FOOD AND NUTRITION GUIDELINES

for

Healthy Children

Aged 2–12 Years

A Background Paper

MINISTRY OF HEALTH
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Foreword

This background paper brings together key nutrition areas presently affecting the health of children aged 2–12 years. It provides the background material for the development of guidelines which are present in the health education booklet *Food Fantastic Eating Well for Healthy Children* (Code 4379).

These guidelines are an important part of the set of National Food and Nutrition Guidelines for all New Zealanders, which are a valuable resource for health professionals, educators and caregivers.

New Zealand offers us a variety of healthy food to choose from and these guidelines will help us make healthy choices for our children based on sound information.

Karen O Poutasi (Dr)
Director-General of Health

Contents

Introduction

Children are one of the most vulnerable groups in our society. They have many special dietary needs which are quite different from those of healthy adults.

Appropriate nutrition during the childhood years is essential for the maintenance of growth and good health. Childhood is a time of change between the infant diet and the adult diet.

Little research has been conducted on children in New Zealand with regard to their dietary intake and nutritional status. Children living in New Zealand come from a variety of different ethnic backgrounds including European, Maori and Pacific Island, each with their own traditions and beliefs about food and health.

This background paper has been prepared to support *Eating for Healthy Children 2–12 Years* (see Appendix 2). These guidelines recommend that healthy children need to:

- eat many different foods
- eat enough for activity and growth
- eat mini-meals or snacks
- have plenty to drink
- have treat foods now and then
- take part in regular physical activity.

This background paper reviews: energy, protein, fat, fibre, iron, calcium, folate, fluids, supplementation, fortification, snacking, treat foods, vegetarian diets, eating behaviour, eating disorders, food allergies and physical activity. Sample diets and advice on planning menus for children are listed in Appendix 3 of this paper.

Energy

Children need enough energy to sustain optimal growth. Young children need to consume energy-dense foods in order to meet their energy requirements. Older children should be encouraged to gain a greater proportion of their energy from breads and cereals and fruits and vegetables. A healthy child appears to be the best judge of how much they should eat.

Childhood obesity may influence adult obesity and thereby increase the risk of obesity-related disorders, so the importance of achieving a healthy bodyweight during childhood cannot be underestimated (see obesity section). Similarly, problematic eating resulting in low energy intakes in the childhood years may lead to short- and long-term problems with underweight.

Energy in the Diet

The maintenance of all body functions requires a constant supply of energy. Energy in the diet is provided by carbohydrates, fats, and proteins, where one gram of carbohydrate (sugars and starches) provides 17 kJ of energy, one gram of fat provides 37 kJ of energy and one gram of protein provides 17 kJ of energy.

Energy in the New Zealand Diet

A study by George et al (1993) looked at the dietary intakes of New Zealand children. A non-random nationally representative sample was obtained using 10 Form One classes (seven in the North Island and three in the South Island). A total of 251 (114 boys, 137 girls) children aged 10–11 years living in rural and urban settings were studied. The majority of children, both boys and girls, were European (72 percent and 74 percent respectively). Eleven percent of boys and 16 percent of girls were Maori, while 7 percent of the boys and 6 percent of the girls were Pacific people. Other ethnic groups represented 9.7 percent of the boys and 4.4 percent of the girls. This study found New Zealand children were receiving adequate energy intakes in relation to Australian recommendations (Truswell et al 1990). Breads and cereals and fruits and vegetables were the predominant sources of energy.

McMahon et al (1993) looked at the effects of dietary habits on dental health. Three hundred and fifty-five preschool children, aged 2–4 years, living in two South Island cities with fluoridated water supplies were studied. Fifty-two percent of the group were boys and 48 percent of the group were girls. Children of Maori or part-Maori ethnicity represented just under 10 percent of the group, while 2 percent of the group were of Polynesian ethnicity. These children were found to have adequate energy intakes.

Balancing Energy Intake with Energy Requirements

Responding to a child's hunger signals is one key to balancing energy. Energy needs depend on the child's rate of growth, increasing body size, gender and level of physical activity. Each of these needs is variable depending on the individual child. The adequacy of a child's energy intake can be determined by several physical measurements of growth and weight for height (Network of the Federal/Provincial/Territorial Group on Nutrition and National Institute of Nutrition 1989; Torun et al 1996). Height - weight charts for New Zealand 1–5- year-olds were developed in 1989 (see Appendix 4). Height - weight charts for school-aged children have not been developed since 1969 (Department of Health 1969) and therefore should be used only as a general guide.

Since appetites fluctuate and food preferences change frequently, the healthy child is often the best judge of how much to eat. Caregivers need to respond to the cues given by the child. Research has shown that although children's food consumption is highly variable from meal to meal, daily energy intake is relatively constant, because children adjust their energy intake at successive meals. This has been described as 'caloric compensation' (Birch et al 1991; Birch, Johnson et al 1993; Shea et al 1992; Johnson and Birch 1994).

Young children grow rapidly (usually in growth spurts) and tend to be very active. Consequently their energy needs, relative to their small size and limited stomach capacity, are very high. Young children need frequent meals and fairly concentrated sources of energy (Buttriss 1987).

Infants grow most rapidly, with an average rate of weight gain of about 9 percent per month, but once the first birthday is reached this rate drops to about 1 percent per month. Many caregivers become concerned at about this time, because they are unaware of the different weight gain rates of different ages. The infant lays down more body fat, compared with the high proportion of lean tissue accumulated by the preschool child. This body fat gain by infants requires more energy per gram of body weight. Hence, the 2-to-5-year-old child requires only half as much energy to gain a gram of weight as the infant (Forbes 1991).

Achieving Healthy Body Weight

Achieving a healthy body weight and composition is of importance in preventing disease and promoting wellbeing. Health risks are associated with being both overweight and underweight. Efforts to achieve a healthy body weight should begin in childhood. There are no agreed standards for defining the range of healthy body weights in children (Agencies for Nutrition Action 1996). The rate of weight and height gain may be more significant than the actual size achieved (Department of Health 1991).

The American Health Foundation's Expert Panel on Healthy Weight (Meisler and St Jeor 1996) choose not to recommend healthy-weight guidelines for children because of the special requirements of childhood and because of the insufficient data available. New Zealand has current height-weight guidelines for children up to five years of age (see Appendix 4).

Overweight

The concern about childhood obesity relates to two issues:

1. A possible link between childhood and adult obesity.
2. The adult obesity-chronic disease link with chronic diseases including hypertension, elevated blood cholesterol levels, ischemic heart disease, stroke, cancer, diabetes and osteoarthritis (Ernst and Obarzanek 1994; Shea et al 1994; Kennedy and Goldberg 1995).

In addition to the risk of chronic disease in adulthood, obese children may suffer psychological and social pressures. Older children associate overweight body shape with poor social functioning, impaired academic success and reduced fitness and health (Hill and Silver 1995).

The risk of developing obesity is determined by both genetic and environmental factors. Therefore, whether a child becomes obese depends on their genetic susceptibility and the presence of environmental fattening stimuli, such as low social class, single parent families, single child families, excessive television viewing and inactivity (Poskitt 1993).

Parental obesity is a strong predictive risk factor for childhood obesity (Maffeis et al 1994). Parenting styles may influence the development of food preferences and the ability for the child to regulate intake. Families serve as models which reinforce and support the acquisition and maintenance of eating and exercise behaviour (Epstein 1996).

Studies on children raised apart from their biological parents have demonstrated familial similarities in fatness that could only have occurred because of their genetic make-up (Fox 1992; Stunkard et al 1986). However, it is unclear how genetic factors predispose children to obesity (Poskitt 1993).

Both diet quantity and quality play an important role in obesity development. Overeating in obese children may be due to a defective or underdeveloped satiety signal, or because they continually over-ride it.

Children have a preference for fat in foods. Possibly increased fat contribution to total energy intake results in an increase in obesity as fats are very energy dense (Poskitt 1993). Obese 9–11-year-old children were found to have lower energy intakes than their non-obese peers after adjustment for body size. However, the percentage energy contribution from fat in the obese subjects was significantly higher than from carbohydrate (Gazzaniga and Burns 1993). It would appear that diet composition rather than total dietary energy intake has a greater influence on adiposity.

A review of the literature over the last decade concludes that energy expenditure plays a crucial role in energy balance in normal individuals and also helps in the disruption of energy balance that characterises obesity (Saltzman and Roberts 1995). Moreover, active individuals are more likely to weigh less and have lower fat mass than sedentary individuals (Flatt 1995; Wilmore 1996).

There is concern over the general reduction in the level of physical activity in children and its association with raised levels of body fat (Davies et al 1995). There are a number of possible reasons for the decline in physical activity levels in children, including an increase in computer game use and television viewing. The increase in television viewing has received the most publicity and Dietz and Gortmaker (1985) report a significant positive association between the amount of television viewed and childhood obesity. However, some research trials do not support this (Durant et al 1994).

Recommendations for physical activity should accompany any dietary recommendations (Torun et al 1996). Because children cannot comprehend the short- or long-term health benefits of physical activity, it is important to show them how enjoyable physical activity can be, thereby promoting good exercise habits for a lifetime (Livingstone 1994). The involvement of the whole family in this lifestyle change is paramount to the success of achieving this recommendation.

Body mass 'tracks' from childhood into the young adult years. Tracking is where, for example, weight retains its rank in the distribution curve through time. A child who ranks at a high level of obesity has a 60–70 percent chance of becoming an obese adult. However, approximately 30 percent of obese children become normal weight adults. The reasons for this have not been determined (Clarke and Lauer 1993). Obesity in younger children (2–8 years of age) correlates less with obesity in adulthood while obesity in older children (10–18 years of age) results in stronger correlation to obesity in adulthood (Guo et al 1994; Ernst and Obarzanek 1994; Must 1996).

Treatment of Obesity

A preferred approach in the treatment of obesity is the prevention of its development as the success in promoting and sustaining fat loss is limited (Gillanders and Tustin 1992). However, when childhood obesity is present, dietary changes and increased physical activity should be initiated for long-term effect (Epstein 1996; Epstein 1995).

Families have a major influence in the food and activity habits of children and thus effective treatment of obesity must take this into consideration. Studies have shown that long-term maintenance of weight loss (ie, from 2–10 years) can be most effectively achieved when the intervention is family-based. Long-term weight reduction in children is associated with a number of factors, including the use of positive reinforcement, techniques such as parental praise, self monitoring and a change in eating habits (Epstein 1996; Nuutinen and Knip 1992). Dietary management of obesity essentially involves education, both of the children and of the family about appropriate food choices.

A strict energy-counted dietary regimen is not appropriate for children under five years of age. Maintaining a child's weight, so that a child grows into his/her ideal weight for height may be the most appropriate approach (Epstein 1996). The adoption of a new diet by the whole family will help move pressure away from the overweight child. Physical activity or play should be encouraged and increased as the importance of physical activity in the treatment of childhood obesity is becoming more apparent (Epstein et al 1996; Epstein 1996). Focusing on physical inactivity (eg, decreasing TV viewing or computer games) may be more effective than simply targeting increasing physical activity (Epstein 1996). For children over five years of age, establishing sensible eating patterns and regular physical activity is the primary goal. All dietary and physical activity goals need to be achievable. It is important the eating pattern is flexible. If it is too strict, adherence will be low.

Davis and Christoffel (1994) found obese preschool children exhibited a greater weight loss than obese school children, if frequently visited by a health professional. There is debate over the way childhood obesity is regarded and treated. The emerging view is that the goal of prevention and treatment is achieving constitutionally appropriate body weight and maintaining that weight through energy balance (Satter 1996).

Underweight

Children can be underweight for a variety of reasons. These can be divided into organic and inorganic causes. Examples of organic causes are genetic factors and physiological factors. Examples of inorganic causes include lack of love and care, psychological poor weight gain, learned food aversion, lack of positive learning experiences with food, and poor child-parent interactions. Persistent feeding problems can also result in inadequate weight gain and poor growth. Parents with children who experience early feeding problems may seek advice and support from health professionals.

Parental health beliefs and exaggerated concerns about preventing obesity are often blamed for inadequate weight gain and delayed linear growth in some toddlers. Bulky, low energy dense weaning diets, which are low in fat and high in fibre, have been linked to multiple nutritional deficiencies and malnutrition in infants and toddlers (Jacobs and Dwyer 1988). In Western civilisations, there have been an increasing number of malnourished infants and children with nutritional deficiencies resulting from the nutritionally unbalanced dietary regimens imposed by their parents (British Dietetic Association 1987; Pugliese et al 1983). Dietary recommendations intended for the adult population should not be directly applied to children without considering their special requirements for growth and development.

Some children with relatively high energy requirements may have difficulty consuming enough food. Furthermore, some typical characteristics of preschool children, such as the need to eat frequently, and finickiness or limited attention span at mealtime, may make it difficult for them to consume enough food to meet their energy needs.

Recommended Energy Intakes for Children

Recommendations for energy intake must take into account all the factors contributing to balance between energy intake and expenditure of energy. The wide range of requirements even in individuals of the same age, sex, weight, height and general pattern of activity, makes setting recommendations for intakes of energy more difficult than for most nutrients. Such recommendations should only be used as a guide (Truswell et al 1990). (See Appendix 1 for Australian recommended energy intakes for children.) The Nutrition Taskforce Report (1991) recommended that the Australian Recommended Dietary Intakes (RDIs) (1990) be adopted for New Zealanders as an interim measure.

In the United Kingdom (UK), estimated average energy requirements have been presented in units of kilojoules per kilogram of body weight per day, for differing activity levels (Department of Health, London 1991). This approach may be more appropriate.

Protein

In the past, there has been concern about the protein content of children's diets. It is now apparent that nearly all freely-chosen diets which supply adequate energy will also supply adequate protein. Satisfactory growth in children is widely regarded as a good index of optimum protein intake.

Protein in the Diet

Both animal and plant foods provide protein. There are no known benefits of consuming a diet high in animal protein. Plant-based diets can provide sufficient quantities of essential amino acids if combined appropriately (refer to Vegetarian section).

High protein foods are those found in two of the four food groups listed in the *New Zealand Food and Nutrition Guidelines* (Department of Health 1991) which are milk and milk products, lean meats, chicken, seafood, eggs, nuts and pulses. Regardless of the protein type, children should be encouraged to choose food from a wide variety of sources. For those children on a plant-based diet, the combination of grains, legumes, seeds, nuts, vegetables and soy products provide all essential amino acids (Department of Health 1991).

Soy foods have recently received a lot of media attention. There is no evidence that soy foods have any adverse effects on infants, children or adults. Soy foods can be included as part of a varied diet.

Protein in the New Zealand Diet

Both 10–11-year-old boys and girls living in New Zealand were found to have mean daily protein intakes (62.3g and 57.4g respectively) well above the RDI values (George et al 1993). The major protein sources were milk and milk products (21 percent), meat and egg dishes (19 percent), and breads and grains (16 percent). A study of preschool children found milk and milk products contributed 24 percent of their protein intake, followed by meat and meat products (21 percent) and bakery products (17 percent) (McMahon 1990). McMahon et al (1993) found protein contributed 13 percent of energy in the diets of 2–5-year-old New Zealand children.

Throughout the first year of life, breast milk or infant formula is the major protein. After this age, if a child dislikes milk, or is unable to tolerate it due to food intolerance, other foods in the diet can supply adequate amounts of protein. Young children's protein needs can be met by a variety of foods. If milk is not included, then meat, seafood, chicken, meat alternates (beans, peas and lentils), bread and cereals should contribute enough protein. If meat and fish are omitted, as in a lacto-ovo or lacto vegetarian diet, milk, cheese and soy products such as tofu may suitably replace them.

Recommended Protein Intakes for Children

Children require protein for the maintenance of body tissues, changes in body composition and synthesis of new tissues. During growth, the protein content of the body increases from about 15 percent at one year of age to 18–19 percent by four years of age, which is a similar value for adults (Department of Health and Human Services, DHHS 1988). As the child's growth rate drops after the first year of life, the maintenance requirement is a gradually increasing proportion of the total protein requirement (Subcommittee on the Tenth Edition of the RDAs et al 1989). For children older than 10 years of age, the protein requirement should take account of gender differences in the timing of the growth spurt, and separate values are necessary for each gender. (See Appendix 1 for Australian recommended protein intakes for children.)

Fat

Fat is an important source of energy for active children who require energy-dense foods for growth. Fat is an essential component of the diet as it provides essential fatty acids and fat-soluble vitamins required by substrates for cell structures. Fat also plays an important role in the endocrine and immune systems.

Infants are accustomed to a relatively high fat diet, as human breast milk and infant formulae provide 50 percent of energy as fat. Once weaning begins, the proportion of total energy from fat in the diet is reduced. However, there is still a need for fat-soluble vitamins and essential fatty acids. By adulthood, total fat intake should provide 30–33 percent of total energy intake (Public Health Commission 1995).

Fat in the Diet

Dietary fat is found in both animal and vegetable foods.

- Saturated fats are commonly found in animal meat, such as beef, mutton and poultry, and animal products like egg yolks and dairy products (cheese, butter and whole milk).
- Polyunsaturated fats are found in plants oils, such as peanut, soybean, cotton seed, corn, safflower and margarine.
- Monounsaturated fatty acids are present in olives, olive oil, peanuts, peanut oil, almonds, pecans and avocado.
- Essential fats are omega-3 (linolenic acid) and omega-6 (linoleic acid) fatty acids which must be obtained from the diet as they cannot be produced by the body. Docosahexanoic acid is synthesised from linolenic acid (18:3n-3) and plays an essential role in brain and retinal visual function (Ziegler and Filer 1996). Leafy vegetables, vegetable oils, fish and seafood contain omega-3, while omega-6 can be found in vegetable oils and meat (Williams 1989; Whitney et al 1990).

Many foods contain a mixture of these fats, although one type may predominate. Biscuits, cakes, chocolates and pastries also can have a high fat content (Williams 1989; Whitney et al 1990). Fast foods tend also to be high in fat and therefore can be a major source of fat in a child's diet (see Treat Foods section). It is recommended that while slowly reducing the total fat in a child's diet, the proportion of monounsaturated and polyunsaturated fats are increased with a simultaneous reduction in the proportion of saturated fat (which is in line with the adult recommendations).

Fat in the New Zealand Diet

In the limited study by George et al (1993), it was found that 10–11-year-old boys living in New Zealand received 36 percent and 10–11-year-old girls living in New Zealand received 35 percent of their total daily energy from fat, with saturated fat providing 16 percent and polyunsaturated fat 4 percent energy. These intakes were above the adult targets of 30–33 percent total energy from fat, with no more than 12 percent from saturated plus trans fatty acids (Public Health Commission 1995). The evening meal provided the greatest proportion of fat for both girls and boys (George et al 1993).

The same study found milk and milk products contributed 18 percent of total fat intake, and in a study on preschool children, 27 percent of total fat intake came from milk and milk products (McMahon 1990).

Cardiovascular Disease and Fat Intake

Development of cardiovascular disease depends on a complex interaction of genetic make-up, and environmental and lifestyle factors. The influence of fat intake on blood lipids is one of the factors thought to influence the development of cardiovascular disease. Excess energy intake and the development of obesity, associated with hypertension and diabetes, have long been recognised as additional risk factors, but there are many others (Mann 1993).

Obesity has also been associated with a high fat intake (see Energy section).

Primary Prevention of Cardiovascular Disease

There are two approaches that can be used to reduce cardiovascular disease; a population-based strategy or an individual, high-risk approach. The aim of a population-based strategy is to move the entire distribution of the risk factor to a range where the overall risk is low. A high-risk strategy solely aims at a relatively small number of individuals who are at greatest risk. Although it is important to identify those at high risk, a population-based strategy will have the greatest impact on the overall reduction of cardiovascular disease.

It is well recognised that atherosclerosis begins in childhood but exactly how it proceeds is uncertain. Cardiovascular disease is the leading cause of death in New Zealand and usually presents itself as a heart attack or stroke (Department of Health 1991).

Development of cardiovascular disease depends on a complex interaction of genetic make-up, environmental and lifestyle factors. Heart disease tends to run in families. This familial tendency appears to be related to both genetic and environmental factors (Network of the Federal/Provincial/Territorial Group on Nutrition and National Institute of Nutrition 1989). Many paediatricians agree that children with a strong family history of cardiovascular disease deserve early identification, surveillance, dietary supervision and possibly treatment.

Although there is no convincing evidence that reducing environmental and lifestyle risk factors in childhood prevents cardiovascular disease in adulthood, there are two arguments supporting primary prevention during childhood (Network of the Federal/Provincial/Territorial Group on Nutrition and National Institute of Nutrition 1989).

- Autopsies conducted on young soldiers and on children killed by accident provide evidence that atherosclerosis begins in childhood (McNamara et al 1971; Boulton et al 1991). Atherosclerosis usually begins with soft fatty streaks accumulating along the inner walls of the arteries. After gradual enlargement they become hardened plaques (Whitney et al 1990).
- Certain risk factors for cardiovascular disease track from childhood into adulthood. These include obesity, blood pressure, and serum lipids. Children who have high serum cholesterol levels are highly likely to become adults with high serum cholesterol levels (Berenson 1986; Boulton et al 1991). This suggests that the presence of risk factors in childhood may predict cardiovascular disease in adulthood. Early identification of high risk children may, therefore, be important (Vobecky et al 1993). For such children, diets that aim to reduce total and saturated fat, substitute some polyunsaturated fat for saturated fat, and decrease dietary cholesterol are recommended (Dwyer 1986). Carbohydrate can replace some of the energy from fat.

Recommended Fat Intakes for Children

The appropriateness of extending adult recommendations for reducing fat intake to children has been debated internationally (Zlotkin 1996; Kleinman et al 1996; National Health and Medical Research Council Australia 1995). Different international bodies reviewing the same literature have developed varying fat recommendations for children (Nutrition and Health: Dietary Guidelines for Americans 1995; National Health and Medical Research Council 1995; Working Group of the Canadian Pediatric Society and Health Canada 1993; American Academy of Paediatrics 1992).

In New Zealand, the Report of the Nutrition Taskforce (Department of Health 1991), *Food for Health*, set the total fat target for adults to provide 30–35 percent of total energy. This should not be applied to children under two years of age. From two to five years, a gradual increase in the proportion of energy from carbohydrates, such as breads, accompanied by a gradual reduction in the proportion of energy from fat is appropriate. This provides an opportunity to develop healthy eating habits for use throughout life.

Based on the evidence available, there is no reason to change New Zealand's fat recommendation for children. The joint FAO/WHO expert consultation on carbohydrate in Human Nutrition (Lauer 1997) has recently published a report which is in line with the New Zealand fat recommendation for children. The American Academy of Paediatrics is currently revising its 1992 statement, due to be released late 1997 (Klish 1997). The revised statement will be similar to the New Zealand recommendation, which implies that after two years of age children should gradually adopt a diet that by about five years of age has the same fat recommendation as adults.

Fat recommendations for children cannot be made in isolation. Families serve as models to support, reinforce and foster positive food preferences. The following are specific suggestions on how to foster positive attitudes and practices related to moderation of fat intake.

- Encourage the child to practise moderation when using spreads (eg, butter or margarine), high fat sauces (eg, creamy pasta sauces), and salad dressings.
- Trim visible fat from meat.
- Limit the use of processed meats, such as battered hot dogs, luncheon meats, sausages, frankfurters, polonies, saveloys and cherios.
- Limit fried foods, such as hot chips, fried fish or chicken to very occasional treats.
- Choose lower fat foods when eating at fast food restaurants.
- Provide fruit, vegetables or bread as alternatives to snacks such as potato crisps, biscuits or pastries. These foods can be used as occasional treats.
- Choose lower fat milk if appropriate.

Milk and milk products are a very important and inexpensive source of energy and nutrients for young children. Milk fat is also the major source of essential fatty acids in the infant and toddler's diet. Thus milk should be a staple item for preschool children. When recommending the type of milk to be used for young children it is important to consider the composition of the child's whole diet. With increasing age, children will begin to eat a wider variety of foods and, therefore, will be able to obtain essential fatty acids and energy from food sources other than milk.

It is recommended that all children under five years have the equivalent of 500 ml of milk daily. Reduced fat milk (1.5 to 2.5 percent milk fat) may be used from two years of age, if the child's overall energy intake is adequate. Non-fat milk (less than 0.5 percent milk fat) is not recommended for children under five years of age. Specific advice on when to introduce low fat milk to children should be based on the individual child's growth and needs (Network of the Federal/Provincial/Territorial Group on Nutrition and National Institute of Nutrition 1989; Anonymous 1987).

Studies have found that a moderate decrease in fat intake does not affect stature or growth. However, children who consume less than 30 percent of energy from fat have been shown to have a lower intake of calcium and phosphorus (Shea et al 1993; Boulton and Margary 1995).

Dietary Fibre

A large number of diseases associated with Western society have been associated with lack of dietary fibre. The majority of evidence for the beneficial effects of fibre is epidemiological and refers to adults. High-fibre diets are not recommended for young children as the bulkiness of high-fibre foods make it difficult for children to eat sufficient to meet their energy requirements. Older children should be encouraged to increase their fibre intake by consuming larger quantities of breads, cereals and grains and fruits and vegetables.

In the absence of a precise definition, dietary fibre has recently been defined as all non-starch polysaccharides, resistant starch and lignin (Baghurst et al 1996). Dietary fibre is plant cell walls, and has a digestible and an indigestible component. Digestible dietary fibre is present in peas, oats, dried beans, lentils barley, pasta and fruit. Fibre which is not digestible may be fermented in the colon.

Fibre in the Diet

Good sources of fibre in the diet are wholegrain cereals (and products made with them), wholemeal bread, pulses, fruit (especially dried fruit) and vegetables. Major food sources of starch include cereal grains, legumes, potatoes and other vegetables (Williams 1989; Whitney et al 1990).

Fibre in the New Zealand Diet

New Zealand 10–11-year-old children were reported to have a daily fibre intake of 15–16 grams, which predominantly came from breads and grains, vegetables and fruit. Recommended fibre intake levels for adults have been set at 25–30 grams per day and, therefore, it seems that there may be some justification in suggesting that older children may need to increase their fibre intake. However, this may not be the case in young children because of their smaller stomach capacity and proportionately greater energy requirements (George et al 1993).

High Fibre Diets

There are three theoretical objections to giving a preschool child a high fibre diet. These objections are as follows:

- Young children have small stomach capacity and diets high in fibre are bulky. It has been suggested that some children on high-fibre diets may not be able to ingest the energy required for growth. This potential hazard may be overcome by an increase in cereals and pulses and some reduction in those fruits and vegetables which have a high fibre content (British Dietetic Association 1987; Williams 1995).
- The bacterial flora of the gut of young children undergoes major change from infancy to adulthood. Too early and too large amounts of fibre may exceed the capacity to ferment indigestible fibre in the colon.
- Dietary fibre and some associated compounds, such as phytate, can restrict the absorption of some minerals, such as calcium, iron, copper, magnesium, phosphorous and zinc. The relative effects of fibre and phytate on mineral absorption is an issue of debate. It is believed that mineral deficiencies are unlikely to develop in children on typical Western diets even with a moderate intake of dietary fibre. One advantage of white flour is that the removal of bran means that much of the phytate is removed. Yeast fermentation will also destroy phytate. Whole wheat bread in this country is generally made with yeast. Children on vegan diets, however, with a greater than average intake of wholegrain cereal, may be at risk of inadequate mineral nutrition. The greater the animal protein content of the diet, the lesser the anti-nutrient effect (Bindra 1985; Williams 1995).

The potential health benefits of a fibre rich diet include regular bowel habits, prevention and treatment of obesity, prevention of diseases of the gastrointestinal tract, blood cholesterol level reduction and postprandial hyperglycemic modulation (Williams 1995). The potential health benefits of increased dietary intake during childhood outweigh the potential risks, especially in an industrialised country like New Zealand (Williams et al 1995).

Resistant Starch

Starches in the diet are in a number of physical forms. During cooking, the highly ordered granules of food starch swell, rupture and the starch molecules are leached out. The leached starch is generally digestible in the small bowel. Some starch will, however, remain resistant to small bowel digestion. Resistant starch is starch still contained in granules and starch that has become retrograded when cooled after heating. It is the variable amount of resistant starch which accounts for the difference between non-starch polysaccharides and the dietary fibre estimates of earlier studies.

In the colon, both resistant starch and indigestible dietary fibre are fermented to short-chain fatty acids which provide energy both locally for the lining of the intestine and also general energy for the maintenance of body energy requirements.

Most of the health benefits of resistant starch relate to its impact on the colon. It increases bowel action with its mild laxative effect, increases the bowel's beneficial microflora, reduces the secondary bile acids in the faeces, beneficially lowers faecal pH and increases the level of short-chain fatty acids, in particular propionate and butyrate (Baghurst et al 1996).

Recommended Fibre Intakes for Children

As dietary habits are formed during childhood, it is suggested that a gradual increase in dietary fibre be recommended. This should occur with a rise in the consumption of legumes, cereals, wholegrain products, fruits and vegetables from the age of two years. Children should be encouraged to meet the serving recommendation of fruit and vegetables and bread and cereals in the *Food and Nutrition Guidelines for Healthy Children Aged 2–12 Years*. A diet that places emphasis on high-fibre, low-energy foods, to the exclusion of other common food groups, is not recommended for children.

There is still international debate concerning the recommended levels of dietary fibre intake for children. The debate is predominately around two issues:

- Methodology for measuring dietary fibre. There is no agreed method and each method measures different components of dietary fibre and resistant starch (methodologies include, the Southgate, Englyst, Theander and Prosky methods).
- There is a lack of data on the physiological effects of dietary fibre in children.

There are two prominent recommendations for dietary fibre in children:

- The UK does not have a specific recommendation for dietary fibre in children. The Panel on Dietary Reference Values (Department of Health 1991) recommended that children should have proportionally lower dietary fibre intakes than adults; the recommended amount is related to body size.
- The American Health Foundation recommends a reasonable goal for minimal intake of dietary fibre for children older than two years of age be the equivalent of the age of the child plus 5 grams of dietary fibre per day (ie, age +5) (Williams et al 1995).

The joint FAO/WHO expert consultation on carbohydrates in Human Nutrition (Lauer 1997) recommendation is compatible with the UK recommendation. Rather than a definitive fibre recommendation, children should be encouraged to eat a wide variety of fruit and vegetables and whole grain cereal products. This recommendation should not result in over consumption of fibre in the child's diet.

Constipation in a preschooler is a frequent complaint and is thought to be caused by a combination of factors, including diet. Little has been written about the normal bowel habit of young children and as a result there is no recorded desirable fibre intake. However, some children experiencing recurrent abdominal pain and constipation show improvement with an concurrent increase in fluid and dietary fibre intake.

The UK national diet and nutrition survey of 1.5–4.5-year-olds (Gregory et al 1995) reported that there is a positive association between the reported number of bowel movements and the mean daily intake of dietary fibre.

Introduction of weaning foods, such as pureed fruits, vegetables and cereals begin to provide both dietary fibre and resistant starch. Unprocessed bran or foods supplemented with bran should not be used for children under five years unless medically prescribed. Foods that are high in dietary fibre should be increased gradually to avoid diarrhoea, excessive wind and abdominal discomfort.

The nutritional needs of children differ fundamentally from adults because of their growth requirements and their larger requirement for nutrients per unit of body weight. Some health professionals and diet-conscious parents have failed to recognise these differences. Some sections of the population, such as strict vegetarians and Asian toddlers, who rely on a diet of grains and cereals, may consume enough fibre to cause suboptimal mineral levels. There are children being seen at clinics and hospitals with a failure to thrive because they are fed diets containing too little fat and too much fibre (Clark 1988). A study of 2–5-year-old children living in the UK reported no evidence of a high fibre intake decreasing the energy intake of the children's diet. Instead it showed that children consuming a high energy diet tended to have higher fibre intakes (Payne and Belton 1992).

Iron

Iron needs are greatest during periods of rapid growth such as early childhood. Failure to obtain an adequate iron intake can result in iron deficiency anaemia. However, non-nutritional factors such as infections, parasites, cancer or blood loss can also produce anaemia.

Iron in the Diet

Dietary iron is present in many foods. It is available in two forms, either as haem iron or as non-haem iron. Haem iron is found in animal tissues, such as meat, fish and poultry, and contributes approximately 40 percent to total dietary iron intake. Non-haem iron contributes about 60 percent of iron in the diet and is found in plant foods (where 100 percent of iron is non-haem), including cereals, vegetables, legumes, nuts and fruits (Monsen 1988; Craig 1994).

However, in a composite meal, 25 percent haem iron is absorbed and 14 percent non-haem is absorbed. The absorption of non-haem iron is also influenced by other components in the diet.

Iron in the New Zealand Diet

In the limited study by George et al (1993), 10–11-year-old boys and girls in New Zealand obtained adequate daily iron intakes. However, continued adequacy may not result as by the age of 12 years, iron RDIs increase due to increased growth rate and menstruation in girls (George et al 1993). The principal sources of dietary iron were cereals and cereal products (30 percent) and meat and meat dishes (25 percent) (Brinsdon et al 1992).

Dietary Iron and Absorption

Maintaining iron balance is dependent on adequate iron absorption. Iron absorption from food is dependent on several factors including:

- Iron status: iron absorption is increased when stores are low.
- Iron requirements: iron absorption is increased when the need is high (eg, in puberty).
- Bioavailability of iron in foods: the haem form of iron found in meat, seafood or chicken is more readily absorbed than non-haem iron found in cereals, vegetables and fruit. Studies on individual food items indicate a range of 1–7 percent absorption of iron from grain and vegetables and 11–20 percent absorption from flesh foods. The absorption of iron from composite meals was 14 percent for non-haem iron and 25 percent for haem iron (Truswell et al 1990).
- Dietary enhancers and inhibitors of iron: the absorption of iron from a food can be influenced considerably by the presence of other foods (Monsen 1988; Baynes and Bothwell 1990; Department of Health 1991). Haem iron is not influenced by other dietary factors (Carpenter and Mahoney 1992). Non-haem iron requires help to achieve absorption (Whitney et al 1990; Dwyer 1991).

Non-heam iron absorption can be enhanced by:

- Vitamin C (ascorbic acid) which keeps non-haem iron in a soluble form. Seventy-five milligrams of ascorbic acid increases the absorption of non-haem iron by three to four times when taken in the same meal (Monsen 1988; Whitney et al 1990).
- Meat, fish and poultry when they are consumed at the same time as vegetable foods (Monsen 1988).

Non-haem iron absorption can be inhibited by:

- Tannins and polyphenols found in tea and coffee which complex with non-haem iron and inhibit its absorption (Carpenter and Mahoney 1992).

- Phytates in plant foods, such as grains, bran and soy products (Monsen 1988; Carpenter and Mahoney 1992).
- Oxalates present in spinach, rhubarb and chocolate form insoluble complexes with non-haem iron and thereby inhibit absorption.
- Eggs have a high iron content. However, the egg yolk contains a phosphoprotein that binds iron and decreases bioavailability.

Dietary Sources of Haem and Non-Haem Iron

Table 1: ***Dietary sources of haem and non-haem iron***

	Haem Iron		
Food	**Iron (per 100 g)**	**Iron (per serving size)**	
Lamb kidney, stewed	11.4 mg	1/2 cup	8.6 mg
Lamb, liver, fried in flour	10.0 mg	1 slice	4.0 mg
Mussels, boiled	7.7 mg	1/2 cup	6.1 mg
Sardines, canned, drained solids	2.9 mg	1 sardine	0.4 mg
Beef, lean mince, stewed	2.7 mg	1/2 cup	2.3 mg
Pork, lean leg steak, grilled	2.7 mg	1 steak	2.2 mg
Lamb, lean, cooked	2.4 mg	1/2 cup	2.3 mg
Chicken, breast, grilled	1.9 mg	1/2 breast	1.6 mg
Snapper, grilled or baked	0.7 mg	1 fillet	0.7 mg
	Non-haem Iron		
Food	**Iron (per 100 g)**	**Iron (per serving size)**	
Oat bran, raw	5.3 mg	1/4 cup	1.6 mg
Weetbix	4.0 mg	1 biscuit	0.6 mg
Egg, boiled	2.2 mg	1 egg, no.7	1.1 mg
Wholemeal bread	1.8 mg	1 med slice	0.5 mg
Raisins	1.6 mg	2 tablespoons	0.3 mg
Baked beans, in tomato sauce	1.4 mg	1/4 cup	1.0 mg
Peas, cooked	1.2 mg	1/4 cup	0.5 mg
Silverbeet, raw	1.2 mg	1/4 cup	0.1 mg
Spinach, cooked, drained	0.7 mg	1/4 cup	0.3 mg

(Adapted from Burlingame et al 1993)

Ensuring an Adequate Iron Intake

When the consumption of iron-fortified infant formula and baby weaning solids decreases towards the end of the first year of life, dietary iron intake frequently falls. The toddler's need for iron is relatively high, yet few iron-rich foods may be consumed. Since milk does not provide sufficient iron, a diet of predominantly milk is not suitable for young children. Milk can easily displace other foods that are better sources of iron. This displacement may occur through the prolonged use of breastfeeding or cow's milk in a bottle, or by giving milk at the beginning of the meal. The transition to established good mixed feeding is an important step in the maintenance of iron status. Young children can obtain adequate iron intake by eating a variety of foods. If the child does not eat meat, foods with iron such as lentils, dried fruits and fortified breakfast cereals should be consumed along with vitamin C which will enhance iron absorption.

Iron Fortification

The 12th Amendment to the New Zealand Food Regulations 1984 came into force in January 1996. The primary purpose of this was to introduce a standard for the addition of vitamins and minerals to general-purpose foods. This standard is almost identical to the Australian standards for vitamin and minerals. The addition of iron to selected foods in New Zealand is voluntary. In most cases the maximum quantity that can be claimed is 25 percent of the recommended intake for iron, per serving of food. Amendment 13 of the New Zealand Food Regulations 1984 came into force in July 1996, and further modified the standard on vitamins and minerals. This amendment modified nutrient additions to special-purpose foods, including supplementary foods for infants and young children (weaning foods). As a result iron may only be added to cereal-based supplementary foods for infants and young children.

Iron Supplementation for Children

Iron supplements are only necessary when there is evidence of iron deficiency or depletion due to blood loss, or when the diet is consistently lacking in iron. Iron supplements should only be used when prescribed by a doctor or paediatrician. They should always be stored well out of reach of children, since there have been cases of young children ingesting toxic doses of medicinal iron.

Iron Deficiency in Children

Iron deficiency can occur in all socioeconomic groups, but historically and currently it is most common amongst lower socioeconomic groups. It has been demonstrated that when incomes fall below the poverty level, impaired iron status is a leading cause of anaemia in 1–5-year-old children in the United States (McNutt 1991). Rose et al (1995) found economic factors to be an important predictor of iron intake in preschool children aged 1–5-years. The full-term infant is born with supplies of iron to last about six months. Delayed introduction of iron rich foods (after 6–9-months) and subsequent inadequate nutrition predisposes preschool children to iron deficiency.

A reduction in haemoglobin-iron (anaemia) and reductions in tissue iron are the functional effects of iron deficiency. Iron deficiency can have wide-ranging effects on the young child's health and wellbeing. Children with low iron status are less resistant to infections than healthy, well-nourished children.

Iron deficiency has been associated with psychological problems in children. Iron-deficient children exhibit shorter attention spans, lower intelligence, lower cognitive process (eg, discrimination learning), delayed psychomotor development and changes in behaviour, with the areas most involved being language and body balance (Beard et al 1993; Pollitt 1993; Walter 1993). Several studies have shown that infants who were iron deficient or anaemic and then received iron supplementation had haematological values that returned to normal but there was no corresponding improvement in their psychological status (Lozoff et al 1987; Walter et al 1983; Pollitt et al 1989). In other studies, anaemic school children aged 9–11-years were shown to improve in haematological and psychological measures after supplementation with iron (Soemantri 1989). Pollitt et al (1993) found that anaemic children had poor school achievement scores, which were not fully corrected after iron supplementation. Adequate iron intake is, therefore, critically important during the early childhood years.

The UK national diet and nutrition survey of 1.5–4.5-year-olds (Gregory et al 1995) revealed that 6 percent of children aged between 2.5–3.5-years were anaemic.

Recommended Iron Intakes for Children

Recommendations for daily iron intakes are based on an estimated average percentage of dietary iron absorbed. Australian recommended intakes are based on 15–20 percent absorption compared with 10 percent absorption used in the United States RDAs. This difference relates predominantly to the estimated intake of known promoters of inorganic iron absorption such as meat and vitamin C. Growing children need 0.5 mg iron/day in excess of body losses in order to support growth (Carpenter and Mahoney 1992). (See Appendix 1 for Australian recommended iron intakes for children.)

Calcium

Most research on calcium has focused on its role in bone health. Osteoporosis is the reduction in bone mass that increases the susceptibility to fracture. It is a disease that predominantly affects post-menopausal women; however, dietary measures taken during childhood have demonstrated a reduction in the severity and onset of osteoporosis.

Calcium in the Diet

Calcium is not widely distributed in the food groups and ensuring an adequate dietary intake can be more difficult than for other nutrients.

Milk and milk-based foods are the major sources of calcium in the New Zealand diet, with milk products contributing as much as 70 percent of dietary calcium for children (Department of Community Services and Health 1989).

Sardines are also a good source of calcium, while smaller amounts of calcium are found in eggs, green leafy vegetables, legumes, nuts and wholegrains (Williams 1989; Whitney et al 1990).

In New Zealand since 1996 selected foods can be fortified with calcium. The maximum quantity that can be claimed is 50 percent of the RDI for calcium per reference quantity of specific foods.

Calcium in the New Zealand Diet

In the limited study by George et al (1993) 45 percent and 30 percent of New Zealand girls and boys (aged 10–11 years), respectively, had calcium intakes that fell below 70 percent of the Australian RDI. The girls consumed less calcium-rich foods than the boys, even though the RDI for calcium intakes is higher for girls (George et al 1993).

Skeletal Calcium and Peak Bone Mass

Bone is in a phase of rapid growth and remodelling from birth until about 16 years of age, with bone mass accumulation extending from puberty to the mid-30s (Ott 1990; Chan 1991). Peak bone mass (PBM) is the maximum level of bone mineral content achieved during young adulthood (MacKerras 1995). The age at which PBM is attained has not been conclusively determined, with the literature suggesting a range between 16 to 40 years. This is most likely because skeletal development is heterogeneous with several organisational levels of the skeleton being involved. The most critical period for maximal bone mass formation is during puberty and early adolescence (7–8 percent gain/year). For females, maximal bone mass formation occurs between nine and 10 years of age, reaching maximum velocity in growth at around 12 years of age (Matkovic 1991). For boys, maximal bone mass occurs at 13 years of age (Fassler and Bonjour 1995). Dietary surveys conducted on children have shown that during the years when an increase in calcium intake is most needed for PBM development, the consumption of milk decreases significantly. The trend seems to be a movement away from drinking milk to drinking increased levels of soft drinks and cordial. Concern that increasing the consumption of milk will lead to an increase in the dietary intake of fat need not be warranted as there are a wide range of low-fat milks available on the market.

A maximal bone mass at skeletal maturity is considered the best protection against age-related bone loss (osteoporosis) and subsequent fracture risk. Peak bone mass is probably the result of the interaction between endogenous (heredity, endocrine) and exogenous (nutrition, physical activity) factors. Eighty percent of peak bone mass is controlled by endogenous factors and 20 percent is controlled by exogenous factors (Weaver 1994).

There are two environmental factors that strongly influence the attainment of PBM. These are weight-bearing exercise (walking, jogging, aerobics) and dietary calcium.

Calcium Absorption and Excretion

Absorption of calcium may not be sufficient at times of high requirements, and its bioavailability from the diet is variable. Calcium is also continuously excreted in urine, faeces and sweat as an obligatory loss.

The major determinants of calcium absorption are the amount of calcium in the diet and the vitamin D status of the individual (Peacock 1991). The presence of lactose in a meal also appears to enhance calcium absorption (Williams 1989; Renner 1994). It is assumed that as most New Zealand children spend plenty of time out of doors, even in winter months, vitamin D status is likely to be adequate. Encouraging regular exercise and play is also important for bone mineralisation.

Several dietary factors affect the bioavailability of calcium. Some foods that contain fibre, oxalic acid (as in spinach) and phytic acid (as in wheat bran) inhibit calcium absorption by combining with calcium and forming insoluble complexes which cannot be absorbed by the body (Williams 1989; Renner 1994). Milk contains no inhibitory factors. The calcium absorption rate of non-fortified soy milk can be reduced by up to 20 percent, compared with cow's milk, due to the presence of phytate (Renner 1994).

The dietary calcium:phosphorus ratio is an important factor in calcium bioavailability. A 16:1 ratio appears to be sufficient in gaining a positive calcium balance. Dairy foods have a 36:1 ratio and, therefore, calcium retention is strongly favoured by consuming milk (Heaney 1993).

The obligatory calcium loss in the urine can also be affected by diet. Increased dietary intakes of sodium and protein elevate urinary calcium excretion (Truswell et al 1990; Heaney 1993). However, no study has proven conclusively that high intakes of either sodium or protein would have a deleterious effect on bone mass during growth (Fassler and Bonjour 1995). As a taste for salt can easily be acquired, sodium intakes should be kept to a minimum by avoiding salty snacks and reducing salt used in food preparation (Goulding 1990). Increased urinary calcium excretion occurs when protein levels are high and if phosphate intake is low. If phosphate intake increases with protein intake, a minimal effect on calcium absorption results (Chan 1991). Excess dietary fat inhibits calcium absorption by forming an insoluble calcium salt. This is excreted with the calcium enclosed. Excess dietary calcium remains unabsorbed by the body and is excreted in the faeces (Williams 1989).

Ensuring an Adequate Calcium Intake

Milk and milk products are very important sources of calcium. It is recommended that children consume at least 2–3 servings of milk and milk products each day. If the child does not drink milk, other milk products should be encouraged such as yoghurt, custards, milk soups or cheese. Milk powder can be added to mashed potatoes, cereal, minced meat and pureed legumes, or blended fruit.

Alternative sources of calcium such as cereals and cereal products, green vegetables, canned fish with bones, beans and nuts, tofu and calcium-enriched soy milks, are recommended for children who do not consume milk or milk products. The reduced bioavailability of calcium from plant foods must be considered. These alternatives may be necessary for children with a primary lactose intolerance or milk allergy, or if they follow a vegan diet.

Lactose Intolerance

Most children with lactose deficiency can tolerate milk products in which the lactose has been fermented, such as yoghurt, buttermilk and some cheeses. There are also low lactose milks available in New Zealand.

Milk Allergy

For those children with proven milk allergy, dairy products can usually be reintroduced without risk of reaction by three years of age (Network of the Federal/Provincial/Territorial Group on Nutrition and National Institute of Nutrition 1989). It is advised that children who are allergic to cow's milk receive a substitute which contains adequate amounts of calcium (eg, supplemented soy milks).

Vegan Diets

A calcium supplement may be recommended for those children who have a suboptimal calcium intake due to allergy or a restrictive long-term vegan dietary regimen. This should be undertaken after consultation with a dietitian or doctor.

Recommended Calcium Intakes for Children

From one to seven years of age, the daily skeletal increment of calcium continues at about 100 mg. The obligatory urinary calcium output rises during this period to about 75 mg/d. When this is added to the skeletal increment of 100 mg of calcium, the net absorption by eight years of age needs to be 175 mg of calcium daily (Truswell et al 1990). Assuming that calcium absorption in children is comparable to that of infants on cow's milk, the required intake by eight years of age is 500 mg/day and the daily allowance, therefore, should be 800 mg of calcium. Intermediate values of 600 and 700 mg of calcium respectively should be interpolated for children aged 1–3 and 4–7-years. (See Appendix 1 for Australian recommended calcium intakes for children.)

In recent years, controversy has arisen over what the recommended calcium intake in children should be. Several studies have noted that by increasing dietary calcium intake at 10–12 years of age an increase in bone mineral density followed (Johnston et al 1992; Lloyd et al 1993). Abrams and Stuff (1994) found that late pubertal girls showed small positive calcium retention even though they were consuming the same levels of calcium as in their prepubertal years. It is suggestive that this emphasises the importance of ensuring adequate calcium intake occurs in early puberty. Rubin et al (1993) also noted that the attainment of PBM in girls may be younger than was previously thought.

After reanalysing a substantial number of calcium balance studies, Matkovic and Heaney (1992) determined the calcium thresholds for different age group; 2–8 years, 139 mg/day; and 9–17 years, 1480 mg/day. Both exceed the RDI for calcium. However, Fassler and Bonjour (1995) warn that the effect of increased calcium intake on bone mineralisation remains to be proven conclusively and this should be undertaken before the current RDIs are changed.

Folate

Poor dietary choice and food preparation can result in poor folate intake. Folate is necessary for growth and is related to the metabolism of homocysteine which may play some role in heart disease.

Folate in the Diet

Concentrated dietary sources of folate are found in fresh, dark green, leafy vegetables such as broccoli, brussel sprouts, cabbage, lettuce and spinach. Moderate levels are found in eggs, fresh fruit, other fresh vegetables, and cereals, while low amounts are present in lean meats, fish, milk and milk products. Therefore, most foods (excluding sugar and fats) contribute to dietary folate intake (Whitney et al 1990). Children choosing a variety of food from the four food groups should obtain adequate folate.

Folate is light and air sensitive and easily leaches into water. Care should be taken in storing foods. Between 50–95 percent or more of food folate may be destroyed in cooking, canning or other forms of processing (Herbert 1963).

Since January 1996, selected foods in New Zealand can be fortified with folate. The maximum quantity that can be claimed is 50 percent of the RDI for folate per reference quantity of food.

Functions of Folate

Folate is a critical component in DNA synthesis. Because growth is dependent on cell replication and cell replication is dependent on DNA synthesis, folate is required for growth (Herbert and Colman 1988; Department of Health 1991; Whitney et al 1990). Folate also participates in the metabolism of several amino acids which are required for the formation of new body proteins (Krumdieck 1976).

Folate Deficiency

Symptoms of folate deficiency range from a decrease in the immune system causing increased risk of infection, gastrointestinal tract deterioration resulting in diarrhoea or constipation, and macrocytic anaemia as red blood cell synthesis is disrupted (Whitney et al 1990).

Low plasma folate concentration is associated with an increased risk of coronary heart disease. A marginal folate, vitamin B12 and vitamin B6 (pyridoxal phosphate) status is associated with high levels of homocysteine in the blood (hyperhomocysteineanemia). It appears that the metabolism of homocysteine links low plasma folate concentration and increased risk of coronary heart disease (Ubbink 1994; Chasan-Taber et al 1996). It is believed that an elevated level of circulating homocysteine is both atherogenic and thrombogenic, indicating that homocysteine is possibly extensively involved in coronary heart disease development (Ubbink 1995).

Recommended Folate Intakes for Children

The New Zealand Nutrition Taskforce recommends children should obtain a sufficient intake of folate-containing foods (Department of Health 1991). Daily folate requirement is closely linked to the daily metabolic and cell turnover rates. It increases with anything that increases cell turnover, for example, rapid tissue growth (Herbert and Colman 1988). Recommendations for daily folate intake are based on free plus conjugated folate. (See Appendix 1 for Australian recommended folate intakes for children.)

Fluids

Children need plenty to drink to maintain bodily functions. The toddler and preschooler need to be constantly reminded to drink. Water is the best fluid. Milk is also a good fluid source. Large intakes of fruit juices and cordials should be discouraged because of their high sugar content.

Water Balance

Maintaining water balance is essential to the young child's health. Although thirst is the best guide to fluid needs, preschool children, particularly toddlers, may not be able to tell caregivers when they are thirsty. They should, therefore, be offered water frequently, especially in situations when water loss may be excessive, such as hot days and during illness. The water requirement is the amount necessary to balance the insensible losses (which can vary remarkably), and maintain a tolerable solute load for the kidneys (which may vary with dietary composition and other factors). It is impossible, therefore, to set a general water requirement (Subcommittee on the Tenth Edition of the RDAs et al 1989).

Suitable Fluids for Children

Children should be encouraged to drink water as a beverage from an early age. Children should be offered drinks of cool water rather than fruit juices and cordials. In this way the young child will be less likely to develop a taste for sugary drinks, and tap water may be readily accepted. Fruit juices, cordials and soft drinks all have a similar sugar content, despite labels which might imply otherwise, for example, 'no added sugar'. Large intakes of fruit juices may displace energy and nutrient dense foods in the diets of young children (Smith and Lifshitz 1994). Fruit juices and many powdered drinks are a source of vitamin C, and may be a useful means of enhancing the absorption of iron from food, particularly if young children refuse to eat fruit and vegetables. However, because of the risk to dental health, fruit juices should always be diluted and offered with meals rather than between meals. Milk contributes valuable calcium, protein and energy, but excessive quantities between and at mealtimes may spoil a child's appetite for other foods.

Fluid Needs of Very Physically Active Children

Very physically active children need more water to replace fluids lost through perspiration. Children should be reminded to drink because a loss of as little as 3 percent of body water could result in exhaustion and dehydration or, less dramatically, cause a child to become tired and less effective during activity. The American College of Sports Medicine recommends that children should drink 15 minutes before exercising, and at 20 minute intervals throughout the exercise period, especially if the climate is hot or dry and windy (Baker and Henry 1987). Thirst is not a reliable monitor of the body's need for water during exercise. However, Meyer et al (1994) found mild dehydration during exercise increased the child's thirst and drink desirability. As the level of dehydration increased so did the sensation of thirst. Drinking should be encouraged in those children who fail to do so during and following exercise.

Sports drinks, advertised as a way to replace water and electrolytes lost during exercise, are not generally recommended for children. Plain water is the most economical source of fluid. Young atheletes can use sports drinks, especially if they exercise for more than 90 minutes. Although water is adequate, children are more likely to drink sufficient quantities of fluid if it is flavoured (Meyer et al 1994). Some of these drinks are high in sugar, which can cause cramps, nausea and diarrhoea in children. Lost electrolytes are usually replaced upon eating.

Supplementation

The best nutrition strategy for promoting optimal health and reducing risk of chronic disease is by obtaining adequate nutrients from a wide variety of foods as recommended in the *Food and Nutrition Guidelines*. Vitamin and mineral supplementation is only appropriate in specific circumstances. Examples of when supplementation may be appropriate in children are:

- children with an appropriately diagnosed milk allergy may require a calcium supplement.
- Vegans require vitamin B12 supplementation.

Supplements are not generally recommended for children. Reasons for this include:

- concerns about the adverse effects related to the continued use of large numbers of certain vitamins or minerals (American Dietetic Association 1996)
- possible unknown benefits of food, due to incomplete identification of all components within the food (American Dietetic Association 1996)
- interactions among minerals and trace elements, which may mean that large supplemental intakes of one nutrient could result in deficiencies of another (Sandstead 1981)
- considerable expenditure on supplements may reduce the money available for purchasing food
- reliance on dietary supplements may be associated with a false sense of security about nutrient adequacy, thus potentially impairing the adequacy of food intake.

There are no data on supplement usage patterns in New Zealand children. The National Nutrition Survey should provide some current information of supplement usage patterns of adult New Zealanders.

Fortification

Nutrients are added for the purpose of improving the quality of food or as a way of helping to improve the nutritional status of a population or a sector of the population.

In July 1996 the joint food standards setting system between Australia and New Zealand was introduced. Until a single set of food standards is developed for both countries, New Zealand allows food products to comply either with the New Zealand Food Regulations 1984 or with the Australian Food Standards Code.

The addition of nutrients to foods is specified in the Food Regulations 1984 (Amendments number 12 and 13). The Regulations list which foods can be fortified, what nutrients can be added and quantities of nutrients that can be added to the food.

Food standards need to be reviewed regularly in response to a population's changing nutritional needs and any emerging health risk which may arise from foods eaten (Ministry of Health 1995). It is reported that there are no known safety concerns resulting in the consumption of foods with added nutrients in the UK (Brady 1996).

Snacking

Snacking is a common practice during the childhood years. Children have small stomachs and need small meals and snacks often. The nutritional composition of a child's diet can be strongly influenced by snack food choices.

Snacking in the New Zealand Diet

In New Zealand, 96 percent of boys and 98 percent of girls aged 10–11 years were found to snack more than once a day, with girls snacking more than boys. Snacks contributed 30 percent to daily total energy intake. Approximately half the daily sugar intake came from snacks, not surprisingly as the majority of snacks were of a high sugar content such as cordial, Milo powder, chocolate and soft drinks (Brinsdon et al 1992). In comparison, Cross et al (1994) found salty/crunchy foods were the most frequently consumed snack group for American children.

Recommended Snacking for Children

Frequency of Snacking

Young children need to eat snacks because it is difficult for them to obtain enough energy and nutrients in the three main meals. In general, nutritious foods (see Table 2) should be offered to young children in small amounts at frequent intervals. Mid-morning, mid-afternoon (especially after school for older children) and after-dinner snacks become part of the daily routine for many children.

It has been demonstrated that preschoolers who ate fewer than four times a day consumed less energy and nutrients than their peers, whereas those who ate more than six times consumed more than other children their age (Network of the Federal/Provincial/Territorial Group on Nutrition and National Institute of Nutrition 1989). However, constant nibbling with no scheduled meals and snacks limits the opportunity for children to develop a healthy appetite.

If snacks are scheduled appropriately, they are unlikely to interfere with eating meals. Snacks provided to young children well in advance of their next meal should not spoil their appetite.

Snacks Should Complement Meals

Carefully planned snack foods should make a valuable contribution to the child's daily nutrient and energy intake. A snack should not take the place of a meal, but can be thought of as a 'mini-meal' that supplies protein, vitamins, minerals and energy (Baker and Henry 1987). Foods that are high in sugar or fat are best kept for occasional treats, or for times when energy expenditure is high.

Control of Snack Food Selection

Because the majority of snacking by children is undertaken in the home, parents can influence snack food choice by providing a variety of healthy choices. This is especially true for younger children.

Nutrition Education and Snack Foods

Children need to learn how to make informed choices as to appropriate snack foods. McClean and Knowles (1992) noted that food advertising during children's programmes was predominantly for low nutritive, high fat, sugar and salt foods. Because children are receiving mixed messages about what food they should eat it is necessary that nutrition education efforts should not neglect snack time.

Snacking and Dental Health

The consumption of high sugar-containing snacks has been associated with an increase in dental caries. Frequency of sugar consumption and the form in which sugar is consumed are suggested to be just as important in the development of dental caries as the total amount of sugar consumed (McMahon et al 1993). Sweet foods which stick to the teeth such as raisins or fruit leather, or those which the child keeps in the mouth for a long time such as lollipops, are particularly cariogenic. Snacks containing protein appear less damaging than snacks rich in sugar. Raw vegetables are thought to promote the flow of saliva; its buffering action counteracts acid attack on the tooth (Network of the Federal/Provincial/Territorial Group on Nutrition and National Institute of Nutrition 1989). The Nutrition Taskforce (Department of Health 1991) has recommended that 'to reduce the risk of dental decay restrict the frequency of eating foods high in added sugar. Sugar foods, if taken, should be taken at meal times instead of snacks'. McMahon et al (1993) studied a group of 2–5-year-old New Zealand children, living in fluoridated areas and found 20 percent of their total energy came from available sugars. However, the study found no reason to suggest that a decrease in sugar containing foods would lead to a decrease in dental caries.

Foods such as citrus fruits and carbonated drinks and sports drinks contain their own acids, which can directly act on tooth enamel. Because these dietary acids are strong they can depress the pH level of the mouth below the point at which bacterial enzymes act. No new acid is formed, but because the dietary acid already present is strong, tooth enamel can be significantly dissolved (Whitney et al 1990).

The ideal food for healthy teeth should have the following attributes:

1. The physical form of the food should stimulate saliva production.
2. The food should produce a minimal amount of adherence to the tooth.

In order to let saliva neutralize acids and remineralize tooth enamel, the frequency of eating and drinking should be limited to not more than six to seven meals or snacks per day (Wei 1995).

Suggestions for Healthy Snack Foods

Preschool Children

Single selections or combinations of foods from Table 2 will provide a variety of healthy snacks for young children. The addition of extra sugar, fat, or salt should be avoided.

Table 2: ***Suggestions for nutritionally and dentally appropriate snacks***

Breads and cereals	Breads including whole wheat breads; crackers; rolls; toast; muffins, and loaves made with minimal amounts of sugar; and unsweetened dry cereals.
Fruits and vegetables	Raw vegetable and fruit pieces; grated vegetables and salads; vegetable juices; fresh or unsweetened, frozen or canned fruit (in own juices).
Milk and milk products	Milk; yoghurt without added sugar; cheese; yoghurt or cottage cheese dips; cheese spreads.
Meat, seafood, chicken,	Hard-cooked egg; cheese; pieces of lean meat or and chicken; tuna or salmon; peanut butter and other spreads made from pureed nuts, seeds and legumes.

School-age Children

Children are generally very hungry after school and require a substantial snack to last them through until the evening meal. Creative and fun snacks using healthy foods may encourage children to make healthy food choices. When the children are home after school, a plastic container which is stored in a special place in the refrigerator can become the snack box. Parents can keep the box stocked with different kinds of after-school snacks. Children are then less likely to 'raid-the-cupboards'.

Table 3: ***Ideas for creative snacking***

- Sandwiches made with peanut butter, cheese or cottage cheese, lean meat slices, tuna fish, or jams or honey.
- Plain savory or sweet biscuits. Adapt biscuit recipes by reducing amounts of butter, margarine and sugar.
- Unsweetened muesli or other wheat cereal, with milk and sliced fresh fruit.
- Washed and cut raw vegetables kept in the refrigerator. Serve with a yoghurt or bean dip.
- In winter, canned, frozen or packet soups.
- Natural popcorn.
- Homemade frozen juice iceblocks made in an ice cube tray.
- Fresh fruit 'smoothies'. Use a blender to mix milk, yoghurt or juice with fresh or frozen fruit. Try a banana, ice-cubes and a spoonful of milk powder blended with milk.

Older children can learn to use the microwave:

- Half a English muffin, pita bread, or mini pizza base covered with tomato sauce and cheese can be made in advance, frozen, and heated in the microwave.
- Cheese slices melted on toast or crackers.
- Cups of soup or leftovers can also be heated by older children.

Treat Foods

Foods that are high in fat, salt or sugar are best left for occasional treats. The frequency of eating fast foods, the choices made and the child's nutrient intake from other foods eaten that day are important considerations in assessing the merits of fast foods.

Fast foods are not inherently 'bad'. The main problem with fast foods is not what they lack, but rather what they provide. Junk food is not fast food, but food which generally contains minimal nutritional value. Diets that are high in fat and salt, and low in fibre, are associated with heart disease and hypertension.

Fast foods may also contribute to excess energy intake. Many fast foods are energy dense and their nutrient density is low relative to their energy content. This can pose a problem in children who frequently consume fast foods.

There are no data on the type or amount of treat foods or foods eaten by New Zealand children, although the UK national diet and nutrition survey of 1.5–4.5-year-olds (Gregory et al 1995) revealed that on average the children sampled derived one-fifth of their energy intake from foods eaten away from home. Observational evidence suggests that New Zealand children are eating away from home more often.

Sustained intake of a diet containing an excess of salt appears to be a critical factor in the eventual onset and maintenance of hypertension in individuals who have a genetic predisposition to this disease. Variation within and between populations with respect to blood pressure levels, is associated with differences in salt (sodium) intake. Sodium is also largely responsible for the rise in blood pressure with increasing age (Elliot et al 1996; Law et al 1991). Prepared foods, such as bread, cakes, biscuits, canned foods, butter and cheese provide the greatest amount of sodium in the diet of New Zealand adults (Department of Health 1991). There are no accurate data on sodium intake of New Zealand children. However, it is likely that processed foods contribute most of the sodium in children's diets.

The principle of moderation is very important when selecting salty snacks, fast foods, convenience meals and confectionery. Children can learn to make healthier fast food choices, such as 'no-salt' fish and chips eaten with a sliced tomato or a piece of fruit, a single hamburger, a grilled chicken sandwich, a low-fat milkshake, salad instead of French fries, or plain pizza. The important thing for parents to remember is that they should compensate for the shortcomings of fast food by serving well-balanced meals and snacks at home. If most of a child's meals are nutritionally sound, occasional treats of potato chips, soft drinks, sweets and fast foods are acceptable (Xhles and Miles 1982).

Vegetarian Diets

There is an increasing interest in vegetarian diets. It is possible to obtain all essential nutrients without eating animal products. Eating a wide variety of different foods will ensure a good balance of nutrients. A considerable body of scientific data suggests positive relationships between vegetarian lifestyles and risk reduction for several chronic degenerative diseases such as obesity, coronary artery disease, hypertension, diabetes mellitus, colon cancer, osteoporosis and others (Halva and Dwyer 1988). Browne (1992) surveyed New Zealand vegetarian mothers of preschool children and found that both parents and health professionals required more information about vegetarian diets for preschoolers.

The term vegetarianism encompasses a wide range of dietary practices that can be divided into a number of sub-groups. Lacto-ovo-vegetarians (LOV) exclude meat, fish and poultry from their diet but they do consume dairy products and eggs. Lacto-vegetarians eat no meat, fish, poultry or eggs but they do include milk and milk products (butter, cheese) in their diet. Vegans adopt the strictest form of vegetarianism as they exclude all animal-derived food from their diet (Whitney et al 1990).

Nutritional Adequacy of Lacto-Ovo-Vegetarian Diets

Lacto-ovo-vegetarian diets that contain milk products and eggs are generally satisfactory for children. They also conform closely with paediatric recommendations for promoting health and reducing the risk of chronic degenerative diseases (Jacobs and Dwyer 1988). In a review of the literature, Sanders (1995) reported that the differences in nutrient intakes between children adopting an omnivorous or LOV diet were not very large. Protein and energy intakes were similar with LOV children consuming less fat and more carbohydrate than non-vegetarian children.

The growth of children consuming a vegetarian diet has caused some concern over the last two decades (Jacobs and Dwyer 1988). After a review of the literature, Jacobs and Dwyer (1988) found children who consumed a LOV diet tended to be shorter than those who did not. However, whether this association was due to diet per se, or other factors such as genetics and other environmental stimuli, could not be determined. Sabate et al (1991) studied a group of Seventh Day Adventist children and concluded that a LOV diet is able to provide adequate nutrients to allow for normal growth.

By the time LOV children reach school age they appear to differ little in nutritional status to their non-vegetarian peers (Dwyer 1991). It is the position of the American Dietetic Association (1988) that vegetarian diets are 'healthful and nutritionally adequate when appropriately planned'.

Nutritional Adequacy of Vegan Diets

Vegans who exclude all animal derived foods from their diet need to plan carefully to meet the RDIs for energy, protein calcium, iron, zinc, riboflavin, vitamins B12 and D, and n-3 fatty acid intakes (Nutrition Standing Committee of the British Paediatric Association 1988; Sanders 1995). Malnutrition in preschool children has been associated with restrictive vegan diets (Jacobs and Dwyer 1988).

Children following vegan diets adopted during the first five years of life have demonstrated low rates of growth. However, continuing on a vegan diet that provides an adequate amount of food, catch up growth occurs by the age of 10 years (Jacobs and Dwyer 1988; Sanders 1995). Ideally, the growth of vegan children should be monitored since significant depressed growth may indicate less than optimal development (Network of the Federal/Provincial/Territorial Group on Nutrition and National Institute of Nutrition 1989). Sanders and Manning (1992) found that vegan children tended to be lighter and shorter than children who consumed mixed diets; even so, the vegan children seemed to fall within normal ranges of growth and development. When milk is not taken, other drinks such as soy milk fortified with calcium and vitamin B12 should be given.

Nutrients to Monitor and Practical Suggestions

It is essential to plan vegetarian or vegan diets for children carefully. As food intake becomes more restricted, there is a greater risk of nutrient deficiencies and an inadequate level of energy intake. The following factors need to be considered:

Energy

A vegetarian and vegan diet tends to be low in energy, particularly if large amounts of fruits and vegetables are consumed. The bulky nature of the vegetarian diet may mean that children have difficulty consuming sufficient nutrients and energy since stomach capacity is small. Thus, serving frequent small meals and snacks is especially important. Cereals, nuts, pulses, legumes, root vegetables (potato, kumara) and dairy products are more energy dense than fruits.

Protein

It is possible for children on a limited vegetarian or vegan diet to have inadequate protein intake. Protein quality may be compromised by limited variety or improper combination of plant sources of protein. Care must be taken to offer the vegan child ample sources of protein and to ensure that energy intakes are adequate. It is important that vegetarian and vegan children consume a variety of protein sources. For vegan diets, it is necessary to combine foods high in lysine but low in sulphur-containing amino acids, such as legumes, with foods high in methionine and threonine and low in lysine, such as grains.

Minerals

Foods commonly consumed in a vegetarian and vegan diet contain large amounts of fibre, phytate and oxalate. These substance are known to bind minerals such as calcium, iron, and zinc and reduce their bioavailability (Freeland-Graves 1988). There is no evidence that this binding will cause deficiency syndromes in an otherwise adequate diet.

Iron

Children consuming a balanced LOV or vegan diet have similar iron status to non-vegetarian children (Craig 1994). Lacto-ovo-vegetarian and vegan children should consume whole-grain and fortified cereals, nuts, seeds, dried fruits, legumes and dark green vegetables as these have a high non-haem iron content. Fruits and vegetables are important foods in the vegetarian diet as they contribute a high quantity of vitamin C, as do fruit juices.

Calcium

Calcium intake is not affected in LOVs as they consume milk and dairy products. Absence of milk products may put vegan children at risk of developing nutritional rickets because of inadequate intakes of dietary vitamin D, calcium and phosphorus (Dwyer 1991). Sources of calcium in vegan diets, include legumes, tofu, oranges, almonds, figs and some leafy vegetables. Calcium fortified soy milk is recommended.

Zinc

Zinc is needed for growth and development and the maintenance of body tissues. Zinc also plays an important role in the synthesis of proteins (Department of Health 1991). Lacto-ovo-vegetarian and vegan diets can be low in zinc due to the dietary exclusion of meats, poultry and seafood, and the binding of zinc by fibre, phytate and oxalate. Another factor influencing zinc quality in LOV and vegan diets may be the extensive use of soy products as meat substitutes. Sources of zinc in LOV and vegan diets include legumes, nuts, miso and tofu, but the availability is questionable.

Zinc deficiency has been reported to slow growth in boys 3–6-years of age. The New Zealand Nutrition Taskforce (Department of Health 1991) recommended that young children on strict vegetarian diets receive an adequate intake of zinc by regularly eating nuts, legumes and whole grain cereals.

Vitamins

Lacto-ovo-vegetarian diets are usually sufficient in vitamin B12, vitamin D and riboflavin, as the main source of riboflavin is milk. Eggs and milk both supply vitamin B12. The vitamins most likely to be deficient in vegan diets are vitamin B12, vitamin D and riboflavin.

Vitamin B12

Vitamin B12 is found exclusively in animal meat and dairy products (Whitney et al 1990). Strict vegans are thus theoretically at great risk of vitamin B12 deficiency (Browne 1991). Vitamin B12 deficiency produces an inadequacy in the production of myelin synthesis which results in neurological damage (Dwyer 1991). A vitamin B12 supplement or injection is recommended in vegan children.

Vitamin D

When adequate exposure to sunlight is not possible, vegans who avoid all meat and dairy products are at greater risk of developing a vitamin D deficiency than LOVs or omnivores (Dwyer 1991).

Riboflavin

Milk and milk products are the major sources of riboflavin. Because vegans avoid consuming these foods, the risk of developing a riboflavin deficiency is increased (Dywer 1991).

n-3 Fatty Acids

Docosahexaenoic acid (22:6n-3; DHA) appears to play an important role in the retina and central nervous system. DHA is not found in foods of plant origin, but DHA can be synthesised, to a limited extent, from linolenic acid (18:3n-3) which is found in plant foods. Due to competitive inhibition from linoleic acid (18:2n-6), a high dietary ratio of linoleic:linolenic acid results in a decrease in DHA production. It is, therefore, suggested that vegans use soybean or canola oil, which have a lower ratio than sunflower, safflower or corn oils which have a high ratio (Sanders 1995).

Eating Behaviour in Children

Infants totally dependent on their caregiver for food. However, as the child continues to grow, the control of food is shared between the child and caregiver. It has been suggested that chronic dieting, eating disorders and out-of-control, disinhibited eating are a result of the control of feeding during early childhood (Birch and Fisher 1995). Once the preschool years are reached, differences in the feeding patterns of boys and girls can be seen (Johnson and Birch 1994). It appears that parents think that it is more acceptable for a boy to be heavy than for a girl, with the parents exercising more control of dietary intakes in females than in males.

Control of Meal Timing

Infants are fed on demand and thus control their food intake. As the infant grows the child must learn to adapt to the social meal patterns of its family and culture. By preschool age, social cues and the environment begin to initiate feeding times (Birch and Fisher 1995). School-age children should be able to eat when they are ready.

Control of Meal Size

Evidence exists that children can regulate their energy. For example, they eat more following low energy meals and they eat less following a high energy meal (Shea et al 1992; Birch, McPhee et al 1993; Johnson and Birch 1994). Intakes at individual meals are highly variable but total daily energy intake is relatively constant (Birch, Johnson et al 1993).

Control of Food Preferences

In order to adjust food intake after an energy-dense meal, children reduce the variety of foods eaten by eating preferred foods and eliminating non-preferred ones. This may have a negative effect on diet quality as most preferred foods tend to be high in sugar and fat with low micronutrient content. Even though parents can control the variety of foods that a child is exposed to, the overall quality of the diet is controlled by what the child prefers to eat.

Food intake in children is determined largely by their food preference. Children will not eat what they do not like. There is evidence to suggest that children can learn to prefer foods especially when they are associated with a positive context. Conversely, children can learn to dislike a food if it is associated in a negative context.

Foods presented as rewards, desserts, part of holidays and celebrations become more preferred. For example, a chocolate bar used as a reward to make a child eat its carrots will result in the child preferring the chocolate bar and disliking the carrots (Horne et al 1995; Birch and Fisher 1995). Children provided with a variety of healthy foods are able to consume a nutritionally adequate diet (Birch et al 1991). However, Klesges et al (1991) found children who were free to choose food from an unrestricted variety tended to choose those that were high in saturated fat, sugar and salt. It appears that parents who allow non-nutritious foods to be available may offset the nutritional balance of their children's diets.

McClean and Knowles (1992) studied television food advertising during children's programmes in New Zealand. The majority of advertisements were for high sugar, fat and salt foods. The relationship between children consuming foods that they have seen their heroes or peers eat (Horne et al 1995) is a particularly relevant area of television advertising as it is more likely that those foods will be consumed because of the image surrounding them.

Family Interaction

Social interaction factors within the family have increasingly been implicated in the aetiology of feeding problems. Within the social learning framework, parental feeding practices and behaviour have been proposed to contribute to the development and maintenance of feeding problems. These include:

- unrealistic or inappropriate expectations of age-appropriate dietary intake and mealtime behaviour
- failure to model appropriate mealtime.

Other factors which have been identified in families of problem eaters include failure to establish a conducive eating environment, such as having irregular meals and presenting meals in an environment containing distractions such as toys and television (Sanders et al 1993).

Neophobia

Neophobia is a term used to describe the fear of the new. Children aged between 3–5 years are neophobic to foods. However, with an increase in exposure to a particular food, preference for the new food will occur. It seems that 8–10 exposures are necessary and tasting the food is essential (Birch, Johnson et al 1993; Pelchat and Pliner 1995).

Unfortunately, parents commonly believe that if a child does not consume a particular food the first time it is offered it means that the child does not like it and as a result the food is not offered again. Children prefer foods that they have seen a peer or hero eating (Horne et al 1995).

Nutrition Knowledge and Practices in Children

Singleton et al (1992) studied a group of 4–7-year-olds and reported that children of this age were able to define health in a positive way. It would seem that because young children are able to comprehend some abstract concepts relating to food, eating behaviour and health, educating preschool children on nutrition matters should not be ignored. Murphy et al (1995) found a similar level of knowledge in kindergarten children. However, the food preferences of these groups did not correspond to their nutrition knowledge. A significant relationship between involvement in food selection and nutrition awareness was demonstrated in 3.5-year-olds (Anliker et al 1992).

Advice for Developing Good Eating Behaviours in Children

Caregivers should:

- provide a wide variety of nutritious foods for children to select from
- give children a large proportion of control over their food intake, especially meal size
- help children adapt to the social timing of meals
- avoid using rewards or forcing or coercing a child to eat
- have mealtimes together as a family (when possible)
- have mealtimes at an appropriate time for young children
- limit distractions at mealtimes
- avoid force feeding children
- have fast foods as an occasional treat not as an everyday food.

Eating Disorders

The increasing prevalence of eating disorders and its development at a young age is concerning. A variety of psychological factors play an important role in eating disorder development.

Prevalence of Eating Disorders

In Australia, 20 percent of young women may be at risk of developing an eating disorder with the prevalence of both anorexia nervosa and bulimia nervosa between the ages of 11 to 25 years increasing. Anorexia occurs 15 times more frequently in females than males (Saxelby 1993).

Risk Factors for the Development of Eating Disorders

Increased fat laid down during puberty is negatively viewed by most girls and as puberty progresses the desire to be thinner increases (Killen et al 1992).

Sasson et al (1995) found that preoccupation with dieting is higher in girls than boys and increases with age, starting at age nine years and increasing till ages 14 and 15 years. There is a strong association between the dietary concerns of girls and those of their mothers (Hill et al 1990). Reports that dieting is being undertaken by nine-year-olds is alarming and undesirable. This is especially so as many of these children, particularly girls, are not overweight (Hill and Rogers 1992; Hill et al 1994).

Individuals who 'refused to eat' during early childhood continue to show problematic eating behaviour in later life (Dahl et al 1994). Parental beliefs and behaviours are likely to be major influences on a child's view of their own body size (Wardle et al 1995). It is important that parents, significant others, and the media do not promote inappropriate body size and shape values. Society's definition of what is an appropriate body size and shape seems to greatly influence young girls (Gustafson-Larson and Terry 1992).

A number of studies have found that many children are not content with their body shape. Most of these studies show that girls aspire to attain a body shape which is thinner than their current shape (Maloney et al 1989; Hill et al 1994; Wardle et al 1995; Sasson et al 1995). Body shape satisfaction (or the point at which preferred shape is equal to current shape) for girls was met at 11 percent below their mean weight. Boys desire a more athletic and muscular build, and have a body shape satisfaction at 12 percent above their mean weight (Wardle et al 1995).

Nutritional Effects of Eating Disorders

The major nutritional problem in these disorders is the lack of food consumption. Energy, vitamin and mineral intakes are inadequate and malnutrition develops. It has been documented that children and young teens who self-impose energy restriction have a retarded growth rate and puberty is delayed (Davis et al 1978; Pugliese et al 1983).

The development of eating disorders during the pre-adolescent years is nutritionally damaging as this is the period when the body lays down fat reserves for the following growth spurt of adolescence.

Food Allergies

The true incidence of food intolerance is probably considerably less than is commonly perceived. Once a food intolerance or allergy has been diagnosed, professional advice should be sought from a dietitian to ensure that the child's diet remains nutritionally adequate following the exclusion of the offending food or food substance.

Definitions

Food intolerance is a reproducible adverse non-immunological, non-psychological reaction to food or food compounds.

Food allergy is a specific immunological reaction to a food component.

Food aversion is a psychological intolerance to a food where an adverse reaction is caused by emotion associated with the food, rather than the food itself, and which does not occur when the food is given in an unrecognisable form (Wham 1989).

Incidence of Food Allergy or Food Intolerance in Childhood

The highest incidence of food allergy onset exists in the 0–1 year group. Between 1 and 2 years of age the incidence rate halves and continues to decrease till seven years of age (Crespo et al 1992). In 80–90 percent of children with food allergy, eggs, peanuts, milk, fish, soy and wheat account for about 90 percent of reactions (Sampson 1988).

Despite a decrease in the incidence of food allergy with age, there are still children on restricted diets which are often unnecessary, and without dietetic guidance or support, these children may be at risk of developing nutritional deficiencies.

Physical Activity

The benefits of regular moderate intensity physical activity for all ages are not debated. Physical activity has numerous benefits on the cardiovascular and musculoskeletal systems as well as the functioning of the metabolic, endocrine and immune systems. The health benefits of physical activity include a reduced risk of cardiovascular disease, hypertension, some cancers, obesity and diabetes. Physical activity also improves mental health, improving mood and reducing depression and anxiety (US Department of Health and Human Services 1996). The greatest health benefit occurs in shifting those who are sedentary into performing at least some activity (Haskell 1994). Physical activity should be part of children's routine in everyday life at school, at home and in the wider community.

The development of regular physical activity patterns should be learned in childhood, and be continued in adolescence and adulthood. Children exercise for a variety of reasons: to have fun, to attain self-confidence and personal satisfaction, to socialise, to achieve personal goals and to combat boredom. They do not exercise to decrease morbidity or mortality (McKeag 1991).

One of the most important aspects of physical activity for children is the moulding of positive attitudes towards active lifestyles (Godin et al 1987). Positive attitudes will most likely be achieved by non-competitive, co-operative, family-linked activities (Shephard 1990). Children should try a variety of activities, to discover those that are personally enjoyable (Shephard 1990).

Physical Activity in New Zealand Children

Physical education at school is compulsory from new entrance to fourth form, ensuring all New Zealand children are undertaking at least a minimum level of activity. Little research has been undertaken on physical activity levels in New Zealand children. There are data on the normal fitness level of New Zealand children in the early 1980s (Russell et al 1989), however no subsequent data are available. It has been estimated that New Zealand school children (aged 5–10 years) are exposed on average to 19 minutes per day of some type of physical activity (Ross and Cowley 1995).

Strategies that may help increase physical activity levels at school include:

- encouraging children to play during lunch time
- encouraging the development of a school policy that promotes physical activity and includes daily physical activity as part of the core curriculum
- ensuring schools have adequate facilities for children to play outside
- encouraging cycle safety
- encouraging children to walk or cycle to school with their caregivers (Cowley and Ross 1997).

School-based intervention for promoting physical activity appear to be successful (US Department of Health and Human Services 1996). The Hillary Commission has programmes such as Kiwidex, which encourage active lifestyles at school. Kiwidex aims to make physical activity enjoyable and available to all children at primary and intermediate schools. It also encourages a commitment to an active lifestyle.

Recommended Level of Physical Activity in Relation to Health

In order to obtain health benefits, the recommended level of physical activity is at least 30 minutes of moderate intense activity on most or preferably all days of the week (eg, brisk walking, playing basketball). Additional benefits will be achieved by further increases in activity. This recommendation has been made for all people of all ages (US Department of Health and Human Services 1996).

Guidelines for children have recently been promoted (Pangrazi et al 1996). These guidelines are compatible with the Surgeon General's Report (US Department of Health and Human Services 1996). It has been recommended that children should accumulate 30–60 minutes of moderate intensity physical activity per

day. This should include spontaneous play, physical education, organised games and sport, as well as lifestyle factors (walking or cycling to school) and domestic activities.

This recommendation of moderate intensity physical activity is substantially different to the exercise guidelines aimed at maintaining or increasing cardiovascular fitness (American College of Sports Medicine 1990). This recommendation states that 15–20 minutes of exercise should be undertaken on 3–5 days per week and should raise heart rate to 60–80 percent of maximum. This recommendation is still relevant to individuals who require cardiovascular fitness.

Glossary

Young child: A child aged between 2 and 6 years.

Older child: A child aged between 7 and 12 years.

Tracking: This is where, for example, weight retains its position in the distribution curve through time. Therefore, a child who is overweight will probably become an adult who is overweight.

Amino acids: These are compounds which form the structural units of protein. Some amino acids are essential where they cannot be synthesised by the human body and, therefore, need to be obtained from the diet. Other amino acids are termed nonessential as they are able to be made by the human body.

Essential fatty acids: These are fatty acids that need to be obtained from the diet as they cannot be made by the human body.

Dietary fibre: This is made up of all non-starch polysaccharides, resistant starch and lignin.

Fortified foods: A term referring to the addition of one or more nutrients to a food, often not originally present and often added in amounts greater than might be found naturally.

Non-starch polysaccharides: These are often referred to as dietary fibre. Non-starch polysaccharides contain both a digestible component and an indigestible component.

Resistant starch: This is starch still contained in granules and starch that has become retrograded when cooled after heating and starch not available because of an intact cell wall. This starch is not digested in the small intestine.

Lignin: A non-carbohydrate type of plant cell wall not digested. It increases with plant ageing.

Peak bone mass: This is the maximum level of bone mineral content achieved during young adulthood.

Lacto-ovo-vegetarian: A lacto-ovo-vegetaran excludes meat, fish and poultry from their diet but consumes dairy products and eggs.

Vegan: A vegan excludes all animal-derived food from their diet.

Anorexia nervosa: Anorexia nervosa is a potentially life-threatening illness. Sufferers exhibit an extreme psychophysiological aversion to food. The disease is characterised by an obsessive compulsion to keep body weight below 85 percent of what would be expected based on age and height.

Bulimia: Bulimia nervosa is characterised by repeated binge and purge sessions. After bingeing on food an overwhelming sense of guilt develops and vomiting, laxative or diuretics are used to purge in order that weight gain is not achieved. Individuals with bulimia nervosa tend not to be as physically ill as individuals with anorexia nervosa.

Food intolerance: This is a reproducible adverse non-immunological, non-psychological reaction to food or food compounds.

Food allergy: This is a specific immunological reaction to a food component.

References

Abrams S and Stuff J. 1994. Calcium metabolism in girls: current dietary intakes lead to low rates of calcium absorption and retention during puberty. *Am J Clin Nutr* 60: 739-43.

Agencies for Nutrition Action. 1996. *Healthy Weight New Zealand*. Auckland: Agencies for Nutrition Action.

American Academy of Paediatrics, Committee on Nutrition. 1992. Statement on cholesterol. *Pediatrics* 90: 469-73.

American College of Sports Medicine. 1990. The recommended quality and quantity of exercise for developing and maintaining fitness in healthy adults. *Medicine Science Sports and Exercise* 22: 265-74.

American Dietetic Association Report. 1996. Position of the American Dietetic Association: vitamins and mineral supplementation. *J Am Diet Assoc* 96: 73-7

Anliker J, Laus M, Samonds K et al. 1992. Mothers' reports of their three-year-old children's control over foods and involvement in food-related activities. *J Nutr Ed* 24: 285-91.

Anonymous. 1987. Advice about milk for infants and young children. *Lancet* 1 (8537): 843-844.

Anonymous. 1988. Bone mineralization and growth in term infants fed soy-based or cows milk based formula. *Nutr Rev* 46: 152-4.

Anonymous. 1992. Maximizing peak bone mass: calcium supplementation increases bone mineral density in children. *Nutr Rev* 50: 335-7.

Baghurst P, Baghurst K, Record S. 1996. Dietary fibre, non-starch polysaccharides and resistant starch: a review. *Food Australia* 48, (3 suppl): S3-35.

Baker S and Henry RR. 1987. *Parents' Guide to Nutrition: Healthy eating from birth through adolescence.* Reading, Mass. Addison-Wesley Publishing Company, Inc.

Baynes R and Bothwell T. 1990. Iron deficiency. *Annu Rev Nutr* 10: 133-48.

Beard J, Connor J, Jones B. 1993. Iron in the brain. *Nutr Rev* 51: 157-70.

Berenson G. 1986. Evolution of cardiovascular risk factors in early life: perspectives on causation. In: GS Berenson (ed). *1986. Causation of Cardiovascular Risk Factors in Children: Perspectives on cardiovascular risk in early life*. New York: Raven Press.

Bindra G. 1985. Fibre and Phytate. *Nutrition and Food Science* July/August 95: 20-21.

Birch L and Fisher J. 1995. Appetite and eating behaviour in children. *Pediatr Clin North Am* 42: 931-53.

Birch L, Johnson S, Andresen G et al. 1991. The variability of young children's energy intake. *N Engl J Med* 324: 232-5.

Birch L, Johnson S, Jones M et al. 1993. Effects of a non-energy fat substitute on children's energy and macronutrient intake. *Am J Clin Nutr* 58: 326-33.

Birch L, McPhee L, Bryant J et al. 1993. Children's lunch intake: effects of midmorning snacks varying in energy density and fat content. *Appetite* 20:83-94.

Boulton T and Magarey A. 1995. Effects of differences in dietary fat on growth, energy and nutrient intake from infancy to eight years of age. *Acta Paediatr* 84: 146-50.

Boulton T, Seal J, Magarey A. 1991. Cholesterol in childhood: how high is O.K? Recommendations for screening, casefinding and intervention. *Med J Aust 154: 847-50.*

Brady MC. 1996. Addition of nutrients: current practice in the UK. *British Food Journal* 98 (9): 12-9.

Brinsdon S, George J, Paulin J. 1992. *A Survey of the Nutrient Intakes of a Sample of Form One Children*. Internal Report. Wellington: Health Research Services, Department of Health.

Brinsdon S, George J, Paulin J et al. 1992. What do snack foods contribute to the diets of Form One children? *Proc Nutr Soc NZ* 17: 105-10.

British Dietetic Association. 1987. *Children's Diets and Change: A report of the Child Health and Nutrition Working Party*. Birmingham: British Dietetic Association.

Browne ME. 1991. *The Adequacy of Vegetarian Diets for Preschool Children.* Thesis. Dunedin: Department of Human Nutrition, University of Otago.

Browne ME. 1992. A nutrition education needs assessment survey of a small group of vegetarian families with preschool children. *Pro Nutr Soc NZ* 17: 111-16.

Burlingame B, Milligan G, Apimerika D et al. 1993. *The Concise New Zealand Food Composition Tables*. Palmerston North, NZ: New Zealand Institute for Crop and Food Research.

Businco L, Bellanti J, Catassi C et al. 1993. Food allergy in childhood. Hypersensitivity to cows milk allergens. *Clin Exp Allergy* 23: 481-3

Buttriss J. 1987. Diet and under fives. *Nutr Food Service* September/October: 10-14.

Capadose A. 1991. *Healthy Eating and Nutrition*. Great Britain (sine loco), Harper Collins Publishers.

Carpenter C and Mahoney A. 1992. Contributions of heme and nonheme iron to human nutrition. *Crit Rev Food Sci Nutr* 31: 333-67.

Chan G. 1991. Dietary calcium and bone mineral status of children and adolescents. *Am J Dis Child* 145: 631-4.

Chasan-Taber L, Selhub J, Rosenberg I et al. 1996. A prospective study of folate and vitamin B6 and risk of myocardial infarction in US physicians. *J Am Coll Nutr 15* (2): 136-43.

Clark B. 1988. Fat, fibre and the under-fives. *Nursing Times* 84: 59-64.

Clarke W and Lauer R. 1993. Does childhood obesity track into childhood? *Crit Rev Food Sci Nutr* 33: 423-30.

Conference on Dietary Fiber in Childhood. 1995. A Summary of conference recommendations on dietary fiber in childhood. *Pediatrics* 96 (5 suppl): S1023-8.

Cowley V and Ross J. Physical activity: recommendations and promotion for New Zealand children and adolescents. *New Zealand Journal of Physical Education.* In press.

Craig W. 1994. Iron status of vegetarians. *Am J Clin Nutr* 59: 1233-7.

Crespo J, Blanco C, Contreras J et al. 1992. Food allergy. A clinical and epidemiological study. *J Allergy Clin Immunol 89: 192.*

Cross A, Babicz D, Cushman L. 1994. Snacking patterns among 1,800 adults and children. *J Am Diet Assoc* 94: 1398-403.

Dahl M, Rydell A-M, Sundelin C. 1994. Children with early refusal to eat: follow-up during primary school. *Acta Paediatr* 83: 54-8.

Davies P, Gregory J, White A. 1995. Physical activity and body fatness in pre-school children. *Int J Obes Relat Metab Disord* 19: 6-10.

Davis D, Apley J, Fill G et al. 1978. Diet and retarded growth. *Brit Med J 539-42.*

Davis K and Christoffel K. 1994. Obesity in preschool and school-age children. *Arch Pediatr Adolesc Med* 148: 1257-61.

Department of Community Services and Health. 1989. *National Dietary Survey of School Children (Aged 10–15 years):1985 no.2 nutrient intakes*. Canberra: Australian Government Publishing Service.

Department of Health and Human Services, DHHS. 1988. *The Surgeon General's Report on Nutrition and Health. US.* Publication No. 88-50210. United States: US Department of Health and Human Services.

Department of Health. 1969. *Physical Development of New Zealand School Children 1969: A survey by the Family Health branch of the Division of Public Health and the Health Services Research Unit.* Wellington: Health Services Research Unit, Department of Health; no 38.

Department of Health. 1991. *Food for Health.* Report of the Nutrition Taskforce to the Department of Health. Wellington: Department of Health.

Department of Health, London. 1991. *Dietary Reference Values for Food Energy and Nutrients for the United Kingdom. Report on Health and Social Subjects 41*. Report of the Panel on Dietary Reference Values of the Committee on Medical Aspects of Food Policy. London: HMSO.

Dietz W and Gortmaker S. 1985. Do we fatten our children at the television set? Obesity and television viewing in children and adolescents. *Pediatrics* 75: 807-12.

Dietz WH. 1994. Critical periods in childhood for the development of obesity. *Am J Clin Nutr* 59: 955-9.

Durant R, Baranowski T, Johnson M et al. 1994. The relationship among television watching, physical activity and body composition of young children. *Pediatrics 94: 449-55.*

Dwyer J. 1991. Nutritional consequences of vegetarianism. *Ann Rev Nutr* 11: 61-91.

Edwards K. 1993. Obesity, anorexia, and bulimia. *Med Clin North Am* 77: 899-909.

Elliott P, Stamler J, Nichols R et al. 1996. Intersalt revisted: further analyses of 24 hour sodium excretion and blood pressure within and across populations. *Brit Med J* 312: 1249-53.

Epstein LH. 1995. Exercise in the treatment of childhood obesity. *Int J Obes Relat Metab Disord* 19(4 Suppl): S117-21.

Epstein LH. 1996. Family based behavioural intervention for obese children. *Int J Obes Relat Metab Disord* 20(1 Suppl): S14-21.

Epstein LH, Coleman KJ, Myers MD. 1996. Exercise in treating obesity in children and adolescents. *Med Sci Sports Exerc* 28(4): 428-35.

Ernst N and Obarzanek E. 1994. Child health and nutrition: obesity and high blood cholesterol. *Prev Med* 23: 427-36.

Esteban M. 1992. Adverse reactions in childhood: concept, importance, and present problems *J Pediatr* 121(5 Pt 2 Suppl): SI-3.

Fassler A and Bonjour J. 1995. Osteoporosis as a pediatic problem. *Pediatr Clin North Am* 42: 811-24.

Flatt J. 1995. McCollum Award Lecture, 1995: diet, lifestyle, and weight maintenance. *Am J Clin Nutr* 62: 820-36.

Fomon S. 1987. Bioavailability of supplemental iron in commercially prepared dry infant cereals. *J Pediatr* 110: 660-1.

Forbes G. 1991. Children and food-order amid chaos. *N Engl J Med* 324: 262-3.

Fox R. 1992. Born to be fat? (Editorial). *Lancet* 340: 881-2.

Freeland-Graves J. 1988. Mineral adequacy of vegetarian diets. *Am J Clin Nutr* 48: 859-62.

Garcia R, Moodie D. 1989. Routine cholesterol surveillance in childhood. *Pediatrics* 84: 751-5.

Gazzaniga J and Burns T. 1993. Relationship between diet composition and body fatness, with adjustment for resting energy expenditure and physical activity, in pre-adolescent children. *Am J Clin Nutr* 58: 21-8.

George J, Brinsdon S, Paulin J et al. 1993. What do young adolescent New Zealanders eat? Nutrient intakes of a nationwide sample of Form 1 children. *NZ Med J* 106: 47-51.

Gillanders L and Tustin G. 1992. Obesity: treatment or prevention? *J NZ Diet Assoc* 46: 6-9.

Godin G, Valois P, Shephard RJ et al. 1987. Prediction of leisure time exercise behavior. A path analysis model. *J Behav Med* 10: 145-58.

Goulding A. 1990. Osteoporosis: why consuming less sodium chloride helps to conserve bone. *NZ Med J* 103: 120-2.

Gregory JR, Collins DL, Davies PSW et al 1995. *National Diet and Nutrition Survey: Children aged 1½–4½ years*. Vol 1. Report of the Diet and Nutrition Survey. London: HMSO.

Guo S, Roche A, Chumlea W et al. 1994. The predictive value of childhood body mass index values for overweight at age 35 years. *Am J Clin Nutr* 59: 810-9.

Gustafson-Larson A and Terry R. 1992. Weight-related behaviours and concerns of fourth grade children. *J Am Diet Assoc* 92: 818-22.

Halva S and Dwyer J. 1988. Position of the American Dietetic Association: vegetarian diets-technical support paper. *J Am Diet Assoc* 88: 352-5.

Haskell WL. 1994. Health consequences of physical activity: understanding and challenges regarding dose-response. *Medicine and Science in Sports and Exercise* 26(6): 649-660.

Heaney R. 1993. Protein intake and the calcium economy. *J Am Diet Assoc* 93: 1259-60.

Herbert V. 1963. A palatable diet for producing experimental folate deficiency in man. *Am J Clin Nutr* 12: 17-20.

Herbert V and Colman W. 1988. Folic acid and vitamin B12. In: M Shils, V Young (eds). *Modern Nutrition in Health and Disease.* Seventh Edition. Philadelphia, Lea and Febiger.

Hill A, Draper E, Stack J. 1994. A weight on children's minds: body shape dissatisfactions at 9–years old. *Int J Obes Relat Metab Disord* 18: 383-9.

Hill A and Rogers P. 1992. Eating in the adult world: the rise of dieting in childhood and adolescence. *Br J Clin Psychol 31: 95-105.*

Hill A and Silver E. 1995. Fat, friendless and unhealthy: 9–year-old children's perception of body shape stereotypes. *Int J Obes Relat Metab Disord* 19: 423-30.

Hill A, Weaver C, Blundell J. 1990. Dieting concerns of 10 year old girls and their mothers. *Br J Clin Psychol* 29: 346-8.

Hill D, Firer M, Ball G et al. 1989. Recovery from milk allergy in early childhood: antibody studies. *J Pediatr* 114: 761-6.

Horne P, Lowe C, Fleming P et al. 1995. An effective procedure for changing food preferences in 5–7-year-old children. *Proc Nutr Soc NZ* 54: 441-52.

Jacobs C and Dwyer J. 1988. Vegetarian children, appropriate and inappropriate diets. *Am J Clin Nutr* 48: 811-8.

Johnson S and Birch L. 1994. Parents' and children's adiposity and eating style. *Pediatrics* 94: 653-61.

Johnston C, Miller J, Slemenda C et al. 1992. Calcium supplementation and increases in bone mineral density in children. *N Engl J Med* 327: 82-7.

Kaplan M. 1993. Complications in children with a severe allergy to cow milk. *Ann Allergy* 71: 529-32.

Kennedy E and Goldberg J. 1995. What are American children eating? Implications for public policy. *Nutr Rev* 53: 111-26.

Killen J, Hayward C, Litt I et al. 1992. Is puberty a risk factor for eating disorders? *Am J Dis Child* 146: 323-5.

Kleinman RE, Finberg LF, Klish WJ, et al. 1996. Dietary guidelines for children: US recommendations. *J Nutr* 126(4 suppl): S1028-30.

Klesges R, Stein R, Eck L et al. 1991. Parental influence on food selection in young children and its relationships to childhood obesity. *Am J Clin Nutr* 53: 859-64.

Klish WJ. 1997. Dietary fats in children: the American perspective. In MJ Ball (ed). *Proceedings of the Child Nutrition Today, health tomorrow symposium*. 1997 May 2-3; Melbourne.

Krumdieck C. 1976. Folic Acid. In D Hegsted, C Chichester, W Darby et al (eds). *Nutrition Reviews: Present knowledge in nutrition.* Fourth Edition. Washington: The Nutrition Foundation Inc.

Lauer D. 1997. *Decreased Fat and Increased Complex Carbohydrate Intakes in Children and Adolescents.* (Joint FAO/WHO expert consultation on carbohydrates in human nutrition) Rome: Italy.

Law M, Frost C, Wald N. 1991. By how much does dietary salt reduction lower blood pressure? *Brit Med J* 302: 811-22.

Livingstone M. 1994. Energy expenditure and physical activity in relation to fitness in children. *Proc Nutr Soc* 53: 207-21.

Lloyd T, Andon M, Rollings N et al. 1993. Calcium supplementation and bone mineral density in adolescent girls. *JAMA* 270: 841-44.

Lozoff B, Brittenham G, Wolf A et al. 1987. Iron deficiency anemia and iron therapy effects on infant developmental test performance. *Pediatrics* 79: 981-95.

McClean H and Knowles S. 1992. Television advertising of foods to children in New Zealand. *J NZ Diet Assoc* April: 11-13.

McKeag DB. 1991. The role of exercise in children and adolescents. *Clinics in Sports Medicine* 10(1) 117-30.

McMahon J. 1990. Dietary habits of pre-school children. MCaps Thesis. Dunedin: University of Otago.

McMahon J. Parnell W, Spears G. 1993. Diet and dental caries in preschool children. *Eur J Clin Nutr* 47: 794-802.

McNamara J, Motor M, Stremple J et al. 1971. Coronary artery disease in combat casualties in Vietnam. *JAMA* 216: 1185-7.

McNutt K. 1991. Are we pickin' on the kids? *Nutrition Today* 26(3): 42-6.

MacKerras D. 1995. Calcium intake and osteoporosis. *Aust J Nutr Diet* 52(1 Suppl): S3-25.

Maffeis C, Micciolo R, Must A et al. 1994. Parental and perinatal factors associated with childhood obesity in North-East Italy. *Int J Obes Relat Metab Disord* 18: 301-305.

Maloney M, McGuire J, Daniels S et al. 1989. Dieting behaviour and eating attitudes in children. *Pediatrics* 84: 482-7.

Mann J. 1993. Diseases of the heart and circulation: the role of dietary factors in aetiology and management. In JS Garrow, WPT James (eds). *Human Nutrition and Dietetics.* Ninth edition. London: Churchill Livingstone.

Mason P. 1992. Dietary needs of special patient groups: (1) vegetarians. *Phamaceutical J* 248: 453-5

Matkovic V. 1991. Diet, genetics and peak bone mass of adolescent girls. *Nutrition Today* 26(2): 21-4.

Matkovic V and Heaney R. 1992. Calcium balance during human growth: evidence for threshold behaviour. *Am J Clin Nutr* 55: 992-6.

Meisler J and St Jeor S. 1996. Summary and recommendations from the American Health Foundation's Expert Panel on Healthy Weight. *Am J Clin Nutr* 63(3 suppl): S474-7.

Mellin L, Irwin C, Scully S. 1992. Prevalence of disordered eating in girls: a survey of middle-class children. *J Am Diet Assoc* 92: 851-3.

Meyer F, Bar-Or O, Salsberg A et al. 1994. Hypohydration during exercise in children: effect on thirst, drink preference, and rehydration. *Int J Sport Nutr* 4: 22-35.

Ministry of Health. 1995. *Proposed Eleventh Amendment to the Food Regulations 1984 Including Draft Standard for the Addition of Vitamins and Minerals to Foods.* Wellington: Ministry of Health.

Ministry of Health. 1996. *Wellchild Tamariki Ora Health Book.* Wellington: Ministry of Health.

Monsen E. 1988. Iron nutrition and absorption: dietary factors which impact iron bioavailability. *J Am Diet Assoc* 88: 786-90.

Morck T, Lynch S, Skinne B et al. 1981. Iron availability from infant food supplements. *Am J Clin Nutr* 34: 2630-4.

Must A. 1996. Morbidity and mortality associated with elevated body weight in children and adolescents. *Am J Clin Nutr* 63(3 suppl): S445-7.

Murphy A, Youatt J, Hoerr S et al. 1995. Kindergarten students' food preferences are not consistent with their knowledge of the dietary guidelines. *J Am Diet Assoc* 95: 219-23.

National Health and Medical Research Council. 1995. *Dietary Guidelines for Children and Adolescents.* Australian Government Publishing Service.

Network of the Federal/Provincial/Territorial Group on Nutrition and National Institute of Nutrition (A joint project). 1989. *Promoting Nutritional Health During thePreschool Years: Canadian guidelines.* Ottawa: The Network.

Nutrition Standing Committee of the British Paediatric Association. 1988. Vegetarian weaning: special report. *Arch Dis Child* 63: 1286-92.

Nuutinen O and Knip M. 1992. Predictors of weight reduction in obese children. *Eur J Clin Nutr* 46: 785-94.

Ott S. 1990. Attainment of peak bone mass. (Editorial) *J Clin Endocrinol* 71: 1082A-1082C.

Paganus A, Juntunen-Backman K, Savilahti E. 1992. Follow-up of nutritional status and dietary survey in children with cow's milk allergy. *Acta Paediatr* 81: 518-21.

Pangrazi RP, Corbin CB, Welk GJ. 1996. Physical activity for children and youth. *Journal of Education, Recreation and Dance* 67 (4):378-43.

Payne J and Belton N. 1992. Nutrient intake and growth in pre-school children. Comparison of energy intake and sources of energy with growth. *J Human Nutr Diet* 5: 287-98.

Peacock M. 1991. Calcium absorption efficiency and calcium requirements in children and adolescents. *Am J Clin Nutr* 54(1 suppl): S26I-5.

Pelchat M and Pliner P. 1995. "Try it. You'll like it". Effects of information on willingness to try novel foods. *Appetite* 24: 153-66.

Polanco I. 1992. Current status of digestive intolerance to food protein. *J Pediatr* 121(5Pt 2): S108-10.

Pollitt E. 1993. Iron deficiency and cognitive function. *Annu Rev Nutr* 13: 521-37.

Pollitt E, Hathirat P, Kotchabhakdi N et al. 1989. Iron deficiency and educational achievement in Thailand. *Am J Clin Nutr* 50: 687 697.

Poskitt E. 1993. Which children are at risk of obesity? *Nutr Research* 13 (1 Suppl): S83-89.

Public Health Commission. 1995. *National Plan of Action for Nutrition. The Public Health Commission's advice to the Minister of Health 1994-1995*. Wellington: Public Health Commission.

Pugliese M. Lifshitz F, Grad G et al. 1983. Fear of obesity. A cause of short stature and delayed puberty. *N Engl J Med* 309(a): 513-8.

Renner E. 1994. Dairy calcium, bone metabolism, and prevention of osteoporosis. *J Dairy Sci* 77: 3498-505.

Report of the Joint Working Group of the Canadian Paediatric Society and Health Canada. 1995. Nutrition recommendations update: dietary fats and children. *Nutr Rev* 53: 367-75.

Robinson T, I Hammer L, Kitten J et al. 1993. Does television viewing increase obesity and reduce physical activity? Cross-sectional and longitudinal analyses among adolescent girls. *Pediatrics* 91: 273-80.

Roesler T, Barry P, Bock S. 1994. Factitious food allergy and failure to thrive. *Arch Pediatr Adolesc Med* 148: 1150-55.

Rolland-Cachera M, Deheeger M, Akrout M et al. 1995. Influence of macro-nutrients on adiposity development: a follow up study of nutrition and growth from 10 months to 8 years of age. *Int J Obes Relate Metab Disord* 19: 573-8.

Rose D, Smallwood D, Blaylock J. 1995. Socio-economic factors associated with the iron intake of pre-schoolers in the United States. *Nutr Research* 15: 1297-309.

Ross JJ and Cowley V. 1995. Just how much physical education are students getting? *Journal of Physical Education New Zealand* 28(1): 3-8.

Rubin K, Schirduan V, Gendreau P et al. 1993. Predictors of axial and peripheral bone mineral density in healthy children and adolescents, with special attention to the role of puberty. *J Pediatr* 123: 863-70.

Russell DG, Isaac A, Wilson PG. 1989. *The New Zealand Fitness Handbook: A test of health related fitness.* Wellington: Hillary Court Print Ltd.

Sabate J, Lindsted K, Harris R et al. 1991. Attained height of lacto-ovo vegetarian children and adolescents. *Eur J Clin Nutr* 45: 51-8.

Saltzman E and Roberts S. 1995. The role of energy expenditure in energy regulation: findings from a decade. *Nutr Rev* 53: 209-20.

Sampson HA. 1988. IgE mediated food intolerance. *J Allergy Clin Immunol* 81: 495-504.

Sanders MR, Patel RK, Le Grice B et al. 1993. Children with persistent feeding difficulties: an observational analysis of the feeding interactions of problem and non-problem eaters. *Health Psychol* 12: 62-71.

Sanders T. 1995.Vegetarian diets and children. *Pediatr Clin North Am* 42: 955-65.

Sanders T and Manning J. 1992. The growth and development of vegan children. *J Human Nutr and Diet* 5: 11-21.

Sandstead HH. 1981. Trace element interactions. *Journal of Laboratory and Clinical Medicine* 98: 457-72.

Sasson A, Lewin C, Roth D. 1995. Dietary behaviour and eating attitudes in Israeli children. *Int J Eat Disord* 17: 67-72.

Satter E. 1996. Internal regulation and the evolution of normal growth as the basis for prevention of obesity in children. *J Am Diet Assoc* 96: 860-4.

Saxelby C. 1993. *Nutrition for Life.* Chatswood, NSW. Reed Publishing.

Shaw V and Lawson M. 1994. *Clinical Paediatric Dietetics.* London: Blackwell Scientific Publications.

Shea S, Basch C, Gutin B et al. 1994. The rate of increase in blood pressure in children 5 years of age is related to changes in aerobic fitness end body mass index. *Pediatrics* 94: 465-70.

Shea S, Basch C, Stein A et al. 1993. Is there a relationship between dietary fat and stature or growth in children three to five years of age? *Pediatrics* 92: 579-86.

Shea S, Stein A, Basch C et al. 1992. Variablity and self-regulation of energy intake in young children in their everyday environment. *Pediatrics* 90: 542-6.

Shephard RJ. 1990. The benefits of exercise in school and in the workplace: cost-effective options. Paper presented at the Commonwealth and International conference on physical education, sports, health, dance, recreation and leisure. Auckland, 1990.

Singleton J, Achterberg C, Shannon B. 1992. Role of food and nutrition in the health perceptions of young children. *J Am Diet Assoc* 92: 67-70.

Smith M and Lifshitz F. 1994. Excess fruit juice consumption as a contributing factor in non-organic factor to thrive. *Pediatrics* 93: 438-43.

Soemantri A. 1989. Preliminary findings on iron supplementation and learning achievement of rural Indonesian children. *Am J Clin Nutr* 50: 608-702.

Stunkard A, Sorensen T, Hanis C et al. 1986. An adoption study of human obesity. *N Engl J Med* 314: 193-8.

Subcommittee on the Tenth Edition of the RDAs, Food and Nutrition Board, Commission on Life Sciences. 1989. *Recommended Dietary Allowances*. Tenth Edition. National Research Council. Washington DC: National Academy Press.

Thompson F and Dennison B 1994. Dietary sources of fats and cholesterol in US children aged 2 through 5 years. *Am J Public Health* 84: 799-806.

Torun B, Davies P, Livingstone M et al. 1996. Energy requirements and dietary energy recommendations for children and adolescents 1 to 18 years old. *Eur J Clin Nutr* 50(1 suppl): S37-81.

Truswell AS, Dreosti E, English M et al. (eds). 1990. *Recommended Nutrient Intakes: Australian papers.* Sydney: Australian Professional Publications.

Ubbink J. 1994. Vitamin nutrition status and homocysteine: an atherogenic risk factor. *Nutr Rev* 52 (1l): 383-93.

Ubbink J. 1995. Homocysteine: an atherogenic and a thrombogenic factor? *Nutr Rev 53* (1l): 323-5.

US Department of Agriculture, US Department of Health and Human Services. 1995. *Nutrition and Your Health Dietary Guidelines for Americans.*

US Department of Health and Human Services. 1996. *Physical Activity and Health: A report of the Surgeon General.* Atlanta: US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion.

Vobecky J, Grant A, Laplante P et al. 1993. Hypercholesterolaemia in childhood: repercussions in adulthood. *Eur J Clin Nutr* 47(1 suppl): S47-56.

Walker W. 1992. Summary and future directions. Adverse reactions to food in infancy and childhood. *J Pediatr* 121(5 Pt 2): S4-6.

Walter T. 1993. Impact of iron deficiency on cognition in infancy and childhood. *Eur J Clin Nutr* 47: 307-16.

Walter T, Kovalskys J, Stekel A. 1983. Effect of mild iron deficiency on infant mental development scores. *J Pediatr* 102: 519-22.

Wardle J, Volz C, Golding C. 1995. Social variation in attitudes to obesity in children. *Int J Obes Relat Metab Disord* 19: 562-9.

Weaver C. 1994. Age related calcium requirements due to changes in absorption and utilization. *J Nutr* 124(8 Suppl): S1418-25.

Wei H. 1995. Diet and dental caries. *Asia Pacific J Clin Nutr* 4 (1 suppl): S45-50.

Wham C. 1989. Position of the New Zealand Dietetic Association: the nutritional management of food intolerance. *J NZ Diet Assoc* 43 (2): 57-66.

Whitney E, Hamilton E, Rolfes S. 1990. *Understanding Nutrition*. Fifth Edition. St. Paul: West Publishing Company.

Whorton J. 1994. Historical development of vegetarianism. *Am J Clin Nutr* 59(5 suppl): S1103-9.

Williams C. 1995. Importance of dietary fiber in childhood. *J Am Diet Assoc* 95(10): 1147-8.

Williams C, Bollella M, Wynder E. 1995. A new recommendation for dietary fibre in childhood. *Pediatrics* 96(5 suppl): S985-8.

Williams S. 1989. *Nutrition and Diet Therapy*. Sixth Edition: St. Louis: Times Mirror/Mosby College Publishing.

Wilmore J. 1996. Increasing physical activity: alterations in body mass and composition. *Am J Clin Nutr* 63(3 suppl): S456-60.

Working Group of the Canadian Pediatric Society and Health Canada. 1993. *Nutrition Recommendation Update: Dietary fat for children.* Working Group, Ottawa, Canada.

Xhles J and Miles T. 1982. Effect of processed foods on the salt intake of preschool children. *Med J Aust* 2: 23-5.

Ziegler EE and Filer LJ (eds) 1996. *Present Knowledge in Nutrition* Seventh edition. Washington DC: International Life Science Institute.

Zlotkin SH. 1996. A review of the Canadian "Nutrition recommendations update: dietary fat and children". *J Nutr* 126(4 suppl): S1022S-27.

Appendix 1:

Recommended Dietary Intakes (RDIs)

RDIs are average daily amounts of nutrients that population groups should consume over a period of time. They are recommendations, and should not be confused with requirements for a specific individual. RDIs exceed the needs of most individuals thus ensuring the needs of nearly all in the population are met.

RDIs for children are derived mainly by interpolation and extrapolation of adult metabolic studies using an agreed rational denominator. It is difficult to do nutrition deprivation, balance studies and turnover studies in children (Truswell et al 1990).

The report of the Nutrition Taskforce to the Department of Health, Food for Health (Department of Health 1991) recommended that the revised Australian Dietary Intakes 1990 (Truswell et al 1990) be adopted by New Zealand until an extensive revision of New Zealand's RDIs is conducted.

	AGE		
	1–3 Years	4–7 Years	8–11 Years
Energy MJ/day	5–6	6–8	7–9
Protein g/day g/kg/day	14–19 1.2	18–24 1.0	27–38 (Male) 27–39 (Female) 1.0
Iron mg/day	6–8	6–8	6–8
Calcium mg/day	700	800	800 (Male) 900 (Female)
Folate µg/day	100	100	150

Appendix 2:

Eating for Healthy Children (2–12 years)

Children need to eat lots of different food to get energy, stay healthy and grow. Children have their own special food needs.

Give healthy children:

- many different foods
- enough food for growth
- plenty of snacks
- plenty to drink
- treat foods now and then
- opportunity to be physically active.

Eat many different foods

Children need a variety of foods from the four food groups every day.

Vegetables and Fruit

Vegetables and fruit have carbohydrates (sugar and starch), fibre, vitamins and minerals.

Preschoolers: Eat at least two servings of vegetables and two servings of fruit each day.

School children: Eat at least three servings of vegetables and two servings of fruit each day.

Serving size examples – vegetables

- 1 medium potato or similar sized root vegetables (135 g)
- half a cup cooked vegetables (50–80 g)
- half a cup salad (60 g)
- 1 tomato (80 g).

Serving size examples – fruits

- 1 apple, pear, banana or orange (130 g)
- 2 small apricots or plums (100 g)
- half a cup fresh fruit salad (120 g)
- half a cup stewed fruit (135 g)
- 1 cup fruit juice (250 ml).

Breads and Cereals

- Breads, cereals, pasta and rice are high in carbohydrates and fibre.
- Preschoolers have small stomachs and cannot eat the same amount of fibre as older children or adults. Increase fibre gradually with a variety of vegetables, fruit, bread and cereals.
- Breads and cereals make good snack foods for school children. Choose some whole grain breads and cereals.

Preschoolers: Eat at least four servings every day.

School children: Eat at least five servings every day.
Older children need at least six servings every day.

Serving size examples (each item represents one serving):

- 1 roll (50 g)
- 1 muffin (80 g)
- 1 medium slice of bread (26 g)
- 1 cup cornflakes (30 g)
- half a cup muesli (55 g)
- half a cup cooked cereal (130 g)
- 1 cup cooked pasta (150 g)
- 1 cup cooked rice (150 g)
- 2 plain sweet biscuits (14 g).

Milk and Milk Products

Children and preschoolers need milk and milk products for protein and calcium.
After two years of age gradually introduce reduced and low fat milk and milk products.

Preschoolers and school children: Eat at least two to three servings every day.

Serving size examples:

- 250 ml milk
- 1 pottle yoghurt (150 g)
- 2 slices of cheese (40 g)
- 2 scoops ice cream (140 g).

Lean Meats, Chicken, Seafood, Eggs and Dried Peas, Beans and Lentils

These foods have protein, vitamins and minerals, including iron and zinc.
Young children need iron. Lean red meats, seafood and chicken have lots of iron.

Preschools and school children: Eat at least one serving every day.

Serving size examples:

- 2 slices of cooked meat (about 100 g)
- 3/4 cup mince or casserole (195 g)
- 1 egg (50 g)
- 1 medium fillet of fish – cooked (100 g)
- 3/4 cup dried cooked beans (135 g)
- 2 drumsticks or 1 chicken leg (110 g)

How to serve: Children eat small amounts of food.

For variety, make up one serving size from a number of part servings. For example, instead of serving one whole potato, serve half a potato with two tablespoons of carrots and two tablespoons of peas.

Vegetarians

- Many vegetarian foods are bulky. Children's stomachs may be too small to eat all the food they need for activity and growth.
- Serve small meals often. Offer a range of bread and cereals, fruit and vegetables, dairy products, eggs, legumes, nuts and seeds.
- Vegetarian children need food with iron, such as whole grains, lentils, dried beans and peas, dried fruits and dark leafy vegetables. Serve these foods with fruit and vegetables high in vitamin C, such as tomatoes and oranges, to help iron absorption.
- When milk is not drunk give other drinks, such as soy milk, with calcium added. If a child eats no meat, dairy or egg products ask your doctor or nurse about seeing a dietitian.

Eat Enough Food for Activity and Growth

- Children need food to get energy for living, growing and for activity. The more active children are, the more energy they need.
- Offer drinks and snacks often when your child is being active.
- Encourage overweight children to be more active. Give them three meals each day, and snacks that are low in fat and sugar.
- Talk to a dietitian if your child is overweight.

Mini Meals and Snacks are OK

As they grow children eat different amounts of food.

- Children have small stomachs and need small meals and snacks often. As they get older encourage them to eat at regular family meal times.
- Children may be very hungry after physical activity or when they get home from school or preschool.
- Give them snacks low in salt and sugar.

Snack Suggestions

- Sandwiches – peanut butter, banana, cheese, cottage cheese, baked beans, jam or honey.
- Spreads used thinly or only on one slice of the bread.
- Bread rolls, rewena bread, crackers, muffins and baked bread fingers as well as bread.
- Vegetable sticks – keep these in the fridge. Serve with cottage cheese or peanut butter.
- Cold cooked vegetables – cook a few extra potatoes, kumara and taro at meal times.
- Fresh fruit – serve whole or cut up with yoghurt.
- Frozen fruit – strawberries, melon, pineapple or chunks of banana are fun in summer.
- Cereals – choose cereals low in fat and sugar.
- Popcorn – pop using a little oil, margarine or butter or use a microwave.
- Yoghurt, cubes of cheese or milk.

New Foods

Involve children in buying and choosing food and getting meals ready.

Preschoolers: Preschoolers generally like trying new foods. Offer these foods one at a time. Serve new food to all the family and at the start of the meal when children are hungry.

School children: School children are curious about different ethnic foods. Talk about new foods they learn about at school.

Drink Plenty Every Day

- Children need plenty to drink to keep their body working. They need to drink more when they are active and when it's hot.
- Children need small drinks often. Keep offering drinks as children may forget to drink when they are busy.
- Water is best – it's cheap and easy to get. Keep a jug of cold water in the fridge. Serve in a coloured glass with a straw.
- Milk is a good drink for children. Serve milk after or in-between meals.
- Fruit juice and cordials are high in sugar. Almost fill a glass with water and then add a little juice. Serve with lots of ice. Add three times more water to cordial and powdered drinks than the instructions suggest.
- Tannins in tea and coffee prevent iron in food from being absorbed. Serve water or fruit juice at meal times, rather than tea and coffee.

Offer Treats Now and Then

- Treat foods and snack foods are not the same. Children need snacks every day, but keep treat foods for special times.
- Treat foods include muesli bars, sweets and lollies, fruit leathers and roll-ups, chippies, chocolates, sweet biscuits, cream and fizzy drinks.
- Sweets and sugary foods, such as raisins, dates, fruit leathers and muesli bars, can cause tooth decay. Keep these for meal times or as treat foods.
- Party ideas: Grapes, mandarins, cubes of cheese and pineapple on sticks, fancy shaped sandwiches, french bread, popcorn, oven-baked chips and fruit and vegetable sticks with dip.

Takeaways

Most takeaways are high in fat, salt and sugar. Have takeaways on special occasions and not as an everyday food.

Choose sandwiches and hamburgers instead of deep fried food.

Make your own takeaways:

- Use lean meat to make hamburgers. Grill the meat and the buns. Fill the bun with lots of salad, but go easy on the salad dressing.
- Put lots of vegetables and a little cheese on pizza.

Opportunity To Be Physically Active

- All children benefit from regular physical activity.
- Encourage children to be physically active.
- Physical activity can include organised sports, playing games (beach cricket, volleyball, tag), mowing lawns, family walks, rollerblading, skateboarding, bicycling, swimming and family visits to playgrounds. The activity needs to be appropriate for the age of the child.

Appendix 3:

Sample Diets

These three-day diets were analysed for major nutrients. The diets are for healthy children aged three, six and 11 years old. The diets were devised to assist in determining serving recommendations. They are not seen as sample diets for children to follow strictly.

Summary of nutrition analyses

	AGE		
	3 Years	**6 Years**	**11 Years**
Energy (kJ)	6100	6500	10200
Total fat (g)	60	59	87
Protein (g)	49	55	94
% fat	36	34	31
Dietary fibre (g)	13	18	30
Calcium (mg)	880	980	1490
Iron (mg)	7	8	14

Three Year Old: Sample Diet

Day 1	Day 2	Day 3
Breakfast		
Weetbix (1)	Weetbix (1)	Porridge (1/2 cup)
Homog milk (100 ml)	Homog milk (100 ml)	Homog milk (100 ml)
Wholemeal toast (1 slice)	Wholemeal toast (1 slice)	Wholemeal toast (1 slice)
Margarine (1 tsp)	Margarine (1 tsp)	Margarine (1 tsp)
Honey (1 tbsp)	Honey (1 tbsp)	Honey (1 tbsp)
Juice (100 ml+100 ml water)	Juice (100 ml + 100 ml water)	Juice (100 ml + 100 ml water)
Mid-morning		
Biscuit (1 plain)	Gingerbread (1 slice)	Cream cracker (1)
Banana (1/2)	Margarine (1 tsp)	Peanut butter (3 tsp)
Homog milk (100 ml)	Juice (100 ml + 100 ml water)	Homog milk (100 ml)
Lunch		
Wholemeal bread (2 slices)	Wholemeal bread (2 slices)	White roll (1)
Margarine (1 1/2 tsp)	Margarine (1 1/2 tsp)	Margarine (1 tsp)
Boiled egg (1)	Luncheon sausage (1 slice)	Cheese (1 slice)
Vegemite (l/2 tsp)	Tomato (2 slices)	Tomato (2 slices)
Plain biscuit (1)	Carrot (1/2)	Lettuce (2 leaves)
Apple (1/2)	Apple (1/2)	Yoghurt (100g)
	Homog milk (100 ml)	Orange (1/2)
		Homog milk (100 ml)
Mid-afternoon		
Cheese (1 slice)	Biscuits (2 plain)	Wholemeal bread (1 slice)
Currant bread (1 slice)	Juice (50 ml + 100 ml water)	Margarine (1 tsp)
Margarine (1 tsp)		Vegemite (1/2 tsp)
Homog milk (100 ml)		
Dinner		
Mince (2 tbsp)	Chicken drumstick (1)	Macaroni cheese (1/2 cup)
Potato (1)	Rice (1/2 cup)	Peas (2 tbsp)
Peas (1 tbsp)	Green beans (2 tbsp)	Tomato (1 whole)
Carrots (1/2 cup)	Kumara (2 tbsp)	Apple Crumple (1/2 cup)
Milk pudding (1 /2 cup)	Peas (2 tbsp)	Homog milk (50 ml)
	Ice cream (2 tbsp)	

Six Year Old: Sample Diet

Day 1	Day 2	Day 3
Breakfast		
Weetbix (1) Homog milk (100 ml) Toast (1 slice) Margarine (1 tsp) Honey (1/2 tsp) Trim milk (1/2 tsp) Drinking chocolate (1 tsp)	Weetbix (1) Homog milk (100 ml) Toast (1 slice) Margarine (1 tsp) Jam (2 tsp) Trim milk (150 ml)	Porridge (3/4 cup) Homog milk (100 ml) Toast (1 slice) Margarine (1 tsp) Jam (2 tsp) Juice (100 ml + 100 ml water)
Mid-morning		
Juice (100 ml + 100 ml water) Bran muffin (1) Margarine (1 tsp)	Banana (1)	Cream crackers (2) Peanut butter (3 tsp)
Lunch		
Wholemeal bread (3 slices) Margarine (2 tsp) Luncheon (1 slice) Tomato (2 slices) Peanut butter (1 tbsp) Apple (1)	Wholemeal bread (2 slices) Margarine (2 tsp) Boiled egg (1) Plain biscuit (1) Vegemite (2 tsp) Apple (1)	Bread roll (1) Margarine (1 tsp) Cheese (1 slice) Tomato (2 slices) Lettuce (2 leaves) Cucumber (5 slices) Yoghurt (150 g) Orange (1)
Mid-afternoon		
Plain biscuits (2) Trim milk (150 ml)	Currant bread (1 slice) Margarine (1 tsp) Trim milk (100 ml)	Whole bread (1 slice) Margarine (1 tsp) Vegemite (1/2 tsp) Trim milk (150 ml)
Dinner		
Chicken drumstick (1) Brown rice (1/2 cup) Green beans (2 tbsp) Kumara (2 tbsp) Pears (2 tbsp)	Mince (2 tbsp) Potato (1) Peas (1 tbsp) Carrots (2 tbsp) Milk pudding (l/2 cup)	Macaroni cheese (3/4 cup) Coleslaw (1/2 cup) Tomato (1) Apple crumble (1/2 cup) Milk (50 ml)

11 Year Old: Sample Diet

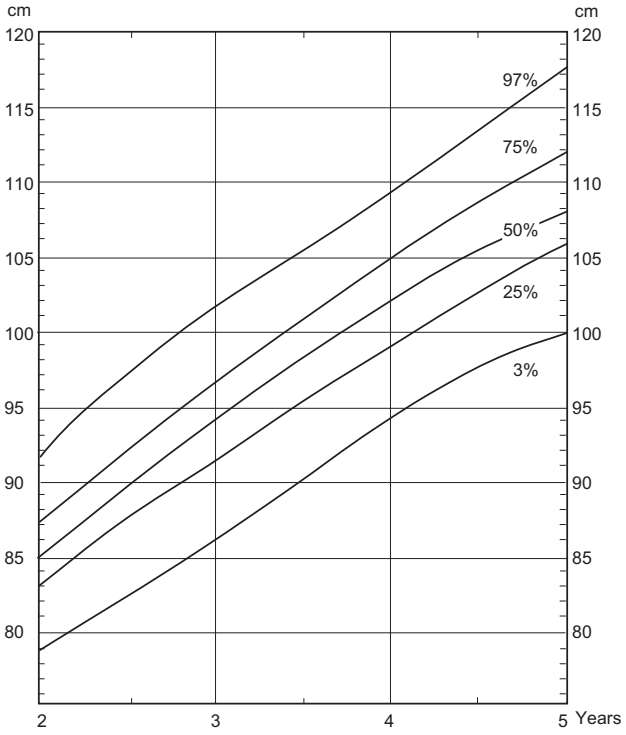
Day 1	Day 2	Day 3
Breakfast		
Weetbix (2) Trim milk (100 ml) Wholemeal toast (2 slices) Margarine (2 tsp) Honey (2 tsp) Trim milk (200 ml) Drinking chocolate (1 tsp)	Weetbix (2) Trim milk (100 ml) Wholemeal toast (2 slices) Margarine (2 tsp) Jam (2 tsp) Trim milk (200 ml)	Porridge (1 cup) Trim milk (100 ml) Wholemeal toast (2 slices) Margarine (2 tap) Jam (2 tsp) Juice (100 ml + 100 ml water)
Mid-morning		
Banana (1) Cream crackers (2) Peanut butter (6 tsp)	Bran muffin (1) Apple (1/2)	Cream crackers (2) Peanut butter (3tsp)
Lunch		
Bread (6 slices) Margarine (4 tsp) Boiled egg (1) Lettuce (2 leaves) Vegemite (l/2 tsp) Baked beans (2 tsp) Plain biscuits (2) Apple (1)	Wholemeal bread (4 slices) Margarine (2 tsp) Luncheon sausage (1 slice) Tomato (1/2) Carrot (I/2) Peanut butter (1 tbsp) Jam (2 tsp) Banana (1)	Bread roll (1) Margarine (2 tsp) Cheese (1 slice) Tomato (3 slices) Lettuce (2 leaves) Cucumber (5 slices) Yoghurt (150 g) Fruit cake (1 piece) Orange (1)
Mid-afternoon		
Currant bread (2 slices) Margarine (1 tsp) Juice (150 ml + 100 ml water)	Plain biscuits (2) Trim milk (120 ml) Apple (1)	Bread (1 slice) Margarine (1 tsp) Jam (2 tsp) Trim milk (200 ml) Plain biscuits (2)
Dinner		
Mince (5 tbsp) Potato (1 large) Peas (2 tbsp) Carrots (3 tbsp) Milk pudding (1 cup) Trim milk (250 ml) Drinking chocolate (1 tsp)	Chicken legs (2) Brown rice (1 cup) Beans (3 tbsp) Kumara (2 tbsp) Pears (2 tbsp) Ice cream (4 tbsp) Apple (1)	Macaroni cheese (1 cup) Coleslaw (1/2 cup) Tomato (1) Apple crumble (1 cup) Trim milk (50 ml) Banana (1)

Appendix 4

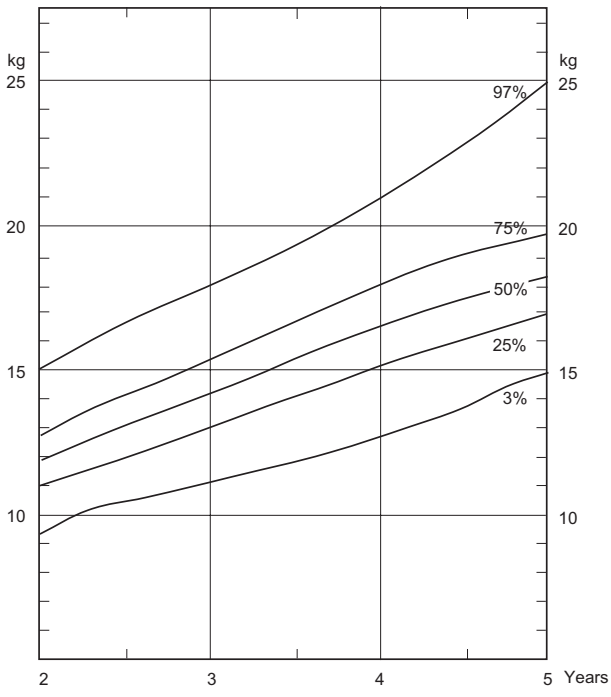
Height and Weight Charts from Birth to Five Years

Girls 2–5 years

Height



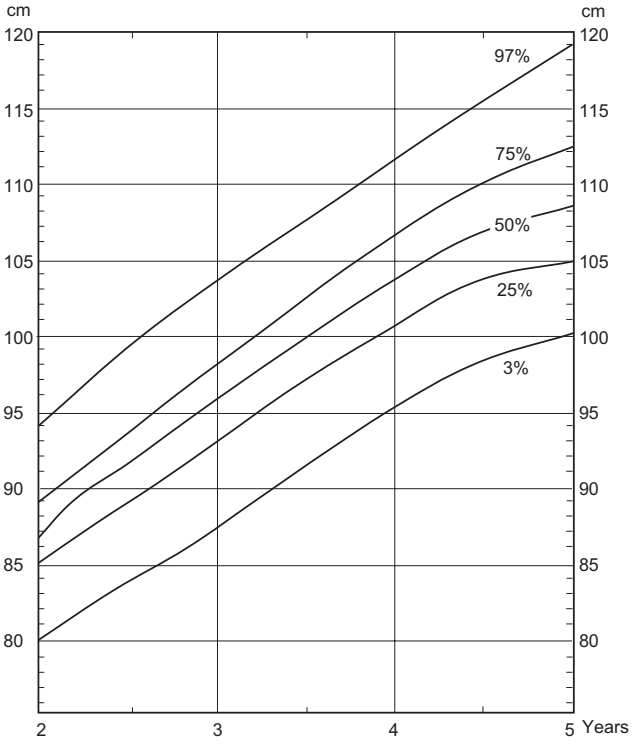
Weight



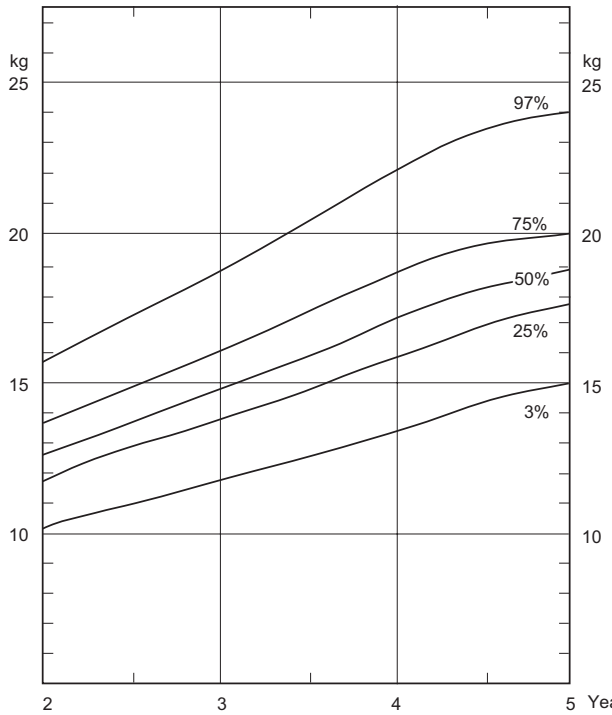
This scale may not be exact. Please refer to the *Wellchild Tamariki Ora Health Book* (Ministry of Health 1996) for the exact scale.

Boys 2–5 years

Height



Weight



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