at least 2 servings</td>
<td>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) ½ cup nuts or seeds (75 g)</td>
</tr>
</tbody>
</table>

Note:

1 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.
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 (e.g., wholegrain breads and cereals, low-fat milk and milk products, and lean meat) 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.

**Note: Minimising choking risk**

Young children can choke on food very easily and any whole pieces of food can cause children to choke. To reduce the risk of choking:

- always closely supervise young children when eating
- only offer food to children when they are seated
- minimise other distractions when children are eating, e.g., turn off the television
- only offer food when children are seated and have minimal distraction
- alter the food texture if necessary – for example, by grating, cooking or mashing foods
- do not give small, hard foods such as whole nuts until children are at least 5 years old
- avoid serving chunky cereal products containing small pieces of dried fruit, which are a choking risk.

**Current intakes**

The recommended intakes of the four food groups are intended to provide a guide to the types and amounts of foods required to meet the nutrient reference values. As foods are generally consumed in combination (i.e., more than one food group) and not necessarily in standard serving sizes, there is limited information on intakes compared with 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 available data.

**Vegetables and fruit**

In 2008/09:

- 40 percent of 5- to 24-year-olds met the recommendation for vegetable intake (three or more servings each day)
- 69 percent met recommendation for fruit intake (two or more servings each day)
- the proportion of children and young people 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).
Breads and cereals

In 2008/09:

- nearly all 5- to 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).

Milk and milk products

In 2008/09:

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

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).

See Appendix 7 for a summary of relevant New Zealand studies: the 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); 2002 National Children’s Nutrition Survey (Ministry of Health 2003b); and the 2006/07 New Zealand Health Survey (Ministry of Health 2008g).

1.3 Nutrient reference values for Australia and New Zealand

The revised Nutrient Reference Values for Australia and New Zealand were released in 2006 (NHMRC 2006). These supersede the 1990 Australian recommended nutrient intakes (Truswell et al 1990), which were adopted by New Zealand in 1991.

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 patterns needed to reduce the risk of chronic disease. Table 2 summarises key definitions for the NRVs.
Table 2: Definitions of nutrient reference values

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated average requirement (EAR)</td>
<td>A daily nutrient level estimated to meet the requirements of half (50%) of the healthy individuals in a particular life stage and gender group</td>
</tr>
<tr>
<td>Recommended dietary intake (RDI)</td>
<td>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</td>
</tr>
<tr>
<td>Adequate intake (AI)</td>
<td>The average daily nutrient intake level based on observed or experimentally determined approximations or estimates of nutrient intake that are assumed to be adequate for a group (or groups) of apparently healthy people</td>
</tr>
<tr>
<td>Estimated energy requirement (EER)</td>
<td>The average dietary energy intake that is predicted to maintain energy balance in a healthy adult of a defined age, gender, weight, health and level of physical activity, consistent with good health. For children and pregnant or lactating women, the EER is taken to include the needs associated with the deposition of tissues or the secretion of milk at rates consistent with good health</td>
</tr>
<tr>
<td>Upper level of intake (UL)</td>
<td>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. Unless otherwise stated, the UL includes dietary intake from all sources, including fortified foods, dietary supplements or medicines</td>
</tr>
<tr>
<td>Acceptable macronutrient distribution range (AMDR)</td>
<td>An estimate of the range of intake for each macronutrient (expressed as its percentage of contribution to energy), which would allow for an adequate intake of all the other nutrients whilst maximising good health (applies only to adults and young people aged 14 years and over)</td>
</tr>
<tr>
<td>Suggested dietary target (SDT)</td>
<td>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)</td>
</tr>
</tbody>
</table>

Source: NHMRC (2006)

The main purpose of the 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). Given the evidence base for the prevention of chronic disease generally rests on data from studies in adults, the AMDRs and SDTs strictly 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.

It is important to understand how NRVs are derived and intended to be used in order to use them appropriately. Actual nutrient requirements are seldom known and will vary considerably between individuals. NRVs are estimates of nutrient requirements, based on the best available evidence and expert opinion. Setting NRVs is not an exact science, which is why different countries set different levels even when using the same evidence base. Setting NRVs for children and young people is especially 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.
The RDI or AI can be used as a goal for usual intake in individuals (Table 3). An individual with a usual intake (i.e., mean intake over a period of three to four days) at or above the RDI or AI has a low probability of inadequate intake, given that the RDI and AI include a safety margin and are intended to meet the needs of nearly all healthy individuals within a particular gender and life stage group. If an individual has a usual intake below the RDI or AI, their intake will not necessarily be inadequate but it is a good idea to try to improve it.

**Table 3:** Uses of nutrient reference values

<table>
<thead>
<tr>
<th>NRV</th>
<th>For individuals</th>
<th>For groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estimated average requirement (EAR)</td>
<td>Used to examine the probability that usual intake is inadequate</td>
<td>Used to estimate the prevalence of inadequate intake within a group</td>
</tr>
<tr>
<td>Recommended dietary intake (RDI)</td>
<td>Usual intake at or above this level has a low probability of inadequacy</td>
<td>Not used to assess intakes of groups</td>
</tr>
<tr>
<td>Adequate intake (AI)</td>
<td>Usual intake at or above this level has a low probability of inadequacy. When the AI is based on median intakes in healthy populations, this assessment is made with less confidence</td>
<td>Mean usual intake at or above this level implies a low prevalence of inadequate intake. When the AI is based on median intakes of healthy populations, this assessment is made with less confidence</td>
</tr>
<tr>
<td>Upper level of intake (UL)</td>
<td>Usual intake above this level may place an individual at risk of adverse effects from excessive nutrient intake</td>
<td>Used to estimate the percentage of the population at potential risk of adverse effects from excessive and nutrient intake</td>
</tr>
</tbody>
</table>

Source: NHMRC (2006)

Appendix 3 includes a summary table of nutrient reference values (EAR, RDI, AI, UL) for all nutrients, by gender and age group (2–3, 4–8, 9–13 and 14–18 years), as well as for pregnant or lactating young women (14–18 years). Note that although NRVs are expressed ‘per day’, they should be applied to usual intake (e.g., mean intake assessed over three to four days).

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).
Part 2: Growth and Body Size

Summary

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 to 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 http://www.moh.govt.nz/moh.nsf/indexmh/childhealth-wellchildservices-growthcharts
- For children and young people aged 5 to 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.

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

Eight percent of New Zealand children and young people aged 2–14 years are obese and a further 21 percent are overweight.


Māori and Pacific children and young people have a higher risk of obesity than children and young people overall: for Māori tamariki and rangatahi the risk 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 any case needs to be investigated.

Note:

* The Ministry of Health is currently reviewing the growth charts options for this age group to identify the preferred option.
2.1 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 two 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 decelerates, 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 parallel one of the centile lines on the chart and lie within one of the inter-centile spaces.

- 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 2.3: Obesity, page 25 and Section 2.4: Underweight, page 29.)

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 varies between individuals (Mann and Truswell 2007).

Growth charts used in New Zealand

From birth to five years: New Zealand–World Health Organization Growth Charts (0–5 years)

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 children born in different regions of the world given the optimal start to life 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, and that thereafter they are 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) 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). This study 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). While 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 WHO Child Growth Standards.

The critical issue in assessing growth for any child is growth velocity. 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 2.3: Obesity, page 25 and section 2.4: Underweight, page 29).
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 (eg, the Centers for Disease Control uses 3rd, 10th, 25th, 50th, 75th, 90th and 97th). 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 bigger and 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 17).

See Appendix 4 for the New Zealand–WHO Growth Charts, 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 http://www.moh.govt.nz/moh.nsf/indexmh/childhealth-wellchildservices-growthcharts.

Please note: 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**

The Ministry of Health is currently reviewing the growth charts options for this age group to identify the preferred option for use in New Zealand. The two growth charts being considered are:

- the WHO Reference 2007
- 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 WHO, 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 http://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 datasets (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: http://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 2009a).
2.2 Body size

Current 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 4. All measures of body size increase with age, with little difference between males and females from 2 to 14 years.

Table 4: Mean height, weight and body mass index for New Zealand children and young people

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Height (cm)</th>
<th>Weight (kg)</th>
<th>BMI (kg/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>2–4</td>
<td>99.8</td>
<td>98.5</td>
<td>17.2</td>
</tr>
<tr>
<td>5–9</td>
<td>125.5</td>
<td>125.4</td>
<td>28.3</td>
</tr>
<tr>
<td>10–14</td>
<td>154.9</td>
<td>154.2</td>
<td>49.9</td>
</tr>
<tr>
<td>15–19</td>
<td>175.8</td>
<td>164.1</td>
<td>73.1</td>
</tr>
</tbody>
</table>

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

As Figures 3 and 4 show, most children and young people have a BMI in the normal range. For children and young people aged 2–14 years, 2.9 percent were underweight, 24.0 percent were overweight and 14.2 percent were obese. For young people aged 15–24 years, 3.2 percent were underweight, 20.9 percent were overweight and 8.7 percent were obese (Ministry of Health 2008g, 2008h).

Information used to classify underweight, normal weight, overweight and obesity is given in section 2.3: Obesity on page 25.
Figure 3: Body size for children and young people aged 2–14 years

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

Figure 4: Body size category for young people aged 15–24 years

Source: 2006/07 New Zealand Health Survey (Ministry of Health 2008g, 2008h)
2.3 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 (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); 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 3 to 8 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 misperceive 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. Unlike for adults, there are no internationally accepted BMI cut-offs for classifying overweight and obesity 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 2009a), 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 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 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 WHO Reference 2007 includes gender-specific BMI-for-age z-score curves which can be used to classify weight status: obesity > 2 standard deviation (SD) and overweight > 1 SD (WHO 2007). The overweight and obesity cut-offs are similar to, but not the same as, the 85th and 95th centiles of the CDC Growth Charts. These cut-offs are described as equivalent to the WHO BMI cut-offs for overweight and obesity for adults aged 18 years and over (25 and 30 kg/m$^2$, respectively) (de Onis et al 2007). Currently there are no published studies linking the WHO Reference 2007 BMI cut-offs to body fatness or disease risk.

Prevalence of obesity

The most recent national data on the prevalence of obesity come from the 2006/07 New Zealand Health Survey (Ministry of Health 2008h). Based on the International Obesity Taskforce population-specific BMI cut-offs, 8.3 percent of children and young people aged 2 to 14 years were obese and a further 20.9 percent were overweight (Table 5).

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

In young people aged 15 to 24 years, 14.2 percent were obese and a further 24.0 percent were overweight (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.
Table 5: Prevalence of obesity in children and young people

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Prevalence (%)</th>
<th>Male</th>
<th>Female</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2–4</td>
<td>7.6</td>
<td>9.1</td>
<td></td>
<td>8.3</td>
</tr>
<tr>
<td>5–9</td>
<td>5.4</td>
<td>8.0</td>
<td></td>
<td>8.2</td>
</tr>
<tr>
<td>10–14</td>
<td>7.7</td>
<td>9.2</td>
<td></td>
<td>8.5</td>
</tr>
<tr>
<td>15–24</td>
<td>12.7</td>
<td>15.7</td>
<td></td>
<td>14.2</td>
</tr>
</tbody>
</table>

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).

It is difficult to compare the prevalence of obesity in New Zealand children and young people with 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

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 12.2: Oral health). Parenting styles and the family food environment are important determinants of eating behaviour and have also been linked to the risk of obesity (see Part 5: The Home Environment).

In New Zealand children and young people, the following risk factors have been associated with obesity in cross-sectional surveys: breakfast skipping, frequent consumption of sugary drinks, and watching two or more hours of television each day (Utter et al 2007d; Duncan et al 2008b). 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).

**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 5), 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 0–5 years found an improvement in children’s diets and reduced obesity at age 2 and 3.5 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.

**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 2009a). 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 2009b). It is anticipated that these guidelines will mainly be used in primary care and community-based initiatives.


### 2.4 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 (Mann and Aitken 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 a 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 CDC gender-specific BMI-for-age growth charts, underweight is defined as BMI-for-age < 5th centile. For children five years and over the WHO Reference 2007 gender-specific BMI-for-age z-score charts define underweight as less than –2 standard deviations (SD) and severe underweight as less than –3 SD (WHO 2007).

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 http://www.moh.govt.nz/moh.nsf/indexmh/childhealth-wellchildservices-growthcharts.

Wasting and stunting are extreme forms of underweight. Wasting is usually defined as weight-for-height two 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 3: Energy and Nutrients

3.1 Introduction

This part covers energy, macronutrients, vitamins and minerals. 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.

The background section provides a brief overview of the purpose or 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 summarises the nutrient reference values (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. (For definitions of RDI, AI and UL, see Table 2 in section 1.3.)

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)
- 1997 National Nutrition Survey, which included young people aged 15–18 years (Russell et al 1999).

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, so a median usual daily intake below this level is not necessarily inadequate. However, 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.

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). Because the NRVs were not published at
the time of the 2002 National Children’s Nutrition Survey, this probability analysis was completed for selected micronutrients using the UK dietary reference values (DRVs) (UK Department of Health 1991). Given that the DRVs are similar to the NRVs, this analysis should provide a reasonable estimate of the prevalence of inadequate intake and highlight population subgroups most at risk of inadequate dietary intake. Note that even if dietary intake appears to be inadequate, this may not translate into inadequate nutrient 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. 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 provide 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 foods (or food groups) that contributed most to nutrient intake in 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.

### 3.2 Energy

**Summary**

Growth and body size are the best guides to adequacy of energy intake in children and young people (see Part 2: 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-fat milk and milk products, and lean meat, poultry, seafood, eggs, legumes, nuts* and seeds.

**Note:**

* Do not give small, hard foods such as whole nuts until children are at least 5 years old. Young children can choke on food very easily (see section 1.2: Food groups and recommended serving sizes, page 12).
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 also a 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. As shown in Table 6, energy expenditure has three main components: basal metabolic rate (BMR), diet-induced thermogenesis and physical activity (WHO 2000; Mann and Truswell 2007).

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage of energy expenditure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basal metabolic rate</td>
<td>40–70</td>
</tr>
<tr>
<td>Diet-induced thermogenesis</td>
<td>10</td>
</tr>
<tr>
<td>Physical activity</td>
<td>20–50</td>
</tr>
</tbody>
</table>

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 (Table 6).

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 to vigorous activity (see Tables A.1 and A.2 in Appendix 3). 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.

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). The best way to ensure that children and young people are meeting their energy requirements is to monitor growth and body size.

Current levels of intake

Current energy intakes are higher for males than females in all age groups (Russell et al 1999; Ministry of Health 2003b) as shown in Table 7.

Table 7: Median daily energy intake for children and young people

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Median daily energy intake (MJ)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
</tr>
<tr>
<td>5–6</td>
<td>7.6</td>
</tr>
<tr>
<td>7–10</td>
<td>8.9</td>
</tr>
<tr>
<td>11–14</td>
<td>10.3</td>
</tr>
<tr>
<td>15–18</td>
<td>12.1</td>
</tr>
</tbody>
</table>


Sources in the diet

In New Zealand children and young people, the main sources of energy are: carbohydrate (55% of energy), fat (30–35%) and protein (14–15%) (Russell et al 1999; Ministry of Health 2003b).

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 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 are: bread; milk and milk products; potatoes, kūmara and taro; biscuits, cakes and muffins; and non-alcoholic beverages (mostly sweetened drinks) (Russell et al 1999; Ministry of Health 2003b).
3.3 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.

While 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 grains have had most or all of the bran and germ removed, so provide considerably less 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.
- The glycaemic index should not be used as the sole guide to choosing carbohydrate-containing foods.

Low glycaemic index foods usually cause a smaller increase in blood glucose that is sustained over a long period and may increase feelings of satiety.

- 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.

Carbohydrates are classified according to their chemical composition; specifically, the number of single sugar units linked together and the types of linkages. The chemical classification of major dietary carbohydrates is shown in Table 8.
Table 8: Classification of major dietary carbohydrates

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

Source: FAO and WHO (1998)

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).

The glycaemic index (GI) has become an accepted indicator for classifying the physiological effect of dietary carbohydrates. GI measures the rate of increase in blood glucose and length of time the rise is sustained for a particular carbohydrate-containing food, relative to a pure glucose solution. This form of measurement is often used to classify carbohydrate-containing foods as high, medium or low GI. In general, low GI foods cause a smaller increase in blood glucose that is sustained over a long period. Research has identified the effect of GI on appetite, specifically linking the consumption of low GI foods with increased feelings of satiety and lower energy intakes (Ludwig 2000). Similar short-term impacts of low GI meals have been found in children with suggestion that low GI foods may have a role in weight control (Warren et al 2003). However, some low GI foods contain substantial amounts of fats and sugars, so GI should not be used as the sole guide to choosing carbohydrate-containing foods (Mann et al 2007).
Recommended intake

There are limited data with which to set an RDI, AI or UL for carbohydrate. The acceptable macronutrient distribution range (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 49–56 percent of energy (Russell et al 1999; Ministry of Health 2003b). Although this range of carbohydrate intake is within the acceptable macronutrient distribution range (AMDR), a high proportion of carbohydrates is from refined cereals and sugars (see Table 9 below).

Table 9: Median carbohydrate intake for children and young people

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Total carbohydrate (g)</th>
<th>Sugars¹ (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>2–3</td>
<td>244</td>
<td>225</td>
</tr>
<tr>
<td>4–8</td>
<td>279</td>
<td>250</td>
</tr>
<tr>
<td>9–13</td>
<td>322</td>
<td>265</td>
</tr>
<tr>
<td>14–18</td>
<td>343</td>
<td>257</td>
</tr>
</tbody>
</table>


Note: ¹ Total 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 What are ‘whole grains’? in 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 less dietary fibre, vitamins and minerals. Legumes are the main source of resistant starch (American Dietetic Association 2008).

Key sources of carbohydrate in the diets of New Zealand children and young people are bread, beverages (mainly powdered drinks and cordial), starchy vegetables (including fried potatoes) and fruit (Russell et al 1999; Ministry of Health 2003b). Key sources of total sugars include beverages (mainly powdered drinks and cordial), fruit and sugar/sweets.
3.4 Dietary fibre

<table>
<thead>
<tr>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dietary fibre is required for adequate functioning of the bowel.</td>
</tr>
<tr>
<td>Dietary fibre improves blood lipid and blood glucose levels, so reduces the risk of cardiovascular disease and diabetes.</td>
</tr>
</tbody>
</table>

To achieve an appropriate intake of dietary fibre:

- encourage consumption of a range of foods from all four food groups (including vegetables and fruit and less refined breads and cereals) in the proportions and amounts recommended (see section 1.2: Food groups and recommended serving sizes) for appropriate growth, adequate gastrointestinal function and laxation.
- increase the proportion of breads and cereals that are whole grain as children grow older.
- offer the appropriate amount of fluids (see section 4.2: 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 the adequate intake. 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.

<table>
<thead>
<tr>
<th>Background</th>
</tr>
</thead>
<tbody>
<tr>
<td>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). 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 absorption efficiency of the small intestine (American Dietetic Association 2008). Foods high in dietary fibre are also good sources of many vitamins and minerals.</td>
</tr>
</tbody>
</table>

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 (NSP) 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 in 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, the AI for dietary fibre ranges from 14–28 g in males and 14–22 g in females (Table 10).

**Table 10:** Adequate intake for dietary fibre for children and young people

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>2–3</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>4–8</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>9–13</td>
<td>24</td>
<td>20</td>
</tr>
<tr>
<td>14–18</td>
<td>28</td>
<td>22</td>
</tr>
</tbody>
</table>

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 (six months–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.

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 1.2: Food groups and recommended serving sizes). Increase the proportion of breads and cereals that are whole grain as children grow older.

An appropriate fluid intake is important as fluid softens insoluble fibre and allows it to swell and move through the gut effectively (for more on fluids, see section 4.2: Recommended intake).

**Current levels of intake**

Note that the estimates of dietary fibre intake shown in Table 11 do not include resistant starch.

**Table 11: Median dietary fibre intake for children and young people**

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Median dietary fibre intake (g)</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>5–6</td>
<td></td>
<td>17</td>
<td>15</td>
</tr>
<tr>
<td>7–10</td>
<td></td>
<td>19</td>
<td>17</td>
</tr>
<tr>
<td>11–14</td>
<td></td>
<td>21</td>
<td>17</td>
</tr>
<tr>
<td>15–18</td>
<td></td>
<td>24</td>
<td>16</td>
</tr>
</tbody>
</table>


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

**Sources 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 are vegetables and fruit, bread and breakfast cereals (Russell et al 1999; Ministry of Health 2003b).

3.5 Fat

**Summary**

Dietary fats:
- are a source of fat-soluble vitamins
- aid in the absorption of fat-soluble vitamins
- 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 as carbohydrate and protein.

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

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 of total energy.

While total fat intake seems 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.

Saturated fat and trans fatty acids increase blood cholesterol concentrations which is a risk factor for cardiovascular disease. Reducing saturated fat intake will have more impact on blood cholesterol as intakes of trans fatty acid are relatively low in New Zealand.

To lower total, saturated and trans fat intake:
- choose lean meat (eg, beef, lamb, venison, pork) and poultry and trim fat off before cooking and eating
- use less spread on bread, crackers and muffins and, when using spreads choose low-fat monounsaturated and polyunsaturated spreads rather than butter
- for children who are aged two years or older and growing well, choose low-fat milk (eg, yellow or green top) 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, olive and rice bran
• 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 or their precursors cannot be synthesised in the body and must be provided by the diet:

• linoleic acids
• α-linolenic acids
• long chain omega-3 fatty acids.

Good sources of linoleic acid, α-linolenic acid and total long chain omega-3 fatty acids include oily fish (eg, canned tuna and salmon), nuts and seeds. Include a regular intake of oily fish and a variety of unsalted raw nuts* (nuts in small amounts eg, 30 grams per day) in the diet.

Note:
* Do not give small, hard foods such as whole nuts until children are at least five years old. Young children can choke on food very easily (see section 1.2: Food groups and recommended serving sizes, page 12).

Background

Dietary fats have many important metabolic, physiological and structural functions in the body. Fats are the most concentrated sources of energy, providing 37 kJ per gram, compared with 17 kJ per gram for carbohydrate and protein. Dietary fats also aid in the absorption of fat-soluble vitamins, act as the precursors of many hormones, and are an important structural component of cell membranes.

Classification of dietary fats

All fats are comprised of fatty acids attached to a backbone structure. Most dietary fats are triglycerides, which are made up of three fatty acids attached to a unit of glycerol. Other types of dietary fats include phospholipids, phytosterols and cholesterol.

Fatty acids are classified according to the number of carbon atoms, the number of double bonds and the position of the double bonds. When each carbon atom is bonded to two hydrogen atoms, fatty acids are called saturated. When a carbon atom is bonded with only one hydrogen atom and forms a double bond with the neighbouring carbon atom, it is termed ‘unsaturated’. Fatty acids containing one double bond are called monounsaturated and those containing two double bonds polyunsaturated.

Some unsaturated fatty acids have one or more double bonds in the trans configuration (ie, adjacent hydrogen atoms are on opposite sides of the double bond), and are referred to as trans fatty acids. Fatty acids with a double bond on the 3rd or 6th carbon atom from the methyl end are called omega-3 (or n-3) and omega-6 (or n-6) fatty acids, respectively. Fatty acids with 20 or more carbon atoms are referred to as
long chain fatty acids. The structure of a fatty acid can be denoted by showing the number of carbon atoms, the number of double bonds and the position of the double bond nearest the methyl end. For example, the fatty acid denoted by 18:2n-6 has 18 carbon atoms, 2 double bonds, and the position of the double bond nearest the methyl end is 6 from the end (ie, on carbon 12).

**Fatty acids in the diet**

As described above, there are three main types of fatty acids in the diet: saturated, monounsaturated and polyunsaturated. Trans fatty acids 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.

Saturated fatty acids and monounsaturated fatty acids can be synthesised in the body so are not required in the diet. 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 are shown in Table 12. Collectively, eicosapentaenoic acid (EPA), docosapentaenoic acid (DPA) and docosahexaenoic acid (DHA) are referred to as long chain omega-3 fatty acids.

**Table 12:** Polyunsaturated fatty acids that must be obtained in the diet

<table>
<thead>
<tr>
<th>Type of fat</th>
<th>Abbreviation</th>
<th>Structure</th>
<th>Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linoleic acid</td>
<td>LA</td>
<td>18:2n-6</td>
<td>Plant oils: sunflower, soybean, safflower, cottonseed, corn</td>
</tr>
<tr>
<td>$\alpha$-linolenic acid</td>
<td>ALA</td>
<td>18:3n-3</td>
<td>Plant oils: flaxseed (also know as linseed), canola, soy, walnut</td>
</tr>
<tr>
<td>Eicosapentaenoic acid</td>
<td>EPA</td>
<td>20:5n-3</td>
<td>Fish, fish oils</td>
</tr>
<tr>
<td>Docosapentaenoic acid</td>
<td>DPA</td>
<td>22:5n-3</td>
<td>Fish, fish oils, animal tissues (brain)</td>
</tr>
<tr>
<td>Docosahexaenoic acid</td>
<td>DHA</td>
<td>22:6n-3</td>
<td>Fish, fish oils, animal tissues (brain)</td>
</tr>
</tbody>
</table>

**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).

Deficiencies resulting from inadequate fatty acids intake 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 from animal products) 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 dietary fat intake is important for children and young people (Daniels and Greer 2008).

**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 and therefore are not required in the diet (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 13). 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 13:** Adequate intake for fatty acids for children and young people

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Linoleic acid (g)</th>
<th>α-linolenic acid (g)</th>
<th>Long chain omega-3 fatty acids (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Male</td>
</tr>
<tr>
<td>2–3</td>
<td>5.0</td>
<td>5.0</td>
<td>0.5</td>
</tr>
<tr>
<td>4–8</td>
<td>8.0</td>
<td>8.0</td>
<td>0.8</td>
</tr>
<tr>
<td>9–13</td>
<td>10.0</td>
<td>8.0</td>
<td>1.0</td>
</tr>
<tr>
<td>14–18</td>
<td>12.0</td>
<td>8.0</td>
<td>1.2</td>
</tr>
</tbody>
</table>

Source: NHMRC (2006)

It was not possible to set an RDI or AI for total fat, but the AMDRs for those aged 14 years and over are:
- total fat: 20–35 percent of total energy.
- saturated + trans fats: ≤ 10 percent of total energy
- linoleic acid: 4–10 percent of dietary energy
- α-linolenic acid: 0.4–1 percent of dietary energy (NHMRC 2006).

**Current levels of intake**

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.

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 (Russell et al 1999; Ministry of Health 2003b). Although total fat intakes are just within the AMDR, too much fat comes from
animal sources and therefore saturated fat intakes are too high. Trans fat intake was not measured in national nutrition surveys, again 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 children and young people exceed the recommendation to limit the combined intake of saturated and trans fats to no more than 10 percent of total energy (NHMRC 2006).

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 means reducing saturated fat intake by reducing intakes of animal products and manufactured foods (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 4.6 and 1.2 mmol/L respectively, giving a total cholesterol to HDL cholesterol ratio of 3.8 (Russell et al 1999). This ratio value is higher than the ratio value of 3.5 given above as the starting point for increasing risk of mortality in adults. This result may be linked to the high intake of saturated fats as described above.

Sources in the diet

Table 12 (see ‘Background’ 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.

The main sources of saturated fats are animal products such as milk, cream, butter, cheese and meat, but they can also occur in palm and coconut oil (used in manufactured foods such as pies, biscuits, cakes and pastries). Monounsaturated fatty acids are found in olives, olive oil, canola oil, peanuts, peanut oil, almonds, avocados,
meat from grass-fed animals in New Zealand, and some margarines and spreads. Polyunsaturated fatty acids are found in most plant oils, particularly sunflower, soybean, safflower and corn, as well as most margarines and spreads.

Most trans fats are produced during the partial hydrogenation of polyunsaturated oils. Partially hydrogenated oils are used in manufactured foods such as cakes, biscuits, pastries, pies and snack foods, and are found in most margarines and spreads. Trans fatty acid levels in New Zealand foods are relatively low compared with countries such as 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 and saturated fat in the diets of New Zealand children and young people are foods of animal origin (eg, meat, butter, cheese, milk), potatoes and kūmara cooked in fat, biscuits, cakes and muffins (Russell et al 1999; Ministry of Health 2003b).

### 3.6 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, 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 11.1: Vegetarian eating).

Note:

* Do not give small, hard foods such as whole nuts until children are at least five years old. Young children can choke on food very easily (see section 1.2: Food groups and recommended serving sizes, page 12).

#### Background

Protein is necessary to build, maintain and repair tissue. After water, proteins are the second most abundant compounds in the body. Proteins form structural and functional components within every cell. Protein is also necessary to synthesise hormones, enzymes and antibodies. Protein 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). 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

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

Source: NHMRC (2006)

**Current levels of intake**

Given that usual 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 13–14 percent of total energy, which is slightly outside the AMDR for protein (15–25% of total energy).

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

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>g/day Male</th>
<th>g/day Female</th>
<th>% energy Male</th>
<th>% energy Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>5–6</td>
<td>62</td>
<td>52</td>
<td>14</td>
<td>13</td>
</tr>
<tr>
<td>7–10</td>
<td>71</td>
<td>61</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>11–14</td>
<td>88</td>
<td>66</td>
<td>14</td>
<td>13</td>
</tr>
<tr>
<td>15–18</td>
<td>107</td>
<td>69</td>
<td>14</td>
<td>14</td>
</tr>
</tbody>
</table>

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, 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).

Key sources of protein in the diet of New Zealand children aged 5–18 years are: meat, poultry and fish; bread and bread-based dishes (eg, sandwiches); and milk and milk products (Russell et al 1999; Ministry of Health 2003b).

3.7 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 vegetables and fruit, and milk and milk products.

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

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 retinol. For information on carotenoid conversion factors refer to the Nutrient Reference Values for Australia and New Zealand (NHMRC 2006).

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. Another indicator of marginal vitamin A deficiency found in children is Bitôt’s spots, which are foamy deposits found on the surface of the eye. Both night blindness and Bitôt’s spots can be treated, but prolonged or severe vitamin A deficiency can change the eye irreversibly. Vitamin A deficiency is also associated with impaired immunity and increased risk of infection.
High levels of vitamin A can be very harmful, with the most serious consequences of vitamin A toxicity being miscarriage and foetal abnormalities. It is rare for vitamin A toxicity to occur from ingestion of foods; it usually occurs as a result of 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

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>RDI (RE)</th>
<th>UL (RE)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>2–3</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>4–8</td>
<td>400</td>
<td>400</td>
</tr>
<tr>
<td>9–13</td>
<td>600</td>
<td>600</td>
</tr>
<tr>
<td>14–18</td>
<td>900</td>
<td>700</td>
</tr>
</tbody>
</table>

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 7.5 percent overall, but was considerably higher for Pacific children and young people (20% male, 37% female). For Māori intake was estimated to be inadequate for 13 percent of males and 4 percent of females (Ministry of Health 2003b).

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

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Median daily vitamin A intake (RE)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
</tr>
<tr>
<td>5–6</td>
<td>527</td>
</tr>
<tr>
<td>7–10</td>
<td>631</td>
</tr>
<tr>
<td>11–14</td>
<td>736</td>
</tr>
<tr>
<td>15–18</td>
<td>1026</td>
</tr>
</tbody>
</table>


**Sources in the diet**

Good sources of vitamin A as retinol include meat (especially liver), eggs, milk, milk products, and oily fish. Good sources of beta-carotene, a precursor for vitamin A,
include carrots, pumpkin, kūmara and dark-green leafy vegetables such as spinach and silver beet.

Key sources of vitamin A in the diets of New Zealand children and young people are vegetables, milk and milk products, butter and margarine, and eggs (Russell et al 1999; Ministry of Health 2003b).

3.8 Riboflavin (vitamin B2)

**Summary**

Riboflavin is involved in energy and nutrient metabolism.

Good and commonly consumed sources of riboflavin are milk, milk products, breads, cereals, yeast extracts and eggs.

**Background**

Riboflavin is an essential component of two important coenzymes involved in energy and nutrient metabolism. The clinical symptoms of riboflavin deficiency are relatively mild, probably due to the body’s ability to conserve riboflavin. Riboflavin deficiency is most commonly seen alongside other B vitamin deficiencies, such as niacin deficiency.

**Recommended intake**

The RDI for riboflavin for children and young people aged 2 to 18 years is outlined in Table 18. No adverse effects have been associated with riboflavin intake from food or supplements, so a UL for riboflavin was not set (NHMRC 2006).

Table 18: Recommended dietary intake for riboflavin for children and young people

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>RDI (mg)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td></td>
</tr>
<tr>
<td>2–3</td>
<td>0.5</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>4–8</td>
<td>0.6</td>
<td>0.6</td>
<td></td>
</tr>
<tr>
<td>9–13</td>
<td>0.9</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>14–18</td>
<td>1.3</td>
<td>1.1</td>
<td></td>
</tr>
</tbody>
</table>

Source: NHMRC (2006)

**Current levels of intake**

Table 19 sets out median usual daily riboflavin intakes in children and young people aged 5 to 18 years. The prevalence of inadequate riboflavin intake in children and young people aged 5–14 years was estimated to be low (2.7%) overall, but higher for Pacific children and young people (12% male, 10% female) (Ministry of Health 2003b).
Table 19: Median riboflavin intake for children and young people

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Median riboflavin intake (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
</tr>
<tr>
<td>5–6</td>
<td>1.6</td>
</tr>
<tr>
<td>7–10</td>
<td>1.8</td>
</tr>
<tr>
<td>11–14</td>
<td>2.0</td>
</tr>
<tr>
<td>15–18</td>
<td>2.1</td>
</tr>
</tbody>
</table>


Sources in the diet

Good sources of riboflavin are milk and milk products, eggs, liver, yeast extracts, breads and cereals.

Key food sources of riboflavin in the diets of New Zealand children and young people are milk and milk products, breakfast cereals and bread (Russell et al 1999; Ministry of Health 2003b).

3.9 Folate

Summary

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

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

All young women of childbearing age should ensure their folate intake is adequate by including foods that are good sources of folate.

The folate requirement for females is higher during preconception and the early stages of pregnancy. Therefore females planning a pregnancy (or who find themselves pregnant) should take either a low- or a high-dose subsidised folic acid tablet – ideally starting at least four weeks before conception and continuing to 12 weeks after conception. The purpose of this regimen is to reduce the risk of the pregnancy being affected by neural tube defects.

For more information on young women’s pregnancy and breastfeeding, see section 11.3: 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 (i.e., 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 20. Note that the UL is based on DFE only from fortified foods and supplements.

Table 20: Recommended dietary intake and upper level of intake for folate for children and young people (per day)

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>RDI (μg DFE)</th>
<th>UL¹ (μg DFE)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>2–3</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>4–8</td>
<td>200</td>
<td>200</td>
</tr>
<tr>
<td>9–13</td>
<td>300</td>
<td>300</td>
</tr>
<tr>
<td>14–18</td>
<td>400</td>
<td>400</td>
</tr>
</tbody>
</table>

Source: NHMRC (2006)

Note:
1  The UL is for dietary folate equivalents from folic acid fortified foods and supplements.

The folate requirement for females is higher during preconception and the early stages of pregnancy. Therefore females planning a pregnancy (or who find themselves pregnant) should take either a low- or a high-dose subsidised folic acid tablet – ideally starting at least four weeks before conception and continuing to 12 weeks after conception.
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 range from 226–277 µg in males and from 194–201 µg for females, as summarised in Table 21. The prevalence of inadequate folate intake in children and young people aged 5–14 years was estimated to be 4.6 percent overall, but was considerably higher for females aged 11–14 years (20%) (Ministry of Health 2003b). The prevalence of inadequate intake for females aged 15–18 years was 22 percent (Russell et al 1999).

**Table 21:** Daily median folate intake for children and young people

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Daily median folate intake (µg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
</tr>
<tr>
<td>5–6</td>
<td>226</td>
</tr>
<tr>
<td>7–10</td>
<td>250</td>
</tr>
<tr>
<td>11–14</td>
<td>283</td>
</tr>
<tr>
<td>15–18</td>
<td>277</td>
</tr>
</tbody>
</table>


**Sources in the diet**

Good sources of naturally occurring folate are dark-green leafy vegetables such as broccoli, cabbage, spinach, lettuce and brussel sprouts. Folate is sensitive to light, air and heat, so fresh vegetables should be cooked and stored carefully to minimise these conditions, with the aim of maximising the folate content of the vegetables.

Since 1996 voluntary fortification of selected foods (eg, breakfast cereals, flour, 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 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 are bread, breakfast cereals and vegetables (Russell et al 1999; Ministry of Health 2003b).
3.10 Vitamin D

**Summary**

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

Vitamin D deficiency can cause rickets in children.

Vitamin D is currently being investigated for its role in non-bone health conditions.

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 October to March it should be possible to meet vitamin D requirements through incidental sunlight exposure outside peak UVI times (ie, before 11 am and after 4 pm).

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

One in three New Zealand children and young people has sub-optimal vitamin D status.

Risk of vitamin D deficiency is highest in people with dark pigmented skin (eg, Māori, Pacific and Asian peoples), those with limited sun exposure, and those who live in the South Island.

Supplementation with 10 µg vitamin D per day may be appropriate for children and young people at risk of vitamin D deficiency or insufficiency.

**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 3.11: 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).

Recently considerable epidemiological evidence has emerged linking sub-optimal vitamin D status to a range of adverse health effects unrelated to calcium and bone health. Vitamin D insufficiency has been associated with some cancers, cardiovascular disease, autoimmune diseases and chronic infections. A meta-analysis of randomised controlled trials showed that vitamin D supplementation reduces total mortality (Autier and Gandini 2007). Although vitamin D receptors have been found in many different cell types and some mechanisms for its actions have been identified, further research is required to provide conclusive evidence that sub-optimal vitamin D status causes these health outcomes.

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; however, currently there is no internationally accepted definition of vitamin D deficiency or sufficiency based on this indicator. Severe vitamin D deficiency, resulting in rickets and osteomalacia, is associated with serum 25-hydroxyvitamin D concentrations < 12.5 nmol/L (Working Group of the Australian and New Zealand Bone and Mineral Society et al 2005). Mild to moderate vitamin D deficiency, resulting in increased parathyroid hormone secretion, increased bone turnover and reduced bone density, is associated with serum 25-hydroxyvitamin D concentrations < 50 nmol/L (Working Group of the Australian and New Zealand Bone and Mineral Society et al 2005). Vitamin D sufficiency was formerly defined as serum 25-hydroxyvitamin D concentrations > 50 nmol/L, but more recently some researchers have suggested vitamin D sufficiency should be defined as > 80 nmol/L or > 100 nmol/L (Bischoff-Ferrari et al 2006).

**Recommended intake**

It was not possible to set an RDI for vitamin D, but the AI for children and young people aged 2 to 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**

There are few data on vitamin D intake in New Zealand. According to data from the 1989 Life in New Zealand (LINZ) survey, median usual vitamin D intake in young people aged 15–18 years was 1.9 µg in males and 1.3 µg in females (LINZ Activity and Health Research Unit 1992). Vitamin D intake was not measured in more 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 showing 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; Grant et al 2009).

In the 2002 National Children’s Nutrition Survey, the prevalence of vitamin D insufficiency (< 37.5 nmol/L) in children aged 5–14 years was 31 percent, including 4 percent who were vitamin D deficient (<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 and insufficiency was significantly higher in winter than in summer (Rockell et al 2005). The clinical implications of these findings are unclear, but the level of vitamin D insufficiency 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 and young people, 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 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; 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, 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, milk, 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 (http://www.sunsmart.org.nz) and the Cancer Society of New Zealand’s SunSmart advice (http://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 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).
   - From October to March, when UV radiation levels are high in New Zealand, most children and young people should be able to meet their vitamin D requirements through incidental UV exposure outside peak times (ie, before 11 am and after 4 pm). However, deliberate exposure during peak UV times is not recommended because it increases the risk of skin and eye damage. During the remaining months of the years (April to September), UV levels are substantially lower and it would be difficult for most people to meet vitamin D requirements through incidental exposure, particularly those with darker-pigmented skin and/or those living at higher latitudes (ie, South Island). Research is currently underway to determine how much sun exposure is required to maintain vitamin D status in New Zealand.
Vitamin D supplementation

Supplemental vitamin D is another source of vitamin D, and may be appropriate for children and young people at risk of vitamin D deficiency (see ‘Risk factors for vitamin D deficiency’ below). Supplementation with 10 μg (400 IU) vitamin D per day may be necessary for children and young people at risk of vitamin D deficiency or insufficiency, as described below. Vitamin D should only be taken under the supervision of a health practitioner (Munns et al 2006). There is no risk of adverse effects with supplementation at the recommended dose of 10 μg per day.

Risk factors for vitamin D deficiency

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

- are not regularly exposed to sunlight
- have darker-pigmented skin
- have their skin covered by clothing (eg, veiling)
- live in the South Island
- have liver or renal disease or malabsorption, or are taking medications that are contraindicative to vitamin D metabolism.

3.11 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 regular fat varieties and are recommended for children from the age of two years.
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 tinned fish with bones, green leafy vegetables, legumes, nuts* and seeds (especially sesame seeds and tahini), and breakfast cereals fortified with calcium.

Note:
* Do not give small, hard foods such as whole nuts until children are at least five years old. Young children can choke on food very easily (see section 1.2: Food groups and recommended serving sizes, page 12).

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 also 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 3.10: 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, 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 to 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 or 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 22.

Table 22: Recommended dietary intake and upper level of intake for calcium for children and young people

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>RDI (mg)</th>
<th>UL (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>2–3</td>
<td>500</td>
<td>500</td>
</tr>
<tr>
<td>4–8</td>
<td>700</td>
<td>700</td>
</tr>
<tr>
<td>9–11</td>
<td>1000</td>
<td>1000</td>
</tr>
<tr>
<td>12–13</td>
<td>1300</td>
<td>1300</td>
</tr>
<tr>
<td>14–18</td>
<td>1300</td>
<td>1300</td>
</tr>
</tbody>
</table>

Source: NHMRC (2006)

Current levels of intake

Median usual daily calcium intakes in children and young people are set out in Table 23. The prevalence of inadequate calcium intake in children and young people aged 5–14 years was estimated to be 15 percent overall, but was substantially higher in young people aged 11–14 years (approximately 30%) and Pacific children and young people (40–45%) (Ministry of Health 2003b).

Table 23: Median calcium intake for children and young people

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Median calcium intake (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
</tr>
<tr>
<td>5–6</td>
<td>677</td>
</tr>
<tr>
<td>7–10</td>
<td>788</td>
</tr>
<tr>
<td>11–14</td>
<td>888</td>
</tr>
<tr>
<td>15–18</td>
<td>894</td>
</tr>
</tbody>
</table>


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 milk (Athar et al 2006). 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 tinned fish (with bones), green leafy vegetables, legumes, nuts and seeds (especially sesame seeds and 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 are milk and milk products, bread, vegetables and fruit (Russell et al 1999; Ministry of Health 2003b).

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 also be added to other foods, such as mashed potatoes and low-fat milk puddings. Milk powder can be added to other foods such as minced meat or mashed legumes. If a child does not consume milk or milk products for other reasons (ie, allergy or vegan), calcium-fortified milk alternatives (eg, soy and rice milk) are recommended as they provide similar amounts of calcium to milk (see Part 4: Fluids). Most children who are lactose intolerant can tolerate small amounts of milk and products in which the lactose has been fermented (eg, hard cheese and yoghurt), especially when accompanied by other foods (Greer et al 2006).

Supplemental calcium may be recommended for children and young people with inadequate calcium intake due to a milk allergy or dietary choice (eg, vegan). 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; Winizenberg et al 2006).

### 3.12 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 via iodised salt in commercially prepared bread is expected to increase daily iodine intakes among the population by 30–70 µg per day (if two to three slices are consumed).

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

It is recommended that pregnant or breastfeeding young women take a daily iodine-only tablet of 150 µg per day. These low-cost tablets are available at pharmacies, either over
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 foetus 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 foetal development causes cretinism and is the leading cause of preventable mental impairment in children worldwide. Mild iodine deficiency impairs mental performance of schoolchildren and lowers 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 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) (Zimmerman 2009). Goitre was common in New Zealand in the early part of last century, which led to the iodisation of salt in 1924, with fortification levels 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, 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 use 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.

Mandatory fortification is expected to increase daily iodine intakes by around 30–70 µg per day if two to three slices of bread (depending on thickness) are eaten (FSANZ 2008).
Recommended intake

The daily RDI and UL for iodine in children and young people are shown in Table 24.

Table 24: Recommended dietary intake and upper level of intake for iodine for children and young people per day

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>RDI (µg)</th>
<th>UL (µg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>2–3</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>4–8</td>
<td>90</td>
<td>90</td>
</tr>
<tr>
<td>9–13</td>
<td>120</td>
<td>120</td>
</tr>
<tr>
<td>14–18</td>
<td>150</td>
<td>150</td>
</tr>
</tbody>
</table>

Source: NHMRC (2006)

It is recommended that pregnant or breastfeeding young women take a daily iodine-only tablet of 150 µg per day. These low-cost tablets are available at pharmacies, either over the counter or on prescription (for more information on issues for young women, see section 11.3: Pregnancy and breastfeeding).

Current estimated levels of intake from simulated diets

Iodine intake has not been measured in past national nutrition surveys because difficulties with quantifying discretionary salt intake meant that New Zealand food composition data for iodine were incomplete.

Iodine intake has been estimated through simulated typical diets in the New Zealand Total Diet Study (NZTDS),¹ which does not include discretionary salt use. Since 1982, NZTDS data have suggested iodine intakes in all age-sex groups are decreasing (Vannoort and Thomson 2005). In 2003/04 estimated mean iodine intakes were: 60 µg in males aged 11–14 years; 50 µg females aged 11–14 years; 43 µg in children aged 5–6 years; and 47 µg in toddlers aged 1–3 years (Vannoort and Thomson 2005). These data suggest children may be at risk of mild or moderate 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 mean urinary iodine of < 5 µg/dL is indicative of moderate iodine deficiency and < 2 µg/dL is indicative of severe iodine deficiency (WHO et al 2007; Zimmerman 2009).

Iodine status is more reliably assessed by biochemical measures (eg, urinary iodine) than simulated diets (as in the NZTDS). In the 2002 National Children’s Nutrition Survey the median urinary iodine concentration was assessed for the first time. Results showed the concentration to be 6.6 µg/dL in children and young people aged

¹ Now called the New Zealand Total Diet Survey.
5–14 years, with little variation by gender and age group (Ministry of Health 2003b). Overall, more than one in four (28%) children and young people had moderate iodine deficiency. For iodine status by age group see Table 25.

Table 25: Iodine status for children and young people

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Median urinary iodine (µg/dL)</th>
<th>Moderate deficiency (percentage &lt; 5 µg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>5–6</td>
<td>7.1</td>
<td>6.0</td>
</tr>
<tr>
<td>7–10</td>
<td>6.6</td>
<td>6.1</td>
</tr>
<tr>
<td>11–14</td>
<td>7.0</td>
<td>6.6</td>
</tr>
</tbody>
</table>

Source: Ministry of Health (2003b)

Note:

1. 15- to 18-year-olds were not sampled in the previous National Nutrition Survey (1997); however, they were in the latest Adult Nutrition Survey (2008/09), with results available in 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 (T₃) and thyroxine (T₄) 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 New Zealand 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 6.6 µg/dL, with 31 percent of these children having moderate urinary deficiency (< 5 µg/dL) and 3.6 percent of these children having severe iodine deficiency (< 2 µg/dL) (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).

Sources in the diet

As stated above, the iodine content of foods reflects 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), as is commercially prepared bread. If using salt, use iodised salt.
3.13 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 poor work capacity.

Haem iron (animal foods) is more bioavailable than non-haem iron (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 most 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 and fish, which are good sources of haem iron and/or
* plant foods such as breads, cereals, vegetables, legumes, nuts* and fruit, which are good sources of non-haem iron
* foods rich in vitamin C (eg, kiwifruit, cauliflower, broccoli, citrus fruits, strawberries, tomatoes) when eating good sources of non-haem iron foods to enhance absorption of iron.

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

Note:

* Do not give small, hard foods such as whole nuts until children are at least five years old. Young children can choke on food very easily (see section 1.2: Food groups and recommended serving sizes, page 12).

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 plant foods. Haem iron is more bioavailable than non-haem iron, 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 (see Table 26). 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, decreased work capacity, fatigue, and some specific cognitive learning effects.

### Table 26: Biochemical measures of iron status

<table>
<thead>
<tr>
<th>Stage</th>
<th>Status</th>
<th>Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Low iron stores</td>
<td>Low serum ferritin</td>
</tr>
<tr>
<td>2</td>
<td>Iron deficiency</td>
<td>At least two of the following: abnormal serum ferritin, red cell distribution width and transferrin saturation</td>
</tr>
<tr>
<td>3</td>
<td>Iron-deficiency anaemia</td>
<td>Iron deficiency and low serum haemoglobin</td>
</tr>
</tbody>
</table>

### Recommended intake

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

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

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>RDI (mg)</th>
<th>UL (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>2–3</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>4–8</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>9–13</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>14–18</td>
<td>11</td>
<td>15</td>
</tr>
</tbody>
</table>

Source: NHMRC (2006)

### Current levels of intake

Median usual daily iron intakes in children and young people are listed in Table 28. The prevalence of inadequate iron intake in children and young people aged 5–14 years was estimated to be 6.6 percent overall, but was substantially higher in menstruating females aged 11–14 years (44%) (Ministry of Health 2003b).
Table 28: Median iron intake for children and young people

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Median iron intake (mg)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td></td>
</tr>
<tr>
<td>5–6</td>
<td>10.0</td>
<td>8.4</td>
<td></td>
</tr>
<tr>
<td>7–10</td>
<td>11.9</td>
<td>9.7</td>
<td></td>
</tr>
<tr>
<td>11–14</td>
<td>14.1</td>
<td>9.9</td>
<td></td>
</tr>
<tr>
<td>15–18</td>
<td>14.7</td>
<td>10.1</td>
<td></td>
</tr>
</tbody>
</table>


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 29). Adolescents, particularly girls, are at greatest risk of iron-deficiency anaemia; within this group, Māori and Pacific females aged 15–18 years are at highest risk (Russell et al 1999; Ministry of Health 2003b).

Table 29: Prevalence of iron deficiency and iron-deficiency anaemia for children and young people

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Iron deficiency (%)</th>
<th></th>
<th></th>
<th>Iron-deficiency anaemia (%)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td></td>
<td>Male</td>
<td>Female</td>
<td></td>
</tr>
<tr>
<td>5–6</td>
<td>0.1</td>
<td>0.0</td>
<td></td>
<td>0.0</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>7–10</td>
<td>0.6</td>
<td>0.6</td>
<td></td>
<td>0.2</td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>11–14</td>
<td>0.6</td>
<td>4.3</td>
<td></td>
<td>0.1</td>
<td>1.2</td>
<td></td>
</tr>
<tr>
<td>15–18</td>
<td>4.0</td>
<td>6.0</td>
<td></td>
<td>4.0</td>
<td>6.0</td>
<td></td>
</tr>
</tbody>
</table>


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 compared with 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 to 14 percent of infants and toddlers (Heath et al 2002; Soh et al 2004; 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, with the good sources being 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. Absorption of non-haem iron can be enhanced by vitamin C, but is inhibited by tannins and polyphenols (found in tea and coffee), and 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 or 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 11.1: Vegetarian eating). The Australia New Zealand Food Standards Code (FSANZ 2010) permits selected foods, including breakfast cereals and breads, to be voluntarily fortified with iron.

Key sources of iron in the diets of New Zealand children and young people are breakfast cereals, bread, beef and veal, vegetables and fruit (Russell et al 1999; Ministry of Health 2003b). 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 tablets should be stored well out of the reach of children because they are toxic in high doses.

3.14 Selenium

Key points for selenium

- 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, and especially fish, shellfish and brazil nuts,* will help ensure adequate selenium intake.

Note:
* Do not give small, hard foods such as whole nuts until children are at least five years old. Young children can choke on food very easily (see section 1.2: Food groups and recommended serving sizes, page 12).

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 serum selenium and selenoproteins, 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 30.

### Table 30: Recommended dietary intake and upper level of intake for selenium for children and young people

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>RDI (µg)</th>
<th>UL (µg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>2–3</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>4–8</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>9–13</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>14–18</td>
<td>70</td>
<td>60</td>
</tr>
</tbody>
</table>

*Source: NHMRC (2006)*

**Current levels of intake**

Median usual daily selenium intakes in children and young people are listed in Table 31. Median usual daily selenium intakes are below the RDI for those aged 11–18 years.

### Table 31: Median selenium intake for children and young people

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Median selenium intake (µg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
</tr>
<tr>
<td>5–6</td>
<td>30</td>
</tr>
<tr>
<td>7–10</td>
<td>35</td>
</tr>
<tr>
<td>11–14</td>
<td>44</td>
</tr>
<tr>
<td>15–18</td>
<td>51</td>
</tr>
</tbody>
</table>

*Source: 2002 National Children’s Nutrition Survey (5–14 years) (Ministry of Health 2003b) and 1997 National Nutrition Survey (15–18 years) (Russell et al 1999).*

**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).
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). Although there are no established international reference ranges for serum selenium, results for New Zealand children fall into the middle of the 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). Because New Zealand soils are low in selenium, imported wheat, which is commonly used in New Zealand 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.

Key sources of selenium in the diets of New Zealand children and young people are fish and seafood, poultry, meat, bread, grains, pasta and milk (Russell et al 1999; Ministry of Health 2003b). Fish is a key source of selenium in the diets of Pacific children and young people (Thomson et al 2007).

3.15 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 by about half resulted in an immediate decrease in blood pressure, which if sustained could lessen 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 or reduced 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.
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 and 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, reducing salt (sodium) intake by about half 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 32. 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 1/6 teaspoon) of salt.

Table 32: Adequate intake and upper level of intake for sodium for children and young people

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

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 350–650 mg per 100g (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.

Sodium intake has not been measured in previous national nutrition surveys because of the difficulty 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 sodium per day, which far exceeds recommendations. Although no New Zealand studies have measured urinary sodium in children and young people, it is likely that sodium intakes in this group exceed recommendations as well, with most sodium coming from salt in processed foods.

In the 2002 National Children’s Nutrition Survey, 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).

**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 cooking or at the table) accounts for another 10–20 percent of intake. Foods that are high in sodium include savoury snacks (eg, chippies), processed meat (eg, sausages, bacon, ham, salami, luncheon sausage), cheese, sauces, some breakfast cereals (eg, cornflakes), and most fast foods and takeaways (Athar et al 2006). Bread contains only moderate amounts of sodium but, because bread is frequently consumed, it is usually a key 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 (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) indicates the need for informed consumer choices and regulations to reduce sodium intake.
per 100 g) (Athar et al 2006) suggests that sodium levels could be substantially reduced without reducing product quality.

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.

3.16 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 and fish are good bioavailable sources of zinc.

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

Note:

* Do not give small, hard foods such as whole nuts until children are at least five years old. Young children can choke on food very easily (see section 1.2: Food groups and recommended serving sizes, page 12).

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. Infants and children are at greatest risk of zinc deficiency.

Recommended intake

Table 33 sets out the daily RDI and UL for zinc in children and young people.

Table 33: Recommended dietary intake and upper level of intake for zinc for children and young people

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>RDI (mg)</th>
<th>UL (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>2–3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>4–8</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>9–13</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>14–18</td>
<td>13</td>
<td>7</td>
</tr>
</tbody>
</table>

Current levels of intake

Median daily usual zinc intakes in New Zealand children and young people are identified in Table 34. Median daily usual zinc intakes are at or above the RDI, which suggests the prevalence of inadequate intake is low. However, data on zinc status (see below) suggest some children and young people may have inadequate zinc intakes.

Table 34: Median zinc intakes for children and young people

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Median zinc intakes (mg)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
</tr>
<tr>
<td>5–6</td>
<td>8.7</td>
</tr>
<tr>
<td>7–10</td>
<td>10.0</td>
</tr>
<tr>
<td>11–14</td>
<td>12.0</td>
</tr>
<tr>
<td>15–18</td>
<td>15.2</td>
</tr>
</tbody>
</table>


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 currently underway.

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 are meat, poultry, bread, milk, grains, pasta and breakfast cereals (Russell et al 1999; Ministry of Health 2003b).
Part 4: 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 in between meals.
- As very high milk intake can displace other foods in the diet, limit preschoolers to around 500 ml 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 standard to low-fat milk (green or yellow).
- 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 fluid for children and young people as they are high in sugar. If consumed, have infrequently in small serving sizes. Choose low-fat flavoured milks and for younger children dilute flavoured milks with plain low-fat milk.

Sugary drinks (including fruit juice, fizzy drinks, cordial, powdered drinks, energy and sports drinks) are high in sugar and energy and are associated with dental caries and increased body weight. It is likely the average consumption of sugary drinks among children and young people in New Zealand has increased as it has in the United States.

- Encourage children 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.
- Encourage parents and caregivers not to keep sugary drinks in the house. Parents and caregivers are important role models and therefore should limit consumption of these drinks too.
- Limit intake of sugary drinks. If children and young people have sugary drinks, 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.
- 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 also 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 energy than regular drinks, but are not recommended for children and young people because they can be acidic (causing dental erosion), and maintain a taste for sweetness.

- If consumed, diet drinks should be consumed infrequently, in small quantities, and with food rather than between meals.
Coffee and tea are not recommended for children. 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 12.3: Alcohol).

4.1 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 thermoregulation 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).

4.2 Recommended intake

Recommended fluid intakes for children and young people are summarised in Table 35. There was insufficient information to set an RDI and UL for daily fluid intake, but an AI was set. Requirements are expressed both as total fluids (which include both foods and drinks) and fluid intake from drinks. Fluid requirements from drinks range from 1.0–1.9 L per day (see Table 35). Note that fluid requirements may be higher in very active children and young people (NHMRC 2006).

Table 35: Adequate intakes for fluids for children and young people

<table>
<thead>
<tr>
<th>Age group (years)</th>
<th>Total fluids (L/day) from foods and drinks</th>
<th>Fluids from drinks (L/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>2–3</td>
<td>1.4</td>
<td>1.4</td>
</tr>
<tr>
<td>4–8</td>
<td>1.6</td>
<td>1.6</td>
</tr>
<tr>
<td>9–13</td>
<td>2.2</td>
<td>1.9</td>
</tr>
<tr>
<td>14–18</td>
<td>2.7</td>
<td>2.2</td>
</tr>
</tbody>
</table>

Source: NHMRC (2006)

High fluid intake can influence diet quality by displacing other foods and nutrients. For example, preschoolelrs 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).
4.3 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, standard 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- to 19-year-olds drank plain 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 (aand Synovate 2010a).

In general, New Zealand surveys show that younger children drink more milk than older children and young people, whereas 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 Stated 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 have few nutritional benefits.

4.4 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 12.2: Oral health). In New Zealand, most water from the tap is safe to drink. For more information on drinking water supplies in New Zealand, refer to Appendix 6.
Milk

Plain milk

Plain 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 (dark blue top) milk to low-fat (green or yellow top) milk after two years of age. Children and young people who do not drink milk should be encouraged to drink calcium-fortified milk alternatives, such as calcium-fortified milk soy or rice milk.

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).

Milk alternatives

Milk alternatives are beverages derived from plants such as legumes (eg, soya) 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 plant milks derived from legumes and cereals.

Regular soy milk contains similar levels of energy, fat and protein to standard 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 milk contains 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.

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 fluid for children and young people. If they are consumed, it should be infrequently in small serving sizes. For younger children, it is recommended that, if used, flavoured milks are diluted with plain milk.

Sugary drinks

If consumed, sugary drinks should be consumed infrequently (less than once a week), in small quantities (one glass or less) and with food rather than between meals. Sugary drinks include fruit juice, powdered drinks, cordial (eg, blackcurrant, lemon barley), carbonated or fizzy drinks (eg, lemonade, cola and orange), energy drinks (see page 79), and flavoured waters. Sugary drinks are high in sugar and energy (see
Table 36) but provide few beneficial nutrients. Sports drinks are also high in sugar and energy but contain electrolytes (eg, sodium, potassium) (see page 80). 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 36: Average sugar and energy levels in sugary drinks

<table>
<thead>
<tr>
<th>Type of drink</th>
<th>Serve</th>
<th>Sugar</th>
<th>Energy (kJ)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>g per 100 ml</td>
<td>g per serve</td>
</tr>
<tr>
<td>Fruit juice</td>
<td>Glass (250 ml)</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>Powered fruit drink</td>
<td>Glass (250 ml)</td>
<td>8</td>
<td>20</td>
</tr>
<tr>
<td>Cordial</td>
<td>Glass (250 ml)</td>
<td>8</td>
<td>20</td>
</tr>
<tr>
<td>Fizzy drink</td>
<td>Can (355 ml)</td>
<td>11</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>Bottle (600 ml)</td>
<td>11</td>
<td>66</td>
</tr>
<tr>
<td>Energy drink</td>
<td>Can (250 ml)</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Bottle (600 ml)</td>
<td>10</td>
<td>60</td>
</tr>
<tr>
<td>Sports drink</td>
<td>Bottle (750 ml)</td>
<td>8</td>
<td>60</td>
</tr>
<tr>
<td>Flavoured waters</td>
<td>Bottle (700 ml)</td>
<td>3</td>
<td>21</td>
</tr>
</tbody>
</table>

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

Notes:
1 1 teaspoon of sugar = 4 grams (Athar et al 2006)
2 Made according to instructions on label.

Sugary drinks provide a lot of energy, particularly if the whole bottle or can is consumed (see Table 36). For example, a 600 ml bottle of fizzy or energy drink or a 750 ml bottle of sports drink contains 15–17 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.

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 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 substrate that is fermented by bacteria to produce acid, which in turn promotes tooth demineralisation. In addition, many sugary drinks are acidic, which causes tooth erosion independently of dental caries (for more information on both these issues, see section 12.2: Oral health). Many sugary drinks also contain artificial food colours (see section 12.6: Food additives) and some contain caffeine (see section 12.8: Caffeine).

Fruit juice

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 36 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).

The Ministry of Health does not recommend fruit juice as a drink for children and young people. 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, intake should be limited 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 12.2: Oral health).

Energy drinks and energy shots

Energy drinks or energy shots are not recommended for children or young people. Energy drinks are high in sugar (see Table 36 above), which contributes to dental caries and excess intake of energy (kJ). A 600 ml bottle of energy drink provides approximately 17 teaspoons of sugar. Most 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 12.8: Caffeine).

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 (Meadows-Oliver and Ryan-Krause 2007; New Zealand Dietetic Association 2008). Some energy drinks also have water soluble vitamins and amino acids added.
Sports drinks

Sports drinks are not necessary for most children and young people. These drinks contain sugar and electrolytes (e.g., 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 an active child or an athlete exercising for less than 60–90 minutes in normal climatic conditions. Electrolytes lost during activity are generally replaced by food.

Sports drinks contain sugar (see Table 36 above) and as they are generally available only in large sizes, so they contribute significant amounts of sugar and energy to the diet of consumers. For example, a 750 ml bottle contains 17 teaspoons of sugar and would provide around 10 percent of the total energy requirements needed by a moderately active 11-year-old boy. Like all sugary drinks, sports drinks are associated with dental caries (American Dietetic Association 2007).

Flavoured waters

Flavoured waters are a better choice than other sugary drinks, but plain water is a much better choice. Flavoured waters have less sugar and energy than other sugary drinks, but they still contain a lot of sugar and energy per serve (see Table 36 above). For example, one 700 ml bottle of flavoured water contains 42 grams (5 teaspoons) of sugar, which is about the same amount as a can of fizzy drink.

Diet drinks

Diet drinks are not recommended for children and young people. However, in recognition that New Zealanders do drink fizzy drinks, a diet fizzy drink would be a better choice than a sugary fizzy 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 infrequently, 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 12.7: 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 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 (see section 12.7: 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 12.6: Food additives) and some contain caffeine (see section 12.8: Caffeine).
Hot drinks

Coffee, tea and chocolate-flavoured drinks contain very few nutrients, 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 12.8: Caffeine.

Coffee and tea are not recommended for children younger than 12 years. If young people aged 13 years or older drink tea and coffee, it is recommended they limit their intake to one to two cups per day. They should avoid drinking tea at mealtimes, as these drinks contain tannins and polyphenols, which can inhibit the absorption of nutrients such as iron.
Summary (including additional recommendations to encourage healthy eating at home)

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

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

Although the adults within the home environment can dictate its nature to a considerable degree, major conditions from the wider environment beyond the home have a strong and often overriding influence. Many of these conditions – for example, broader economic and social conditions – are not within the control of individuals or groups.

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.

Food insecurity disproportionately affects households that:
- have low socioeconomic status
- contain Māori and Pacific children and young people
- are comprised of a larger number of people (i.e., seven or more members).

Recommendations

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’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 table and chairs for eating meals and snacks, preferably in a place with few distractions such as toys.

Turn off the TV and other distracting technology during mealtimes.

Provide routine by having set times for meals and snacks. Offer children 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.
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.

**Sociocultural environment**

Create a happy and positive atmosphere at meal times.

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. Adults need to eat a range of the foods on offer to provide a good example.

Involve the children in meal preparation from an early age. As they get older, consider giving them responsibility for a meal once a week.

Be responsive to children’s hunger and satiety cues. To support self-regulation of food intake, encourage children to notice their own feelings of hunger and fullness.

Be clear on roles and responsibilities around food and eating in the household. Parents and caregivers are responsible for what food is bought and offered, the timing of meals and where meals take place. Children are responsible for what and how much food they choose from what is on offer at a meal or snack (Ventura and Birch 2008).

Avoid restrictive and coercive child-feeding practices such as putting negative or excessive pressure on children to eat specific foods or telling them to ‘clear your plate’.

Emotions around food refusal can be high. Try not to react negatively; downplay the situation.

Mealtimes should last around 30 minutes. If the food hasn’t been eaten, remove the plate without comment and do not offer anything else until the next meal or snack time.

Parents and caregivers can act as ‘gatekeepers’ to social influences surrounding children’s eating, including through controlling access to media, role-modelling and so on.

**Specific feeding problems**

To encourage healthy eating in children and young problem 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. 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 (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.
• 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).

5.1 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 sweet, salty and calorie-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 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). Aspects of these influences are discussed in section 6.3: The wider food environment.

5.2 Physical, economic and sociocultural factors within the home environment

Family 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
• economic factors, such as household income and expenses
• sociocultural factors, such as parental modelling including parental intake, family rules about eating, parental encouragement, frequency of family dinners, religion and ethnicity.
These factors interact with and impact heavily on each other. For example, economic factors like household income could dictate whether the family 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). Although this is a positive finding, this survey found that many less healthy foods were also commonly available in the home. For example, the following foods were found in most homes: potato chips and other salty snacks (94%), 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 amount of food available
As well as what is available in the home, an influence on the intake of children and young people is the amount of specific foods available to them. 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 sizes should be age-appropriate (Benton 2004), meaning that they should be smaller for children than for young people and adults. To enhance children’s ability to eat appropriate amounts and self-regulate their energy intake, encourage parents and caregivers to help them recognise satiety cues (ie, feelings of hunger and fullness).
Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2–18 Years)

(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 a third important physical factor of the home food environment (Scaglioni et al 2008). An appropriate eating environment includes a table and chairs where the family can sit and eat together, in a place with a comfortable temperature and lighting and few distractions such as television and toys.

Visual and auditory distractions, particularly television, can impair people’s ability to monitor their food intake by distracting from satiety cues (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 PlayStation (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).

Economic factors in the home environment
Household economic factors impact significantly on the diet of the whole family.

Household income and expenditure
Household income and expenditure directly affect the amount of money available to purchase food. The 2006/07 Household Economic Survey shows that the average New Zealand household spends $155.60 on food each week, representing 16.3 percent of their total household expenditure (Statistics New Zealand 2007b).

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

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.
Household food security was assessed in the 2002 National Children’s Nutrition Survey, based on a series of questions about the affordability of food. Although mostly limited to economic aspects of food security at a household level, the results provide some useful information. While most (78%) households with children aged 5–14 years reported they can afford to eat properly ‘always’, one in five (20%) of households reported they can afford to eat properly only ‘sometimes’ (Ministry of Health 2003b). Other indicators of food insecurity from the survey are shown in Table 37.

Table 37: Food insecurity in households with children and young people aged 5–14 years

<table>
<thead>
<tr>
<th>Indicator – Because of lack of money</th>
<th>Often</th>
<th>Sometimes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food runs out</td>
<td>3.6%</td>
<td>18.5%</td>
</tr>
<tr>
<td>Eat less</td>
<td>2.8%</td>
<td>15.3%</td>
</tr>
<tr>
<td>Variety of foods limited</td>
<td>9.0%</td>
<td>25.6%</td>
</tr>
<tr>
<td>Rely on others</td>
<td>1.5%</td>
<td>10.3%</td>
</tr>
<tr>
<td>Use food grants/banks</td>
<td>0.8%</td>
<td>8.6%</td>
</tr>
<tr>
<td>Stressed about lack of money for food</td>
<td>6.4%</td>
<td>18.1%</td>
</tr>
<tr>
<td>Stressed when no food for social occasions</td>
<td>3.3%</td>
<td>16.9%</td>
</tr>
</tbody>
</table>

Source: Ministry of Health (2003b)

Food insecurity disproportionately affects households that have low socioeconomic status, that contain Māori and Pacific children and young people, and that are comprised of a larger number of people (ie, seven or more members) (Ministry of Health 2003b).

For further discussion of food security see Part 6: The Wider Environment, Part 8: Considerations for Māori Tamariki, Rangatahi and Their Whānau, Part 9: Considerations for Pacific Children, Young People and Their Families and Part 10: Considerations for Asian and Other Populations.

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 by what they eat or drink all of the time (National Research Bureau 2008).
Eating together

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

Although many New Zealand children and young people have main meals with their family, a substantial proportion do not on a regular basis (see section 5.3: Meal patterns, page 94). There are many factors that might make it difficult for families to have meals together. Most families lead busy lives: demanding work schedules including long hours and shift work along with extra-curricular activities of children and young people limit the number of meals that can be eaten as a family. In other words, for many households, ‘the family dinner has become the exception rather than the rule’ (Lichtenstein and Ludwig 2010).

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 high-calorie, low-nutrient 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 negative or excessive pressure on children to eat healthy foods and to eat more in general can be counterproductive. Research has linked pressure to eat 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). 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 (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). Although children need some guidance and control, for example in the provision of a range of foods low in energy density, 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. Such a balance has been found to promote good nutrition and growth (Savage et al 2007).

Roles and responsibility

Parents and caregivers are also responsible for ensuring that mealtimes are enjoyable for the family. Having clear roles and responsibilities within the family 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, while the children are responsible for what and how much of this food they eat. This knowledge, along with positive parental modelling and a focus on and acceptance of internal cues of hunger and fullness, may contribute to enjoyable mealtimes.

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; 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:

- http://www.incredibleyears.com
- http://www.education.auckland.ac.nz/uoa/triple-p#
- http://www33.triplep.net/

Planning is also underway for initiatives providing evidence-based advice on parenting practices that promote healthy eating and deal effectively with problematic eating. These initiatives will be available through a range of primary care services and non-governmental organisations.

## Food neophobia and picky eating

Picky or fussy eating is defined as the rejection of a large proportion of foods, both familiar and new. It is a common occurrence amongst 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). Often 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, kūmara), whereas foods with bitter tastes can be either low in calories (eg, leafy greens) or, in some cases, toxic.

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.

While 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).

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 above. 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).
5.3 Meal patterns

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).

Encourage a healthy lunch every day.

- Lunch contributes significantly to daily energy and nutrient intakes, and provides energy when levels may be flagging.
- Research shows foods brought from home are likely to be more nutritious and economic 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- to 18-year-olds get their lunch from the school canteen or tuck-shop. Encourage school boards to actively promote and sell healthy food and drinks through their canteens or tuck-shops.

Encourage nutritious family/whānau dinners, during which everyone sits down together at the table.

Offer healthy snacks, for example: fruit, yoghurt, vegetable sticks with a low-fat dip (eg, hummus and tzatziki), mini-sandwiches, mini homemade ‘pizzas’, ‘mousetraps’ (toasted cheese and yeast extract spread on bread), nuts and milk.

High fat, sugar and salt (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- to 14-year-olds which indicates healthier foods are being displaced in the diet.
Consumption of HFSS foods and drinks needs to be limited. However, limiting them is difficult as they are widely available, often inexpensive and heavily marketed.

Encourage healthier choices when the family is deciding on takeaways. For example, choose kebabs, wraps, pizza with lots of vegetables and minimal cheese, Asian rice or noodles dishes with lots of vegetables, sushi, and some takeaway hot-filled 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.

Because they are growing rapidly and typically engage in moderate to high levels of physical activity, young children have energy requirements that are high relative to their small size and limited stomach capacity. Similarly significant growth and relatively high activity levels can increase energy and nutrient requirements for young people. Eating regular meals and small snacks over 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 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 (e.g., 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 12.2: Oral health). Continuous eating can also increase the risk of overeating.

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, thiamine, 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 healthier 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, 2008a; 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 and European/Other children and young people.

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.

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 (summarised in Appendix 7), approximately two-thirds of secondary students aged 12–18 years (65% females, 68% males) ate lunch on four to five school days each week (Utter et al 2008a). One-third of students (35% female, 37% male) sourced their lunch from home, whereas nearly half of students (49% females, 46% 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 6.3: The wider food environment, page 103).

**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.

In the 2007 New Zealand Children’s Food and Drinks Survey, nearly all (98%) of parents and caregivers said their child sometimes had their main meal sitting down with the rest of the family (National Research Bureau 2008). In a national survey of secondary school students, just over half of students reported that their family ate meals together on five or more days of the week (Adolescent Health Research Group 2008a). In the Obesity Prevention in Communities study, 42 percent of New Zealand secondary school students had eaten a family meal on all of the previous five school nights and a further 30 percent had eaten a family 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 tends to decrease with age.

**Snacks**

Snacks can be considered ‘mini-meals’ that make a valuable contribution to energy and nutrient intake in 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 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 tzatziki), 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 Part 6: The Wider Environment, page 103).

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 linked to overweight and obesity (see section 2.3: 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).

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 food 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 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).

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2 Do not give small, hard foods such as whole nuts until children are at least five years old. Young children can choke on food very easily (see section 1.2: Food groups and recommended serving sizes, page 12).
With busy lifestyles, eating out and takeaways are becoming an increasingly more common option for many families/whānau. However, there are many healthier commercially prepared meal options available, which means a takeaway can still be healthy choice for families/whānau. Examples are kebabs, wraps, pizza (with lots of vegetables, and less cheese and high-fat meats, eg, salami), Asian rice or noodle dishes with lots of vegetables, sushi, and some takeaway hot-filled rolls, pasta with tomato-based sauces and baked potatoes with meat, beans and salad.
### Part 6: 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.

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 of 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.

Overall food prices in New Zealand are increasing. Between 2006 and 2009 the Food Price Index increased by 20 percent (twice the rate of inflation).

In some food categories (eg, meat, cheese and spreads) healthy choices are more expensive, whereas in other categories (eg, tinned 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 Food and Beverage Classification System and the National Heart Foundation’s website for its Healthy Heart Awards).

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#### 6.1 Introduction

While the family/whānau plays a significant role in what children and young people eat, the wider physical, sociocultural and economic environment of the household 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.
6.2 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). How sociocultural and economic factors influence dietary choices is often, but not always, obvious. Income affects the type, quantity and quality of food that is purchased for a household. Income also influences the cooking and storage facilities available in a household, which in turn influences food choice. Moreover, 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 (Dubowitz 2007).

Many of the key determinants of health are unevenly distributed within society according to socioeconomic status, which is the primary cause of differences in health status within in New Zealand (Ministry of Health 2002a). International (Darmon et al 2008) and New Zealand research (Metcalf et al 2006) have 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 has provided evidence that socioeconomic deprivation, diet and eating patterns are linked. For example, females in NZDep01 Group I (least deprived: see box below) had a lower proportion of energy from total fat than those from groups IV and V (most deprived). In addition, the proportion of participants in NZDep01 Group V reporting that they added fat to cooked vegetables at least weekly was higher than that for participants in the groups with higher socioeconomic status (Ministry of Health 2003b).

New Zealand socioeconomic deprivation index

The index of socioeconomic deprivation is constructed from information on nine variables collected during each five-yearly census, which reflect eight dimension of deprivation. The dimensions of deprivation considered are income, home ownership, family support, employment, qualifications, living space (related to numbers living in the home), communication (access to a phone) and transport. It provides a summary deprivation score from 1 to 10 for small areas (mesh blocks) and suburbs (area units). A score of 1 is allocated to the least deprived 10 percent of areas, and 10 is allocated to the most deprived 10 percent of areas. For describing and mapping purposes, the 10 deciles are often collapsed into pairs, giving five quintiles, of which Group I describes the least deprived areas as represented by the two least deprived deciles and Group V the most deprived areas as represented by the two most deprived deciles.

There are indexes of socioeconomic deprivation for 1991 (NZDep91), 1996 (NZDep96), 2001 (NZDep01) and 2006 (NZDep 06).
Food security

As discussed in section 5.2: Physical, economic and sociocultural factors within the home environment (page 86), **food security** is the ready availability of sufficient nutritionally adequate and safe foods and the ability to acquire such foods in a socially acceptable way. Food security is another determinant of health that is unequally distributed. Research from both of the national nutrition surveys (Parnell et al 2001; Ministry of Health 2003b) found that food insecurity was more common for socioeconomically deprived households. Both nutrition surveys indicate that food insecurity is more common for Māori and Pacific peoples than for European/Other (see Part 8: Considerations for Māori Tamariki, Rangatahi and Their Whānau and Part 9: Considerations for Pacific Children, Young People and Their Families).

In most developed countries the diets of people who are food insecure provide enough kilojoules to meet or exceed energy 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).

The determinants of food security can be grouped into two main categories (New South Wales Centre for Public Health Nutrition 2003):

1. **food supply** which incorporates location of food outlets; availability in outlets, price; quality; variety; and promotion
2. **access to food**, which is related to the ability to make use of the local food supply. This category incorporates financial resources; distance and transport to shops; knowledge, skills and preferences; storage facilities; preparation and cooking facilities; times and mobility; and social support.

Aspects of both these categories are discussed in more detail in the next section.

6.3 The wider food environment

In the last 20 to 30 years, there have been widespread changes in the food environment in New Zealand, including in terms of 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 in which 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 strongly promoted via a range of marketing techniques, including advertising, sponsorship and sales promotions.
This section includes 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).

A New Zealand study examining physical access to a range of community resources found that, on average, the most socioeconomically deprived neighbourhoods had significantly better access (as indicated by travel distance) to supermarkets and convenience stores compared with the least deprived neighbourhoods (Pearce et al 2007b), although this trend was not found in all regions or in rural areas (Pearce et al 2008b). However, the travelling distances described in the New Zealand research (Pearce et al 2007b, 2008b) were based on travelling times by car. In New Zealand, approximately 10 percent of households do not have access to a car (Statistics New Zealand 2007f), which is associated with a lower socioeconomic status (Pearce et al 2007b). Grocery shopping for a family group without the use of a car is difficult and can become a barrier to obtaining more affordable, healthy food. For example, walking or using public transport to get to a supermarket can increase time needed to complete the shopping task and limit the amount that can be bought in one visit to the supermarket.

The recent growth of farmers’ markets, where food producers sell directly to consumers, provides an opportunity to purchase lower-priced produce. However, for those without a car the barriers detailed above remain. The use of farmers’ markets can also mean an additional shopping trip which may be another barrier for time-poor families.

**Changes in 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, 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.

The changing number and type of food outlets may have contributed to changes in the pattern of food spending in New Zealand, in particular an increase in spending on meals away from home and prepared foods. 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 1997/1998 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).

Overall food prices in New Zealand are increasing. Statistics New Zealand monitors food prices via the Food Price Index (FPI), a subset of the Consumer Price Index (CPI) which is a key indicator of inflation. The FPI increased at a similar rate to the CPI during the early 2000s, but from 2006 to 2009 the FPI increased by 20 percent (Statistics New Zealand 2009b) which was twice the rate of inflation (Statistics New Zealand 2009a). This pattern of increase is consistent with international trends which show global food prices increased by 26 percent from 2006 to 2009 (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 (e.g., canned fish) were not more expensive, healthy choices within other categories (e.g., 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 spreads, dairy products, biscuits, crackers and chocolate sold in two supermarkets. The study found that foods with low-fat equivalents (< 20% saturated fat) were between 8 and 109 percent more expensive than their high-saturated fat (> 20% saturated fat) (Wilson and Mansoor 2005).

The cost of food required to meet the nutritional needs of most healthy individuals or families is measured annually in the Food Cost Survey. In 2009 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 38.
Table 38: Estimated weekly family food costs for children and young people, 2009

<table>
<thead>
<tr>
<th>Age</th>
<th>Estimated cost of type of diet(^1) per child/young person ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Basic diet</td>
</tr>
<tr>
<td>4 years</td>
<td>32–34</td>
</tr>
<tr>
<td>5 years</td>
<td>34–36</td>
</tr>
<tr>
<td>10 years</td>
<td>51–54</td>
</tr>
<tr>
<td>Adolescent girl</td>
<td>65–68</td>
</tr>
<tr>
<td>Adolescent boy</td>
<td>78–81</td>
</tr>
</tbody>
</table>

Source: Department of Human Nutrition (2010)

Note:
1 For a definition of each diet type, see http://nutrition.otago.ac.nz/consultancy/foodcostsurvey (the website of the yearly Food Cost Survey).

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 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 one can often 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).
Food marketing

Marketing has four key components: product, price, placement and promotion. 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 also predominantly unhealthy foods (Maher et al. 2005). An analysis of advertising expenditure in New Zealand provides further evidence that non-essential foods (e.g., chocolate, confectionery and fizzy drinks) are much more likely to be promoted than core foods (e.g., 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 soft drinks, salty snacks and fast foods (Utter et al. 2006a).

Sales promotions are another common form of food marketing for unhealthy foods and drinks (Allen 2007; Pollock et al. 2009). Sales promotions can include price reductions, loyalty card discounts and/or points, coupon discounts, multi-buys (e.g., three for the price of two), quantity deals (e.g., 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).

New Zealand currently has a self-regulatory system related to advertising standards which is directed by the Advertising Standards Authority. In 2009 Authority reviewed its Codes of Advertising to Children and Advertising of Food. As a result it developed a new Children’s Code for Advertising Food which brings together specific considerations related to children and the marketing of food (Advertising Standards Authority 2010).

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 tuck-shops or through fundraising activities were high in fat, sugar and/or salt (Carter and Swinburn 2004; Richards et al. 2005). There is also evidence that the physical environment surrounding schools promotes obesity: most outdoor food advertisements and foods available in the vicinity of 10 schools in Wellington were inconsistent with Ministry of Health’s Food and Nutrition Guidelines for Healthy Adolescents (Maher et al. 2005).

The National Administration Guidelines set out principles of conduct or administration for schools. From June 2008 Boards of Trustees were required to promote healthy food and nutrition for all students. Similarly ECE settings are required to provide food that meets the nutritional needs of the children attending.

The Food and Beverage Classification System was developed to support schools and ECE settings to provide healthy food and beverages. It provides a range of useful resources for schools and ECE settings, including a User Guide with a nutrition
framework for classifying foods, as well as menu ideas, suggestions for preparing and cooking healthy foods, and recipes. For more information, visit the following websites:


The Ministry of Health funds the National Heart Foundation to administer the Health 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. 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:

Part 7: 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 co-ordination and movement control.

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

Establishing good physical activity habits during childhood and maintaining these during adolescence have many long-term health benefits and reduce the risk of cardiovascular disease, diabetes, cancer, osteoporosis, respiratory disease and depression.

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

Recommendations

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, eg, 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.

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

7.1 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 just organised sport (eg, netball); it also includes active recreation (eg, playing in the park), active transport (eg, walking to and from school or the shops), everyday or incidental activities (eg, walking up stairs, household chores) and physically active roles.

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, 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.

### 7.2 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 co-ordination 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)

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).

### 7.3 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. Examples of sedentary behaviours include sitting watching television and other screen based activities, such as video games and 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).

### 7.4 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:

- throughout 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

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3 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.
be active with friends and whānau, at home, school and in their community
spend less then 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 SPARC’s website:
http://www.sparc.org.nz/en-nz/young-people/Ages-0-5-Years/Active-Movement-
Resources1.

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

According to accelerometry data, in 2008/09 almost all five- to nine-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- to 14-year-olds and 41 percent in 15- to 19-year-olds (Clinical Trials Research Unit
and Synovate 2010a).

Figure 5 shows how time spent in moderate- to vigorous-intensity physical activity
decreases 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).
Physical activity patterns vary with age. As Table 39 shows:

- five- to nine-year-olds spent the most time of any age group in free play
- 10- to 14-year-olds spent more time on organised sport than other age groups, but they spent twice as much time in free play than in organised sport
- 15- to 19-year-olds spent the most time 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, scooter) to get to and from school (Ministry of Health 2008g).

Screentime refers to time spent watching television, 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 five- to nine-year-olds
- 33 percent in 10- to 14-year-olds
- 30 percent in 15- to 19-year-olds.

Among five- to 24-year-olds overall, females (44%) are more likely to meet the guideline than males (35%) (Clinical Trials Research Unit and Synovate 2010a).

**Table 39:** Average time children and young people spend each day on selected activities

<table>
<thead>
<tr>
<th>Group</th>
<th>Organised sport</th>
<th>Free play</th>
<th>Active transport</th>
<th>Passive transport</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall (5- to 24-year-olds)</td>
<td>29.3</td>
<td>77.6</td>
<td>43.0</td>
<td>45.6</td>
</tr>
<tr>
<td>Females</td>
<td>20.2</td>
<td>77.4</td>
<td>35.6</td>
<td>45.5</td>
</tr>
<tr>
<td>Males</td>
<td>37.8</td>
<td>77.7</td>
<td>49.9</td>
<td>45.8</td>
</tr>
<tr>
<td>5- to 9-year-olds</td>
<td>23.0</td>
<td>141.2</td>
<td>30.4</td>
<td>40.2</td>
</tr>
<tr>
<td>10- to 14-year-olds</td>
<td>42.3</td>
<td>86.5</td>
<td>44.4</td>
<td>38.2</td>
</tr>
<tr>
<td>15- to 19-year-olds</td>
<td>28.8</td>
<td>29.7</td>
<td>52.2</td>
<td>53.7</td>
</tr>
<tr>
<td>20- to 24-year-olds</td>
<td>10.0</td>
<td>17.5</td>
<td>47.8</td>
<td>60.7</td>
</tr>
</tbody>
</table>

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

**Note:**

1 The highest value in each column is highlighted in bold.

### 7.6 Increasing physical activity levels

Children and young people should be encouraged to do activities that are fun, and appropriate for their age, gender and ethnic group. 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. For example, younger 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 children grow older, they may start structured weight programmes as part of specific sport training.

### 7.7 Types of physical activity

Physical activities for children and young people can be split into three types: aerobic and strengthening of the muscles and bones. 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. Muscle-strengthening activities can provide additional benefits not found with aerobic activity. These benefits include 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, hopping and running.

Table 40 sets out examples of appropriate activities for children and young people that fall under each of these activity types.
### Table 40: Some beneficial physical activities for children and young people

<table>
<thead>
<tr>
<th>Type of activity</th>
<th>Children’s activities</th>
<th>Young people’s activities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Moderate-intensity aerobic</strong></td>
<td>Rollerblading, skateboarding, Brisk walking, Bicycle riding, Games that require catching and throwing (eg, softball), Dancing, Kapa haka, Skipping</td>
<td>Rollerblading, skateboarding, Brisk walking, Bicycle riding, Games that require catching and throwing (eg, softball), Dancing, Kapa haka, House and yard work</td>
</tr>
<tr>
<td><strong>Vigorous-intensity aerobic</strong></td>
<td>Active games such as running and chasing (eg, tag), Fast bicycle riding, Waka ama, Fast skipping, Martial arts, such as karate, Running, Sports such as soccer, rugby, touch rugby, swimming, Ki-o-Rahi, Vigorous dancing, Bouncing on a trampoline</td>
<td>Active games such as ultimate frisbee, Fast bicycle riding, Waka ama, Fast skipping, Martial arts, such as karate, Running, Sports such as soccer, rugby, touch rugby, swimming, Ki-o-Rahi, Vigorous dancing</td>
</tr>
<tr>
<td><strong>Muscle-strengthening</strong></td>
<td>Games such as tug-of-war, Modified push-ups, Climbing, pulling using body weight or resistance, Rope or tree climbing, Sit-ups, Swinging on playground equipment/bars</td>
<td>Games such as tug-of-war, Push-ups and pull-ups, Resistance exercises with exercise bands, weight machines and hand-held weights, Climbing wall, Sit-ups, Chin-ups</td>
</tr>
<tr>
<td><strong>Bone-strengthening</strong></td>
<td>Hopping, jumping, skipping, Bouncing on a trampoline, Skipping, Running, Sports such as gymnastics, basketball, volleyball, Games such as hopscotch</td>
<td>Hopping, jumping, skipping, Bouncing on a trampoline, Skipping, Running, Sports such as gymnastics, basketball, volleyball</td>
</tr>
</tbody>
</table>

Source: Adapted from Ministry of Health and Clinical Trials Research (2009a)

Notes:
1. Activities such as bicycle riding can be moderate- or vigorous-intensity depending on the effort level.
2. The Ministry of Health recommends that young people only undertake weight training under supervision and when it is age and developmentally appropriate.
7.8 Barriers to and motivators for 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 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 2005b).

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 include having fun, improving skills, being with friends or making new friends, experiencing thrills or excitement, attaining success and developing fitness and a positive body image.

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, approximately half of all secondary 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 6: The Wider Environment, the current physical activity 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 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).
7.9 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 12.1: Body image, disordered eating and eating disorders).

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.
Part 8: Considerations for Māori Tamariki, Rangatahi and their Whānau

Summary

In 2006, 35 percent of Māori were aged under 15 years, compared with 22 percent of the total population in this age group.

Nutrition related risk factors (eg, high blood pressure, high cholesterol, obesity and inadequate vegetable and fruit intake) contribute to 47 percent of mortality in Maori.

Nutritional concerns for Māori tamariki and rangatahi (although they are not specific to Māori only) include:

- low vegetable and fruit intake
- frequent consumption of sugary drinks and fast foods
- skipping breakfast
- low intakes of some nutrients (low vitamin A, folate, calcium, 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.

Māori have a holistic view of health, encompassing four main dimensions: tinana (physical health), hinengaro (mental health), wairua (spiritual health) and whānau (family health).

- Where possible and if appropriate, 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;
  - are located within a Māori world view;
  - are inclusive of the whānau;
  - and build on the strengths of the whānau.

- Ensure Māori patients, clients, whānau and communities receive the right information and tools in a culturally appropriate mode to make informed choices. This approach includes having Māori-specific resources available.
8.1 Introduction

This part identifies key issues related to nutrition and physical activity for Māori tamariki (children) and rangatahi (young people). It also provides some background and context aimed to enhance the cultural competence of those working with Māori, including a Māori world view of health, wellbeing and kai (food). 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). Part 5: The Home Environment and Part 7: The Wider Environment also provide information that may 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).
Health status

It is well known that Māori have poorer health status than non-Māori. Māori have lower life expectancy, greater exposure to health risks and higher rates of chronic disease (Ministry of Health 2006d). 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.

Although the factors that lead to poor health status are complex, many are linked to the uneven distribution of the key determinants of health such as income, housing, education and employment. 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).

Other factors thought to contribute to the health disparity, include disparities in access to health care, lifestyle factors (eg, smoking) and racism (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 nutrition-related risk factors (higher than optimal body mass index (BMI), blood pressure and blood cholesterol, and inadequate vegetable and fruit intake) contribute to 47 percent of mortality in Māori, compared with 39 percent in non-Māori (Lawes et al 2006).
8.2 Nutrition and health indicators

Data from the 2002 National Children’s Nutrition Survey (Ministry of Health 2003b) and the 2006/07 New Zealand Health Survey (Ministry of Health 2008g) provide an indication of the dietary and physical activity habits of Māori tamariki and rangatahi.

Dietary habits

Vegetables and fruit

Māori tamariki (5–14 years) were just as likely as children overall to meet the recommended servings for vegetables and fruit:

- three or more servings of vegetables per day (54% Māori boys, 53% Māori girls, versus 57% in children overall)
- two or more servings of fruit per day (40% Māori boys, 43% Māori girls, versus 43% in children overall) (Ministry of Health 2003b).

Milk intake

Among five- to 14-year-olds, daily milk drinking was slightly less common in Māori (39% boys and 33% girls) than in children overall (38%) (Ministry of Health 2003c).

Breakfast

Among two- to 14-year-olds, Māori tamariki were less likely to eat breakfast at home every day (84% Māori, 88% overall) (Ministry of Health 2008g).

High fat, sugar and salt foods and drinks

Among two- to 14-year-olds, Māori tamariki were more likely than children overall to have had:

- three or more fizzy drinks in the past week (25% Māori, 20% overall)
- fast food three or more times in the past week (10% Māori, 7% overall) (Ministry of Health 2008g).

Food security

Māori experience less food security than the total population, which is likely to contribute to nutritional inequalities (Parnell et al 2001). Sixty-four percent of households with Māori tamariki (5–14 years) reported always being able to afford to eat properly, compared with 78 percent of households overall (Ministry of Health 2003b).

Table 41 shows six indicator statements related to food insecurity, comparing the responses of Māori households with those of New Zealand households overall.

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4 Data related to rangatahi aged 15–18 years, from the 2008/09 Adult Nutrition Survey and other national surveys, will be included in the final background paper. They were not available for the draft.
Table 41: Food insecurity in Māori households versus households overall with children and young people aged 5–14 years

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Often (%)</th>
<th></th>
<th></th>
<th>Sometimes (%)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Māori households</td>
<td>Households overall</td>
<td>Māori households</td>
<td>Households overall</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Because of lack of money:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>▪ Food runs out</td>
<td>6.9</td>
<td>3.6</td>
<td>30.6</td>
<td>18.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>▪ Eat less</td>
<td>6.2</td>
<td>2.8</td>
<td>24.5</td>
<td>15.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>▪ Variety of foods limited</td>
<td>14.1</td>
<td>9.0</td>
<td>31.1</td>
<td>25.6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>▪ Rely on others</td>
<td>3.6</td>
<td>1.5</td>
<td>19.8</td>
<td>10.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>▪ Using food grants/banks</td>
<td>2.6</td>
<td>0.8</td>
<td>17.4</td>
<td>8.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Ministry of Health (2003b)

**Nutrient intake and nutritional status**

Nutrients of concern for Māori tamariki and rangatahi as identified in the 2002 National Children’s Nutrition Survey (Ministry of Health 2003b) are summarised below.

**Nutrient intake**

Māori tamariki (5 to 14 years) are at risk of inadequate intakes of the following nutrients: calcium, folate, iron, iodine and zinc (Ministry of Health 2003b).

**Nutritional status**

- Māori tamariki have a higher risk of iron deficiency compared with children overall.
- Iron-deficiency anaemia was more prevalent in Māori girls aged 11–14 years (4% vs 1.2% of girls in this age group overall)
- Approximately 40 percent of Māori tamariki were vitamin D insufficient, including 5 percent who were vitamin D deficient (Rockell et al 2005). Māori tamariki are at higher risk of sub-optimal vitamin D status because their darker skin colour reduces the synthesis of vitamin D in response to sunlight (see section 3.10: Vitamin D).
- Serum zinc concentrations were low in 22 percent of Māori boys and 9 percent of Māori girls.
- About one in four Māori tamariki (24% boys and 29% girls) had low urinary iodine concentrations, which is indicative of mild iodine deficiency (Ministry of Health 2003b).

**Body size**

- Sixty percent of Māori tamariki aged 2–14 years were in the normal range for BMI; a quarter (26%) were overweight, one-eighth (12%) obese and very few (2%) underweight.
• 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 Māori tamariki aged 5–14 years (Ministry of Health 2008h).

• Among rangatahi (12–18 years), most (81%) Māori secondary school students were satisfied with their body weight. However, over half (54%) had tried to lose weight in the previous year (Clark et al 2008).

### Physical activity and sedentary behaviours

• Physical activity levels of Māori secondary school students (aged 12–18 years) are similar to those for students overall (Clark et al 2008).
  - 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.
  - Only 12 percent obtained the recommended 60 minutes of physical activity each day (compared with 11% of students overall).
  - Over half (54%) participated in a school sports team.

• Half of Māori tamariki (5–14 years) usually used active transport to get to and from school (boys 56%; girls 44%).

• Three-quarters (76%) of Māori tamariki (2–14 years) watched two or more hours of television each day (compared with 62% European/Other) (Ministry of Health 2008h).

### 8.3 A Māori world view 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.

Te Whare Tapa Whā is a well-known Māori model of health. It has four dimensions: tahu wairua (spiritual), tahu hinengaro (mental), tahu tinana (physical) and tahu whānau (family) (Durie 1985). These four dimensions of Māori wellbeing represent the four sides of the wharenui (meeting house). If one of the four sides is missing or damaged, then a person may become unbalanced or unwell. Tahu wairua (spiritual) is the dimension most often lacking in mainstream health services.

The four dimensions of health are important in relation to kai (food), nutrition and physical activity. The following examples indicate how these issues may fit within each of the four dimensions.

• Tahu wairua (spiritual): Kai has an important role in both traditional and contemporary Māori life. Kai is a highly prized taonga (treasure) that is valued for its spiritual origins (see the next section).

• Tahu hinengaro (mental): Healthy eating and physical activity are very important for mental health. Food insecurity may increase stress.
• Tahu tinana (physical): Kai provides sustenance for physical wellbeing. Kai aids physical growth and development, and provides energy for daily activities and sport. Physical activity develops strength, co-ordination and weight maintenance, and improves health outcomes.

• Tahu whānau (family): Advice about healthy eating and physical activity needs to focus on the whānau, not just on individuals.

For more information on Māori models of health, visit the Ministry of Health’s Māori Health website: http://www.maorihealth.govt.nz.

8.4 Traditional foods and cultural practices

The traditional Māori diet was based on birds, seafood, wild herbs, roots and berries, supplemented by Māori potatoes and kūmara (sweet potato). Kai has an important role in both traditional and contemporary Māori life. A number of traditional foods continue to be an important part of the diet for many Māori. Traditional vegetables include kūmara, kamokamo (marrow), pūhā and watercress (green leafy vegetables), pikopiko (fern shoots) and kāngawai (fermented corn).

Kai moana (seafood) continues to form a significant part of Māori diet in coastal areas. It includes kina (sea urchins), pāua, pipi, kōura (crayfish), ngaeti (periwinkles), tun (eel), pātiki (flounder), inanga (whitebait), kuku (mussels) and parengo (a type of seaweed). Tītī (muttonbird) and rēwena (bread) are also highly regarded. Traditional foods are generally compatible with the Food and Nutrition Guidelines, provided they are prepared with minimal added fat, salt and sugar.

Kai is 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 has been recognised as sacrifices of the atua (gods) and it is important in manaaki (blessings). Kai is critical to the lives of all peoples, as it provides sustenance for physical wellbeing of te tinana (the body).

Kai also has very important social and cultural significance. Mahikai (the gathering of kai) is an important practice. A person’s ability 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.

8.5 Working with Māori tamariki, rangatahi and their whānau

The cultural competence of practitioners is key to working with Māori tamariki, rangatahi 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 health policy, programmes and services.

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).

Quality service is more likely to be achieved through reorienting practice to a more patient-centred approach. Such an approach recognises the values, beliefs and the lived realities of the patients as the basis of a quality interpersonal interaction between practitioner and patient (Ryan, cited in Kiro 2009).

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 patients. Tools to help integrate cultural competence at all levels are identified below.

Useful resources and tools

He Korowai Oranga: Māori Health Strategy (Minister of Health and Associate Minister of Health 2002) provides a framework for improving Māori health. It is therefore 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: http://www.maorihealth.govt.nz.

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 (http://www.moh.govt.nz/moh.nsf/indexmh/inequalities-tools).

- 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 website (http://www.moh.govt.nz/moh.nsf/indexmh/inequalities-tools).

- 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.

Māori-specific health education resources are available from:

- Ministry of Health at www.healthed.govt.nz
Part 9: Considerations for Pacific Children, Young People and Their Families

Summary

The term ‘Pacific peoples’ is used to describe the diverse and dynamic cultures of peoples from Polynesia, Melanesia and Micronesia.

In 2006, 38 percent of Pacific peoples were aged under 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 specific to Pacific peoples only) include:

- frequent consumption of sugary drinks and fast foods
- skipping breakfast
- risk of inadequate dietary intake (vitamin A, riboflavin, folate, calcium, iron and zinc)
- sub-optimal nutritional status (increased risk of iron deficiency, 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, preferable during a home visit.

Successful health initiatives:

- are community based
- have multiple interventions
- are specifically designed for and delivered by Pacific people for Pacific people within the context of cultural values, beliefs and the social environment.
9.1 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)

Part 5: The Home Environment and Part 6: The Wider Environment also provide information that may be useful when considering nutrition issues for Pacific peoples.

Pacific peoples in New Zealand

The term ‘Pacific peoples’ is used to describe the diverse and dynamic 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 (Table 42). 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, although the proportion of Pacific children and young people is expected to stay about the same (Statistics New Zealand 2009c). Most Pacific peoples live in the Auckland (67 percent) or Wellington (13 percent) region (Statistics New Zealand 2007e).
Table 42: Demographic information for the seven Pacific ethnic groups with the largest population size in New Zealand

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Samoan</td>
<td>131,103</td>
<td>14</td>
<td>62</td>
<td>85</td>
</tr>
<tr>
<td>Cook Islands</td>
<td>58,008</td>
<td>10</td>
<td>73</td>
<td>92</td>
</tr>
<tr>
<td>Tongan</td>
<td>50,481</td>
<td>24</td>
<td>56</td>
<td>84</td>
</tr>
<tr>
<td>Niuean</td>
<td>22,476</td>
<td>12</td>
<td>73</td>
<td>91</td>
</tr>
<tr>
<td>Fijian</td>
<td>9864</td>
<td>40</td>
<td>42</td>
<td>93</td>
</tr>
<tr>
<td>Tokelauan</td>
<td>6819</td>
<td>10</td>
<td>69</td>
<td>88</td>
</tr>
<tr>
<td>Tuvaluan</td>
<td>2628</td>
<td>34</td>
<td>32</td>
<td>79</td>
</tr>
<tr>
<td>Total</td>
<td>265,974</td>
<td>15</td>
<td>61</td>
<td>87</td>
</tr>
</tbody>
</table>

Source: Statistics New Zealand (2007e)

Note:
1 Figures for individual groups may not sum to totals 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). Thirty-eight percent of Pacific peoples were aged under 15 years in 2006, 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
Health status

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 (Ministry of Health 2004b). 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: 36 percent live in NZDep01 deprivation Group 10 neighbourhoods (the most deprived 10% of neighbourhoods) and over two-thirds (70%) live in deprivation index Groups 8–10 neighbourhoods (White et al 2008) (for more on the socioeconomic deprivation index, see section 6.2: The broader determinants of health and their influence on family/whānau dietary choices). In addition, having large families has been linked to increased food insecurity (Ministry of Health 2003b). As discussed in section 6.2, lower socioeconomic status impacts both directly and indirectly on food choices and ultimately on nutrition.

The dietary pattern of Pacific communities is influenced by an interplay of many factors including income, occupation (often involving long working hours), living arrangements, obligation and commitments to family, community and church (Muimuiheata 2009).

Experiences of perceived racism may contribute to disparities in health between Pacific peoples and Europeans (Harris et al 2006a). According to data from the 2002/03 New Zealand Health Survey, Pacific adults were more likely to report an experience of racial discrimination than European adults (24.5 vs 14.6%), including unfair treatment (because of ethnicity) by a health professional (5.8 vs 1.4%) (Harris et al 2006b).

In a recent 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.

9.2 Nutrition and health indicators

Data from the 2002 National Children’s Nutrition Survey (Ministry of Health 2003b) and the 2006/07 New Zealand Health Survey (Ministry of Health 2008g) provide an indication of the dietary and physical activity habits of Pacific children.

Data related to Pacific young people aged 15–18 years, from the 2008/09 Adult Nutrition Survey and other national surveys, will be included in the final background paper. They were not available for the draft.
Dietary habits

Vegetable and fruit intake
Pacific children (5–14 years) were more likely than children overall to meet recommended servings for vegetables and fruit:
- three or more servings of vegetables per day (59% Pacific boys, 65% Pacific girls; 57% overall)
- two or more servings of fruit per day (50% Pacific, 45% overall) (Ministry of Health 2003b).

Milk intake
Among five- to 14-year-olds, daily milk drinking was less common in Pacific children (32% boys, 23% girls) than children overall (38%) (Ministry of Health 2003b).

Breakfast
Among two- to 14-year-olds, Pacific children were less likely to eat breakfast at home every day (80% Pacific, 88% overall) (Ministry of Health 2008g).

Eating at school
After controlling for age, sex and socioeconomic deprivation of the neighbourhood, in comparison with European/Other children, Pacific children (5–14 years) were approximately:
- two times more likely to sometimes or always skip lunch
- three times more likely to buy most/some food for the school day from the tuckshop
- five times more likely to buy food for the school day from a dairy
- one-quarter as likely to bring food for the school day from home (Utter et al 2006b).

High fat, sugar and salt foods and drinks
Pacific children (2–14 years) were about 15 percent more likely than children overall to have had three or more fizzy drinks in the past week. They were also about twice as likely to have eaten fast food three or more times in the past week (Ministry of Health 2008g).

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).
- However, in the Pacific Islands Families Study (Rush et al 2008) only 5 percent of children aged four years consumed traditional foods, with taro the most common traditional food, followed by cassava, canned corned beef, boiled corned beef, fish and cooked green banana.
Food security

Pacific people reported the least food security compared with European/Other and Māori (Parnell et al 2001). Forty-seven percent of Pacific households with children reported always being able to afford to eat properly, compared with 78 percent of households overall (Ministry of Health 2003b).

Table 43 shows six indicator statements related to food insecurity which compares Pacific households with New Zealand households overall.

Table 43: Food insecurity in Pacific households with children and young people aged 5–14 years

<table>
<thead>
<tr>
<th>Indicator – because of lack of money:</th>
<th>Often (%)</th>
<th></th>
<th>Sometimes (%)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pacific households</td>
<td>Households overall</td>
<td>Pacific households</td>
<td>Households overall</td>
</tr>
<tr>
<td>Food runs out</td>
<td>6.2</td>
<td>3.6</td>
<td>47.7</td>
<td>18.5</td>
</tr>
<tr>
<td>Eat less</td>
<td>3.5</td>
<td>2.8</td>
<td>44.2</td>
<td>15.3</td>
</tr>
<tr>
<td>Variety of foods limited</td>
<td>9.1</td>
<td>9.0</td>
<td>51.3</td>
<td>25.6</td>
</tr>
<tr>
<td>Rely on others</td>
<td>1.3</td>
<td>1.5</td>
<td>27.8</td>
<td>10.3</td>
</tr>
<tr>
<td>Using food grants/banks</td>
<td>1.2</td>
<td>0.8</td>
<td>18.1</td>
<td>8.6</td>
</tr>
</tbody>
</table>

Source: Ministry of Health (2003b)

Nutrient intake and nutritional status

Nutrients of concern in Pacific children and young people as identified in the 2002 National Children’s Nutrition Survey (Ministry of Health 2003b) are summarised below.

Nutrient intake

- As with all New Zealand children and young people, intakes of saturated fat in Pacific children (14.5% of energy intake) are higher than the recommendation 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, riboflavin, folate, calcium, iron and zinc.

Nutritional status

- Pacific girls aged 11–14 years have a higher prevalence of iron-deficiency anaemia compared with all girls in this age group (3.9% vs 1.2%).
- Serum zinc concentrations were low in 23 percent of boys and 16 percent of girls.
- About one in four Pacific children (22% boys and 24% girls) had low urinary iodine concentrations, which is indicative of mild iodine deficiency.
- Three out of five (59%) Pacific children were vitamin D insufficient, including 8 percent who were vitamin D deficient (Rockell et al 2005). Pacific children are at
higher risk of sub-optimal vitamin D status because their darker skin colour reduces vitamin D synthesis in response to sunlight (see Section 3.10: 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%) obese and very few (1%) were underweight (Ministry of Health 2008h).
- Pacific children were 2.8 times more likely to be obese than those in the total child population (once data were adjusted for age) (Ministry of Health 2008h).
- Data on body size show no significant change in the prevalence of overweight or obesity in Pacific children aged 5–14 years from 2002 to 2006/07 (Ministry of Health 2008h).
- One-third of Pacific youth (36% males, 32% females) aged 12–18 years were obese and a further one-third (35% males, 36% females) were overweight (Utter et al 2008a).
- Four out of 10 Pacific youth (40% males, 44% females) perceived themselves to be overweight, but more than half (53% males, 61% 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\(^6\) found no significant difference in the proportion of Pacific secondary school students (68%) and New Zealand European students (74%) 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 and young people usually used active transport to get to and from school, compared with 47 percent of all children and young people (Ministry of Health 2008g).
- The proportion of children and young people who watched two or more hours of television per day was similar for Pacific (66%) and the total population (64%) (Ministry of Health 2008g).

**9.3 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.

\(^6\) For more information about the studies mentioned in this section, refer to Appendix 7.
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 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).

Models of health

Pacific models of health care that recognise Pacific worldviews and beliefs about health have been developed. The Fonofale model was created for use in the New Zealand context and is discussed below as an example of a Pacific model of health. 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).

The Fonofale model of health

The Fonofale model is based on a metaphor for a fale (or house), with a roof and foundations (Figure 8). This metaphor with the foundation or floor, posts and roof, encapsulated in a circle, promotes the philosophy of holism and continuity.

Figure 8: Fonofale health model

The names in the brackets represent the creators of the models; they are not referring to a specific publication.
The roof represents the cultural values and beliefs that shelter life, including traditional methods of healing. The foundation represents the family, the foundation of the Pacific culture. The pou, or posts, connect the roof to the foundations. They represent the connection between the family, culture and dimensions of spiritual wellbeing, physical wellbeing, mental and emotional wellbeing and other variables, such as gender, sexual orientation, age and social class.

Thus this model reflects what is most important for Pacific peoples – family, culture and spirituality – and identifies components that are important to the health of Pacific peoples.

**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 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 2009). Among younger people, aged approximately 12 to 18 years, Pacific perceptions of body size and beauty are changing: 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: 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).

Pacific peoples also perceive different health services in different ways according to the illness. One study, for example, found Samoan people divided illness into Samoan illness and Palagi (European) illness. If sick with a ‘Samoan illness’, Samoan patients would visit a traditional healer, but if sick with a ‘Palagi illness’ they would go to a western-trained doctor (Ministry of Health 2008b).
9.4 Traditional foods and cultural practices

The traditional diet of many Pacific peoples comprises: mainly coconuts, starchy root vegetables and other staples (taro, cassava, kūmara, yams, pandanus and sago); fruit when in season (bananas, pawpaw, mangoes, breadfruit, 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). While many of these foods are eaten widely across the Pacific Islands region, each of the Pacific nations have their 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’).

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 (Moata‘ane 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. Many Pacific peoples do not understand some terminology regarding food and nutrition. For example, the term ‘serving’ has no meaning to many Pacific peoples, so it is better to use plates or food models to give examples of recommended amounts.
9.5 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. Pacific peoples are less likely to access some primary health care services, such as general practitioners and dentists, than their non-Pacific counterparts in New Zealand (Ministry of Health 2008g).

Cultural competence is the capacity of a health system to improve health and wellbeing by integrating cultural practices and concepts into health service delivery (Tiatia 2008). Although there is no universally accepted single definition of cultural competence, most definitions have a common element: that is, an adjustment to or acknowledgement of one’s own culture in order to understand the culture of clients, patients, work colleagues or communities. The ability to integrate or acknowledge Pacific values, principles, structures, attitudes and practices in the care and delivery of service to Pacific clients, their families and communities will enhance Pacific cultural competence. Cultural competence presumes that difference and diversity between and within groups are valued and acknowledged. Increasing cultural competency is the responsibility of individuals and organisations.

Pacific cultural competencies are crucial to better health outcomes for Pacific peoples. The provision of culturally competent 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) 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, 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.

Lessons from ‘by ethnic for ethnic’ services, the importance of relevant settings for Pacific peoples (ie, churches, community halls) and the need to include Pacific peoples in decision-making processes have huge implications for future service delivery. Successful initiatives have been those that were community-based, incorporated multiple interventions, and were specifically designed for and delivered by Pacific peoples for Pacific peoples within the context of cultural values, beliefs and the social environment (Tiatia 2008).
Useful resources and tools

‘Ala Mo’ui: Pathways to Pacific Health and Wellbeing 2010–2014 is the Ministry of Health’s Pacific Health and Disability Action Plan (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.

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: http://www.moh.govt.nz/pacific.

For further information on Pacific peoples, please 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 and Mental Health: A paper for the Pacific Health and Disability Action Plan review* (Ministry of Health 2008e)

Health education resources specific to Pacific peoples are available from:

- Ministry of Health at http://www.healthed.govt.nz
Part 10: Considerations for Asian and Other Populations

Summary

The term ‘Asian’ is used to describe peoples from the Asian continent, including peoples from China, India, Korea, the Philippines, Japan, Sri Lanka, Cambodia and Afghanistan.

The term ‘Other’ populations includes people 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 with length of time in New Zealand.

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.

Working with Asian, migrant and refugee populations

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.

10.1 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.

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, India, Korea, the Philippines, Japan, Sri Lanka, Cambodia 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 page 138).

The ‘Asian’ ethnic group, as defined by Statistics New Zealand, is now the third largest in New Zealand, after New Zealand European and Māori (Statistics New Zealand 2007f). At the 2006 Census, there were 354,552 Asian people living in New Zealand, representing 9.2 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 4).

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 44). The proportion of Asian people in the total population is expected to continue increasing, reaching 15 percent by 2021 (Statistics New Zealand 2009c).

Four out of five (79%) Asian New Zealanders were born overseas (see Table 44). 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 44:** Demographic information for the seven Asian ethnic groups with the largest population size in New Zealand

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Chinese</td>
<td>147,570</td>
<td>40</td>
<td>77</td>
<td>79</td>
</tr>
<tr>
<td>Indian</td>
<td>104,583</td>
<td>68</td>
<td>76</td>
<td>88</td>
</tr>
<tr>
<td>Korean</td>
<td>30,792</td>
<td>62</td>
<td>93</td>
<td>68</td>
</tr>
<tr>
<td>Filipino</td>
<td>16,938</td>
<td>53</td>
<td>82</td>
<td>95</td>
</tr>
<tr>
<td>Japanese</td>
<td>11,910</td>
<td>19</td>
<td>79</td>
<td>79</td>
</tr>
<tr>
<td>Sri Lankan</td>
<td>8310</td>
<td>19</td>
<td>87</td>
<td>92</td>
</tr>
<tr>
<td>Cambodian</td>
<td>6918</td>
<td>31</td>
<td>76</td>
<td>73</td>
</tr>
<tr>
<td><strong>Total</strong>¹</td>
<td><strong>354,552</strong></td>
<td><strong>49</strong></td>
<td><strong>79</strong></td>
<td><strong>82</strong></td>
</tr>
</tbody>
</table>

Source: Statistics New Zealand (2007c)

Note:

¹ Figures for individual groups may not sum to totals 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 9).
Figure 9: Population age structure for the total population and Asian peoples, 2006

Source: 2006 Census of Population and Dwellings

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 even 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 138).

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 10). 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).
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 is 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 in New Zealand are eligible for publicly funded health services (Ministry of Health 2008).

Refugees differ from other migrants in many ways (Ministry of Health 2001). Refugees do not usually choose to leave their homeland and often flee in response to a crisis. They often have little choice about where they go or by what means they will travel, and may have to leave family members behind.

Each year, New Zealand accepts approximately 750 people under the Refugee Quota Programme. In addition, New Zealand accepts annually up to 1800 applications 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. Of the 875 refugees who received health screenings from May 2004 to May 2005, 49 percent were aged 16 years or younger (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 10.3: Nutrition and health indicators, page 141). 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 2: 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).

### 10.2 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 countries 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). 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 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).

10.3 Nutrition and health indicators

The 2002 National Children’s Nutrition Survey data 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. Instead, data from regional studies have been included as indicated to offer more information on nutrition and health indicators for Asian and refugee children and young people.

Dietary habits

Asian children and young people (2–14 years) had similar or healthier dietary habits than children and young people in the total population. For example:

- 90% had breakfast at home every day (88% overall)
- 21% had fizzy drinks three or more times a week (20% overall)
- 7% had fast food three or more times in the past week (14% overall) (Ministry of Health 2008g).

Youth’07 provides some evidence that duration of residence in New Zealand influences dietary habits in Asian secondary school students (12–18 years). While 21 percent of Asian females and 12 percent of Asian males reported ‘hardly ever’ eating breakfast, 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).
Nutrient intake and nutritional status

Asian populations

Regional studies suggest Asian populations are at risk of sub-optimal iron, vitamin B12 and vitamin D status.

- An Auckland study of secondary school students (mean age 16 years) found the prevalence of iron deficiency with 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 3.10: Vitamin D).

Refugee populations

For young refugees, consider the possibility of:

- iron-deficiency anaemia, which 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 associated with intestinal parasites
- other micronutrient deficiencies such as vitamin A, vitamin C, folate and vitamin B12 (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 vitamin D deficient (serum 25-hydroxyvitamin D concentrations 25–49 nmol/L) (Wishart et al 2007).

Body size

- Most (71.4%) Asian children aged 2–14 years were in the normal range for BMI, 5.9 percent were obese, 14.6 percent overweight and 8.2 percent were underweight (Ministry of Health 2008h).
- The Obesity Prevention in Communities study, while not involving a nationally representative sample, found that Asian adolescents (36% female, 42% male) are less likely to be happy or very happy with their body weight than European adolescents (15% female, 19% male) (Adolescent Health Research Group 2008a).

Physical activity and sedentary behaviours

- Asian students aged 12–18 years, (36% female, 57% male) were less likely to report at least three occasions of strenuous exercise in the past week than students overall (57% female, 70% male) (Rasanathan et al 2006a).
- Nearly half (47%) of Asian children aged 2–14 years reported using active transport to get to and from school, which is the same proportion as children overall (Ministry of Health 2008h).
- A New Zealand study of physical activity patterns in a multiethnic sample of female children and young people found that South and East Asian girls were less active
than girls from other ethnic groups, with lower step counts both on weekdays and weekends (Duncan et al 2008a).

- The proportion of Asian children who watched two or more hours of television a day (61%) was not significantly different from that of children overall (64%) (Ministry of Health 2008h).

- Asian students (12–18 years) born in New Zealand or who 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).

### 10.4 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 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 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 tuck-shop. There are also anecdotal reports that reduced- and low-fat milk is not considered healthy for Asian 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; a number of dairy products now indicate whether the rennet used is halal. Some people following the Hindi faith follow a vegetarian diet or avoid beef.

### 10.5 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 than all children and young people (92.5% vs 97.9%) (Ministry of Health 2008h).
However, there was no difference in the proportion of Asian and all children and young people who had seen a GP in the last 12 months.

- 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 Youth2000, Chinese young people or those who had been living in New Zealand fewer than five years were less likely to access health care (Rasanathan et al 2006a; Ameratunga et al 2008).

### 10.6 Working with Asian and other populations

As Asian peoples living in New Zealand are a heterogeneous group, health practitioners will benefit from recognising and understanding different cultural practices and beliefs in relation to health, food and nutrition. The needs of children and young people who are recent migrants are likely to differ to 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.

The nutrition-related health of children and young people from Asian and other populations in New Zealand may be affected by:

- for refugees and migrants, 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 and tools – Asian health

For useful information on Asian health in New Zealand visit these websites:

- Asian Health, which is part of the Ministry of Health’s website: http://www.moh.govt.nz/moh.nsf/indexmh/asianhealth
- Asian Health, which was established by the Auckland Regional Public Health Service and includes useful links: http://www.asianhealth.govt.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

In addition, the refugee services of the Auckland Regional Public Health Service provides useful information on refugee health in New Zealand, along with resources and links, at: http://www.refugeehealth.govt.nz.

The Ministry of Health also 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: http://www.healthed.govt.nz.
Part 11: Special Dietary Considerations

This part summarises special dietary considerations related to vegetarian (including vegan) diets; allergy in children and young people; and young women who are pregnant or breastfeeding.

11.1 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 (e.g., 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). Young 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.

When milk and/or milk products are not consumed, encourage 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 (e.g., dried beans, peas, lentils, soy products), nuts,* seeds and eggs.

Nutrients to monitor in vegetarian and vegan children and young people include energy, protein, calcium, iron, zinc, vitamin B12 and omega-3 fatty acids.

See a dietician if concerned about nutrient intakes in vegetarian and vegan children and young people.

Note:
* Do not give small, hard foods such as whole nuts until children are at least five years old. Young children can choke on food very easily (see section 1.2: Food groups and recommended serving sizes, page 12).

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 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, less than 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 1997 National Nutrition Survey, approximately 1 percent of young people aged 15–18 years were vegetarian (Russell et al 1999).

**Nutrients to monitor**

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. Nutrients of potential concern for vegetarian children and young people are outlined below.

**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\(^8\) should be increased.

Although the emphasis should be on whole grains 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, peas, beans, lentils, tofu), soy products, nuts and seeds.\(^8\)

For children and young people consuming regular meals and a variety of 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 amino acids, but when eaten together in certain combinations ‘complement’ each other and so provide all the indispensable amino acids in one meal. Indispensable amino acids are the amino acids that cannot be synthesised by the body (see section 3.6: Protein). Vegetarian children and young people should eat at least two servings of plant-based protein foods each day.

**Vitamin B12**

Animal products are the only natural sources of 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 4: Fluids). Fermented soy products, algae and spirulina have been proposed as sources of vitamin B12 and may contain vitamin B12 analogues. 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.

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\(^8\) Do not give small, hard foods such as whole nuts until children are at least five years old. Young children can choke on food very easily (see section 1.2: Food groups and recommended serving sizes, page 12).
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, fruit and vegetables) 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 (raising) 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 4: Fluids). Note that rice and oat 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 only in fish and fish oils. 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 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, soybean oil, walnuts and walnut oil.

**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 adolescent, they should be encouraged to seek specialist advice from a dietician. 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: http://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 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 useful basis for discussion.

**11.2 Food allergy**

<table>
<thead>
<tr>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cow’s milk, eggs, peanuts, tree nuts, soybeans and wheat account for most food allergies in children.</td>
</tr>
<tr>
<td>Most children will outgrow their allergy to cow’s milk, eggs, soy and wheat by five to seven years of age, but nearly all peanut and tree nut allergies persist into adulthood.</td>
</tr>
<tr>
<td>While most other allergies develop in very early childhood (around 6–23 months of age), fish and shellfish allergies usually develop in adolescence or adulthood.</td>
</tr>
<tr>
<td>Accurate diagnosis of a food allergy is important. Diagnosis initially involves a detailed history and physical examination.</td>
</tr>
<tr>
<td>Food allergies may affect 4–8 percent of children and 2–3 percent of adults.</td>
</tr>
<tr>
<td>The prevalence of food allergy appears to be increasing in economically developed countries. The reasons for the increase are not yet clear.</td>
</tr>
<tr>
<td>There is no cure for food allergies, so management focuses on preventing symptoms by removing the food allergens from the diet.</td>
</tr>
<tr>
<td>Food allergies should be managed jointly by the referring doctor/specialist, the dietician and the family.</td>
</tr>
<tr>
<td>A comprehensive management plan is required for children at risk of anaphylaxis.</td>
</tr>
<tr>
<td>In the case of suspected anaphylaxis, emergency medical treatment is required immediately.</td>
</tr>
</tbody>
</table>
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:

- A food intolerance is an adverse reaction to food that is non-immunological and caused by some unique physiological characteristic of the host, such as a metabolic disorder. Lactose intolerance (due to lactase deficiency) is an example of a food intolerance.

- A food allergy is an abnormal immunological reaction to a food component, which can result in mild (eg, rash) or severe (eg, anaphylaxis) reactions. Most food allergy reactions are mediated by immunoglobulin E (IgE) antibody, but others are cell-mediated or a combination of both. The most common symptoms involve the skin (eg, rash, hives, swelling, eczema), gastrointestinal tract (eg, vomiting, abdominal pain, cramping, diarrhoea) and respiratory tract (eg, hay fever, asthma, wheeze). The most severe reaction is anaphylaxis, which can cause death (Lack 2008b).

Most food allergies originate in early childhood, usually between six and 24 months of age, although fish and shellfish allergies usually develop in late childhood or adulthood (see Table 45). Cow’s milk, eggs, peanuts, tree nuts, soy and wheat account for most food allergies in children, with allergies to seeds (especially sesame) and some fruit (eg, kiwifruit) reported more recently. Note that IgE-mediated allergies to wheat and soy are rarely confirmed by specialists (Lack 2008b). Moreover, there is no evidence that restricting these foods from a child’s diet or delaying their introduction will prevent the development of food allergies in children at high risk (eg, 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 45: Common food allergens and natural course of food allergy

<table>
<thead>
<tr>
<th>Food</th>
<th>Usual age of onset</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cow’s milk</td>
<td>6–12 months</td>
<td>75% of cases resolve by 5 years</td>
</tr>
<tr>
<td>Eggs</td>
<td>6–24 months</td>
<td>75% of cases resolve by 7 years</td>
</tr>
<tr>
<td>Peanuts</td>
<td>6–24 months</td>
<td>Persistent (20% of cases resolve by 5 years)</td>
</tr>
<tr>
<td>Wheat</td>
<td>6–24 months</td>
<td>80% of cases resolve by 5 years</td>
</tr>
<tr>
<td>Soy</td>
<td>6–24 months</td>
<td>65% of cases resolve by 2 years</td>
</tr>
<tr>
<td>Sesame seeds</td>
<td>6–36 months</td>
<td>Persistent (20% resolve by 7 years)</td>
</tr>
<tr>
<td>Tree nuts</td>
<td>1–7 years</td>
<td>Persistent (10% resolve after 5 years)</td>
</tr>
<tr>
<td>Fish</td>
<td>Late childhood and adulthood</td>
<td>Persistent</td>
</tr>
<tr>
<td>Shellfish</td>
<td>Adulthood</td>
<td>Persistent</td>
</tr>
<tr>
<td>Kiwifruit</td>
<td>Any age</td>
<td>Unknown</td>
</tr>
</tbody>
</table>

Source: Adapted from (Lack 2008b)
Accurate diagnosis of a food allergy is important. The gold standard for diagnosing a food allergy is a double-blind, placebo-controlled food challenge. However, this method is time consuming and not practical in most settings so the diagnosis of a food allergy initially involves a detailed history and physical examination. 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 eating the food and symptoms, details of the symptoms, and reproducibility of symptoms in response to the same food (Lee and Burks 2006). Skin prick tests are commonly used to detect food-specific IgE antibodies. For food allergy that is not IgE-mediated, an oral food challenge is the only method of 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). Reviews of the literature suggest food allergies 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).

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, and the hygiene hypothesis (Lack 2008a). There is currently no evidence to support any of the dietary hypotheses, but limited evidence to support the hygiene hypothesis (Lack 2008a). 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 allergies, so management focuses on preventing symptoms by removing the food allergens from the diet (Sampson 2004; Lee and Burks 2006). Completely removing them can be difficult because the most common causes of food allergy in children (eg, cow’s milk, eggs and peanuts) are ingredients in a wide range of prepared and processed foods. It is very important that food allergies are managed in consultation with an allergy specialist and dietician. For children at risk of anaphylaxis, a comprehensive management plan needs to be developed.

Parents, caregivers and family members need to be educated about allergen avoidance, including in regard to reading food labels, managing situations where there are lots of unlabelled foods (eg, parties, restaurants), recognising symptoms and managing severe reactions (Sampson 2004).
Standard 1.2.3 of the Australian New Zealand Food Standards Code (FSANZ 2010) requires most common food allergens (ie, gluten, shellfish, eggs, fish, cow’s milk, peanuts, soy, sulphites (in concentrations of 10 mg/kg or more), tree nuts and sesame seeds) to be declared on food labels. The allergens must be declared when they are an ingredient, food additive, processing aid or a component of any of these.

Cow’s milk allergy

Cow’s milk, milk products (eg, yoghurt, cheese, ice-cream) and foods in which milk or milk products are an ingredient (eg, many cakes, biscuits, desserts, sauces and soups) must be avoided. 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’s and sheep milk (Restani et al 1999). One study of children aged five months to seven years with IgE-mediated cow’s milk allergy found that 92 percent reacted to goat’s milk (Bellioni-Businco et al 1999). Some children with IgE-mediated cow’s milk allergy also have adverse reactions to soy milk (Zeiger et al 1999).

Milk is a source of many important nutrients, such as protein, calcium, riboflavin, vitamin A and vitamin B12, so it is essential that these nutrients are sourced from other foods when a milk-free diet is adopted. Clinical dieticians can offer specific dietary advice on suitable alternatives.

Egg allergy

Eggs from all poultry (eg, hen, duck, quail), and both the egg white and yolk, need to be avoided. It is also necessary to avoid all foods in which egg is an ingredient, including many cakes, muffins, quiches and desserts. Most people with an egg allergy should be able to eat chicken meat safely.

Peanut and tree nut allergy

Because allergies to peanuts and tree nuts can result in severe reactions (ie, anaphylaxis), it is very important to avoid these foods, as well as any foods with nuts as ingredient. For some people it may also be necessary to avoid all foods prepared on the same premises or manufacturing line as nuts.

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). Of greater concern, 35–50 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 almonds, brazil nuts, cashews, chestnuts, hazelnuts, hickory nuts, macadamia nuts, pecans, pine nuts, pistachios and walnuts.
Wheat allergy
Wheat allergy can be particularly difficult to manage because wheat is an ingredient in so many staple foods, such as bread, cereals and pasta. Therefore, suitable bread and cereal alternatives must be found. Fortunately, most (80%) children will outgrow a wheat allergy by the age of five years. More wheat-free foods are becoming available and these are clearly labelled.

Fish and shellfish allergy
Fish and shellfish allergies are rare in young children, but can appear in adolescence. All fish and shellfish and products containing them (eg, some salads and soups) need to be avoided.

Soy allergy
All soy products (eg, soy milk and tofu) and all foods containing soy must be avoided. Completely avoiding them can be difficult because soy is used as an ingredient in many processed foods, so avoidance requires good label-reading skills.

Sesame seed allergy
Sesame seed allergy is not very common, but requires avoidance of sesame seeds and products containing them (eg, dips such as tahini and hummus). Sesame oil, and foods prepared with sesame oil, should also be avoided.

Useful resources and tools
For useful information on many aspects of allergies including how to substitute foods, read food labels and identify foods that may contain allergens, please refer to Allergy New Zealand's website: http://www.allergy.org.nz.

For lists of commercially prepared foods suitable for people with specific allergies (egg, milk, peanut, soy, legume, wheat, gluten), refer to the Manufactured Food Database website: http://www.mfd.co.nz. (Note, however, that there is no requirement for manufacturers to provide data, so the list of foods is incomplete.)

11.3 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). 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. Regular monitoring of growth and development of both mother and baby is essential.

Recommended nutrient intakes
The nutrient reference values (NRVs) for pregnant and breastfeeding young women (aged 14–18 years and 19–30 years) are presented in Appendix 3.

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: http://www.moh.govt.nz/moh.nsf/pagesmh/4676.

Note that the recommended nutrient intakes in the 2006 document 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: http://www.healthed.govt.nz.
Part 12: Other Issues

This part sets out other issues of relevance to 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.

12.1 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, 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 body size and shape
- accepting other people’s body size and shape
- being critical of media portraying 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.

- Eat together as a family as often as possible. Family support and positive role modelling help protect against eating disorders.

Eating disorders are rare and complex psychiatric disorders that can have serious consequences. They usually begin in adolescence or young adults, 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.

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, either rating themselves 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 2008a). In the Obesity Prevention in Communities study, less than half of adolescents (36% female, 44% males) were happy or very happy with their body weight (Adolescent Health Research Group 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 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 46).

Table 46: Perceptions of own body weight among young people, by ethnicity and gender

<table>
<thead>
<tr>
<th>Ethnic group</th>
<th>Percentage ‘happy’ or ‘very happy’ with own body weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Female</td>
</tr>
<tr>
<td>Māori</td>
<td>41</td>
</tr>
<tr>
<td>Pacific</td>
<td>35</td>
</tr>
<tr>
<td>Asian</td>
<td>36</td>
</tr>
<tr>
<td>European</td>
<td>15</td>
</tr>
</tbody>
</table>

Source: Adolescent Health Research Group (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 (81%) Māori secondary school students 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 four out of 10 Pacific youth (40% males, 44% females)
perceived themselves to be overweight, but more than half (53% males, 61% females) were trying to lose weight (Utter et al 2008a).

Individual, family, 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.

In addition, the widespread attention to and publicity on the ‘obesity epidemic’ in recent years may have made children, young people and their families more aware of and concerned about body size. Although strong evidence supports the link between heavy body weight and risk of disease (see section 2.3: 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 the participants increased their knowledge of eating disorders, their beliefs, attitudes, intent and behaviour in relation to body image and eating did not 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 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 include:

- chaotic eating (eg, irregular meals, skipping meals)
- restrictive behaviours (eg, excessively cutting back on the amount of food eaten, prolonged fasting)
- strict rules about eating, limiting variety of foods
• avoidance of social eating
• binge eating, purging (eg, self-induced vomiting)
• excessive exercise
• repeated weighing (Treasure et al 2010).

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 57.8 percent reported ‘unhealthy weight control behaviours’. The equivalent figures for males participants were 25.3 percent and 31.3 percent respectively (Neumark-Sztainer et al 2006).

A review article by 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 (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.

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) (http://www.psych.org/mainmenu/research/dsmiv/dsmivtr.aspx). The following are definitions from the DSM-IV.

**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, and excessive exercise.

**Eating disorders not otherwise specified** 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 amount 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 aetiology and pathology. Therefore treatment will require the involvement of a team of experts, including a psychiatrist and dietician 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.

12.2 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: microorganisms (*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.

**Recommendations**

Give the following advice to parents and caregivers, children and young people.

- Practise good oral hygiene, including regular tooth brushing using a full-strength (1000 ppm) fluoride toothpaste.
- Eat a combination of foods at each meal, including whole grains, vegetables and fruit.
- If drinking fruit juice or other 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, be expensive to treat, and cause tooth disease and tooth loss. Diet and nutrition are important components of oral health. While 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: microorganisms (*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, 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 2006/07 New Zealand Health Survey assessed a range of oral health behaviours in children and young people. Nearly two-thirds (62.1%) of children aged 2–14 years brush their teeth at least twice a day (Ministry of Health 2008h). However, 7 percent of children surveyed had not brushed their teeth on the previous day.

As would be expected, the percentage of children who had never had a filling decreased with age: 92 percent of children 2–4 years had never had a filling, compared with 48 percent of children aged 5–9 years, and 30 percent of children aged 10–14 years (Ministry of Health 2008g). When adjusted for age, Māori children aged 2–14 years were significantly more likely to have had a filling and Asian children were significantly less likely to have had a filling than children overall (Ministry of Health 2008g).

Tooth loss is an indicator of poor oral health. One or more teeth had been removed due to decay, abscess, infection or gum disease in 2 percent of children aged 2–4 years, 14.6 percent of children aged 5–9 years, 13.5 percent of children aged 10–14 years and 12.9 percent of young people aged 15–24 years (Ministry of Health 2008g). When adjusted for age, Māori and Pacific children aged 2–14 years were significantly more likely to have had one or more teeth removed than children overall.
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 surfaces (Gussy et al 2006). Sucrose is of particular concern because when it is metabolised it produces dextran, which enable bacteria to more easily adhere to the teeth (Gussy et al 2006). Cariogenic foods (food containing fermentable carbohydrates) include sugary drinks (eg, fizzy drink, 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 is very important. For example, foods that stick to the teeth (eg, roll-ups for 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.

Avoid putting children to bed with a bottle of juice or other sugar-containing beverage, as this practice causes long-term exposure to sugar and acid. Night-time drinks to avoid include 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: 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.

Tooth brushing is an important aspect of oral hygiene. However, tooth brushing alone will not prevent dental caries. Good oral hygiene and use of fluoridated toothpaste can prevent dental caries. A recent 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 New Zealand are fluoridated, so water (and beverages or food made with water) are the main source of fluoride in the diet. Another source of fluoride is toothpaste. Full-strength fluoride toothpaste (1000 ppm) is recommended for all children and young people, especially those with unfluoridated water supplies. 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 basic oral health services from birth to 18 years of age.

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 website at: http://www.moh.govt.nz/moh.nsf/indexmh/letstalkteeth-service.

Useful resources and tools

For further information on oral health, refer to Oral Health on the Ministry of Health’s website: http://www.moh.govt.nz/oralhealth.


For children up to five years, the New Zealand Dental Association, in conjunction with the Ministry of Health, has produced Healthy Smiles, Healthy Child: Oral health guide for Well Child providers (New Zealand Dental Association 2008). This document is available on the New Zealand Dental Association website: http://www.nzda.org.nz.

12.3 Alcohol

Summary

Alcohol is the most commonly used recreational drug in New Zealand. The majority of New Zealanders, including young people, consume alcohol at least occasionally.

Of those aged 15–17 years, 74 percent have had a drink containing alcohol in the previous 12 months.

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), it contains no other nutrients.
An increasing alcohol intake is associated with a decline in diet quality and it has been linked to both malnutrition and obesity.

Alcohol may adversely affect brain development and when consumption starts at a young age, there is an increased risk of many mental health and social issues.

Compared with the rest of the population, young people (aged 15–24 years) experience a disproportionate amount of harm from alcohol-related accidents and injury.

Nearly one in five (21% male, 17% female) young drinkers have a potentially hazardous drinking pattern.

**Recommendations**

For children and young people younger than 18 years, not drinking alcohol is the safest option for their health and wellbeing.

- Parents and caregivers should be advised that children under 15 years of age are at the greatest risk of harm from drinking and that for this age group, avoiding alcohol is especially important.
- For young people aged 15–17 years, the safest option is to delay the initiation of drinking for as long as possible.

If people in the 15–18 years age group do drink, it should be at a ‘low-risk level’ and in a safe environment, supervised by adults.

**Background**

Alcohol has a complex role in New Zealand society. It is the most commonly used recreational drug in New Zealand: the majority of New Zealanders, including young people, consume alcohol at least occasionally.

People drink for a wide range of reasons including to be sociable, to participate culturally, as a result of peer influence, for pleasure, for relaxation, out of habit and to overcome inhibitions (NHMRC 2009).

However, drinking alcohol can have serious health, social and economic costs. Physically, alcohol consumption affects nearly every organ system in the body. It is a major cause of liver disease (eg, cirrhosis), high blood pressure and haemorrhagic stroke (Foster and Harriott 2006; Mann and Truswell 2007). Alcohol is also causally associated with many cancers (World Cancer Research Fund and American Institute for Cancer Research 2007).

Alcohol is an addictive drug that affects many neurological processes, including brain function (Mann and Truswell 2007). Alcohol dependence is one of the most prevalent psychiatric disorders in New Zealand, affecting one in six (16.7%) young people aged 16–24 years (Oakley Browne et al 2006). Alcohol, in the short term, produces a number of psychological and psychomotor changes which can result in impaired motor
skills and judgement, increased risk taking, changes in mood and increased aggression. As a result, it can contribute to death and injury from road traffic accidents, drowning, suicide, assaults and domestic violence (NHMRC 2009). Alcohol contributed to nearly 5 percent of the global burden of disease and injury in 2004 in the total population (Rehm et al 2009).

**Specific issues related to alcohol and young people**

In general, young people are less tolerant to alcohol, and have less experience of drinking and its effects. Compared with the rest of the population, young people (aged 15–24 years) experience harm from alcohol-related accidents and injury disproportionately. Young drinkers (17 years and under) are much more likely than older drinkers to undertake risky or antisocial behaviour connected with their drinking.

In addition, alcohol may adversely affect brain development and lead to alcohol-related problems in later life. Alcohol use, especially when started at a young age, increases the risk of many mental health and social issues (Brown and Tapert 2004).

**Alcohol and nutrition**

Alcohol (ethanol) is produced by fermentation of glucose in fruit juice (eg, grape) and cereals (eg, barley) (Mann and Truswell 2007). 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 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). As a result, it has been linked to both malnutrition and obesity (NHMRC 2006).

**Current levels of intake and patterns of drinking**

In the 2006/07 New Zealand Health Survey, approximately three-quarters (74%) of young people aged 15–17 years had a drink containing alcohol in the previous 12 months (Ministry of Health 2008g). What is most concerning about drinking in young people younger than 18 years is the pattern of drinking. Nearly one in five (21% male, 17% female) young drinkers surveyed had a potentially hazardous drinking pattern, meaning they are at high risk of future harm from alcohol (Ministry of Health 2008g).

The Youth’07 national survey of the health and wellbeing of New Zealand secondary school students found that over half (61%) had consumed alcohol in the last 12 months (Adolescent Health Research Group 2008b). This survey showed unhealthy patterns of drinking, with 28 percent of secondary school students consuming five to nine drinks in a typical session and a further 18 percent consuming 10 or more alcoholic drinks in a typical session. About one-third (34%) reported an episode of binge drinking (five or more drinks in one session) in the last four months, and one in ten (10.7%) current
drinkers were worried about how much they drink. Among current drinkers, many students reported problems from drinking alcohol, such as unsafe sex (14%), unwanted sex (7%) and injuries (22%). The most common sources of alcohol for secondary school students were their parents (54%) and friends (53%). These data confirm that many young people have drinking patterns that are potentially very harmful.

**Recommendations**

For children and young people younger than 18 years, not drinking alcohol is the safest option for health and wellbeing.

- Parents and caregivers should be advised that children under 15 years of age are at the greatest risk of harm from drinking and that for this age group, not drinking alcohol is especially important.
- For young people aged 15–17 years, the safest option is to delay the initiation of drinking for as long as possible.

If people in the 15–18 years age group do drink, it should be at a low-risk level (see ‘Useful tools and resources’ below) and in a safe environment, supervised by adults.

In New Zealand, there is no minimum age under which it is illegal to drink alcohol but it is illegal for young people under 18 years to purchase alcohol. It is also an offence to purchase or acquire an alcoholic beverage with the intention of supplying it to a young person under the age of 18 years, except when supplied by their parent or guardian.

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 foetal alcohol spectrum disorder. For women who are breastfeeding, not drinking is the safest option. 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: http://www.moh.govt.nz/moh.nsf/pagesmh/4676.

See also the brochure *When You Drink, So Does Your Baby* on the Health Education website: www.healthed.govt.nz.

**Useful resources and tools**

Another useful source of information is the Alcohol Advisory Council of New Zealand (ALAC) website, which has guidelines\(^\text{10}\) for low-risk drinking:

The phone number for the Alcohol Drug Helpline is 0800 787 797.

### 12.4 Dietary supplementation

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<th>Summary</th>
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<tr>
<td>Unless a particular need is identified, dietary supplementation is not recommended for children and young people for the following reasons.</td>
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<tr>
<td>- Eating a variety of food from each food group should provide sufficient nutrients to maintain health.</td>
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<tr>
<td>- Food is a better source of nutrients than supplements.</td>
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<tr>
<td>- High intakes of some supplements can have serious adverse effects, either by exceeding the upper level of intake or by interacting with other nutrients or medicines.</td>
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<tr>
<td>- Spending money on dietary supplements may reduce money available for healthy food.</td>
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<tr>
<td>- Reliance on dietary supplements may lead to a false sense of security about nutritional adequacy and promote poor food choices.</td>
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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.

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<th>Background</th>
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<tr>
<td>Good nutrition primarily depends on making appropriate food choices. For most children and young people, following the food and nutrition guideline statements, including by 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.</td>
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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 (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.

\(^{10}\) ALAC is currently updating these guidelines.
1. By obtaining nutrients from foods, nutrient requirements can be met 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 (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 11.2: 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 11.1: Vegetarian eating).

- Children and young people diagnosed with iron-deficiency anaemia will require iron supplement supplementation (see section 3.13: Iron).

- It is recommended that young women who plan to become pregnant take 800 µg of folic acid tablet daily for at least four weeks prior to conception and for 12 weeks after conceiving to reduce the risk of neural tube defects.

- It is recommended that young women who are pregnant or breastfeeding take a 150 µg iodine tablet.

- 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 3.10: 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). 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 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% male, 6.0% female) 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 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 use of supplements over time and/or the study population (Europeans are more likely to take supplements than other ethnic groups).

**12.5 Food safety**

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<th>Summary</th>
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<tr>
<td>Food safety refers to the microbiological and chemical safety of food. The New Zealand Food Safety Authority is responsible for food safety in New Zealand.</td>
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<tr>
<td>Food-borne illness is generally preventable. Appropriate food handling and preparation reduce the risk of contracting food-borne illness.</td>
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<tr>
<td>The New Zealand Total Diet Study is a key means of monitoring chemicals in food. This survey is repeated every 3–5 years, with the most recent survey beginning in 2009.</td>
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<th>Recommendations</th>
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<td>The following advice for parents and caregivers is recommended.</td>
</tr>
<tr>
<td><strong>Clean:</strong> Clean hands, cooking areas and tools. It is especially important to wash hands before handling food; and after touching raw meat and poultry, going to the toilet, changing nappies, touching pets and doing gardening. The cooking area and utensils should be cleaned between tasks, particularly after preparing raw meat or</td>
</tr>
</tbody>
</table>
poultry. Tea towels and dish cloths should be cleaned regularly and not used to wipe meat and poultry juice spills, hands or the floor. Wash hands in warm water with soap and dry them thoroughly with a clean towel or paper towel. Thoroughly drying hands is important, as wet hands are more likely to transfer pathogens.

- **Cook:** Thoroughly cook meat that can be contaminated with harmful bacteria. Poultry especially should be cooked right through, as should sausages and mince. Using a meat thermometer can help ensure meat is properly cooked.

---

**Cover:** Cover all raw and cooked food to prevent air-borne pathogens (i.e., disease-causing micro-organisms) and insects from contaminating the food. It is particularly important to prevent raw meat and poultry from cross-contaminating raw foods (e.g., salads).

**Chill:** Keep your fridge within the recommended temperature range of 2–4°C. Most pathogenic bacteria cannot grow at low temperatures. Cool hot foods slightly before putting them in the refrigerator to help avoid raising the temperature. Avoid over-filling the fridge as this prevents cold air circulating.

---

**Background**

**Food safety** refers to the microbiological and chemical safety of food. The New Zealand Food Safety Authority (NZFSA) 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 campylobacteriosis, 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: http://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 4Cs (clean, cook, cover, chill) and proper hand washing (NZFSA 2009c).
For more information on food safety, refer to the booklet *Food Safety in the Home* (NZFSA 2009c). NZFSA also produces food safety advice for Māori, Pacific and other cultures (NZFSA 2009e). You can access this information from NZFSA’s website at: http://www.nzfsa.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 12.6: Food additives below)
- agricultural compounds, which are chemicals used in the production of plants and animals
- toxins and other contaminants, which can occur naturally occur or artificially produced (NZFSA 2009b).

Chemicals in food are managed and monitored in a variety of ways. The New Zealand Total Diet Study\(^\text{11}\) is a key means of monitoring chemicals in food. This survey is repeated every 3–5 years, with the most recent survey beginning in 2009. Results from the 2003/04 New Zealand Total Diet Survey show that exposure to agricultural compounds, nutrients and contaminants is generally low in New Zealand (Vannoort and Thomson 2005). For more information on the New Zealand Total Diet Survey and monitoring of chemicals in food, visit the New Zealand Food Safety Authority’s website at: http://www.nzfsa.govt.nz.

Where people are concerned about chemicals in food, they can reduce exposure by selecting organic foods. While organic foods may have some environmental benefits, a recent systematic review found no difference in the nutrient quality of organic and conventionally produced foods (Dangour et al 2009).

### 12.6 Food additives

<table>
<thead>
<tr>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>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.</td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>

\(^{11}\) Formerly known as the New Zealand Diet Survey.
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.

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.

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 foods with few or no additives is likely to have many nutritional benefits, including gaining higher levels of fibre and micronutrients, 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. Table 47 shows common types of food additives and their purpose in foods.

Table 47: Types of food additives

<table>
<thead>
<tr>
<th>Type</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acidity regulator</td>
<td>Maintain level of acidity, which is important for taste and can help prevent spoilage</td>
</tr>
<tr>
<td>Anticaking agents</td>
<td>Keep powdered products free flowing (eg, salt, grated cheese)</td>
</tr>
<tr>
<td>Antioxidant</td>
<td>Act by preventing oxidation (eg browning of white vegetables)</td>
</tr>
<tr>
<td>Bulking agents</td>
<td>Contribute to the volume of food, without contributing significantly to energy (kJ)</td>
</tr>
<tr>
<td>Colourings</td>
<td>Add or restore colour to foods</td>
</tr>
<tr>
<td>Emulsifiers</td>
<td>Prevent oil and water mixtures separating</td>
</tr>
<tr>
<td>Firming agents</td>
<td>Contribute to firmness or interact with gelling agents to produce or strengthen a gel</td>
</tr>
<tr>
<td>Flavour enhancers</td>
<td>Improve savoury taste or aroma</td>
</tr>
<tr>
<td>Flavours</td>
<td>Add flavour to food or restore losses of flavour due to processing, maintain uniformity and make food more palatable</td>
</tr>
<tr>
<td>Foaming agents</td>
<td>Maintain the uniform distribution of gases in aerated foods</td>
</tr>
<tr>
<td>Gelling agents</td>
<td>Modify the texture of food through gel formation</td>
</tr>
<tr>
<td>Glazing agents</td>
<td>Provide protective coating or shiny appearance</td>
</tr>
<tr>
<td>Humectants</td>
<td>Make food more moist, reduce moisture loss and prevent foods drying out</td>
</tr>
<tr>
<td>Preservatives</td>
<td>Reduce or inhibit deterioration caused by micro-organisms (fungi and bacteria), thus preventing spoilage</td>
</tr>
<tr>
<td>Raising agents</td>
<td>Increase the volume of doughs prior to baking by releasing gases</td>
</tr>
<tr>
<td>Stabilisers</td>
<td>Maintain the uniform distribution of substances in food and strengthen the structure of food</td>
</tr>
<tr>
<td>Sweeteners</td>
<td>Add sweetness with significantly less energy (kJ) than sugar</td>
</tr>
</tbody>
</table>
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. Some food additives are manufactured while others are derived from foods including many of the thickeners (eg, starch) and colours (eg, the purple colour from grape skins – anthocyanins).

All new food additives are subject to a safety assessment before they are approved for use. Toxicological tests on animals are normally used to determine the amount of additive that is expected to be safe for humans. The acceptable daily intake (ADI) is a measure of the amount of a food additive in food or drinks that can be ingested daily over a lifetime without an appreciable health risk. ADIs are usually expressed in mg per kilogram of body weight per day. ADIs for humans are usually 100 times less than the maximum daily dose at which no effects are observed over the animal’s lifetime. The ADI is not a threshold value above which harmful effects will occur in humans and 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 most additives, are required to be listed on the food label. The ingredients are listed in descending order by weight. Usually the food additive name or class is listed, as well as a number (eg, ascorbic acid (300), food acids (260, 270)), although sometimes only the number is listed. 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. The New Zealand Food Safety Authority produces a booklet entitled Identifying Food Additives, which includes a list of additive names and numbers (NZFSA 2008a). To view this booklet, visit the NZFSA website at: http://www.nzfsa.govt.nz/consumers/chemicals-nutrients-additives-and-toxins/additives-booklet/index.htm.

Some food additives, such as enzymes and flavours, are not required to be specified by name or identified with code numbers, but they are required to be labelled by their class name. Although vitamins and minerals are not classified as additives under the Australia New Zealand Food Standards Code (FSANZ 2010), some do have a code number as they are also used as additives (eg, ascorbic acid is the same as vitamin C).

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. A meta-analysis of good-quality studies (ie, double-blind, placebo-controlled trials) shows that artificial food colours may promote hyperactivity in children diagnosed with hyperactivity syndromes (Schab and Trinh 2004). This finding suggests that for sensitive individuals, some colours may increase hyperactive tendencies.

Recently the UK Food Standards Agency commissioned a randomised, double-blinded, placebo-controlled cross-over trial to test whether intake of commonly used food additives (artificial colours and preservatives) affected childhood behaviour. The study found a small but inconsistent effect with two mixtures of food additives on hyperactivity in children aged three years and 8–9 years in the general population (Stevenson et al 2007). However, it was not possible to determine whether it was one or more of the artificial colours (sunset yellow, carmoisine, tartrazine, ponceau 4R, quinoline yellow and allura red) and/or the preservative (sodium benzoate) that had the effect (Stevenson et al 2007). In response to this study, UK food manufacturers are voluntarily removing the artificial food colours that were tested and are looking for alternatives to sodium benzoate. However, there is little scientific evidence to date to support any real benefit of this action (NZFSA, personal communication, August 2010).

The European Food Safety Authority’s panel on additives recently reviewed the safety of six food colour additives and consequently decreased the ADI for sunset yellow, ponceau red (4R) and quinoline yellow (European Food Safety Authority 2010). The panel found no causal link between the six colours investigated and possible behavioural effects, nor a causal link between five colours and intolerance reactions such irritations to the skin. Tartrazine could cause intolerance reactions in a small part of the population.

The Joint FAO/WHO Expert Committee on Food Additives, the international body that evaluates the safety of food additives, will review the evidence to support any changes to the ADIs of food colourings sunset yellow, ponceau red (4R) and quinoline yellow in June 2011. If there are significant changes, Food Standards Australia New Zealand (FSANZ) will be able to revise its current estimates of dietary exposure (NZFSA 2008b) to these additives before deciding if any changes related to additives in the Food Standards Code (FSANZ 2010) are required.

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 heart beat and difficulty breathing (particularly people with asthma) (NZFSA 2009f). Sulphites may cause asthma-like symptoms in people with asthma (NZFSA 2009a).
Recommendations

Food additives are subject to safety assessments before being approved for use. 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 foods with few or no additives is likely to have many nutritional benefits, including gaining higher levels of fibre and micronutrients, and reducing levels of sugar, fat and salt.

Useful resources and tools

Food Standards Australia New Zealand 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: http://www.foodstandards.govt.nz.

The New Zealand Food Safety Authority, as part of ensuring a safe and suitable food supply, monitors adherence to the Food Standards Code. For further information on the work of NZFSA (including food additives) visit: http://www.nzfsa.govt.nz.

12.7 Intense sweeteners

Summary

Eight 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).

There is some evidence that very high intakes of intense sweeteners may increase the risk of bladder cancer for humans.

There is no evidence that aspartame increases the risk of cancer.

Recommendations

Choosing a diet based on fewer refined foods with few or no additives is likely to have many nutritional benefits, including gaining higher levels of fibre and micronutrients, and reducing levels of sugar, fat and salt.

If consumed, drinks with intense sweeteners (ie, diet soft drinks) should be consumed infrequently, in small quantities (a glass or less), and with food rather than between meals.
Drink plenty of fluid each day, preferably water or low-fat milk.

**Background**

**Intense sweeteners**, previously referred to as artificial sweeteners, are a type of food additive (see section 12.6: Food additives). Intense sweeteners are regulated by Standard 1.3.1 of the Australia New Zealand Food Standards Code (FSANZ 2010). Eight intense sweeteners are permitted for use in the New Zealand food supply (see Table 48). Standard 1.3.1 includes permissions regarding the foods that can contain intense sweeteners and the amounts that can be added. Aspartame, sucralose, thaumatin and neotame are permitted to be added to the majority of processed foods and beverages at good manufacturing practice levels, provided they are added only in amounts necessary to replace sweetness normally provided by sugar, or as a flavour enhancer. However, in other foods (eg, soft drinks) the use of aspartame, sucralose and thaumatin is restricted. The use of acesulphame-K, cyclamates, saccharin and alitame is restricted in all foods.

**Table 48:** Intense sweeteners permitted for use in the New Zealand food supply

<table>
<thead>
<tr>
<th>Sweetener</th>
<th>Sweetness</th>
<th>Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acesulphame–K (950)</td>
<td>200</td>
<td>Table top sweetener, canned and other foods, drinks and confectionery</td>
</tr>
<tr>
<td>Alitame (956)</td>
<td>2000</td>
<td>Rarely used in foods</td>
</tr>
<tr>
<td>Aspartame (951)</td>
<td>200</td>
<td>Carbonated soft drinks, yoghurt and confectionery</td>
</tr>
<tr>
<td>Cyclamate (952)</td>
<td>30–50</td>
<td>Confectionery, foods and drinks</td>
</tr>
<tr>
<td>Neotame (961)</td>
<td>7000–1300</td>
<td>Canned fruit, drinks and confectionery</td>
</tr>
<tr>
<td>Saccharin (954)</td>
<td>300</td>
<td>Foods, drinks and confectionery</td>
</tr>
<tr>
<td>Sucralose (955)</td>
<td>600</td>
<td>Foods, drinks and confectionery</td>
</tr>
<tr>
<td>Thaumatin (957)</td>
<td>2000–3000</td>
<td>Marketed as Talin</td>
</tr>
</tbody>
</table>


Note:
1 Compared with sucrose, where sweetness = 1.

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, the international body that evaluates the safety of food additives (for more information on ADIs, see section 12.6: Food additives, page 174).

**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, although exposure to some intense sweeteners had increased since 1994 (trends for Australia only), mean exposure to all intense sweeteners was well below the ADI (see Table 49).
As a percentage of the ADI, cyclamate exposure was the highest. Cordials, fruit drinks and carbonated soft drinks were the major contributors of cyclamate, and consumption of these products was higher in New Zealand than Australia (FSANZ 2004). 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 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 soft drinks and low-joule fruit and vegetable juice products (FSANZ 2007).

Table 49: Estimated exposure to intense sweeteners in consumers, New Zealand 2002/03

| Sweetener     | ADI (mg/kg) | Mean exposure (mg/kg) | Exposure p95 | Exposure p95
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acesulphame-K</td>
<td>0–15</td>
<td>0.4</td>
<td>1.6</td>
<td></td>
</tr>
<tr>
<td>Alitame</td>
<td>0–1</td>
<td>NA²</td>
<td>NA²</td>
<td></td>
</tr>
<tr>
<td>Aspartame</td>
<td>0–40</td>
<td>1.7</td>
<td>5.4</td>
<td></td>
</tr>
<tr>
<td>Cyclamate</td>
<td>0–11</td>
<td>2.2</td>
<td>8.8</td>
<td></td>
</tr>
<tr>
<td>Neotame</td>
<td>0–2</td>
<td>NA²</td>
<td>NA²</td>
<td></td>
</tr>
<tr>
<td>Saccharin</td>
<td>0–5</td>
<td>0.3</td>
<td>1.2</td>
<td></td>
</tr>
<tr>
<td>Sucralose</td>
<td>0–15</td>
<td>0.8</td>
<td>2.3</td>
<td></td>
</tr>
<tr>
<td>Thaumatin</td>
<td>NS³</td>
<td>NA²</td>
<td>NA²</td>
<td></td>
</tr>
</tbody>
</table>

Source: FSANZ (2004); Whitehouse et al (2008)

Notes:
1  p95 is the 95th centile, meaning 95 percent of the population have intakes below this level. The 5 percent of the population with intakes above this level are referred to as high consumers.
2  NA = not available (not included in the study to estimate intake).
3  NS = not specified.

Health effects

Despite extensive safety testing and a rigorous process for setting the ADI, concerns about the safety of some intense sweeteners remain. 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 they contain phenylalanine on the food label.
Some intense sweeteners, such as saccharin and cyclamate, have been linked to cancer. A review of literature found that heavy use of intense sweeteners (> 1680 mg per day) may increase the risk of bladder cancer for humans (Weihrauch and Diehl 2004). In this study it was not possible to identify the exact agents that were responsible because many intense sweeteners are used in combination (Weihrauch and Diehl 2004). In New Zealand, mean intakes of five intense sweeteners (aspartame, cyclamate, saccharin, acesulphame-K and sucralose) are estimated to total 386 mg per day in those who consume foods or drinks with intense sweeteners (FSANZ 2004).

Although intakes of cyclamate at twice the ADI are unlikely to be harmful, the ADI is a recommended safety level. Therefore it is sensible to keep the intakes of children and young people below the ADI.

There is no evidence that aspartame increases the risk of cancer (Weihrauch and Diehl 2004). Due to lack of evidence, the potential carcinogenic risk of newer-generation intense sweeteners, such as acesulfame-K, sucralose, alitame and neotame, cannot be established yet (Weihrauch and Diehl 2004).

The main benefit of intense sweeteners is that they provide sweetness with little or no energy (kJ). While 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 cola) can be acidic, which can contribute to tooth erosion. It has also been suggested that intense sweeteners may increase the palatability of healthy foods, such as fruits, vegetables and wholegrain breads and cereals if added to them (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**

Choosing a diet based on fewer refined foods with few or no additives is likely to have many nutritional benefits, including gaining higher levels of fibre and micronutrients, and reducing levels of sugar, fat and salt.

If consumed, drinks with intense sweeteners (ie, diet soft drinks) should be consumed infrequently, in small quantities (a glass or less) and with food rather than between meals.

Drink plenty of fluid each day, preferably water or low-fat milk.
### 12.8 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.

The evidence from investigations into long-term adverse effects is less 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 body weight per day has been suggested as a cautious toxicological limit on which to base risk assessment for children, based on 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).

**Recommendations**

Children and young people should limit their intake of foods and drinks containing caffeine.

Pregnant and breastfeeding women should also limit their caffeine intake.

Energy drinks and energy shots are not recommended for children or young people.

Coffee and tea are not recommended for children (2–12 years).

If drinking tea and coffee, it is recommended young people (13–18 years) limit their intake to one to two cups per day.

If young people drink tea, they should avoid drinking it with meals as it can inhibit the absorption of some nutrients from the food, such as iron.

**Background**

In New Zealand, caffeine occurs naturally in coffee, tea, cocoa 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).

While a small amount of caffeine can increase alertness or ability to concentrate, it has a range of adverse effects. 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 (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).

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 body weight per day has been suggested as a cautious toxicological limit on which to base risk assessment for children, grounded on limited evidence (Thomson and Schiess 2010). While 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 body weight per day for adults, based on limited evidence of acute anxiety effects, has been suggested (Thomson and Schiess 2010).

**Recommended intake**
- Children and young people should limit their intake of foods and drinks containing caffeine.
- Pregnant and breastfeeding women should also limit their caffeine intake.

See Table 50 for examples of the caffeine content of drinks and foods.

**Children (2–12 years)**
- Coffee and tea are not recommended for children.
- Energy drinks and energy shots are not recommended for children.

**Young people (13–18 years)**
- If young people drink tea and coffee, it is recommended they limit their intake to one to two cups per day.
- If young people drink tea, they should avoid drinking it with meals as it can inhibit the absorption of some nutrients from the food, such as iron.
- Energy drinks and energy shots are not recommended for young people.

For more information, see section 4.4: Sources of fluid in the diet, pages 79 and 81.
**Current levels of intake**

New Zealand dietary exposure to caffeine has been estimated for seven population groups, including children (5–12 years) and young people (13–19 years) (Thomson 2009, cited in Thomson and Schiess 2010). Recent data on caffeine containing foods and beverages (Athar et al 2009) were combined with 24-hour diet recall information from the 1997 National Nutrition Survey and 2002 National Children’s Nutrition Survey. The analysis showed that 73 percent of children along with 79 percent of young people consumed caffeine in some form.

Because some children and young people had very high intakes, mean daily intakes were considerably higher (20 mg/day and 82 mg/day respectively) (see Table 50).

**Table 50:** Caffeine exposure estimates for New Zealand children and young people

<table>
<thead>
<tr>
<th>Estimated exposure (mg/day)</th>
<th>Children (5–12 years)</th>
<th>Young people (13–19 years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median</td>
<td>7</td>
<td>41</td>
</tr>
<tr>
<td>Mean 20 (0.6 mg/kg/day)</td>
<td>82 (1.2 mg/kg/day)</td>
<td></td>
</tr>
<tr>
<td>Range 1 &lt; 1–644</td>
<td>&lt; 1–2664</td>
<td></td>
</tr>
<tr>
<td>P5 1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>P95 2 74 (2.0 mg/kg/day)</td>
<td>294 (4.5 mg/kg/day)</td>
<td></td>
</tr>
</tbody>
</table>

Source: Thomson and Schiess (2010)

Notes:
1 P5 = 5th centile, representing low caffeine consumers.
2 P95 = 95th centile, representing high caffeine consumers.

**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 cola drinks, energy drinks and some dietary supplements.

As shown in Table 51, during childhood (5–12 years) 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, soft drinks and tea to particularly coffee consumption. Adults get most of their caffeine from coffee and tea (Nawrot et al 2003; Frary et al 2005).
Table 51: Contributions of caffeine-containing foods to caffeine dietary exposure for New Zealand children and young people

<table>
<thead>
<tr>
<th>Food</th>
<th>Percentage contribution</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Children (5–12 years)</td>
</tr>
<tr>
<td>Biscuits, cakes, pastries</td>
<td>11</td>
</tr>
<tr>
<td>Cereal</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Chocolate deserts</td>
<td>1</td>
</tr>
<tr>
<td>Chocolate confectionery</td>
<td>6</td>
</tr>
<tr>
<td>Cocoa and chocolate drinks</td>
<td>7</td>
</tr>
<tr>
<td>Coffee</td>
<td>10</td>
</tr>
<tr>
<td>Energy drinks</td>
<td>2</td>
</tr>
<tr>
<td>Soft drinks</td>
<td>30</td>
</tr>
<tr>
<td>Tea</td>
<td>32</td>
</tr>
</tbody>
</table>

Source: Thomson and Schiess (2010)

Note: Figures in bold represent those foods contributing 10 percent or more to total caffeine exposure.

Energy drinks and energy shots

Energy drinks only contribute a small amount of caffeine to the diet according to the data presented in Table 52. 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 (Thomson and Schiess 2010).

The only current 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- to 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 250–600 ml and contain 75–240 mg caffeine per retail unit. Energy shots range from 30–120 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 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. 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 52: Concentration of caffeine in a selection of New Zealand foods and beverages

<table>
<thead>
<tr>
<th>Food or beverage</th>
<th>Caffeine concentration (mg/100 g)</th>
<th>Serve/unit (g)</th>
<th>Caffeine concentration mg/serve</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bakery products</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biscuit, chocolate coated</td>
<td>8</td>
<td>1 biscuit/10.5</td>
<td>1</td>
</tr>
<tr>
<td>Large biscuit eg, 'Cookie Time original'</td>
<td>12</td>
<td>1 biscuit/92</td>
<td>11</td>
</tr>
<tr>
<td>Cake, chocolate, butter icing</td>
<td>3</td>
<td>1/8 cake/79</td>
<td>3</td>
</tr>
<tr>
<td><strong>Beverages, non alcoholic</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Milo, made with trim milk</td>
<td>T</td>
<td>1 cup/280</td>
<td>1</td>
</tr>
<tr>
<td>Chocolate, drinking, powder</td>
<td>51</td>
<td>1 tsp/2.5</td>
<td>1</td>
</tr>
<tr>
<td>Coffee, café latte, caffeinated</td>
<td>99</td>
<td>1 cup/272</td>
<td>269</td>
</tr>
<tr>
<td>Coffee, espresso, brewed</td>
<td>212</td>
<td>1 cup/272</td>
<td>577</td>
</tr>
<tr>
<td>Coffee, decaffeinated</td>
<td>160</td>
<td>1 tsp/1.8</td>
<td>3</td>
</tr>
<tr>
<td>Coffee, instant powder</td>
<td>3700</td>
<td>1 tsp/1.5</td>
<td>56</td>
</tr>
<tr>
<td>Energy drink eg, ‘V Drink’</td>
<td>28</td>
<td>1 cans/250</td>
<td>72</td>
</tr>
<tr>
<td>Soft drink eg, ‘Cola-Diet’</td>
<td>14</td>
<td>1 can/350</td>
<td>49</td>
</tr>
<tr>
<td>Soft drink eg, ‘Coca-Cola’</td>
<td>9</td>
<td>1 can/355</td>
<td>33</td>
</tr>
<tr>
<td>Tea, Indian, infused</td>
<td>22</td>
<td>1 bottle/500</td>
<td>46</td>
</tr>
<tr>
<td><strong>Chocolate confectionery</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chocolate bar, milk</td>
<td>20</td>
<td>1 small bar/50</td>
<td>10</td>
</tr>
</tbody>
</table>

Source: Adapted from Thomson and Schiess (2010)
## Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Acceptable daily intake (ADI)</strong></td>
<td>A measure of the amount of a specific substance (e.g., 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.</td>
</tr>
<tr>
<td><strong>Acceptable macronutrient distribution ranges (AMDR)</strong></td>
<td>An estimate of the range of intake for each macronutrient (expressed as percentage contribution to energy), which 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).</td>
</tr>
<tr>
<td><strong>Adequate intake (AI)</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Alpha (α)-linolenic acid (ALA)</strong></td>
<td>An omega-3 fatty acid with 18 carbon atoms. Found in flaxseed (also known as linseed) and 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.</td>
</tr>
<tr>
<td><strong>Anaemia</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Anaphylaxis</strong></td>
<td>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. Common triggers include food, stinging insects and medication.</td>
</tr>
<tr>
<td><strong>Anorexia nervosa</strong></td>
<td>A psychiatric disorder characterised by low body weight and body image distortion.</td>
</tr>
<tr>
<td><strong>Arachidonic acid</strong></td>
<td>An omega-6 fatty acid with 20 carbon atoms, found in egg yolk and meats (particularly organ meat).</td>
</tr>
<tr>
<td><strong>Artificial sweeteners</strong></td>
<td>See intense sweeteners.</td>
</tr>
<tr>
<td><strong>Australia New Zealand Food Standards Code</strong></td>
<td>A set of food labelling and composition standards for both New Zealand and Australia.</td>
</tr>
<tr>
<td><strong>Basal metabolic rate (BMR)</strong></td>
<td>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. Accounts for 40–70 percent of total energy expenditure.</td>
</tr>
</tbody>
</table>
Bioavailability: The degree to which a drug or nutrient (e.g., 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 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, buckwheat, quinoa and sorghum. The intact cereal (also called grain) is made up of the endosperm, bran and germ. Cereals can be ground, cracked, milled or flaked. Cereal foods include breads, breakfast cereals, rice and pasta.

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.
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
</table>
| 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. They are intended for ingestion as a pill, capsule, tablet or liquid and do not usually resemble conventional foods. |
| 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 100g).                                             |
| Energy-dense foods                        | Foods with more than about 1000 kJ per 100g.                                                |
| Energy drink                              | A beverage containing added caffeine, vitamins and other bioactive substance.                |
| Energy shot                               | A small-volume liquid product containing added caffeine, vitamins and other bioactive substances. |
| Essential amino acids                     | See indispensable amino acids.                                                               |
| 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 pregnant and lactating women, the EER is taken to include the needs associated with the deposition of tissues 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 (e.g., 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.

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.

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.

Kai
Food.

Kai moana
Seafood.

Kapa haka
Māori performing arts.

Kina
Sea-eggs
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ki-o-Rahi</td>
<td>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.</td>
</tr>
<tr>
<td>Kōura</td>
<td>Crayfish.</td>
</tr>
<tr>
<td>Kūmara</td>
<td>Sweet potato.</td>
</tr>
<tr>
<td>Lacto-vegetarian</td>
<td>A person who eats only plant foods, milk and milk products.</td>
</tr>
<tr>
<td>Lacto-ovo vegetarian</td>
<td>A person who eats only plant foods, milk, milk products and eggs.</td>
</tr>
<tr>
<td>Legumes</td>
<td>Fruit or seed (produced in a pod) from plants in Fabaceae family. Common examples include peas, beans, lentils and peanuts.</td>
</tr>
<tr>
<td>Linoleic acid</td>
<td>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).</td>
</tr>
<tr>
<td>Long-chain polyunsaturated fatty acids</td>
<td>Polyunsaturated fatty acids with 20 or more carbon atoms. Include eicosapentaenoic acid (EPA, 20:5n-3) and docosahexaenoic acid (DHA, 22:6n-3). Occur in some foods and can be made from precursors.</td>
</tr>
<tr>
<td>Mahikai</td>
<td>The gathering of food.</td>
</tr>
<tr>
<td>Mana</td>
<td>Prestige.</td>
</tr>
<tr>
<td>Meta-analysis</td>
<td>An analysis that combines the results of similar studies (eg, randomised controlled trials) to produce a summary effect size.</td>
</tr>
<tr>
<td>Metabolic equivalents (METs)</td>
<td>Multiples of resting metabolic rate. One MET is equivalent to rest. METs are used to classify the intensity of physical activity (low intensity &lt; 3 METs; moderate intensity 3–5.9 METs; vigorous intensity ≥6 METs).</td>
</tr>
<tr>
<td>Metabolism</td>
<td>The digestion, absorption, transport of food and disposal of waste products.</td>
</tr>
<tr>
<td>Monounsaturated fatty acid</td>
<td>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.</td>
</tr>
<tr>
<td>Neural tube defects</td>
<td>Group of birth defects where the brain, spinal cord or covering of these organs has not developed properly.</td>
</tr>
<tr>
<td>Niacin equivalents</td>
<td>The nicotinic acid, nicotinamide and contribution of niacin obtained by conversion from dietary l-tryptophan.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Non-starch polysaccharides (NSP)</td>
<td>Component of dietary fibre. Found in plant foods.</td>
</tr>
<tr>
<td>Nutrient-dense</td>
<td>Foods with lots of beneficial nutrients per gram (eg, vegetables, fruit and whole grains).</td>
</tr>
<tr>
<td>Nutrient reference values (NRVs)</td>
<td>A set of recommendations for intakes of nutrients.</td>
</tr>
<tr>
<td>Obesity</td>
<td>Excess weight for height to the extent that health may be affected.</td>
</tr>
<tr>
<td>Omega-3 fatty acid</td>
<td>A polyunsaturated fatty acid that is found in oily fish, vegetable oils, nuts and seeds. Some omega-3 fatty acids are indispensable (essential). Common omega-3 fatty acids in the body are alpha (α)-linolenic acid, eicosapentaenoic acid and docosahexaenoic acid.</td>
</tr>
<tr>
<td>Omega-6 fatty acid</td>
<td>A polyunsaturated fatty acid that is found in vegetable oils, nuts and seeds. Some omega-3 fatty acids are essential. Common omega-6 fatty acids in the body are linoleic acid and arachidonic acid.</td>
</tr>
<tr>
<td>Omnivore</td>
<td>A person who eats both animal and plant foods.</td>
</tr>
<tr>
<td>Physical activity</td>
<td>All movement produced by skeletal muscle that increases energy expenditure, whether it is incidental, occupational or recreational.</td>
</tr>
<tr>
<td>Physical activity level (PAL)</td>
<td>Estimation of energy intake.</td>
</tr>
<tr>
<td>Phytates</td>
<td>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.</td>
</tr>
<tr>
<td>Polymerisation</td>
<td>A chemical process that combines several small molecules (monomers) to form a large molecule (polymer).</td>
</tr>
<tr>
<td>Polyunsaturated fatty acid</td>
<td>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.</td>
</tr>
<tr>
<td>Portion size</td>
<td>The amount of food typically eaten during one eating occasion.</td>
</tr>
<tr>
<td>Prevalence</td>
<td>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.</td>
</tr>
<tr>
<td>Protective factor</td>
<td>A factor associated with reduced risk of developing a condition. Compare with risk factor.</td>
</tr>
<tr>
<td>Rangatahi</td>
<td>Youth, the younger generation.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Recommended dietary intake (RDI)</td>
<td>The average daily dietary intake level that is sufficient to meet the needs of nearly all (97–98 percent) healthy individuals in a particular life stage and gender group.</td>
</tr>
<tr>
<td>Resistant starch</td>
<td>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.</td>
</tr>
<tr>
<td>Retinol equivalent (RE)</td>
<td>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.</td>
</tr>
<tr>
<td>Ribonucleic acid (RNA)</td>
<td>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.</td>
</tr>
<tr>
<td>Rickets</td>
<td>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.</td>
</tr>
<tr>
<td>Risk factor</td>
<td>A factor associated with increased risk of developing a condition. Compare with protective factor.</td>
</tr>
<tr>
<td>Saturated fatty acid</td>
<td>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).</td>
</tr>
<tr>
<td>Sedentary behaviours</td>
<td>Distinct class of activity characterised by low energy expenditure. Examples include sitting, watching television and doing other screen-based activities, such as video games and computing.</td>
</tr>
<tr>
<td>Socioeconomic status</td>
<td>Social position, as measured by one or more socioeconomic indicators such as income, occupation and education.</td>
</tr>
<tr>
<td>Sodium</td>
<td>Essential nutrient required in very small amounts. To convert sodium to salt, multiply by 2.5.</td>
</tr>
<tr>
<td>Sugar</td>
<td>A sweet ingredient used in some foods (ie, white, brown, raw sugar).</td>
</tr>
<tr>
<td>Sugars</td>
<td>Chemical classification used to describe mono and disaccharides in food.</td>
</tr>
<tr>
<td>Sugary drinks</td>
<td>All drinks containing sugars, including fruit juice, powdered drinks, cordial (eg, blackcurrant, lemon barley), carbonated or fizzy drinks (eg, lemonade, cola, orange), energy drinks, sports drinks, flavoured waters and iced teas.</td>
</tr>
<tr>
<td>Term</td>
<td>Definition</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Suggested dietary target (SDT)</td>
<td>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).</td>
</tr>
<tr>
<td>Tāngata whenua</td>
<td>People of the land.</td>
</tr>
<tr>
<td>Tapu</td>
<td>Sacred.</td>
</tr>
<tr>
<td>Tamariki</td>
<td>Children.</td>
</tr>
<tr>
<td>Total Diet Survey (TDS)</td>
<td>A periodic survey measuring contaminants and selected nutrients in some commonly eaten New Zealand foods.</td>
</tr>
<tr>
<td>Trans fatty acids</td>
<td>Unsaturated fatty acids with one or more double bonds in the <em>trans</em> 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.</td>
</tr>
<tr>
<td>Triglycerides (or triacylglycerols)</td>
<td>The most common type of fat in the diet. Consist of one glycerol and three fatty acids.</td>
</tr>
<tr>
<td>Type 1 diabetes mellitus</td>
<td>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.</td>
</tr>
<tr>
<td>Type 2 diabetes mellitus</td>
<td>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, tablets and/or insulin injections. Sometimes referred to as adult-onset diabetes mellitus or non-insulin dependent diabetes mellitus.</td>
</tr>
<tr>
<td>Upper level of intake (UL)</td>
<td>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.</td>
</tr>
<tr>
<td>Vegan</td>
<td>A person who eats only plant foods and nothing of animal origin.</td>
</tr>
<tr>
<td>Vegetarian</td>
<td>A person who does not eat lean meat, poultry or fish, but does eat foods derived from animals (eg, milk, eggs). See also <em>lacto-vegetarian</em> and <em>lacto-ovo-vegetarian</em>.</td>
</tr>
<tr>
<td>Waka ama</td>
<td>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).</td>
</tr>
<tr>
<td>Whānau</td>
<td>Extended family, family group. A familiar term of address to a number of people.</td>
</tr>
<tr>
<td>Whole grain</td>
<td>The intact grain (cereal) seed or kernel, including the bran, germ and endosperm. If the kernel has been cracked, crushed, ground, milled or flaked, it 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).</td>
</tr>
<tr>
<td>Wholemeal</td>
<td>A product containing milled grain, with the proportion of endosperm, germ and bran similar to the intact grain.</td>
</tr>
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## Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
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<tr>
<td>ADI</td>
<td>Acceptable daily intake</td>
</tr>
<tr>
<td>AI</td>
<td>Adequate intake</td>
</tr>
<tr>
<td>AMDR</td>
<td>Acceptable macronutrient distribution range</td>
</tr>
<tr>
<td>BMR</td>
<td>Basal metabolic rate</td>
</tr>
<tr>
<td>EAR</td>
<td>Estimated average requirement</td>
</tr>
<tr>
<td>EER</td>
<td>Estimated energy requirement</td>
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<tr>
<td>g</td>
<td>gram/s</td>
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<td>GI</td>
<td>Glycaemic index</td>
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<td>IgE</td>
<td>Immunoglobulin E</td>
</tr>
<tr>
<td>kJ</td>
<td>kilojoule/s</td>
</tr>
<tr>
<td>L</td>
<td>litre/s</td>
</tr>
<tr>
<td>µg</td>
<td>microgram/s</td>
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<td>milligram/s</td>
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<td>MJ</td>
<td>Megajoule/s</td>
</tr>
<tr>
<td>nmol</td>
<td>nanomole/s</td>
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<td>NRV</td>
<td>Nutrient reference value</td>
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<td>NSP</td>
<td>Non-starch polysaccharide</td>
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<td>PAL</td>
<td>Physical activity level</td>
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<td>RDI</td>
<td>Recommended dietary intake</td>
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<td>RE</td>
<td>Retinol equivalent</td>
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<tr>
<td>SD</td>
<td>Standard deviation</td>
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<tr>
<td>SDT</td>
<td>Suggested dietary target</td>
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<tr>
<td>UL</td>
<td>Upper level of intake</td>
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<td>UV</td>
<td>Ultraviolet</td>
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<td>WHO</td>
<td>World Health Organization</td>
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Appendix 1: New Zealand Policy Context

Statement of Intent 2010–2013

The Statement of Intent sets out the Ministry of Health’s strategic direction for 2010 to 2013 (Minister of Health 2010). The Government’s overall goal is a growing, sustainable economy providing security, prosperity and opportunities for all New Zealanders. Contributing to the achievement of this goal are the two health and disability system outcomes:

- New Zealanders living 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. good health and independence are protected and promoted
2. a more unified and improved health and disability system
3. people receive better health and disability services
4. the health and disability system and services are trusted and can be used with confidence.

A key action under Outcome 1 of the Ministry’s work programme is ‘Maintaining up-to-date nutrition and physical activity guidelines and health education resources’.

To access the Statement of Intent, visit the Ministry’s website at: http://www.moh.govt.nz/moh.nsf/indexmh/soi1013.

Child Health Strategy

The Ministry of Health’s Child Health Strategy (Ministry of Health 1998) was developed through extensive consultation with stakeholders from the child health community in New Zealand. The Strategy reflects the child health community’s views about what is needed to improve health outcomes for children/tamariki and their families and whānau in New Zealand.

To access the Strategy, visit the Ministry’s website at: http://www.moh.govt.nz/moh.nsf/wpg_Index/Publications-Child+Health+Strategy.

Youth Health: A guide to action

Youth Health: A guide to action (Ministry of Health 2002b) sets out the goals, objectives and specific actions identified to improve the health of New Zealand’s young people aged 12–24 years. It was developed to guide the health sector and other sectors that have an impact on the wellbeing of young people. The guide to action shares the positive youth development approach of the Youth Development Strategy Aotearoa, which aims to shift the way that young people have traditionally been viewed – from a
problem to be solved, to being valued partners participating in decisions that affect them.

To access the guide to action, visit the Ministry’s website at:

**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 2009a) stand alongside the *New Zealand Guidelines for Weight Management in Adults* (Ministry of Health and Clinical Trials Research Unit 2009b). 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:

**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:

**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
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.


**'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

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 on the Ministry’s website at: http://www.moh.govt.nz/pacific.
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 foetal 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, national policies and action plans** to improve diets and increase physical activity that are sustainable, 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 with 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.
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: http://www.dietandcancerreport.org.

**Global Strategy on Prevention and Control of Non-communicable Diseases and Action Plan**

As part of the 2008–2013 Action Plan for the Global Strategy on 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:
Appendix 3: Nutrient Reference Values

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. A PAL of 1.75 or above is considered compatible with good health in adults (NHMRC 2006), although it is unclear whether this value applies to children and young people. 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 to 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 A.1: Estimated energy requirements (EERs) for children and young people – males

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight (kg)</th>
<th>Height (m)</th>
<th>BMR (MJ/d)</th>
<th>PAL 1.2</th>
<th>PAL 1.4</th>
<th>PAL 1.6</th>
<th>PAL 1.8</th>
<th>PAL 2.0</th>
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</table>

Source: NHMRC (2006)

Notes:
1. Reference weights and heights are from the CDC Growth Charts for the United States (Kuczmarski et al 2000).
2. BMR is estimated using Schofield (1985) equations for weight, height and age group (3–10 and 10–18 years).
Table A.2: Estimated energy requirements (EERs) for children and young people – females

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Weight (kg)</th>
<th>Height (m)</th>
<th>BMR (MJ/d)</th>
<th>PAL 1.2</th>
<th>PAL 1.4</th>
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<td>7.2</td>
<td>8.4</td>
<td>9.5</td>
<td>10.7</td>
<td>11.9</td>
<td>13.1</td>
</tr>
<tr>
<td>17</td>
<td>55.1</td>
<td>1.63</td>
<td>5.9</td>
<td>7.2</td>
<td>8.4</td>
<td>9.6</td>
<td>10.8</td>
<td>12.0</td>
<td>13.2</td>
</tr>
<tr>
<td>18</td>
<td>56.2</td>
<td>1.63</td>
<td>6.0</td>
<td>7.3</td>
<td>8.5</td>
<td>9.7</td>
<td>10.9</td>
<td>12.1</td>
<td>13.3</td>
</tr>
</tbody>
</table>

Source: NHMRC (2006)

Notes:
1. Reference weights and heights are from the CDC Growth Charts for the United States (Kuczmarski et al 2000).
2. BMR is estimated using Schofield (1985) equations for weight, height and age group (3–10 and 10–18 years).
Table A.3: Nutrient reference values for children and young people, 2–3 years

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>EAR</th>
<th>RDI</th>
<th>AI</th>
<th>UL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein (g)</td>
<td>12 (0.92 g/kg)</td>
<td>14 (1.08 g/kg)</td>
<td>–</td>
<td>NP&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>Total fat (g)</td>
<td>No EAR, RDI or AI recommendations for total fat</td>
<td>–</td>
<td>–</td>
<td>NP&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td>Linoleic acid (g)</td>
<td>–</td>
<td>–</td>
<td>5.0</td>
<td>NP</td>
</tr>
<tr>
<td>α-linolenic acid (g)</td>
<td>–</td>
<td>–</td>
<td>0.5</td>
<td>NP</td>
</tr>
<tr>
<td>LC omega-3 (mg)</td>
<td>–</td>
<td>–</td>
<td>40</td>
<td>3000</td>
</tr>
<tr>
<td>Carbohydrate (g)</td>
<td>No EAR, RDI or AI recommendations for carbohydrate</td>
<td>–</td>
<td>–</td>
<td>NP&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td>Dietary fibre (g)</td>
<td>–</td>
<td>–</td>
<td>14</td>
<td>NP</td>
</tr>
<tr>
<td>Water (fluids) (L)</td>
<td>–</td>
<td>–</td>
<td>1.0</td>
<td>NP</td>
</tr>
<tr>
<td>Vitamin A (µg RE)</td>
<td>210</td>
<td>300</td>
<td>–</td>
<td>600&lt;sup&gt;4&lt;/sup&gt;</td>
</tr>
<tr>
<td>Thiamin (mg)</td>
<td>0.4</td>
<td>0.5</td>
<td>–</td>
<td>NP</td>
</tr>
<tr>
<td>Riboflavin (mg)</td>
<td>0.4</td>
<td>0.5</td>
<td>–</td>
<td>NP</td>
</tr>
<tr>
<td>Niacin (mg NE)</td>
<td>5</td>
<td>6</td>
<td>–</td>
<td>10&lt;sup&gt;5&lt;/sup&gt;</td>
</tr>
<tr>
<td>Vitamin B6 (mg)</td>
<td>0.4</td>
<td>0.5</td>
<td>–</td>
<td>15&lt;sup&gt;6&lt;/sup&gt;</td>
</tr>
<tr>
<td>Vitamin B12 (µg)</td>
<td>0.7</td>
<td>0.9</td>
<td>–</td>
<td>NP</td>
</tr>
<tr>
<td>Folate (µg DFE)</td>
<td>120</td>
<td>150</td>
<td>–</td>
<td>300&lt;sup&gt;7&lt;/sup&gt;</td>
</tr>
<tr>
<td>Pantothenic acid (mg)</td>
<td>–</td>
<td>–</td>
<td>3.5</td>
<td>NP</td>
</tr>
<tr>
<td>Biotin (µg)</td>
<td>–</td>
<td>–</td>
<td>8</td>
<td>NP</td>
</tr>
<tr>
<td>Choline (mg)</td>
<td>–</td>
<td>–</td>
<td>200</td>
<td>1000</td>
</tr>
<tr>
<td>Vitamin C (mg)</td>
<td>25</td>
<td>35</td>
<td>–</td>
<td>NP&lt;sup&gt;8&lt;/sup&gt;</td>
</tr>
<tr>
<td>Vitamin D (µg)</td>
<td>–</td>
<td>–</td>
<td>5</td>
<td>80</td>
</tr>
<tr>
<td>Vitamin E (mg α-TE)</td>
<td>–</td>
<td>–</td>
<td>5</td>
<td>70</td>
</tr>
<tr>
<td>Vitamin K (µg)</td>
<td>–</td>
<td>–</td>
<td>25</td>
<td>NP</td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>360</td>
<td>500</td>
<td>–</td>
<td>2500</td>
</tr>
<tr>
<td>Chromium (µg)</td>
<td>–</td>
<td>–</td>
<td>11</td>
<td>NP</td>
</tr>
<tr>
<td>Copper (mg)</td>
<td>–</td>
<td>–</td>
<td>0.7</td>
<td>1</td>
</tr>
<tr>
<td>Fluoride (mg)</td>
<td>–</td>
<td>–</td>
<td>0.7</td>
<td>1.3</td>
</tr>
<tr>
<td>Iodine (µg)</td>
<td>65</td>
<td>90</td>
<td>–</td>
<td>200</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>4</td>
<td>9</td>
<td>–</td>
<td>20</td>
</tr>
<tr>
<td>Magnesium (mg)</td>
<td>65</td>
<td>80</td>
<td>–</td>
<td>65&lt;sup&gt;9&lt;/sup&gt;</td>
</tr>
<tr>
<td>Manganese (mg)</td>
<td>–</td>
<td>–</td>
<td>2</td>
<td>NP</td>
</tr>
<tr>
<td>Molybdenum (µg)</td>
<td>13</td>
<td>17</td>
<td>–</td>
<td>300</td>
</tr>
<tr>
<td>Phosphorus (mg)</td>
<td>380</td>
<td>460</td>
<td>–</td>
<td>3000</td>
</tr>
<tr>
<td>Potassium (mg)</td>
<td>–</td>
<td>–</td>
<td>2000</td>
<td>NP</td>
</tr>
<tr>
<td>Selenium (µg)</td>
<td>20</td>
<td>25</td>
<td>–</td>
<td>90</td>
</tr>
<tr>
<td>Sodium (mg)</td>
<td>–</td>
<td>–</td>
<td>200–400</td>
<td>1000</td>
</tr>
<tr>
<td>Zinc (mg)</td>
<td>2.5</td>
<td>3.0</td>
<td>–</td>
<td>7</td>
</tr>
</tbody>
</table>


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 n-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 A.4: Nutrient reference values for children and young people, 4–8 years

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>EAR</th>
<th>RDI</th>
<th>AI</th>
<th>UL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein (g)</td>
<td>16 (0.73 g/kg)</td>
<td>20 (0.91 g/kg)</td>
<td>–</td>
<td>NP(^1)</td>
</tr>
<tr>
<td>Total fat (g)</td>
<td>–</td>
<td>–</td>
<td>8.0</td>
<td>NP</td>
</tr>
<tr>
<td>Linoleic acid (g)</td>
<td>–</td>
<td>–</td>
<td>0.8</td>
<td>NP</td>
</tr>
<tr>
<td>α-linolenic acid (g)</td>
<td>–</td>
<td>–</td>
<td>3000</td>
<td></td>
</tr>
<tr>
<td>LC n-3 (mg)</td>
<td>–</td>
<td>–</td>
<td>55</td>
<td></td>
</tr>
<tr>
<td>Carbohydrate (g)</td>
<td>–</td>
<td>–</td>
<td>18</td>
<td>NP</td>
</tr>
<tr>
<td>Dietary fibre (g)</td>
<td>–</td>
<td>–</td>
<td>1.2</td>
<td>NP</td>
</tr>
<tr>
<td>Vitamin A (µg RE)</td>
<td>275</td>
<td>400</td>
<td>–</td>
<td>900(^4)</td>
</tr>
<tr>
<td>Thiamin (mg)</td>
<td>0.5</td>
<td>0.6</td>
<td>–</td>
<td>NP</td>
</tr>
<tr>
<td>Riboflavin (mg)</td>
<td>0.5</td>
<td>0.6</td>
<td>–</td>
<td>NP</td>
</tr>
<tr>
<td>Niacin (mg NE)</td>
<td>6</td>
<td>8</td>
<td>–</td>
<td>15(^5)</td>
</tr>
<tr>
<td>Vitamin B6 (mg)</td>
<td>0.5</td>
<td>0.6</td>
<td>–</td>
<td>20(^6)</td>
</tr>
<tr>
<td>Vitamin B12 (µg)</td>
<td>1.0</td>
<td>1.2</td>
<td>–</td>
<td>NP</td>
</tr>
<tr>
<td>Folate (µg DFE)</td>
<td>160</td>
<td>200</td>
<td>–</td>
<td>400(^7)</td>
</tr>
<tr>
<td>Pantothenic acid (mg)</td>
<td>–</td>
<td>–</td>
<td>4</td>
<td>NP</td>
</tr>
<tr>
<td>Biotin (µg)</td>
<td>–</td>
<td>–</td>
<td>12</td>
<td>NP</td>
</tr>
<tr>
<td>Choline (mg)</td>
<td>–</td>
<td>–</td>
<td>250</td>
<td>1000</td>
</tr>
<tr>
<td>Vitamin C (mg)</td>
<td>25</td>
<td>35</td>
<td>–</td>
<td>NP(^8)</td>
</tr>
<tr>
<td>Vitamin D (µg)</td>
<td>–</td>
<td>–</td>
<td>5</td>
<td>80</td>
</tr>
<tr>
<td>Vitamin E (mg α-TE)</td>
<td>–</td>
<td>–</td>
<td>6</td>
<td>100</td>
</tr>
<tr>
<td>Vitamin K (µg)</td>
<td>–</td>
<td>–</td>
<td>35</td>
<td>NP</td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>520</td>
<td>700</td>
<td>–</td>
<td>2500</td>
</tr>
<tr>
<td>Chromium (µg)</td>
<td>–</td>
<td>–</td>
<td>15</td>
<td>NP</td>
</tr>
<tr>
<td>Copper (mg)</td>
<td>–</td>
<td>–</td>
<td>1.0</td>
<td>3</td>
</tr>
<tr>
<td>Fluoride (mg)</td>
<td>–</td>
<td>–</td>
<td>1.0</td>
<td>2.2</td>
</tr>
<tr>
<td>Iodine (µg)</td>
<td>65</td>
<td>90</td>
<td>–</td>
<td>300</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>4</td>
<td>10</td>
<td>–</td>
<td>40</td>
</tr>
<tr>
<td>Magnesium (mg)</td>
<td>110</td>
<td>130</td>
<td>–</td>
<td>110(^9)</td>
</tr>
<tr>
<td>Manganese (mg)</td>
<td>–</td>
<td>–</td>
<td>2.5</td>
<td>NP</td>
</tr>
<tr>
<td>Molybdenum (µg)</td>
<td>17</td>
<td>22</td>
<td>–</td>
<td>360</td>
</tr>
<tr>
<td>Phosphorus (mg)</td>
<td>405</td>
<td>500</td>
<td>–</td>
<td>3000</td>
</tr>
<tr>
<td>Potassium (mg)</td>
<td>–</td>
<td>–</td>
<td>2300</td>
<td>NP</td>
</tr>
<tr>
<td>Selenium (µg)</td>
<td>25</td>
<td>30</td>
<td>–</td>
<td>150</td>
</tr>
<tr>
<td>Sodium (mg)</td>
<td>–</td>
<td>–</td>
<td>300–600</td>
<td>1400</td>
</tr>
<tr>
<td>Zinc (mg)</td>
<td>3</td>
<td>4</td>
<td>–</td>
<td>12</td>
</tr>
</tbody>
</table>


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 n-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 A.5: Nutrient reference values for children and young people, 9–13 years

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>EAR Male</th>
<th>EAR Female</th>
<th>RDI Male</th>
<th>RDI Female</th>
<th>AI Male</th>
<th>AI Female</th>
<th>UL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein (g)</td>
<td>31 (0.78 g/kg)</td>
<td>24 (0.61 g/kg)</td>
<td>40 (0.94 g/kg)</td>
<td>35 (0.87 g/kg)</td>
<td>–</td>
<td>–</td>
<td>NP³</td>
</tr>
<tr>
<td>Total fat (g)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>NP²</td>
</tr>
<tr>
<td>Linoleic acid (g)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>10</td>
<td>8</td>
<td>NP²</td>
</tr>
<tr>
<td>α-linolenic acid (g)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>1.0</td>
<td>0.8</td>
<td>NP²</td>
</tr>
<tr>
<td>LC n-3 (mg)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>70</td>
<td>70</td>
<td>3000</td>
</tr>
<tr>
<td>Carbohydrate (g)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>24</td>
<td>20</td>
<td>NP²</td>
</tr>
<tr>
<td>Dietary fibre (g)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>1.6</td>
<td>1.4</td>
<td>NP²</td>
</tr>
<tr>
<td>Water (fluids) (L)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>1.6</td>
<td>1.4</td>
<td>NP²</td>
</tr>
<tr>
<td>Vitamin A (µg RE)</td>
<td>445</td>
<td>420</td>
<td>600</td>
<td>600</td>
<td>–</td>
<td>–</td>
<td>1700⁴</td>
</tr>
<tr>
<td>Thiamin (mg)</td>
<td>0.7</td>
<td>0.7</td>
<td>0.9</td>
<td>0.9</td>
<td>–</td>
<td>–</td>
<td>NP²</td>
</tr>
<tr>
<td>Riboflavin (mg)</td>
<td>0.8</td>
<td>0.8</td>
<td>0.9</td>
<td>0.9</td>
<td>–</td>
<td>–</td>
<td>NP²</td>
</tr>
<tr>
<td>Niacin (mg NE)</td>
<td>9</td>
<td>9</td>
<td>12</td>
<td>12</td>
<td>–</td>
<td>–</td>
<td>20⁵</td>
</tr>
<tr>
<td>Vitamin B6 (mg)</td>
<td>0.8</td>
<td>0.8</td>
<td>1.0</td>
<td>1.0</td>
<td>–</td>
<td>–</td>
<td>30⁵</td>
</tr>
<tr>
<td>Vitamin B12 (µg)</td>
<td>1.5</td>
<td>1.5</td>
<td>1.8</td>
<td>1.8</td>
<td>–</td>
<td>–</td>
<td>NP²</td>
</tr>
<tr>
<td>Folate (µg DFE)</td>
<td>250</td>
<td>250</td>
<td>300</td>
<td>300</td>
<td>–</td>
<td>–</td>
<td>600⁷</td>
</tr>
<tr>
<td>Pantothenic acid (mg)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>5</td>
<td>4</td>
<td>NP²</td>
</tr>
<tr>
<td>Biotin (µg)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>20</td>
<td>20</td>
<td>NP²</td>
</tr>
<tr>
<td>Choline (mg)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>375</td>
<td>375</td>
<td>1000</td>
</tr>
<tr>
<td>Vitamin C (mg)</td>
<td>28</td>
<td>28</td>
<td>40</td>
<td>40</td>
<td>–</td>
<td>–</td>
<td>NP³</td>
</tr>
<tr>
<td>Vitamin D (µg)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>5</td>
<td>5</td>
<td>80</td>
</tr>
<tr>
<td>Vitamin E (mg α-TE)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>9</td>
<td>8</td>
<td>180</td>
</tr>
<tr>
<td>Vitamin K (µg)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>45</td>
<td>45</td>
<td>NP²</td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>9–11 years 800</td>
<td>9–11 years 1000</td>
<td>12–13 years 1050</td>
<td>12–13 years 1300</td>
<td>–</td>
<td>–</td>
<td>2500</td>
</tr>
<tr>
<td>Chromium (µg)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>25</td>
<td>21</td>
<td>NP²</td>
</tr>
<tr>
<td>Copper (mg)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>1.3</td>
<td>1.1</td>
<td>5</td>
</tr>
<tr>
<td>Fluoride (mg)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>2</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>Iodine (µg)</td>
<td>75</td>
<td>75</td>
<td>120</td>
<td>120</td>
<td>–</td>
<td>–</td>
<td>600</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>6</td>
<td>6</td>
<td>8</td>
<td>8</td>
<td>–</td>
<td>–</td>
<td>40</td>
</tr>
<tr>
<td>Magnesium (mg)</td>
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<td>200</td>
<td>240</td>
<td>240</td>
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<td>–</td>
<td>NP³</td>
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<td>–</td>
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<tr>
<td>Molybdenum (µg)</td>
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<td>26</td>
<td>34</td>
<td>34</td>
<td>–</td>
<td>–</td>
<td>1100</td>
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<tr>
<td>Phosphorus (mg)</td>
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<td>1055</td>
<td>1250</td>
<td>1250</td>
<td>–</td>
<td>–</td>
<td>4000</td>
</tr>
<tr>
<td>Potassium (mg)</td>
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<td>–</td>
<td>–</td>
<td>–</td>
<td>3000</td>
<td>2500</td>
<td>NP²</td>
</tr>
<tr>
<td>Selenium (µg)</td>
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<td>40</td>
<td>50</td>
<td>50</td>
<td>–</td>
<td>–</td>
<td>280</td>
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<tr>
<td>Sodium (mg)</td>
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<td>–</td>
<td>–</td>
<td>400–800</td>
<td>400–800</td>
<td>2000</td>
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<td>Zinc (mg)</td>
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<td>6</td>
<td>6</td>
<td>–</td>
<td>–</td>
<td>25</td>
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</table>

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 n-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 niacinamide 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>
<thead>
<tr>
<th>Nutrient</th>
<th>EAR (Male)</th>
<th>EAR (Female)</th>
<th>RDI (Male)</th>
<th>RDI (Female)</th>
<th>AI (Male)</th>
<th>AI (Female)</th>
<th>UL</th>
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<tr>
<td>Protein (g)</td>
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<td>35 (0.62 g/kg)</td>
<td>65 (0.99 g/kg)</td>
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<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>NP</td>
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<td>–</td>
<td>–</td>
<td>12</td>
<td>8</td>
<td>NP</td>
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<td>–</td>
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<td>0.8</td>
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<td>40</td>
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<td>–</td>
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<td>–</td>
<td>10</td>
<td>8</td>
<td>250</td>
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<tr>
<td>Vitamin K (µg)</td>
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<td>–</td>
<td>–</td>
<td>55</td>
<td>55</td>
<td>NP</td>
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<td>Calcium (mg)</td>
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<td>–</td>
<td>2500</td>
</tr>
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<td>Chromium (µg)</td>
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<td>25</td>
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<td>Copper (mg)</td>
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<td>1.5</td>
<td>1.1</td>
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<td>–</td>
<td>–</td>
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<td>900</td>
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<td>3.5</td>
<td>3.0</td>
<td>NP</td>
</tr>
<tr>
<td>Molybdenum (µg)</td>
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<td>43</td>
<td>43</td>
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<td>–</td>
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<tr>
<td>Phosphorus (mg)</td>
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<td>1250</td>
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</tr>
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<td>–</td>
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<td>Sodium (mg)</td>
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<td>460–920</td>
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<td>7</td>
<td>–</td>
<td>–</td>
<td>35</td>
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</table>

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 n-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 A.7: Nutrient reference values for pregnancy

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>EAR 14–18 years</th>
<th>EAR 19–50 years</th>
<th>RDI 14–18 years</th>
<th>RDI 19–50 years</th>
<th>AI 14–18 years</th>
<th>AI 19–50 years</th>
<th>UL 14–18 years</th>
<th>UL 19–50 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein (g)</td>
<td>47 (0.82 g/kg)</td>
<td>49 (0.80 g/kg)</td>
<td>58 (1.02 g/kg)</td>
<td>60 (1.00 g/kg)</td>
<td>–</td>
<td>–</td>
<td>NP1</td>
<td>NP1</td>
</tr>
<tr>
<td>Total fat (g)</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NP2</td>
<td>NP2</td>
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<td>Linoleic acid (g)</td>
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<td>–</td>
<td>–</td>
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<td>NP</td>
</tr>
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<td>α-linolenic acid (g)</td>
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<td>–</td>
<td>–</td>
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<td>1.0</td>
<td>NP</td>
<td>NP</td>
</tr>
<tr>
<td>LC n-3 (mg)</td>
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<td>–</td>
<td>–</td>
<td>–</td>
<td>110</td>
<td>115</td>
<td>3000</td>
<td>3000</td>
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<tr>
<td>Carbohydrate (g)</td>
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<td>–</td>
<td>–</td>
<td>25</td>
<td>28</td>
<td>NP</td>
<td>NP</td>
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<td>Dietary fibre (g)</td>
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<td>–</td>
<td>1.8</td>
<td>2.3</td>
<td>2800</td>
<td>3000</td>
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<tr>
<td>Water (fluids) (L)</td>
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<td>–</td>
<td>–</td>
<td>1.8</td>
<td>2.3</td>
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<td>NP</td>
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<tr>
<td>Vitamin A (µg RE)</td>
<td>530</td>
<td>550</td>
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<td>800</td>
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<td>800</td>
<td>2800</td>
<td>3000</td>
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<tr>
<td>Thiamin (mg)</td>
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<td>NP</td>
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<td>Riboflavin (mg)</td>
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<td>Niacin (mg NE)</td>
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<td>18</td>
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<td>1.9</td>
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<tr>
<td>Folate (µg DFE)</td>
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<td>600</td>
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<td>100</td>
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<td>10000</td>
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<td>Pantotenolic acid (mg)</td>
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<td>–</td>
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<td>5</td>
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<td>NP</td>
</tr>
<tr>
<td>Biotin (µg)</td>
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<td>–</td>
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<td>30</td>
<td>NP</td>
<td>NP</td>
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<tr>
<td>Choline (mg)</td>
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<td>4.4</td>
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<tr>
<td>Vitamin D (µg)</td>
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<td>–</td>
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<td>–</td>
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<tr>
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<td>–</td>
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<td>30</td>
<td>NP</td>
<td>NP</td>
</tr>
<tr>
<td>Copper (mg)</td>
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<td>–</td>
<td>–</td>
<td>–</td>
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<td>1.3</td>
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<td>10</td>
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<td>–</td>
<td>3</td>
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<td>220</td>
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<td>900</td>
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<tr>
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<td>45</td>
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<td>2000</td>
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<td>Magnesium (mg)</td>
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<td>3500</td>
<td>3500</td>
<td>3500</td>
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</table>

| (19-30yr)              |                 |                 |                 |                 |                |                |                |                |
| Calcium (mg)           | 1050            | 840             | 1300            | 1000            | 2500           | 2500           | 2500           | 2500           |
| Iron (mg)              | 23              | 22              | 27              | 27              | 45             | 45             | 1700           | 2000           |
| Magnesium (mg)         | 335             | 290             | 400             | 350             | 3500           | 3500           | 3500           | 3500           |

| (19-30yr)              |                 |                 |                 |                 |                |                |                |                |
| Magnesium (mg)         | 335             | 290             | 400             | 350             | 3500           | 3500           | 3500           | 3500           |

| Manganese (mg)         | –               | –               | –               | –               | 5              | 5              | NP             | NP             |
| Molybdenum (µg)        | 40              | 40              | 50              | 50              | 1700           | 1700           | 4000           | 4000           |
| Phosphorus (mg)        | 1055            | 580             | 1250            | 1000            | 4000           | 4000           | 3500           | 3500           |
| Potassium (mg)         | –               | –               | –               | –               | 2800           | 2800           | NP             | NP             |
| Selenium (µg)          | 55              | 55              | 65              | 65              | 400            | 400            | 400            | 400            |
| Sodium (mg)            | –               | –               | –               | –               | 460–920        | 460–920        | 2300           | 2300           |
| Zinc (mg)              | 8.5             | 9               | 10              | 11              | 35             | 40             | 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 n-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 A.8: Nutrient reference values for lactation

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>EAR 14–18 years</th>
<th>RDI 14–18 years</th>
<th>RDI 19–50 years</th>
<th>AI 14–18 years</th>
<th>AI 19–50 years</th>
<th>UL 14–18 years</th>
<th>UL 19–50 years</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Protein (g)</strong></td>
<td>51 (0.90 g/kg)</td>
<td>54 (0.88 g/kg)</td>
<td>63 (1.11 g/kg)</td>
<td>67 (1.10 g/kg)</td>
<td>–</td>
<td>–</td>
<td>NP¹</td>
</tr>
<tr>
<td><strong>Total fat (g)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NP²</td>
</tr>
<tr>
<td>Linoleic acid (g)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>12</td>
<td>12</td>
<td>–</td>
<td>NP</td>
</tr>
<tr>
<td>α-linolenic acid (g)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>1.2</td>
<td>1.2</td>
<td>–</td>
<td>NP</td>
</tr>
<tr>
<td>LC n-3 (mg)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>140</td>
<td>145</td>
<td>3000</td>
<td>3000</td>
</tr>
<tr>
<td>Carbohydrate (g)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>NP³</td>
</tr>
<tr>
<td>Dietary fibre (g)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>27</td>
<td>30</td>
<td>–</td>
<td>NP</td>
</tr>
<tr>
<td>Water (fluids) (L)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>2.3</td>
<td>2.6</td>
<td>–</td>
<td>NP</td>
</tr>
<tr>
<td>Vitamin A (µg RE)</td>
<td>780</td>
<td>800</td>
<td>1100</td>
<td>1100</td>
<td>–</td>
<td>–</td>
<td>2800³, 3000⁴</td>
</tr>
<tr>
<td>Thiamin (mg)</td>
<td>1.2</td>
<td>1.2</td>
<td>1.4</td>
<td>1.4</td>
<td>–</td>
<td>–</td>
<td>NP</td>
</tr>
<tr>
<td>Riboflavin (mg)</td>
<td>1.3</td>
<td>1.3</td>
<td>1.6</td>
<td>1.6</td>
<td>–</td>
<td>–</td>
<td>NP</td>
</tr>
<tr>
<td>Niacin (mg NE)</td>
<td>13</td>
<td>13</td>
<td>17</td>
<td>17</td>
<td>–</td>
<td>–</td>
<td>30, 35³</td>
</tr>
<tr>
<td>Vitamin B6 (mg)</td>
<td>1.7</td>
<td>1.7</td>
<td>2.0</td>
<td>2.0</td>
<td>–</td>
<td>–</td>
<td>40, 50⁶</td>
</tr>
<tr>
<td>Vitamin B12 (mg)</td>
<td>2.4</td>
<td>2.4</td>
<td>2.8</td>
<td>2.8</td>
<td>–</td>
<td>–</td>
<td>NP, NP</td>
</tr>
<tr>
<td>Folate (µg DFE)</td>
<td>450</td>
<td>450</td>
<td>500</td>
<td>500</td>
<td>–</td>
<td>–</td>
<td>800³, 1000⁷</td>
</tr>
<tr>
<td>Pantothenic acid (mg)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>6</td>
<td>6</td>
<td>–</td>
<td>NP</td>
</tr>
<tr>
<td>Biotin (µg)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>35</td>
<td>35</td>
<td>–</td>
<td>NP</td>
</tr>
<tr>
<td>Choline (mg)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>525</td>
<td>550</td>
<td>3000</td>
<td>3500</td>
</tr>
<tr>
<td>Vitamin C (mg)</td>
<td>58</td>
<td>60</td>
<td>80</td>
<td>85</td>
<td>–</td>
<td>–</td>
<td>NP, NP³</td>
</tr>
<tr>
<td>Vitamin D (µg)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>5</td>
<td>5</td>
<td>–</td>
<td>80</td>
</tr>
<tr>
<td>Vitamin E (mg α-TE)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>12</td>
<td>11</td>
<td>–</td>
<td>250, 300</td>
</tr>
<tr>
<td>Vitamin K (µg)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>60</td>
<td>60</td>
<td>–</td>
<td>NP</td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>1050</td>
<td>840</td>
<td>1300</td>
<td>1000</td>
<td>–</td>
<td>–</td>
<td>2500, 2500</td>
</tr>
<tr>
<td>Chromium (µg)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>45</td>
<td>45</td>
<td>–</td>
<td>NP, NP</td>
</tr>
<tr>
<td>Copper (mg)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>1.4</td>
<td>1.5</td>
<td>–</td>
<td>8, 10</td>
</tr>
<tr>
<td>Fluoride (mg)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>3</td>
<td>3</td>
<td>–</td>
<td>10, 10</td>
</tr>
<tr>
<td>Iodine (µg)</td>
<td>190</td>
<td>190</td>
<td>270</td>
<td>270</td>
<td>–</td>
<td>–</td>
<td>900, 1100</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>7</td>
<td>6.5</td>
<td>10</td>
<td>9</td>
<td>–</td>
<td>–</td>
<td>45, 45</td>
</tr>
<tr>
<td>Magnesium (mg)</td>
<td>300</td>
<td>255</td>
<td>360</td>
<td>310</td>
<td>–</td>
<td>–</td>
<td>350, 350³</td>
</tr>
<tr>
<td>Manganese (mg)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>5</td>
<td>5</td>
<td>–</td>
<td>NP, NP</td>
</tr>
<tr>
<td>Molybdenum (µg)</td>
<td>35</td>
<td>36</td>
<td>50</td>
<td>50</td>
<td>–</td>
<td>–</td>
<td>1700, 2000</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>1055</td>
<td>580</td>
<td>1250</td>
<td>1000</td>
<td>–</td>
<td>–</td>
<td>4000, 4000</td>
</tr>
<tr>
<td>Potassium (mg)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>2800</td>
<td>2800</td>
<td>–</td>
<td>NP, NP</td>
</tr>
<tr>
<td>Selenium (µg)</td>
<td>65</td>
<td>65</td>
<td>75</td>
<td>75</td>
<td>–</td>
<td>–</td>
<td>400, 400</td>
</tr>
<tr>
<td>Sodium (mg)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>460–920</td>
<td>460–920</td>
<td>–</td>
<td>2300, 2300</td>
</tr>
<tr>
<td>Zinc (mg)</td>
<td>9</td>
<td>10</td>
<td>11</td>
<td>12</td>
<td>–</td>
<td>–</td>
<td>35, 40</td>
</tr>
</tbody>
</table>

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 n-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 A.1: Height, weight and head circumference, girls 1–5 years
Figure A.2: Height, weight and head circumference, boys 1–5 years

Measure length until age 2, measure height after age 2. A child's height is usually slightly less than their length.

Data Recording

<table>
<thead>
<tr>
<th>Measurement 1</th>
<th>Recording Date</th>
<th>Weight</th>
<th>Head Circumference</th>
<th>Length/Height</th>
<th>Location</th>
<th>Health worker name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement 2</td>
<td>Recording Date</td>
<td>Weight</td>
<td>Head Circumference</td>
<td>Length/Height</td>
<td>Location</td>
<td>Health worker name</td>
</tr>
<tr>
<td>Measurement 3</td>
<td>Recording Date</td>
<td>Weight</td>
<td>Head Circumference</td>
<td>Length/Height</td>
<td>Location</td>
<td>Health worker name</td>
</tr>
<tr>
<td>Measurement 4</td>
<td>Recording Date</td>
<td>Weight</td>
<td>Head Circumference</td>
<td>Length/Height</td>
<td>Location</td>
<td>Health worker name</td>
</tr>
<tr>
<td>Measurement 5</td>
<td>Recording Date</td>
<td>Weight</td>
<td>Head Circumference</td>
<td>Length/Height</td>
<td>Location</td>
<td>Health worker name</td>
</tr>
<tr>
<td>Measurement 6</td>
<td>Recording Date</td>
<td>Weight</td>
<td>Head Circumference</td>
<td>Length/Height</td>
<td>Location</td>
<td>Health worker name</td>
</tr>
<tr>
<td>Measurement 7</td>
<td>Recording Date</td>
<td>Weight</td>
<td>Head Circumference</td>
<td>Length/Height</td>
<td>Location</td>
<td>Health worker name</td>
</tr>
<tr>
<td>Measurement 8</td>
<td>Recording Date</td>
<td>Weight</td>
<td>Head Circumference</td>
<td>Length/Height</td>
<td>Location</td>
<td>Health worker name</td>
</tr>
<tr>
<td>Measurement 9</td>
<td>Recording Date</td>
<td>Weight</td>
<td>Head Circumference</td>
<td>Length/Height</td>
<td>Location</td>
<td>Health worker name</td>
</tr>
<tr>
<td>Measurement 10</td>
<td>Recording Date</td>
<td>Weight</td>
<td>Head Circumference</td>
<td>Length/Height</td>
<td>Location</td>
<td>Health worker name</td>
</tr>
</tbody>
</table>
**Figure A.3:** 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 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 A.9–A.12) 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. Children and young people who are more physically active will also have increased energy requirements.

After the sample meal plans, Table A.13 provides a breakdown of the specific nutrients that each of the plans provides.
Plan for three-year-old

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 A.9: Sample three-day meal plan for three-year-old girl

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Breakfast</strong></td>
<td><strong>Breakfast</strong></td>
<td><strong>Breakfast</strong></td>
</tr>
<tr>
<td>• Weetbix: 2</td>
<td>• Porridge with raisins: ½ cup</td>
<td>• Weetbix: 1</td>
</tr>
<tr>
<td>• Trim milk: 125 ml</td>
<td>• Banana: ½</td>
<td>• Trim milk: 125 ml</td>
</tr>
<tr>
<td>• Banana: ½</td>
<td>• Trim milk: 125 ml</td>
<td>• Wholemeal toast: 1 slice</td>
</tr>
<tr>
<td>• Yoghurt: 2 tbsp</td>
<td>• Tomato: 2 slices</td>
<td>• Peanut butter: 1 tsp</td>
</tr>
<tr>
<td>• Water: 125 ml</td>
<td>• Trim milk: 125 ml</td>
<td>• Water: 125 ml</td>
</tr>
<tr>
<td><strong>Mid-morning snack</strong></td>
<td><strong>Mid-morning snack</strong></td>
<td><strong>Mid-morning snack</strong></td>
</tr>
<tr>
<td>• Mandarin: 1</td>
<td>• Water crackers: 4</td>
<td>• Blueberry muffin: 1 mini (4x4cm)</td>
</tr>
<tr>
<td>• Fruit biscuit: 1</td>
<td>• Cheese: 2 cubes</td>
<td>• Kiwifruit: 1</td>
</tr>
<tr>
<td>• Trim milk: 125 ml</td>
<td>• Tomato: 2 slices</td>
<td>• Water: 125 ml</td>
</tr>
<tr>
<td><strong>Lunch</strong></td>
<td><strong>Lunch</strong></td>
<td><strong>Lunch</strong></td>
</tr>
<tr>
<td>• Wholemeal bread: 2 slices</td>
<td>• Wholemeal roll: 1</td>
<td>• Wholemeal bread: 2 slices</td>
</tr>
<tr>
<td>• Margarine: 1 tsp</td>
<td>• Margarine: 1 tsp</td>
<td>• Margarine: 1 tsp</td>
</tr>
<tr>
<td>• Baked beans: ½ cup</td>
<td>• Pumpkin soup: ½ cup</td>
<td>• Boiled egg: 1</td>
</tr>
<tr>
<td>• Smoothie: 125 ml</td>
<td>• Apple: ½</td>
<td>• Cheese: 2 slices</td>
</tr>
<tr>
<td><strong>Mid-afternoon snack</strong></td>
<td><strong>Mid-afternoon snack</strong></td>
<td><strong>Mid-afternoon snack</strong></td>
</tr>
<tr>
<td>• Pear: ½</td>
<td>• Apple: ½</td>
<td>• Wholemeal bread: 1 slice</td>
</tr>
<tr>
<td>• Rice crackers: 3 plain</td>
<td>• Plain biscuit: 2</td>
<td>• Margarine: ½ tsp</td>
</tr>
<tr>
<td>• Hummus: 2 tbsp</td>
<td>• Water: 125 ml</td>
<td>• Cottage cheese: 2 tsp</td>
</tr>
<tr>
<td>• Water: 125 ml</td>
<td><strong>Dinner</strong></td>
<td>• Tomato: 4 slices</td>
</tr>
<tr>
<td><strong>Dinner</strong></td>
<td><strong>Dinner</strong></td>
<td>• Mandarin: 1</td>
</tr>
<tr>
<td>• Mince: 60 g</td>
<td>• Chicken: 60 g</td>
<td>• Water: 125 ml</td>
</tr>
<tr>
<td>• Pasta shapes: ½ cup</td>
<td>• Kūmara: 1 small</td>
<td><strong>Extras</strong></td>
</tr>
<tr>
<td>• Broccoli: ½ cup</td>
<td>• Mixed vegetables: ½ cup</td>
<td><strong>Extras</strong></td>
</tr>
<tr>
<td>• Trim milk: 125 ml</td>
<td>• Water: 125 ml</td>
<td>• Fresh fruit salad: ½ cup</td>
</tr>
<tr>
<td><strong>Extras</strong></td>
<td><strong>Extras</strong></td>
<td>• Yoghurt: 4 tbsp</td>
</tr>
<tr>
<td>• Rice pudding: ½ cup</td>
<td><strong>Extras</strong></td>
<td><strong>Extras</strong></td>
</tr>
<tr>
<td>• Apricots in juice: ½ cup</td>
<td>• Frozen yoghurt: small scoop</td>
<td><strong>Extras</strong></td>
</tr>
</tbody>
</table>

Notes: tbsp = tablespoon, tsp = teaspoon
Plan for six-year-old

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 A.10: Sample three-day meal plan for six-year-old girl

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Breakfast</strong></td>
<td><strong>Breakfast</strong></td>
<td><strong>Breakfast</strong></td>
</tr>
<tr>
<td>· Muesli: ¼ cup</td>
<td>· Weetbix: 2</td>
<td>· Porridge with raisins: ¾ cup</td>
</tr>
<tr>
<td>· Milk: 125 ml</td>
<td>· Milk: 125 ml</td>
<td>· Banana: ½</td>
</tr>
<tr>
<td>· Peaches in juice: ¼ cup</td>
<td>· Banana: ½</td>
<td>· Trim milk: 125 ml</td>
</tr>
<tr>
<td>· Wholemeal toast: 1 slice</td>
<td>· Wholemeal toast: 1 slice</td>
<td></td>
</tr>
<tr>
<td>· Peanut butter: 1 tsp</td>
<td>· Margarine: 1 tsp</td>
<td></td>
</tr>
<tr>
<td>· Water: 150 ml</td>
<td>· Jam: 1 tsp</td>
<td></td>
</tr>
<tr>
<td></td>
<td>· Water: 150 ml</td>
<td></td>
</tr>
<tr>
<td><strong>Mid-morning snack</strong></td>
<td><strong>Mid-morning snack</strong></td>
<td><strong>Mid-morning snack</strong></td>
</tr>
<tr>
<td>· Mandarin: 1</td>
<td>· Kiwifruit: 1</td>
<td>· Plum: 1</td>
</tr>
<tr>
<td>· Fruit bread: 1 slice</td>
<td>· Bran muffin: 1 small (4x6cm)</td>
<td>· Yoghurt: 1 pottle</td>
</tr>
<tr>
<td>· Margarine: 1 tsp</td>
<td>· Water: 150 ml</td>
<td>· Water: 150 ml</td>
</tr>
<tr>
<td><strong>Lunch</strong></td>
<td><strong>Lunch</strong></td>
<td><strong>Lunch</strong></td>
</tr>
<tr>
<td>· Wholemeal bread: 2 slices</td>
<td>· Wholemeal bread: 2 slices</td>
<td>· Mixed grain roll: 1</td>
</tr>
<tr>
<td>· Margarine: 2 tsp</td>
<td>· Margarine: 1 tsp</td>
<td>· Margarine: 1 tsp</td>
</tr>
<tr>
<td>· Lean corned beef: 2 slices</td>
<td>· Boiled egg: 1</td>
<td>· Tinned tuna or salmon: 50 g</td>
</tr>
<tr>
<td>· Tomato: 4 slices</td>
<td>· Tomato: 1</td>
<td>· Beetroot: 2 slices</td>
</tr>
<tr>
<td>· Lettuce: 2 leaves</td>
<td>· Apple: 1</td>
<td>· Grated carrot: 2 tbsp</td>
</tr>
<tr>
<td>· Banana: 1</td>
<td>· Water: 150 ml</td>
<td>· Lettuce: 1 leaf</td>
</tr>
<tr>
<td>· Water: 150 ml</td>
<td></td>
<td>· Water: 150 ml</td>
</tr>
<tr>
<td><strong>Mid-afternoon snack</strong></td>
<td><strong>Mid-afternoon snack</strong></td>
<td><strong>Mid-afternoon snack</strong></td>
</tr>
<tr>
<td>· Crispbread: 2</td>
<td>· Raw nuts and seeds: 2 tbsp</td>
<td>· Wholemeal bread: 1 slice</td>
</tr>
<tr>
<td>· Cottage cheese: 2 tbsp</td>
<td>· Smoothie: 150 ml</td>
<td>· Cheese: 2 slices</td>
</tr>
<tr>
<td>· Tomato: 2 slices</td>
<td></td>
<td>· Marmite: ½ tsp</td>
</tr>
<tr>
<td>· Trim milk: 125 ml</td>
<td></td>
<td>· Trim milk: 150 ml</td>
</tr>
<tr>
<td><strong>Dinner</strong></td>
<td><strong>Dinner</strong></td>
<td><strong>Dinner</strong></td>
</tr>
<tr>
<td>· Grilled fish fillet: 1 small</td>
<td>· Bolognese sauce: ½ cup</td>
<td>· Chicken: 80 g</td>
</tr>
<tr>
<td>· Potato: 1 small</td>
<td>· Spaghetti: ½ cup</td>
<td>· Kūmara: ½</td>
</tr>
<tr>
<td>· Green beans: ¼ cup</td>
<td>· Peas: ¼ cup</td>
<td>· Broccoli: ¼ cup</td>
</tr>
<tr>
<td>· Sweetcorn: ½ cob</td>
<td>· Carrots: ¼ cup</td>
<td>· Mixed vegetables: ¼ cup</td>
</tr>
<tr>
<td>· Water: 150 ml</td>
<td>· Water: 125 ml</td>
<td>· Water: 150 ml</td>
</tr>
<tr>
<td><strong>Extras</strong></td>
<td><strong>Extras</strong></td>
<td><strong>Extras</strong></td>
</tr>
<tr>
<td>· Fresh fruit salad: ½ cup</td>
<td>· Peaches in juice: ¼ cup</td>
<td>· Apple crumble: ½ cup</td>
</tr>
<tr>
<td>· Yoghurt: ½ pottle</td>
<td>· Custard: ½ cup</td>
<td>· Frozen yoghurt: small scoop</td>
</tr>
</tbody>
</table>

Notes: tbsp = tablespoon, tsp = teaspoon
Plan for 11-year-old

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 A.11: Sample three-day meal plan for 11-year-old girl

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Breakfast</strong></td>
<td><strong>Breakfast</strong></td>
<td><strong>Breakfast</strong></td>
</tr>
<tr>
<td>Muesli: 1/3 cup</td>
<td>Wheat biscuits: 2</td>
<td>Light &amp; Tasty cereal: 3/4 cup</td>
</tr>
<tr>
<td>Trim milk: 125 ml</td>
<td>Trim milk: 125 ml</td>
<td>Trim milk: 125 ml</td>
</tr>
<tr>
<td>Banana: ½</td>
<td>Pears in juice: ½ cup</td>
<td>Banana: 1</td>
</tr>
<tr>
<td>Wholemeal toast: 1 slice</td>
<td>Wholemeal toast: 1 slice</td>
<td>Wholemeal toast: 1 slice</td>
</tr>
<tr>
<td>Peanut butter: 2 tsp</td>
<td>Margarine: 1 tsp</td>
<td>Margarine: 2 tsp</td>
</tr>
<tr>
<td>Water: 200 ml</td>
<td>Marmite: 1 tsp</td>
<td>Water: 200 ml</td>
</tr>
<tr>
<td></td>
<td>Water: 200 ml</td>
<td></td>
</tr>
<tr>
<td><strong>Mid-morning snack</strong></td>
<td><strong>Mid-morning snack</strong></td>
<td><strong>Mid-morning snack</strong></td>
</tr>
<tr>
<td>Apple: 1</td>
<td>Mandarin: 1</td>
<td>Plum: 1</td>
</tr>
<tr>
<td>Bran muffin: 1 medium (6x7.5cm)</td>
<td>Fruit bread: 1 slice</td>
<td>Wholemeal crackers: 4</td>
</tr>
<tr>
<td>Water: 200 ml</td>
<td>Margarine: 1 tsp</td>
<td>Peanut butter: 4 tsp</td>
</tr>
<tr>
<td></td>
<td>Water: 200 ml</td>
<td>Water: 200 ml</td>
</tr>
<tr>
<td><strong>Lunch</strong></td>
<td><strong>Lunch</strong></td>
<td><strong>Lunch</strong></td>
</tr>
<tr>
<td>Wholemeal pita pocket: 1</td>
<td>Wholemeal bread: 2 slices</td>
<td>Bagel: 1</td>
</tr>
<tr>
<td>Avocado: ¼</td>
<td>Margarine: 1 tsp</td>
<td>Mayonnaise: 1 tsp</td>
</tr>
<tr>
<td>Refried kidney beans: 60 g</td>
<td>Chicken: 60 g</td>
<td>Tuna: 60 g</td>
</tr>
<tr>
<td>Lettuce: 2 leaves</td>
<td>Coleslaw: 1/3 cup</td>
<td>Lettuce: 2 leaves</td>
</tr>
<tr>
<td>Tomato: 4 slices</td>
<td>Mayonnaise: 1 tsp</td>
<td>Tomato: 4 slices</td>
</tr>
<tr>
<td>Yoghurt: 1 pottle</td>
<td>Bananas: 1</td>
<td>Yoghurt: 150 g</td>
</tr>
<tr>
<td>Water: 200 ml</td>
<td>Water: 200 ml</td>
<td>Water: 200 ml</td>
</tr>
<tr>
<td><strong>Mid-afternoon snack</strong></td>
<td><strong>Mid-afternoon snack</strong></td>
<td><strong>Mid-afternoon snack</strong></td>
</tr>
<tr>
<td>Rice crackers: 5</td>
<td>Wholemeal crispbread: 4</td>
<td>Fruit smoothie: 200 ml</td>
</tr>
<tr>
<td>Hummus: 2 tbsp</td>
<td>Cheese: 2 slice</td>
<td>Raw almonds: 15</td>
</tr>
<tr>
<td>Carrot: ½</td>
<td>Feijoas: 2</td>
<td>Kiwifruit: 1</td>
</tr>
<tr>
<td>Trim milk: 200 ml</td>
<td>Water: 200 ml</td>
<td>Water: 200 ml</td>
</tr>
<tr>
<td><strong>Dinner</strong></td>
<td><strong>Dinner</strong></td>
<td><strong>Dinner</strong></td>
</tr>
<tr>
<td>Grilled fish fillet: 1</td>
<td>Chilli con carne: ¾ cup</td>
<td>Frittata with potato, onion, capsicum and feta: 1 slice</td>
</tr>
<tr>
<td>Kūmara: 1</td>
<td>Rice: ¾ cup</td>
<td>Coleslaw or salad: 1/3 cup</td>
</tr>
<tr>
<td>Broccoli: ½ cup</td>
<td>Peas: ½ cup</td>
<td>Mayonnaise: 1 tsp</td>
</tr>
<tr>
<td>Sweetcorn: ½ cup</td>
<td>Carrots: ½ cup</td>
<td>Water: 200 ml</td>
</tr>
<tr>
<td>Water: 200 ml</td>
<td>Water: 200 ml</td>
<td></td>
</tr>
<tr>
<td><strong>Extras</strong></td>
<td><strong>Extras</strong></td>
<td><strong>Extras</strong></td>
</tr>
<tr>
<td>Apple crumble: ½ cup</td>
<td>Fresh fruit salad: ½ cup</td>
<td>Frozen yoghurt: 2 scoops</td>
</tr>
<tr>
<td>Yoghurt: 4 tbsp</td>
<td>Trim milk: 200 ml</td>
<td>Plain popcorn: 1 cup</td>
</tr>
<tr>
<td></td>
<td>Drinking chocolate: 2 tsp</td>
<td></td>
</tr>
</tbody>
</table>
Notes: tbsp = tablespoon, tsp = teaspoon

## Plan for 16-year-old

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 slightly higher (EER 11.8 MJ).

### Table A.12: Sample three-day meal plan for 16-year-old girl

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Day 2</th>
<th>Day 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Breakfast</strong></td>
<td><strong>Breakfast</strong></td>
<td><strong>Breakfast</strong></td>
</tr>
<tr>
<td>Wholegrain toast: 3 slices</td>
<td>Weetbix: 3</td>
<td>Natural muesli: ½ cup</td>
</tr>
<tr>
<td>Poached egg: 1</td>
<td>Trim milk: 125 ml</td>
<td>Trim milk: 125 ml</td>
</tr>
<tr>
<td>Margarine: 2 tsp</td>
<td>Peaches in juice: ½ cup</td>
<td>Yoghurt: 75 ml</td>
</tr>
<tr>
<td>Marmite: 2 tsp</td>
<td>Currant toast: 2 slices</td>
<td>Banana: ½</td>
</tr>
<tr>
<td>Trim milk: 250 ml</td>
<td>Margarine: 2 tsp</td>
<td>Wholegrain toast: 1 slice</td>
</tr>
<tr>
<td><strong>Mid-morning snack</strong></td>
<td><strong>Mid-morning snack</strong></td>
<td>Peanut butter: 2 tsp</td>
</tr>
<tr>
<td>Apple: 1</td>
<td>Kiwifruit: 2</td>
<td></td>
</tr>
<tr>
<td>Bran muffin: 1 medium (6x7.5cm)</td>
<td>Wholegrain crackers: 4</td>
<td></td>
</tr>
<tr>
<td>Water: 250 ml</td>
<td>Cheese: 20 g</td>
<td></td>
</tr>
<tr>
<td><strong>Lunch</strong></td>
<td><strong>Lunch</strong></td>
<td><strong>Lunch</strong></td>
</tr>
<tr>
<td>Wholemeal pita pocket: 1</td>
<td>Wholegrain bread: 2 slices</td>
<td>Tortilla: 1</td>
</tr>
<tr>
<td>Canned salmon or tuna: 60 g</td>
<td>Margarine: 1 tsp</td>
<td>Chicken: 60 g</td>
</tr>
<tr>
<td>Coleslaw: ½ cup</td>
<td>Baked beans: 1 cup</td>
<td>Avocado: ¼</td>
</tr>
<tr>
<td>Mayonnaise: 1 tsp</td>
<td>Apple: 1</td>
<td>Tomato: 4 slices</td>
</tr>
<tr>
<td>Yoghurt: 1 pottle</td>
<td>Plain popcorn: 1 cup</td>
<td>Lettuce: 2 leaves</td>
</tr>
<tr>
<td>Orange: 1</td>
<td>Water: 250 ml</td>
<td>Yoghurt: 1 pottle</td>
</tr>
<tr>
<td>Water: 250 ml</td>
<td></td>
<td>Water: 250 ml</td>
</tr>
<tr>
<td><strong>Mid-afternoon snack</strong></td>
<td><strong>Mid-afternoon snack</strong></td>
<td></td>
</tr>
<tr>
<td>Smoothie: 250 ml</td>
<td>Kiwifruit: 2</td>
<td></td>
</tr>
<tr>
<td>Ryvita crackers: 4</td>
<td>Date scone: 1 medium</td>
<td></td>
</tr>
<tr>
<td>Cottage cheese: 2 tbsp</td>
<td>Margarine: 1 tsp</td>
<td></td>
</tr>
<tr>
<td>Hummus: 2 tbsp</td>
<td>Trim milk: 250 ml</td>
<td></td>
</tr>
<tr>
<td>Water: 250 ml</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Dinner</strong></td>
<td><strong>Dinner</strong></td>
<td><strong>Dinner</strong></td>
</tr>
<tr>
<td>Beef and vegetable stir fry: ¾ cup</td>
<td>Grilled fish fillet: 1</td>
<td>Tomato pasta sauce with chicken: 1 cup</td>
</tr>
<tr>
<td>Extra vegetables: 1 cup</td>
<td>Potato chips baked: 15</td>
<td>Pasta shapes: 1 cup</td>
</tr>
<tr>
<td>Noodles or rice: 1 cup</td>
<td>Tomato sauce: 1 tbsp</td>
<td>Broccoli: ½ cup</td>
</tr>
<tr>
<td>Water: 250 ml</td>
<td>Salad: 1 cup</td>
<td>Carrot: ½ cup</td>
</tr>
<tr>
<td></td>
<td>Vinaigrette: 1 tsp</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Water: 250 ml</td>
<td></td>
</tr>
</tbody>
</table>
### Extras
- Frozen yoghurt: 2 scoops
- Plain popcorn: 1 cup
- Drinking chocolate: 2 tsp
- Fruit finger biscuit: 2
- Custard: ½ cup
- Pears in juice: ½ cup
- Raw nuts and seeds: 20 g

Notes: tbsp = tablespoon, tsp = teaspoon

### Table A.13: Nutritional analysis\(^1\) of three-day meal plans, average per day

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>3-year-old girl</th>
<th>6-year-old girl</th>
<th>11-year-old girl</th>
<th>16-year-old girl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water (L)</td>
<td>1.3</td>
<td>1.6</td>
<td>2.1</td>
<td>2.4</td>
</tr>
<tr>
<td>Energy (kJ)</td>
<td>5257</td>
<td>6047</td>
<td>8003</td>
<td>9505</td>
</tr>
<tr>
<td>Protein (g)</td>
<td>59 (19% TE)</td>
<td>71 (20% TE)</td>
<td>88 (18% TE)</td>
<td>110 (19% TE)</td>
</tr>
<tr>
<td>Carbohydrate (g)</td>
<td>177 (56% TE)</td>
<td>199 (55% TE)</td>
<td>269 (56% TE)</td>
<td>298 (53% TE)</td>
</tr>
<tr>
<td>Fibre(^2) (g)</td>
<td>22</td>
<td>22</td>
<td>37</td>
<td>42</td>
</tr>
<tr>
<td>Total fat (g)</td>
<td>36 (25% TE)</td>
<td>42 (25% TE)</td>
<td>55 (25% TE)</td>
<td>72 (28% TE)</td>
</tr>
<tr>
<td>Saturated fat (g)</td>
<td>11</td>
<td>12</td>
<td>15</td>
<td>21</td>
</tr>
<tr>
<td>Vitamin A (µg RE)</td>
<td>593</td>
<td>928</td>
<td>1166</td>
<td>1034</td>
</tr>
<tr>
<td>Riboflavin (mg)</td>
<td>1.8</td>
<td>1.9</td>
<td>2.3</td>
<td>3.2</td>
</tr>
<tr>
<td>Total folate(^3) (µg)</td>
<td>368</td>
<td>446</td>
<td>523</td>
<td>537</td>
</tr>
<tr>
<td>Vitamin B12 (µg)</td>
<td>2.7</td>
<td>3.6</td>
<td>4.9</td>
<td>4.9</td>
</tr>
<tr>
<td>Vitamin C (mg)</td>
<td>82</td>
<td>110</td>
<td>178</td>
<td>201</td>
</tr>
<tr>
<td>Vitamin D (µg)</td>
<td>0.7</td>
<td>3.4</td>
<td>4.2</td>
<td>4.3</td>
</tr>
<tr>
<td>Calcium (mg)</td>
<td>858</td>
<td>876</td>
<td>1084</td>
<td>1336</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>8.3</td>
<td>10.2</td>
<td>14.9</td>
<td>16.8</td>
</tr>
<tr>
<td>Selenium (µg)</td>
<td>29</td>
<td>39</td>
<td>59</td>
<td>62</td>
</tr>
<tr>
<td>Sodium (mg)</td>
<td>1730</td>
<td>1871</td>
<td>2221</td>
<td>2872</td>
</tr>
<tr>
<td>Zinc (mg)</td>
<td>7.6</td>
<td>8.7</td>
<td>11.5</td>
<td>13.5</td>
</tr>
</tbody>
</table>

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 DFE.
Appendix 6: Drinking-water

To check the quality of a water supply, ask the health protection officer at the public health unit of the local District Health Board, or check the Register of Community Drinking-Water Supplies in New Zealand. The register summarises the health risk of all community drinking-water supplies known to the Ministry of Health (Ministry of Health 2005). All public libraries hold a copy of the register and it is available on the Ministry of Health website (http://www.moh.govt.nz).

If water is not from a community drinking-water supply (eg, from a tank or bore), you may want to have it checked. Bore water should be checked for its nitrate concentration. Contact your local public health unit for advice.

Water being used directly from the tap should be taken from the cold tap. Many New Zealand water supplies are aggressive (corrosive) and will leach heavy metals from some pipes and fittings. Running the tap for 10–15 seconds will flush away most of the corrosion. If the piping is copper, run the tap until the water is as cold as it will get (Ministry of Health 2005). Running the tap before drinking water is most important if the tap has not been used for a while (eg, overnight).

For more information about water in New Zealand, refer to the Ministry of Health’s resources on drinking water at: http://www.moh.govt.nz/moh.nsf/indexmh/drinking-water-info-for-public.
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 A.14 below.

Table A.14: Summary of key New Zealand studies

<table>
<thead>
<tr>
<th>Name of survey or study</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002 National Children's Nutrition Survey</td>
<td>National cross-sectional survey of 3275 children and young people aged 5–14 years (1224 Mãori, 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. (<a href="http://www.moh.govt.nz/moh.nsf/pagesmh/4330">http://www.moh.govt.nz/moh.nsf/pagesmh/4330</a>)</td>
</tr>
<tr>
<td>1997 National Nutrition Survey</td>
<td>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. (<a href="http://www.moh.govt.nz/moh.nsf/pagesmh/852">http://www.moh.govt.nz/moh.nsf/pagesmh/852</a>)</td>
</tr>
<tr>
<td>2006/07 New Zealand Health Survey</td>
<td>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, and health status; and measurement of body size. (<a href="http://www.moh.govt.nz/moh.nsf/indexmh/portrait-of-health">http://www.moh.govt.nz/moh.nsf/indexmh/portrait-of-health</a>)</td>
</tr>
<tr>
<td>2008/2009 Adult Nutrition Survey</td>
<td>National cross-sectional survey of 4724 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. Please note: Survey results were not available at the time of printing of the Draft for Consultation of Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2–18 Years): A background paper. These results (for ages 15–18 years) will be incorporated in the final Guidelines. (<a href="http://www.moh.govt.nz/moh.nsf/indexmh/dataandstatistics-survey-nutrition">http://www.moh.govt.nz/moh.nsf/indexmh/dataandstatistics-survey-nutrition</a>)</td>
</tr>
<tr>
<td>A National Survey of Children and Young People's Physical Activity and Dietary Behaviours in New Zealand: 2008/09 – Key Findings</td>
<td>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. Please note: Only results from selected topics in this report have been incorporated into the Draft for Consultation of Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2–18 Years): A background paper. Other results from this report will be incorporated in the final Guidelines document as appropriate. (<a href="http://www.moh.govt.nz/moh.nsf/indexmh/national-survey-cyp-physical-activity-dietary-behaviours-08-09-sept2010?Open">http://www.moh.govt.nz/moh.nsf/indexmh/national-survey-cyp-physical-activity-dietary-behaviours-08-09-sept2010?Open</a>)</td>
</tr>
<tr>
<td>Name of survey or study</td>
<td>Details</td>
</tr>
<tr>
<td>------------------------</td>
<td>---------</td>
</tr>
<tr>
<td>Youth2000</td>
<td>National cross-sectional survey of 9699 secondary school children 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. (<a href="http://www.youth2000.ac.nz">http://www.youth2000.ac.nz</a>)</td>
</tr>
<tr>
<td>2007 New Zealand Children’s Food and Drinks Survey</td>
<td>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.</td>
</tr>
<tr>
<td>Obesity Prevention in Communities (OPIC)</td>
<td>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.</td>
</tr>
<tr>
<td>Dunedin Multidisciplinary Health and Development Study (also known as the Dunedin Longitudinal Study)</td>
<td>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. (<a href="http://dunedinstudy.otago.ac.nz">http://dunedinstudy.otago.ac.nz</a>)</td>
</tr>
</tbody>
</table>
References


SPARC. 2005b. Motivations and barriers to participating in sport (11–14 years). TNS New Zealand Ltd for SPARC.


Submission Booklet: Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2–18 Years): A background paper

Your comments on the Draft for Consultation of the document detailed above are welcome. Please use the following form to complete your submission and note:

Only submissions written in or attached to this booklet, either as electronic or hard copy, will be accepted.

*Handwritten comments written within the draft background paper for consultation will not be read or accepted.*

All submissions must be received no later than **5 pm on Monday 13 December 2010.**

**Either** post your completed submission booklet to:

Jane Anderson  
Ministry of Health  
PO Box 5013  
WELLINGTON  
Marked: ‘Submission – Food and Nutrition Guidelines for Healthy Children and Young People: A background paper’

**Or** complete the electronic submission booklet available online at: www.moh.govt.nz, then email to: NutritionGuidelinesCYP@moh.govt.nz

You do not have to answer all the questions or provide personal information if you do not want to.

When commenting on the document, where appropriate, support your comments with evidence and include any relevant literature references if you have them.
Submission booklet

Name of person making submission or contact person (if on behalf of organisation/group):  
(required) 
Postal address:  
(required) 
Phone:  
Contact email:  

Are you submitting this as:
(Tick one box only in this section)

An individual (not on behalf of an organisation)  
On behalf of a group or organisation  
Name of organisation:  
Other (please specify)  

Please indicate which sector(s) your submission represents
(You may tick as many boxes as apply)

Academic/research  
Māori  
Pacific  
Asian  
Education/training  
Non-government agency  
Health sector (personal)  
Health sector (public)  
Industry  
Other (please specify)  

All submissions will be acknowledged by the Ministry of Health, and a summary of submissions will be sent to all those who request a copy. The summary will include the names of all those who made a submission. In the case of those who withhold permission to release personal details, the name of the organisation will be given if supplied.

Do you wish to receive a copy of the summary of submissions?

Yes  
No  

Your submission may be requested under the Official Information Act 1982. If this happens, the Ministry of Health will release your submission to the person who requested it. However, if you are an individual as opposed to an organisation, the Ministry will remove your personal details from the submission if you tick the following box.

I do not give permission for my personal details to be released to persons under the Official Information Act 1982.
Submission questions

This questionnaire has two sections. The first focuses on issues related to the whole document, while the second deals with more specific issues from each part of the document.

Section A: Overall document

1. The target audience for the background paper is health practitioners who provide nutrition advice and develop nutrition programmes (including nurses, doctors, dieticians, nutritionists, primary health care providers, health promoters and teachers).

Would you use the background paper in your work? Please tick:

- Yes ☐
- No ☐

If your answer is ‘yes’, please provide some examples of how you would use the background paper. If your answer is ‘no’, please explain why not.

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The Introduction section of the Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2–18 Years): A background paper identifies four main aims. Consider these aims when answering the remaining questions in this section.

2. Do you have any general comments on the overall document such as on its readability, language and structure? Please suggest alternatives to each issue you identify.

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3. Do you think the background paper achieves the four aims set out in the Introduction of the document?

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<tr>
<td>Achieves ALL aims</td>
<td></td>
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<td></td>
<td></td>
<td>Achieves NONE of the aims</td>
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Please comment.

4. The summary at the beginning of most sections aims to highlight the important messages, including any recommendations for practice contained in each section.

Do you find these summaries useful?

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<tr>
<td>Very useful</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Not at all useful</td>
</tr>
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</table>

Please comment. Include any suggestions to improve the summaries, or indicate an alternative approach that could be more useful.
5. Are there any issues relevant to the nutritional status of healthy children and young people (aged 2–18 years) omitted from this background paper that you would have included?

Yes, there are omissions. □
No, there are no omissions. □

If your answer is ‘yes’, please list omissions and justify/include evidence for inclusion of new topics, including any literature references if you have them.

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Section B: Specific parts/chapters

   a. The Guideline Statements are the key messages for the public regarding nutrition and physical activity for healthy children and young people. Do you have any comments on them and/or suggestions for improvement?
   b. Is the discussion on the nutrient reference values useful?
   c. Do you have any other comments on Part 1?

7. Part 2: Growth and Body Size
   a. Do you have any comments on the New Zealand–World Health Organization Growth Charts (0–5 years)?
b. Which growth chart do you prefer to use to monitor growth of 5- to 18-year-olds?

- WHO Reference Charts 2007
- 2000 CDC Growth Charts
- Other (please specify)

Please comment.


c. Any other comments related to Part 2?


8. **Part 3: Energy and Nutrients**

a. Is there too much detailed background information on nutrients in this chapter?

- Yes
- No

Please comment.


b. Do you have any other comments related to Part 3?

9. If you would like to make additional comments, please add them below. Attach a separate sheet if required.

Please note that handwritten comments within the Draft for Consultation background paper will not be accepted.
Thank you. Your comments are appreciated.