An Investigation of the Breakfast Habits and Dietary Intakes of Year 8 Auckland Children

A thesis presented in partial fulfilment of the requirements for the degree of Master of Science in Nutritional Science at Massey University, Albany, New Zealand

Claire Anne Svendsen

2006

Abstract

Breakfast is often referred to as the most important meal of the day. Studies have consistently shown that regular breakfast consumption makes a significant contribution to nutrient intake. Additionally, individuals who have skipped breakfast often do not make up for the missed nutrients during the remainder of the day. Results from the National Children's Nutrition Survey show that breakfast consumption varies with ethnicity and age. In particular, Pacific Island children and older children were less likely than other ethnic and age groups to have breakfast.

The overall aim of the current study was to collect detailed information on dietary intake, breakfast habits, choices, and preferences of intermediate school children. Two multi-cultural decile six intermediate schools in North Shore City, Auckland were selected to participate. A dietary assessment of over two hundred students (12-13 years of age) was completed using a dietary recall methodology. Data were also collected on breakfast habits and preferences, and anthropometric measurements made. A subset group of 52 students was randomly selected to provide detailed information on their nutrient intake. Each student within the subgroup completed two 24-hour recalls during the school week, and a food diary on a Saturday.

Findings from this research showed that both male and female students had a high level of breakfast consumption, with over half of the students reporting that this represented their daily habit. Overall, only 4% reported that they rarely or never have breakfast. The most reported reason given for skipping breakfast was not being hungry in the morning, followed by preferring to sleep in, and then lack of time. There was some evidence from this study that the daily commitments of family members (e.g., working parents) may influence breakfast eating habits. Additionally, it is likely that the availability of preferred breakfast foods at home contributed to high breakfast consumption observed in this study population.

Interestingly, breakfast consumption was not significantly associated with gender, but was however influenced by ethnicity, with Maori/Pacific Island children less likely to eat breakfast than children of other ethnic groups (P = 0.001). Breakfast skippers had a significantly higher body mass index (BMI) compared to breakfast eaters, although further research is required to assess the association between habitual breakfast consumption and BMI.

The majority of breakfast consumers chose foods and beverages that contributed to a balanced breakfast. Of those subjects who had breakfast, over 60% consumed a cereal, with the most popular being Weet-Bix. Findings from the subgroup analysis showed that the consumption of breakfast made a significant contribution to the daily intake of nutrients such as iron, calcium, folate, riboflavin, and thiamin, for both male and female breakfast eaters.

The information gained from this study may facilitate the implementation of nutrition education and intervention programmes designed to improve eating patterns (in particular breakfast consumption) and the dietary intake of children and adolescents. Promoting and maintaining good breakfast habits in children of this age group may lead to improved breakfast consumption patterns and health as they progress through adolescence.

Acknowledgements

I would like to express my sincere thanks to my supervisor, Dr Pauline Ashfield-Watt, for her guidance and commitment to this project. I would also like to thank the staff, parents, and students of Birkdale Intermediate School and Northcote Intermediate School, who participated in the study.

I want to thank my family for their support and encouragement, and I would also like to thank my partner Mike, for his patience and continued support during the completion of this project.

Table of Contents

List of Tables

List of Figures

List of Abbreviations

BMI	Body Mass Index
CHO	Carbohydrate
CNS	Child Nutrition Survey
NZ	New Zealand
NZFCD	New Zealand Food Composition Database
NZNF	New Zealand Nutrition Foundation
MOH	Ministry of Health
MUFA	Monounsaturated Fatty Acids
PUFA	Polyunsaturated Fatty Acids
RDA	Recommended Dietary Allowances
RDI	Recommended Dietary Intakes
RTE	Ready-to-eat
SBP	School Breakfast Programme
SES	Socioeconomic status
SFA	Saturated Fatty Acids
UK	United Kingdom
US	United States
USDA	United States Department of Agriculture
WHO	World Health Organization
WRAT	Wide Range Achievement Test

1 Introduction

1.1 Background

Adequate nutrition during childhood and adolescence, and the continuation of healthy eating patterns into adulthood is vital for long term health and the prevention of chronic disease in later life (Hackett, Gibbon, Sratton, & Hamill, 2002; McKinley et al., 2005). In the recent National Children's Nutrition Survey (CNS), New Zealand (NZ) children were found to have low intakes of dietary fibre, riboflavin, folate, calcium, and iron and the nutritional status of older children in the survey (11-14 years of age) was appreciably worse than the younger children (5-10 years of age) (Ministry of Health, 2003). This finding suggests that age specific dietary recommendations are required.

With regards to eating patterns, the survey indicated that the consumption of the breakfast meal varies with age and ethnicity. In particular, Pacific Island children and older children were less likely than other ethnic and age groups to have breakfast before leaving for school in the morning. It is possible that by increasing breakfast consumption in these demographic groups, nutritional status may improve. Furthermore, in those children who consume breakfast cereals, these foods represent major sources of fibre, folate, and iron. In addition, the associated consumption of milk provides a good source of calcium and riboflavin, and the consumption of bread at breakfast also contributes to the intake of several nutrients including dietary fibre, folate, calcium, and iron.

More detailed information on dietary patterns and eating behaviours of children and adolescents regarding breakfast consumption is currently unavailable in New Zealand.

1.2 What is breakfast?

There are two important issues to consider when defining the breakfast meal. First, the types of foods and beverages that constitute a breakfast meal, and second, the time when the breakfast meal is eaten. For example, can a pie and

a soft drink purchased from the local shop on the way to school be classified as breakfast for that individual? Whether or not this type of meal is regarded as breakfast depends on the individual's perspective. For some, breakfast is eaten at home and incorporates 'traditional breakfast foods' such as cereal with milk and toast, and for others breakfast may be an egg and bacon muffin from a fast food restaurant, eaten later in the morning. The significance and the make-up of the breakfast meal vary between populations and ethnic groups. Depending on an individual's cultural practice, the breakfast meal could include choices such as a bowl of cereal, toast, leftover dinner, rice, milk, vegetables, and meats (Liu, 2002).

There are many psychosocial reasons that individuals regularly consume breakfast. For example, eating breakfast may be part of the family routine with family members eating breakfast together every morning. Breakfast consumption may also be a long-term habit, and children may eat breakfast because their parents ensure that they have something to eat before leaving for school. Alternatively, for others, breakfast may be governed by hunger, time constraints, and work patterns. This study however will focus on the nutritional aspects of consuming or omitting breakfast and the effect of dietary patterns and eating behaviours on total daily nutrient intake.

From a nutritional standpoint, when investigating the importance of the breakfast meal to dietary intake it is essential to establish: why breakfast is important, what the ideal breakfast meal is, the key influences on breakfast consumption e.g., age, gender, personal preferences, socioeconomic status, and what are the major motivators and the barriers to breakfast consumption.

When reviewing studies that have investigated breakfast consumption it is apparent that researchers define the breakfast meal in different ways. In general, studies investigating breakfast consumption may focus on whether breakfast is eaten, what is eaten and/or examine the effects of eating breakfast on various performance measures (Briefel, Murphy, Kung, & Devaney, 1999). Studies examining whether or not breakfast is consumed typically employ a broader definition of any food or beverage consumed between waking and late

morning, and studies that examine the impact of eating breakfast on behaviour or performance measures typically use a more precise definition that may include a minimum energy content or specific food groups consumed (Briefel et al., 1999).

In a study investigating breakfast consumption patterns, Morgan, Zabik, and Stampley, (1986a) specified that a breakfast had to contain at least one food/beverage item that had nutritive value, in order to be included in their analysis e.g., a coffee or tea alone was not considered a consumed breakfast. Ruxton, O'Sullivan, Kirk, and Belton (1996) defined breakfast as a solid item of food taken before attending school or before 11:00 am at weekends. In a nationally representative survey of the breakfast consumption trends of children in the US, Siega-Riz, Popkin, and Carson (1998) defined the breakfast meal as the consumption of food, beverage, or both between 5:00 am. and 10:00 am.

The breakfast meal can also be defined as the first meal consumed after waking, or the first meal of the day. In the CNS, breakfast consumption was defined as any food or beverage consumed at home before leaving for school (Ministry of Health, 2003). This definition of breakfast consumption will be used in the current research project.

1.2.1 Breakfast: The most important meal of the day

Breakfast is often referred to as the most important meal of the day. Individuals who eat breakfast on a regular basis have more adequate micronutrient intakes, a lower percentage of calories from fat, and a higher fibre intake than non-consumers of breakfast (Morgan, Zabik, & Leveille, 1981; Schlundt, Hill, Sbrocco, Pope-Cordle, & Sharp, 1992; Siega-Riz et al., 1998). The omission of breakfast or the consumption of an inadequate breakfast may contribute to dietary inadequacies in children and adolescents (Morgan et al., 1986a; Ohlson & Hart, 1965; Ortega et al., 1996).

Children and adolescents who miss breakfast in the mornings will possibly feel hungry by mid-morning and over-eat at other meals or will eat too many snacks during the day. In addition, individuals who skip breakfast in the mornings often do not make up for the missed nutrients during the remainder of the day

(Morgan, Zabik, & Stampley, 1986b; Nicklas, Bao, Webber, & Berenson, 1993; Ortega et al., 1996).

The omission of breakfast may result in lower concentration levels and poor school performance. Teachers from two Auckland schools commented that at the schools they worked, a lack of breakfast, as well as consumption of unhealthy breakfast foods was a major problem. Children who did not have breakfast before school would be so hungry that they would eat their lunch for breakfast, leaving no food for the remainder of the school day. Teachers described children who arrived to school without having breakfast as hungry, lethargic, tired, cannot listen and concentrate, fidgety, and having sore tummies (Liu, 2002). The teachers also commented that some children would buy pies, sweets, and potato crisps from the local dairy to eat on their way to school.

For breakfast to significantly contribute to the nutritional status of an individual, the breakfast meal should provide between one quarter and one third of the recommended dietary needs for the day, in terms of energy and certain nutrients (Briefel et al., 1999; Cereal Institute, 1962; Kennedy & Davis, 1998; New Zealand Nutrition Foundation, 1993). In the school resource pack *Break into Breakfast*, the New Zealand Nutrition Foundation (NZNF) states that a balanced breakfast means:

- Choosing foods mainly from the bread, cereals, and fruit and vegetable food groups.
- Including some dairy foods for calcium and protein.
- Choosing high fibre foods as these are more likely to satisfy hunger.

1.3 Adolescent energy and nutrient needs

Adolescence is the period of transition from childhood to adulthood. Besides birth, adolescence is the only time in life when the velocity of growth increases. This rapid rate in growth is called the growth spurt, which indicates the onset of puberty, and is associated with hormonal, cognitive, and emotional changes (Spear, 1996). On average the growth spurt in boys takes place between 12.5 and 15.5 years of age, and in girls the growth spurt occurs on average two

years earlier. In adolescent females, the onset of menarche (the first menstrual period) in most cases indicates that the peak height of the growth spurt has been achieved (Tanner, 1981). The World Health Organization (WHO) defines the period of adolescence as between 10 and 19 years of age (World Health Organization, 1999). However, due to the variability in physiological development among adolescents, age is often a poor indicator of physiological maturity and nutrition needs (Spear, 2002).

Adolescence is considered a nutritionally vulnerable period of life (Nicklas, Reger, Myers, & O'Neil, 2000; Sjoberg, Hallberg, Hoglund, & Hulthen, 2003; Spear, 1996) as an increase in physical growth and development during this period creates a high demand for energy and nutrients (Story & Resnick, 1986). Also, during adolescence changes of lifestyle and food habits occur, which affect nutrient intakes and needs (Spear, 2002).

Adolescence can be a critical time for the development of health behaviour patterns that are independent from the family (Mays & Orr, 1996) and that have long term health implications. Due to the specific energy and nutrient needs of adolescents, which differ from other age groups, certain countries and health agencies have developed dietary guidelines specifically for adolescents. The dietary guidelines for New Zealand adolescents are detailed below.

The energy and nutrient needs of adolescents vary greatly and depend on gender, current rate of growth, body composition, and physical activity levels. In the background paper *Food and Nutrition Guidelines for Healthy Adolescents*, it is recommended that adolescents should have a variety of healthy foods and snacks for growth and physical activity. Healthy adolescents should choose foods low in fat, sugar, and salt, drink plenty of water, avoid alcohol, and take part in regular physical activity (Ministry of Health, 1998).

1.3.1 Macronutrients

As previously mentioned the energy needs of adolescents vary greatly and are higher for boys, as they generally have a faster growth rate than girls, and develop a greater proportion of lean body mass (Whitney & Rolfes, 2002). The

daily Recommended Dietary Intake (RDI) for energy for New Zealand adolescents aged 12-15 years is between 9,200-11,800 kJ for males, and between 8,100-9,800 kJ for females.

Carbohydrates, proteins, and fats provide energy in the diet. The Nutrition Taskforce recommends that New Zealand adults obtain 50-55% of total energy from carbohydrate, and recommends an intake of 25-30 g of dietary fibre per day. Sucrose and other refined sugars should be restricted to no more than 15% of the total energy intake (Department of Health, 1991). The Food and Nutrition Guidelines state that since energy intakes of adolescents are likely to be higher than those of adults, adolescents should aim for no less than the recommended intake levels of carbohydrate and dietary fibre for adults (Ministry of Health, 1998).

During adolescence, protein energy needs are high because protein is an essential nutrient for growth and the maintenance of tissues. Depending on peak growth and energy requirements, protein should contribute to 12-14% of total energy intake, or in the range of 0.8-1.6 g/kg body weight (Ministry of Health, 1998). Average intakes of protein in adolescents are generally above the recommended level (Ministry of Health, 2003; Spear, 2002). In the CNS the median usual daily intake of protein in males (11-14 years) was 88 g, and in females 66 g. Protein contributed a mean of 14% as a percentage of energy intake for males, and 13.5% for females, which is within the recommended guidelines.

Data from the CNS showed that the mean contribution to daily energy intake from total fat was 33.2% for males and 32.9% for females. These levels of fat intake were within the Nutrition Taskforce recommendation that total fat intake should provide 30-35% of total energy intake.

1.3.2 Micronutrients

There is an increased need for vitamins thiamin and riboflavin during adolescence, which are required for the release of energy from carbohydrates. Vitamins B6, B12 and folate are essential for metabolism and tissue and cell

growth, (Ministry of Health, 1998) and there is an increased requirement for vitamins A, C, and E which are needed for new cell growth (Spear, 2002) and to act as antioxidants (Ministry of Health, 1998). An increased intake of vitamin D is essential during adolescence for rapid bone cell growth (Spear, 2002).

The recommended dietary intake for iron increases during adolescence, as there is an increased requirement for iron throughout this period. The RDI for iron increases from 6-8 mg for 8-11 year olds, to 10-13 mg for 12-18 year olds. In males, there is an increased requirement for iron during puberty due to an increase in lean body mass and blood volume, as well as a rise in haemoglobin concentration that occurs with sexual maturation. For female adolescents the growth spurt is not as great; however, there is an increased need for iron to replace menstrual iron loss (Spear, 2002).

Sufficient iron intake is of particular concern for adolescent females who have a low energy and protein intake and consume less iron-rich foods. It is possible that these female adolescents may fail to consume an adequate iron intake for their increasing needs (Whitney & Rolfes, 2002).

Puberty/early adolescence are crucial times for the development of maximal bone mass (Matkovic, Fontana, Tominac, Goel, & Chestnut, 1990), with 45% of the skeletal mass formed during this period. Adequate calcium intake permits the production of a greater bone mass (Ortega et al., 1998), and the attainment of peak bone mass during adolescence may potentially be a factor in the prevention of osteoporosis in later life (Fisher, Mitchell, Smiciklas-Wright, Mannino, & Birch, 2004; Martin, Bailey, McKay, & Whiting, 1997; Spear, 2002)

Calcium needs are greatest during puberty and adolescence (Spear, 2002). The RDI for calcium are 1,200 mg/day for males and 1,000 mg/day for females aged 12-15 years, and 1,000 mg/day for males and 800 mg/day for females aged 16-18 years. Milk consumption has been found to decline during late adolescence compared to early childhood, and in contrast, the consumption of soft drinks increases (Fisher et al., 2004). It has been suggested that the consumption of

soft drinks and other sweet drinks may contribute to low calcium intake because adolescents may be substituting these high sugar drinks for milk (Spear, 2002).

1.4 Food consumption patterns of adolescents

Children and adolescents tend to have diets that vary from day to day and food habits that can change rapidly (Livingstone, Robson, & Wallace, 2004). As children move into adolescence they become more autonomous and often spend time away from their parents and the family home. Adolescents will therefore gain increased control over their eating habits and have more access to food outside of the home, compared to children in younger age groups where parental choices determine dietary intake (Dwyer et al., 2001; Hill, 1995). Adolescent food patterns and eating behaviours are characterised by an increased tendency to skip meals, inconsistent meal patterns, snacking, inappropriate consumption of fast foods, and dieting. A concern with appearance and body weight is also common during adolescence and can influence dietary intake (Anderson, MacIntyre, & West, 1994).

Food from outside of the home e.g., from shops/cafes or the school canteen, contributed approximately 30% of total energy intake in a sample of 379 schoolchildren in the United Kingdom (UK) (Adamson, Rugg-Gunn, Butler, & Appleton, 1996). Subjects (aged 11-12 years) completed two 3-day dietary records, followed by an interview with a trained dietician, to determine the contribution of foods eaten outside of the home to nutrient intake. Results showed that the child's home was the largest source of energy and nutrients (70% of total energy intake); however, the majority of subjects (100% girls, 99% boys) reported receiving some of their nutrient intake from sources outside of the home. Girls were found to obtain a greater percentage (33%) of their total energy intake, compared to boys (29%), from sources outside the home. A concern regarding the significant contribution of such foods to dietary intake highlighted by this study was that foods purchased from shops/cafes or school canteens were of poor nutrient quality for all nutrients measured.

An investigation into the prevalence of snacking among 2-18 year old children in the United States (US), analysed nationally representative dietary intake data from cross-sectional data collected in the years between 1977 to 1996 (Jahns, Siega-Riz, & Popkin, 2001). Results showed that the prevalence of snacking increased in all age groups (77% to 91%) during the period studied, with the majority of the increase occurring between 1989 and 1996. While the average size and energy provided per snack remained relatively constant during the study period, the number of snacking occasions significantly increased, which in turn increased the average daily energy from snacks. Snacks were found to have a lower contribution of calcium and a higher energy density and proportion of energy from fat, compared to meals. Researchers concluded that there is a strong possibility that the increase in the role of snacking has contributed to the obesity epidemic in US children.

1.5 Breakfast consumption patterns

Several studies that have investigated patterns of breakfast consumption in various population groups, report a trend towards more breakfast omission in older children and adolescents compared to younger children, and in girls compared to boys. This trend was observed in studies performed by Seiga-Riz et al. (1998), Nicklas et al. (2000), and Videon and Manning (2003) in the US, and studies by Hackett et al. (2002) and Currie and Todd (1992) in the UK. Studies performed by Otega et al. (1996) and Aranceta, Serra-Majem, Ribas, and Perez-Rodrigo (2001) in Spain also found that older adolescents and girls in their respective studies had the lowest breakfast consumption rates. In addition, an Australian study by Shaw (1998) found that girls in the study sample skipped breakfast more often than boys.

1.5.1 United States of America

A cross-sectional study by Siega-Riz et al. (1998) of the breakfast consumption trends of 1-10 year old children and 11-18 year old adolescents in the US, in 1965, 1977 to 1978, and 1989 to 1991, indicated a decline in breakfast consumption, particularly for adolescents. Data from this study showed that for boys, breakfast consumption declined from 89.7% in 1965 to 74.9% in 1989-

1991, and for girls, breakfast consumption declined from 84.4% to 64.7% over the same period.

A multivariate analysis was conducted to identify whether the populations changing sociodemographic patterns e.g., the increase in divorce rates and the increasingly large number of women in the labour force, contributed to the decline in breakfast consumption. It has been hypothesised that these changes may be associated with a growing number of children and adolescents who are responsible for preparing their own meals, and therefore missing breakfast (Briefel et al., 1999). These researchers, however, concluded that breakfast consumption trends were associated with behavioural changes by certain subgroups rather than the country's changing sociodemographic characteristics.

An interesting finding from this study was that the nutritional quality of foods consumed at breakfast had improved since 1965. By analysing breakfast food choices over time, it was demonstrated that a significant shift towards consumption of lower-fat milk, more fruit, and whole grains occurred and the consumption of butter, margarine, white bread, and bacon and eggs declined significantly among those who ate breakfast (Siega-Riz et al., 1998). However, this study did not examine whether the trend of improved nutritional quality of foods consumed at breakfast was related to improved dietary intake of breakfast consumers throughout the day, or how missing breakfast affected total daily dietary intakes in non-breakfast consumers.

Morgan et al. (1981) investigated breakfast consumption patterns from 7-day food diaries of a cross-sectional sample of US children aged 5-12 years (N = 657). Their research showed that only a small percentage (1.5%) of the sample population were non-breakfast eaters and that only 2.6% of all possible breakfasts (N = 4,599) were skipped. The low percentage of non-breakfast eaters reported in this study may have been due to the socioeconomic characteristics of the study sample; middle to upper-class, two-parent families with parents with a higher educational level than the general population.

The Bogalusa Heart Study is an epidemiological investigation of cardiovascular risk factors and environmental determinants in a biracial population (White and Black children) in Bogalusa, Los Angeles. Using nutrient intake information obtained from this study, Nicklas et al. (1993) evaluated the nutrient intakes of breakfast eaters compared to non-breakfast eaters, and the relationship between breakfast consumption and total daily intake and dietary adequacy. From 24-hour dietary interviews conducted in two cross-sectional surveys in 1984-1985 (N = 268 children, 10 years of age) and 1987-1988 (N = 199, 10 years of age), it was found that 84% were breakfast eaters. Compared to non-breakfast eaters, the children who consumed breakfast had higher daily intakes of calcium, phosphorus, magnesium, vitamins A, B12, riboflavin, and folate.

In a more recent study also from the US, Nicklas et al. (2000) assessed the contribution of breakfast consumption (with and without dietary supplement intake) to total daily nutrient intake of students 15 years of age. To assess dietary intake, a single 24-hour recall was collected from 711 students at school by a trained nutritionist. In this study breakfast was defined as an eating occasion which the student considered to be his or her breakfast. Results showed that 19% of the study participants skipped breakfast, with more females (23%) skipping breakfast than males (14%). Within this study sample, investigators found that a significantly higher percentage of non-Whites than White students skipped breakfast (32% versus 16% respectively; $P < 0.05$), especially non-White females (36%).

From an analysis of 18,177 adolescents (aged 11-21 years) from a national longitudinal survey in the US, Videon and Manning (2003) found that one in five adolescents reported skipping breakfast the previous day. Girls and older adolescents were significantly more likely to report eating nothing for breakfast the previous day, compared to boys and younger adolescents in the survey.

1.5.2 United Kingdom

As part of a pilot study for a health promotion initiative, in Liverpool, UK, Hackett et al. (2002) conducted a survey using a food intake questionnaire, to describe the eating habits of 3,556 children aged 9-10 years, and 649 children aged 11-

12 years. The results showed that the proportion of children not having anything to eat at breakfast before leaving home for school was significantly higher in older children and amongst older girls (31.9%) compared to older boys (17.9%).

In a study investigating the health behaviours of Scottish schoolchildren, Currie and Todd (1992) reported that only 62% of 11-15 year olds had breakfast everyday and that 20% had breakfast only once a week. A report published by the same research unit in 2000, investigating eating patterns and physical activities in the 1990s, showed that between 1990 and 1998 a significant decrease occurred in the proportion of 15 year old boys and 13 and 15 year old girls who reported eating breakfast every day. However a significant increase in breakfast consumption occurred among 11 year old boys (Todd, Currie, & Smith, 2000).

Ruxton et al. (1996) conducted a study examining the contribution of breakfast to the diets of primary schoolchildren in Edinburgh. From a sample of 136 students aged 7-8 years, it was found that breakfast was consumed five to seven times per week by the majority (94%) of schoolchildren in the study and no child missed breakfast more than five times per week. The most popular breakfast choice in this sample was a breakfast including a ready-to-eat (RTE) breakfast cereal. Analysis of the contribution of breakfast to daily energy and nutrient needs showed that breakfast contributed 14% of energy, 10% of fat, 16% of protein, 18% of carbohydrate, and 16% of total sugar. No significant differences were found in the contribution of breakfast to overall diet in boys and girls.

1.5.3 Europe

In a representative community-based sample of 1,108 French children (aged 2-10 years), adolescents (aged 10-18 years), and adults (aged 18-65 years), dietary intakes were estimated using the dietary history method (Preziosi et al., 1999). In this study, breakfast consumption was defined as the first eating occasion involving a solid food or beverage that occurred after waking. Breakfast skippers were classified as omitting breakfast completely (at least five times a week) or consumed only a non-caloric beverage e.g., tea or coffee

without milk or sugar. The results showed that 90% of all respondents ate breakfast, with 86% eating breakfast frequently and 4% occasional breakfast eaters. Also, breakfast consumption was found to be the highest among children and adolescents and lowest among adults.

In a study investigating the breakfast habits of Spanish schoolchildren, 742 pupils aged between 9 and 13 years, completed a questionnaire on their breakfast habits on both schooldays and holidays (Ortega et al., 1996). Only four percent of children skipped breakfast. On schooldays, 95% of children had breakfast at home, either alone (42%) or with their brothers and sisters (43%). Only 25% had breakfast with their parents on schooldays. During the holidays the percentage of children missing breakfast decreased to 2% of boys and 1% of girls, and there was an overall increase in the number of foods consumed. In agreement with the other studies mentioned, it was found that as age increased, breakfast habits deteriorated. Skipping breakfast was more common in girls compared to boys, and investigators concluded that girls' breakfasts were more likely to be insufficient because the number of food groups included and the time spent at breakfast was lower in girls than in boys (Ortega et al., 1996). The most frequent foods consumed at breakfast were cookies (24%), fortified breakfast cereals (23%), bread (19%), and bakery products (16%). In this study population, breakfast made a contribution of 15.6% to the recommended daily intake of energy.

In a more recent study examining the breakfast consumption patterns of a sample of Spanish children and young people (aged 2-24 years), Aranceta et al. (2002) surveyed 3,534 subjects and found that 91.2% of boys and 92.2% of girls in the study sample usually had breakfast. Males 18 years and over (85.6%) and females 14-17 years (89.6%) had the lowest breakfast consumption rates and 8% of the study sample reported that they did not usually have breakfast, just seldom or not at all. At breakfast the main sources of energy were milk and dairy products (34%) with breakfast cereals providing on average only 5.2% of energy intake.

Sjoberg et al. (2003) investigated the meal patterns of 1,245 Swedish students 15-16 years of age, by diet history method, questionnaire, and an individual interview. The frequency of regular breakfast consumption was 76% for girls and 88% for boys. Investigators found in this study population that irregular breakfast eating (omitted breakfast at least once a week) was related to negative lifestyle factors such as smoking, and to irregular intake of lunch and dinner (omitted lunch and/or dinner at least once a week).

1.5.4 South Africa

In South Africa, Walker, Walker, Jones, and Ncongwane (1982) used a questionnaire to investigate breakfast habits of 4,717 pupils, 16-18 years of age. Subjects were grouped into four ethnic groups; Blacks, Indians, European-African-Malay and Whites. In each ethnic group the percentage of pupils who did not have a solid breakfast on the day questioned were; rural Blacks (21%), urban Blacks (19%), Indian (13%), European-African-Malay (13%), and Whites (14%). In the varied social and ethnic groups studied, the investigators concluded that there was no clear difference between the variables of weight, height, social class, or frequency of absence from school among breakfast eaters compared to non-breakfast eaters.

A high percentage of adolescents consumed porridge or bread for breakfast, especially rural and urban Black students (77% and 73% respectively) and European-African-Malay pupils (71%). It is possible that this type of breakfast is consumed more frequently among pupils from families of low socioeconomic status (SES) as this type of breakfast is inexpensive. Cereals e.g., Corn Flakes were consumed twice as frequently among White students compared to Indian or European-African-Malay students and only up to 1% of Black students consumed a packet cereal on the day questioned. Four percent of Black, 16% of Indian, 8% of European-African-Malay, and 35% of White students consumed a cooked breakfast (e.g., eggs, bacon, fish, and baked beans). This study used a very simple questionnaire to assess breakfast consumption and the types of breakfast foods consumed for one day only, therefore results do not indicate subject's usual breakfast consumption patterns.

1.5.5 Australia

An investigation into the incidence of breakfast skipping among an Australian adolescent population was carried out in a sample originating from the Mater Hospital-University of Queensland Study of Pregnancy (Shaw, 1998). The study, with an original sample of 8,556 pregnant women, was a prospective longitudinal research project that included six phases of follow-up of the subjects' children. To investigate breakfast skipping, results were taken from Phase VI, which was conducted when the child was aged thirteen. During this phase both the mother and child completed questionnaires and only those children who completed a subsection of the questionnaire on food and eating habits were included in the investigation (n = 699 valid cases).

Approximately one year after the questionnaire was completed supplementary data was collected via telephone. Respondents who reported not eating breakfast (n = 82, 11.7%) formed the sample for the follow-up and from this sample 56 completed interviews (68%). Respondents were asked how often they ate breakfast. Subjects who did not eat breakfast were asked to state their reasons for skipping. Of the 56 subjects interviewed, 27% always or almost always ate breakfast, while 16% sometimes and 57% rarely or never ate breakfast. The only significant sociodemographic variable associated with breakfast skipping was gender ($P < 0.01$); with females skipping breakfast more than three times as often as males. Females were also more likely to skip lunch and to have been on a diet to lose weight. Sociodemographic variables such as total family income and education of mother were not significantly related to skipping breakfast.

O'Dea and Caputi (2001) found that older children (12-19 years of age) of low SES were more likely to regularly skip breakfast then those of middle/high SES (31 versus 22%). In this study, 1,126 students aged 6-19 years from 12 schools in the state of New South Wales completed a pre-validated questionnaire and had their height and weight measured. It was found that low SES children in this study group where more likely to be overweight, and older females were more likely to skip breakfast then older males (25% versus 16%) (O'Dea & Caputi, 2001).

1.5.6 New Zealand

Brinsdon, George, and Paulin (1992) used a combination of a 24-hour record and a recall to assess dietary intakes of a nationally representative sample of 630 New Zealand Form one students (10-11 years of age). Researchers found that 92.1% of boys and 92.7% of girls consumed breakfast during the 24-hour period assessed. In a study by the same research group, on a separate nationally representative sample ($N = 475$) of Form three and four students (13-15 years of age), 95.1% of boys and 88.6% of girls consumed a breakfast meal on the day questioned (Brinsdon, George, Paulin, & McFarlane, 1993). This result suggests that older adolescent girls were more inclined to skip breakfast compared to the younger girls, whereas a higher percentage of older boys consumed breakfast compared to the younger boys in the Form one study.

Table 1.01 shows the mean percentage that the breakfast meal contributed to the intake of selected nutrients for both the Form one and Forms three and four surveys.

Table 1.01 Percentage contribution of the breakfast meal to intake of selected nutrients of a nationally representative sample of New Zealand boys and girls 10-11 years and 13-15 years of age

Nutrient	FORM 1 BOYS (10-11 years) Breakfast (%)	FORM 1 GIRLS (10-11 years) Breakfast (%)	FORMS 3 & 4 BOYS (13-15 years) Breakfast (%)	FORMS 3 & 4 GIRLS (13-15 years) Breakfast (%)
Energy	16.5	16.0	16.0	13.9
Carbohydrate	20.2	18.7	20.1	17.7
Protein	18.0	16.6	15.2	12.9
Fat	11.0	11.8	11.1	9.50
Calcium	25.7	23.1	22.2	20.1
Iron	22.8	19.3	19.3	16.4
Zinc	22.3	17.6	15.8	13.7
Sucrose	15.0	13.2	16.6	14.9

Note. Adapted from: Brinsdon et al. (1992, 1993)

The table above shows that the Form three and four girls consumed less energy at breakfast and therefore less carbohydrate, protein, and fat compared to the Form three and four boys, and both Form one, boys and girls. The Form three and four girls also had lower calcium, iron, and zinc intakes at breakfast compared to children in the other gender and age groups.

Findings from the 2002 CNS showed that males were more likely to usually eat or drink at home before school (86.2%) compared to females (79.2%). The older children surveyed (11-14 years of age) were less likely to usually eat or drink at home before school than the younger children (5-6 years of age). New Zealand European children were more likely to usually eat or drink at home before school, followed by Maori, and then Pacific Island children. Female subjects attending rural schools were more likely to usually eat or drink at home before school (84.3%) compared to female subjects attending urban schools (78.2%), however, this affect was not found in boys (Ministry of Health, 2003).

Table 1.02 summarises the percentage of children/adolescents consuming breakfast by age and country in 18 studies of breakfast consumption.

Table 1.02 Summary of the percentage of children/adolescents consuming breakfast by age and country

Reference	Country	Age (Years)	Sample Size	Breakfast Consumption (%)
Siega-Riz et al. (1998)	US (1965)	1-18	7,513	89.7 (boys) 84.4 (girls)
	US (1989-91)	1-18	4,289	84.4 (boys) 64.7 (girls)
Morgan et al. (1981)	US	5-12	657	98.5
Nicklas et al. (1993)	US	10	467	84
Nicklas et al. (2000)	US	15	711	81
Videon and Manning (2003)	US	11-21	18,177	80
Hackett et al. (2002)	UK	9-10	3,556	92.2 (boys) 90 (girls)
		11-12	649	82.1 (boys) 68.1 (girls)
Ruxton et al. (1996)	Scotland	7-8	136	94
Currie and Todd (1992)	Scotland	11-15	4,079	62**
Aranceta et al. (2001)	Spain	2-24	3,534	91.2*(boys) 92.2* (girls)
Otega et al. (1996)	Spain	9-13	742	96
Preziosi et al. (1999)	France	2-65	1,108	90 (86% frequent eaters, 4% occasional eaters)
Sjoberg et al. (2003)	Sweden	15-16	1,245	76*(girls) 88* (boys)
Walker et al. (1982)	South Africa	16-18	4,717	79 (rural Blacks) 81 (urban Blacks) 87 (Indian) 87 (Euro-African-Malay 86 (Whites)
Story (1998)	Australia	13	699	88.3
O'Dea and Caputi (2001)	Australia	6-19	1,126	84 (boys) 75 (girls) (12-19 years who regularly consume breakfast)
Ministry of Health (2002)	New Zealand	5-14	3,275	86.2* (boys) 79.2* (girls)
Brinsdon et al. (1992)	New Zealand	10-11	260	92.1 (boys) 92.7 (girls)
Brinsdon et al. (1993)	New Zealand	13-14	266	95.1 (boys) 88.6 (girls)

Note.
* Usually had breakfast
** Had breakfast everyday

The conclusions drawn from investigations into breakfast consumption patterns may vary due to the different methodologies implemented to assess dietary intake and how the breakfast meal is defined. Therefore, accurate comparisons cannot always be made between studies when assessing breakfast consumption. A varying effect of SES, culture, and ethnicity on breakfast consumption can be concluded from the review of breakfast consumption studies. In some instances a statistically significant difference between ethnic groups was evident, for example in the study by Nicklas et al. (2000), and in others, there was no clear difference between ethnic (Walker et al., 1982) and socioeconomic groups (Shaw, 1998) studied.

An overall trend observed from the review of the above studies is that skipping breakfast is more prevalent in older children and adolescents compared to younger children, and in girls compared to boys. It is possible that children and adolescents who regularly skip breakfast may not be meeting their dietary intake requirements and nutritional inadequacies may occur as a result.

1.6 The contribution of breakfast to nutrient intake

A consistent finding of breakfast consumption studies in various study populations is that eating breakfast makes a significant contribution to nutrient intake. The 1962 Iowa Breakfast Studies recommended that the breakfast meal should provide one-quarter of the recommended daily energy needs and one-quarter of daily protein needs (Cereal Institute, 1962). Nicklas et al. (1993) found that total daily intakes of total energy and nutrients were significantly higher for children who consumed breakfast compared to children who did not consume breakfast. Morgan and colleagues (1981) found in their study that on average children (aged 5-12 years) consumed adequate breakfasts which contributed at least one-quarter of the Food and Nutrition Board's Recommended Dietary Allowances (RDA) for all nutrients.

Dietary deficiencies in many population groups may be a result of breakfast omission (Hill, 1995), and children who skip breakfast often do not make up for

the loss in nutrient intake at other meals during the day (Morgan et al., 1981; Nicklas, O'Neil, & Berenson, 1998).

A study conducted in France by Preziosi et al. (1999) investigated the relationship between breakfast consumption and dietary intake. Dietary intakes were obtained using the dietary history method and serum bioassays were used to assess vitamin and mineral status. This study showed that carbohydrates supplied between 57% and 62% of breakfast energy; proteins supplied between 11% and 13% of energy, and fats supplied between 27% and 30% of energy. It was found that this contribution of energy decreased considerably among adults, who generally consumed a breakfast of lower energy value compared to children and adolescents. Adults were less likely to be consumers of RTE cereals than children and adolescents and RTE cereal consumption was found to be associated with high-energy breakfasts. Breakfast, especially breakfasts containing RTE cereals, contributed substantially to recommended dietary allowances for vitamin and mineral intake for both children and adolescents, with reference to selected biomarkers.

Nicklas et al. (2000) observed from their breakfast consumption study that regardless of vitamin or mineral self-supplementation, consuming breakfast made an important nutritional contribution to total daily intake in students 15 years of age. In this study, 19% of students reported that they missed breakfast on the day questioned and it was found that students who missed breakfast consumed a higher percentage of energy from fats and a lower percentage of energy from carbohydrates. Also, breakfast skippers had lower intakes of most vitamins and minerals (with or without supplementation) compared to those who consumed breakfast. A limitation of this study, acknowledged by the authors, was that the study sample contained a biased selection of White students from middle-to upper-middle class families, and only contained a small sample of ethnic groups other than White students. Also, it is important to consider that in this study a single 24-hour recall was utilised to gain information on dietary intake from each student. While this method is appropriate when characterising the group as a whole, usual intakes could not be assessed, and a single weekday recall can not account for weekend eating patterns.

Many researchers have observed that RTE cereals make a substantial contribution to the nutrient and energy density of the breakfast meal (McNulty et al., 1996; Nicklas, Myers, Berenson, 1995; Ruxton et al., 1996). This finding has led to studies investigating the relationship between RTE cereal consumption and daily nutrient intake.

1.7 Ready-to-eat breakfast cereals

Ready-to-eat (RTE) breakfast cereals are not only frequently consumed by children and adolescents at breakfast, they are also eaten as a snack food throughout the day. Research has shown that children who are regular eaters of RTE breakfast cereals are less likely to skip breakfast compared to non RTE cereal eaters and have a lower daily intake of energy, total fat, saturated fat, sodium, and cholesterol (Barton et al., 2005; Morgan et al., 1981; Morgan et al., 1986a).

Breakfast cereals provide energy, carbohydrate, and fibre as well as vitamins and minerals and are often fortified with nutrients. When consumed frequently, breakfast cereals are significant contributors to total daily nutrient intake (Hill, 1995; Subar, Krebs-Smith, Cook, & Kahle, 1998; Webster, 1995). Fortified breakfast cereals may be particularly important to the diets of at-risk subgroups such as female adolescents following a weight loss diet (McNulty et al., 1996), vegetarians, and for women of childbearing age where there is evidence for the increased requirement of folate to prevent neural tube defects. In New Zealand, breakfast cereal manufacturers have been fortifying breakfast cereals with folic acid since 1996 when the voluntary fortification of certain food products with folic acid was first permitted (Ministry of Health, 1999a).

However, not all RTE cereals are fortified with vitamins and minerals and the nutrient content of fortified versus non-fortified cereals varies. In addition, different brands of cereals differ in sugar, fibre, fat, and sodium composition (Consumer, 2003). Processed cereals often contain added sucrose, glucose, honey, and dried fruit and can be high in sugar and energy. Ready-to-eat breakfast cereals also differ in fibre content, with some cereals high in fibre and

some cereals stripped of fibre during processing (Consumer, 2003). Although the majority of cereals are not high in fat, muesli-based cereals that are toasted or baked in oil tend to have a higher fat content compared to non-muesli cereals. In addition, muesli often contains nuts, seeds, and coconut which contribute to total fat content. Some cereal brands are high in salt, for example brands of puffed rice and Corn Flakes which have a sodium content of more than 800 mg per 100 g (Consumer, 2003). Choosing processed RTE cereals which are high in sugar and salt and low in fibre (for breakfast or as a snack) may not positively contribute to the nutritional adequacy of the adolescent diet.

Nicklas and colleagues (1995) investigated consumption of RTE cereals in 10 year old children from the Bogalusa Heart Study sample. Data from young adults aged 19-28 years were also included in the analysis. For the 10 year old children, 21% consumed cereal at some time during the day. Of these, sixty-three percent consumed a cereal at breakfast, 36% consumed cereal as a snack, and 6% consumed cereal at two meals during a 24-hour period. For young adults, 16% consumed a cereal sometime during the day, 65% at breakfast, and 24% as a snack. Five percent consumed cereal at two meals during a 24-hour period (Nicklas et al. 1995).

There was no significant difference in total daily macronutrient consumption between consumers and non-consumers of RTE cereals. The RTE cereal consumers in the young adult group had a significantly ($P < 0.01$) greater consumption of total carbohydrates compared to non-consumers, (52.9% versus 48.6% of energy from carbohydrate; $P < 0.05$). The RTE cereal consumers in this age group had a lower percentage of calories from fat (33.2% versus 36.9%; $P < 0.05$). Micronutrient intakes in the two groups differed with RTE cereal eaters consuming greater ($P < 0.05$) amounts of vitamin A, thiamin, riboflavin, niacin, vitamin B6, vitamin B12, folic, acid and iron. It is likely that this result is due to the consumption of RTE cereals that are fortified with the above nutrients. There was no significant difference ($P < 0.05$) in intakes of vitamin E, zinc, sodium, or potassium between consumers and non-consumers of RTE cereals, in both age groups. A limitation of this study is that researchers did not differentiate the types of cereals consumed in the RTE cereal group. Different

types of fortified cereals and pre-sweetened and non-sweetened breakfast cereals were analysed as one group.

McNulty et al. (1996) studied the contribution of fortified breakfast cereal to overall nutrient intakes and achievement of current dietary recommendations in schoolchildren aged 12-15 years in Northern Ireland. Results showed that a large number of children reported eating fortified breakfast cereals (94% boys, 83% girls). Of those consuming breakfast cereals, a large proportion (84% males, 60% females) consumed at least one serving of breakfast cereal per day. Consumers of fortified breakfast cereals showed significantly higher intakes of micronutrients traditionally added to breakfast cereals (vitamin B12, folate, iron, calcium, and zinc) and fibre compared to non-consumers. Intakes of thiamin, riboflavin, niacin, and calcium increased significantly with increasing level of consumption of fortified breakfast cereal in all age-sex groups. Similarly, Preziosi et al. (1999) found that children and adolescent consumers of RTE cereals had higher intakes of calcium, phosphorous, iron, and vitamins B1 and B2 compared to non-consumers. Furthermore, cereal consumers derived more daily energy from carbohydrate and less energy from fat than non-cereal consumers.

From a study assessing the contribution of breakfast to dietary intake in 136 schoolchildren in Edinburgh, Ruxton et al. (1996) concluded that those children who ate a RTE breakfast cereal nearly every day had higher energy and micronutrient intakes, both at breakfast and overall, compared to those who ate RTE cereals less frequently. Also, it was found that breakfasts frequently containing RTE cereals were lower in fat (22% energy) compared with breakfasts containing RTE cereals less frequently (25% energy) or not at all (34% energy).

From a nationwide sample of 603 children, aged 4-12 years in the US, Albertson, Harvey Anderson, Crockett and Goebel (2003) found that more than 90% of children consumed RTE cereal at least once during a two week dietary data collection period. This study found that children who consumed eight or more servings of cereal during the 14-day study period had lower mean body

mass indexes and were least likely to be at risk for overweight than those who consumed two or fewer servings, across all age groups. Additionally, children who consumed the greatest number of servings of cereal had significantly lower fat and cholesterol intakes and higher intakes of many micronutrients.

Barton et al. (2005) found a similar result from their recent longitudinal observational cohort study of 2,379 White and Black girls in the US. Subjects, who were 9 and 10 years at baseline, completed annual 3-day food records, up to 19 years of age. Investigators found that cereal consumption had positive effects on nutrient intake, resulting in diets higher in calcium and fibre and significantly lower in fat and cholesterol. An important finding from this study was that as the subjects matured through adolescence, the frequency of breakfast and cereal consumption decreased with age. Also, cereal consumption was found to be predictive of a lower BMI in this subject group (Barton et al., 2005).

Research has found that for consumers of breakfast cereals, the significant increases in intakes of nutrients such as calcium, magnesium, zinc, and Vitamin D are likely due to the increase in milk which is generally consumed with cereal (McNulty et al., 1996; Ortega, 1998). Morgan et al. (1981) reported that 97% of the time cereal was consumed for breakfast, it was eaten with milk. Nicklas et al. (1995) found that 96% of 10 year olds who ate RTE cereals also consumed a milk food item, which led the authors to conclude that the promotion of RTE cereal consumption could help to provide the additional calcium needed by this age group, especially by the females.

In the CNS, 40% of New Zealand children reported eating breakfast cereal at least once a day, 45% reported consuming a breakfast cereal weekly, and 15% less often. The frequency of breakfast cereal consumption declined with age, and more males than females ate breakfast cereals daily. The daily consumption of breakfast cereal was higher in children in the Maori and New Zealand European ethnic groups compared to children in the Pacific Island ethnic group. Weet-Bix (62%) was the most common breakfast cereal consumed weekly by children in this survey. Corn Flakes were eaten weekly by

50% of children, Rice Bubbles 36%, and Coco Pops 25%. Porridge was eaten weekly by 25% of children, a multigrain cereal 9%, and muesli was eaten weekly by 8% of children.

As well as being the most commonly consumed cereal in the CNS, Sanitarium's Weet-Bix is the biggest selling breakfast cereal in New Zealand (Consumer, 2003). Weet-Bix is low in sugar and fat and is a good source of dietary fibre and iron. Also, Weet-Bix is cost effective at around 50 cents per 100 g (Consumer, 2003). While the pattern of intake of breakfast cereals in the CNS suggests that cereals high in sugar are not widely consumed, it is possible that children who eat low-sugar cereals such as Weet-Bix are increasing their sugar intake by the self-addition of sugar to their cereal.

RTE cereal consumption may be a marker for healthy lifestyle factors practiced by children and adolescents, which would explain the association between cereal consumption and BMI as shown in studies by Albertson et al. (2003) and Barton et al. (2005). A similar association was discovered by Schlundt et al. (1992) who reported that more frequent breakfast eating was associated with lower BMI in adults.

In agreement with findings from studies investigating the relationship between consumption of RTE breakfast and dietary intake in children and adolescents, Morgan et al. (1986b) and Stanton and Keast (1989) found that adults who consumed RTE cereals had significantly lower intakes of fat and cholesterol compared to non-consumers of RTE cereals. The associations reported in the above studies provide evidence for the benefits of establishing frequent breakfast intake in childhood, on future health practices and outcomes.

There is wide variation in the nutrient composition of RTE cereals. Some brands of cereals are high in fibre and are nutrient dense and others are low in fibre and contain more sugar. There has been little research investigating the types of RTE cereals and the effect on nutrient intakes. Morgan et al. (1981) grouped RTE breakfast eaters into pre-sweetened (greater than 7.7 g sugars per serving) RTE cereal consumers, and non-sweetened (less than 7.69 g sugars

per serving) RTE cereal consumers. Analysis of nutrient intake over a one week period showed that children who ate pre-sweetened RTE cereal for breakfast three or more times during the week, were found to have consumed significantly less protein, cholesterol, crude fibre, phosphorus, sodium, potassium, and magnesium than children who consumed non-sweetened RTE cereal. However, the average energy consumption and total sugar intake at breakfast was similar for the two RTE cereal groups. This result may be due to children's self-application of sugar to non-sweetened RTE cereals.

1.8 Childhood and adolescent overweight and obesity

The rapid increase in childhood and adolescent obesity has become a major national health concern and obesity is now recognised as a global public health problem (Carter & Swinburn, 2004; Ministry of Health, 2004; World Health Organization, 2000). Overweight children and adolescents often become overweight adults (Must, 1996; Whitaker, Wright, Pepe, Seidel, & Dietz, 1997) who may be predisposed to morbidity in adulthood (St-Onge, Keller, & Heymsfield, 2003) because obesity is a risk factor for many chronic diseases including type two diabetes, heart disease, hypertension, and stroke, and some cancers (Ministry of Health, 2004; World Health Organization, 2000).

Obesity can be defined as a condition of abnormal or excessive fat accumulation in adipose tissue, which in turn impairs health (World Health Orgnaization, 2000). The obesity epidemic has been attributed to changing social and physical environments, in which people are consuming excess energy through food and beverages and not expending adequate energy through physical activity (Ministry of Health, 2004).

Anthropometric measures of 3,275 children who participated in the CNS found that approximately one third of New Zealand children between 5-14 years were overweight (21%) or obese (10%). Overweight and obesity levels were the highest for Pacific Island males (33.9%; 26.1%) and females (32.9%; 31%), followed by Maori males (19.6%; 15.7%), and females (30.6%; 16.7%), and then New Zealand European males (18.4%; 4.7%) and females (18.8%; 6%).

When comparing obesity levels by gender, males were similar across all age groups, however obesity levels for females increased from 6.7% (5-6 years of age) to 11.5% (11-14 years of age). From this survey overweight and obesity appear to be a particular concern for children in the Pacific Island ethnic group, where over one fifth of children were found to be obese, and over one third of Pacific Island females 11-14 years classified as obese. The prevalence of obesity was found to increase with increasing age in this ethnic group.

A rise in body weight for Pacific Islanders has been observed after migration to Westernised countries, and it has been hypothesised that for Pacific Islanders, there is a genetic susceptibility to weight gain when introduced to the Western diet and or lifestyle (Gordon et al., 2003). In a study of 3-7 year old Pacific children living in Dunedin, New Zealand, Gordon et al. (2003) assessed the growth and body composition of a sample of 41 children using anthropometric measurements including dual energy X-ray absorptiometry. The estimated percentage of children classified as obese ranged from 34% to 49% depending on the reference criterion used. Over 75% of children in the study had a total body fat percentage of 15% or more.

Estimates of obesity from this study must be interpreted cautiously as non-random sampling was used and a small sample size was surveyed. Also BMIs were compared to reference data based on Caucasian populations. A finding of particular concern, however, was that over 60% of subjects had high levels of abdominal fat, as measured by dual energy X-ray absorptiometry, and classified according to the suggested cut-off points defined by Taylor, Jones, Williams, and Goulding (2000) from a Caucasian population. This finding demonstrates the need for specific cut-offs for Pacific Island populations, especially considering the variation in regional fat distribution among different ethnic groups (Gordon et al., 2003).

The shifting food patterns over the past few decades have been linked to an increase in overweight and obesity in children and adolescents. There is an increased reliance on convenience foods and foods consumed away from the home, because more families have two working parents and time limitations

become important when considering the types of foods consumed (Jahns et al., 2001; St-Onge et al., 2003). Due to a combination of convenience, peer pressure, food prices, advertising, and food marketing, fast food outlets and convenience foods are very appealing to children and adolescents. Foods promoted by the fast food and convenience food industries are generally unhealthy food choices as they are high in fat (especially saturated fat) and sugar and are therefore energy dense foods (St-Onge et al., 2003). Some fast food companies, who have come under pressure for their involvement in the 'obesity epidemic' and have faced declining sales, have recently amended their menus to include 'healthy' fast food options. In February 2004, McDonalds New Zealand introduced a range called SaladsPlus to their menu. All SaladsPlus products contain less than nine grams of fat per average serve and include salads, low-fat yoghurt with fruit and oats, smoothies, deli-style sandwiches, and Kellogg's cereals. McDonalds also added milk, juices, and a fruit bag as a healthy alternative to soft drinks and fries in Happy Meals.

Investigations into the beverage consumption of children and adolescents have found that the consumption of soft drinks and sugar-sweetened drinks has increased in recent decades (St-Onge et al., 2003). A longitudinal study by Ludwig, Peterson, and Gortmaker (2001) associated the increased consumption of soft drinks with weight gain and obesity in children. Children who consume equal to or greater than 265 mL of soft drink per day have an energy intake of 188 kcal per day higher than children who do not consume soft drinks (Harnack, Stang, & Story, 1999).

In an analysis of the 'obesogenic' (obesity promoting) food environment in New Zealand primary and intermediate schools, Carter and Swinburn (2004) concluded that the food environment was not conducive to healthy food choices for children at New Zealand schools. Of the school canteens surveyed, less healthy foods and beverage choices dominated sales by a ratio of more than 2:1. The most commonly available food items for sale were pies (79%), juice (57%), and sausage rolls (54%), while fruit was the least frequent item offered for sale (28%). Pies were the top selling item with more than 55,000 pies sold at school canteens across New Zealand per week.

From the findings of the analysis by Carter and Swinburn (2004) it can be speculated that children who come to school without having had breakfast, are likely to purchase unhealthy foods such as pies and beverages, which are high in energy and sugar, from the school canteen.

1.9 Breakfast consumption and weight control

Regular breakfast consumption has been associated with lower body weight and BMI (Ruxton & Kirk, 1997; Siega-Riz et al., 1998). Having a substantial breakfast prevents hunger during the morning and may lead to a decrease in snacking and energy consumed during the day (Morgan et al., 1981). Individuals trying to lose or control their weight, however, often believe that by omitting breakfast they can reduce their total energy intake (Schlundt et al., 1992). Adolescent females have reported omitting breakfast because they are trying to lose weight or are on a diet (Shaw, 1998). However, it has been observed that individuals who skip breakfast select more energy dense foods later in the day and do not reduce their total energy intake (Morgan et al., 1986b).

Levine et al. (1989) conducted two experimental studies to test the hypothesis that consumption of a high-fibre breakfast cereal may decrease short-term food intake. In the first study, 14 healthy subjects (24-59 years of age) consumed one of five cereals of varying fibre content at 7:30 am and were presented with an ad libitum buffet lunch at 11:00 am. This experiment found a significant inverse linear correlation between fibre content of the five cereals examined and energy intake at lunch. This relationship was further examined by the second study in which 19 subjects (24-55 years of age) followed the same protocol as the first study, except subjects randomly received either a very low-fibre cereal or a very high-fibre cereal. Results showed that subjects consumed less energy at lunch after ingesting the high-fibre cereal compared to the low-fibre cereal ($P = 0.05$).

In this study, the high-fibre cereals contained less energy per serving therefore the consumption of a high-fibre cereal for breakfast resulted in a decrease in

energy consumed at breakfast as well as energy consumed at lunch. It is possible that a decrease in short-term food intake, as a result of the consumption of a high-fibre breakfast cereal, could result in weight loss if this breakfast diet was continued long-term. The validity of the above study may be questionable because of the small sample size in the trials.

As well as being a factor in weight control in healthy subjects, consuming a healthy breakfast has also been found to help reduce dietary fat and snacking in obese adult subjects. Schlundt et al. (1992) examined the role of breakfast consumption in a 12-week weight-reduction programme and evaluated the effects of eating breakfast on changes in body weight, body composition, resting metabolic rate, macronutrient intake, and psychological adjustment and eating behaviours. Fifty-two obese women aged 18-55 years were stratified according to their baseline breakfast habits and randomly allocated to one of two weight-loss programmes. The energy content of the two weight-loss programmes was identical (5016 kJ/d) and the diets differed only in the number of meals per day. The three meals per day programme included breakfast, and the two meals per day programme did not include breakfast. Subjects were given sample menus and were trained to use the food group exchange system to make substitutions to the menu pattern (Schlundt et al., 1992).

While neither the eating breakfast treatment nor the no breakfast treatment provided a significant advantage in total weight loss, there was a trend towards a greater reduction in dietary fat and less impulse snacking in the breakfast group, compared to the two-meal a day group. This suggests that breakfast consumption may be an important part of a weight-reduction programme; however, further research into the long-term impact of changing breakfast habits on weight-control is required to further investigate this relationship.

1.10 Effect of diet in childhood and adolescence on chronic disease in adulthood

Diet in childhood is considered to be an important factor in the development of chronic disease in later life as many adult diet-associated chronic diseases such

as heart disease develop over several decades and originate in childhood and adolescence (McNulty et al., 1996; St-Onge et al., 2003). Epidemiological studies have demonstrated that childhood plasma lipids, blood pressure, and BMI at the upper end of the distribution in childhood appear to continue into adulthood (Webber, Srinivasan, Wattingey, & Berenson, 1991). Eating patterns established earlier in life have been shown to continue into adulthood (Gift, Washbon, & Harrison, 1972; Morgan et al., 1981; Paulus, Saint-Remy, & Jeanjean, 2001; Videon & Manning, 2003). Therefore introducing healthy eating behaviour during early childhood may prevent or delay the onset of chronic disease in later life.

1.11 Breakfast, cognition, and behaviour

The longest time period in which children and adolescents go without an external supply of energy and nutrients during a 24-hour period is between the evening meal and breakfast the next morning (Pollitt, 1995). During this time, the liver begins glucose production and will continue until approximately one half of the glycogen stores are depleted (Hill, 1995). When the breakfast meal is missed fuel homeostasis is not reached and the fasting period is extended, leading to a gradual decline of insulin and glucose levels which may interfere with cognitive function (Pollitt, 1995) and therefore school performance.

Since the 1970s, there have been a number studies investigating the effects of breakfast consumption on mood, cognitive performance, and school performance. When reviewing the literature on the relationship between breakfast consumption, cognition, and school performance, the most common protocols employed are experimental laboratory based studies and field evaluations. The advantages of conducting an experimental study are that confounding variables can be controlled in a laboratory environment, for example, energy and nutrient intake (Pollitt, 1995). However for field evaluations within the school environment, subjects are examined under 'normal conditions' and the effectiveness of breakfast programmes can be evaluated (Pollitt, 1995). Disruption to subjects' daily activities is minimised when they are examined under 'normal conditions'. Also, subjects are less likely

to change their behaviour, which is common when examined under experimental conditions.

When investigating breakfast consumption in children with respect to scholastic performance, studies have been conducted over the short-term, examining the effect of missing a single meal, and over the long-term, examining the effect of repeated breakfast omission (Papamandjaris, 2000). Investigators have also researched the effects in malnourished and well-nourished children (Papamandjaris, 2000).

1.11.1 Breakfast, cognition, and behaviour in well-nourished subjects

In 1981, Pollitt, Leibel, and Greenfield implemented an experimental study to determine the effects of skipping breakfast (after an overnight fast) on speed and accuracy in problem solving tasks administered to 9-11 year old children. The study sample included 34 well-nourished, middle class children who were admitted to a research facility in the US, on two separate evenings. At 5:00 pm subjects were served dinner and at 8:00 am the following day, half were served breakfast. Anthropometric and biochemical parameters were measured and a series of behavioural tests were administered. Researchers hypothesised that in fasted children, metabolic stress occurs to maintain the circulation of glucose which is critical to brain function.

From this sample group, researchers found that a significant difference occurred between the fed and fasted states in the biochemical parameters β-hydroxybutyrate, lactate, and free fatty acids which suggest that subjects in the fasted state were under metabolic stress. However, there was no difference in mean glucose values between the two groups. In the fasted subjects the biochemical parameters reflect the use of an alternative fuel source (e.g., fat) to compensate for reduced availability of carbohydrate (hepatic glycogen) (Pollitt, et al., 1981).

When researchers analysed the cognitive effects of the fasted verses fed state, results indicated that fasting had an adverse effect on the accuracy of

responses in problem solving. Children with an IQ below the median made more errors in the behavioural tests in the fasted compared to the fed state. However, fasting had a beneficial effect on immediate recall in short-term memory and response time, which may be explained by a heightened arousal level due to the experimental fast (Pollitt et al., 1981). This study involved only a small subject group who were all well-nourished children from middle-class families. Therefore, it should be noted that results found in the above study should not be generalised to other population groups. This experiment should be replicated in a larger sample group of varying nutrition and socioeconomic status.

A Swedish study by Wyon and colleagues in 1997, aimed to determine the effect of breakfast consumption on the cognitive capacity of 195 10 year old school children. Children were randomly allocated standard breakfasts in two different orders, over four days. Breakfasts consisted of either 567 kcal or 832 kcal for girls and boys respectively, or 147 kcal or 197 kcal for girls and boys respectively. After each breakfast condition, children were tested by their teachers at school. The tests used were addition, multiplication, grammatical reasoning, number checking, and creativity. Mood and physical endurance were also assessed. Researchers found that voluntary physical performance and creativity test performance was significantly enhanced after a breakfast from which children derived over 20% of their recommended daily energy intake compared to after a breakfast from which 10% of recommended values was derived (Wyon, Abrahamsson, Jartelius, & Fletcher, 1997). In tests of addition, error rates were negatively correlated to energy intake, and in number checking, work rate increased with energy intake. No significant effects were found in multiplication or grammatical reasoning.

While short-term fasting (breakfast omission) studies conducted on well-nourished children from developed countries have shown inconsistent findings regarding performance in various cognitive function tests (Pollitt et al., 1981; Wyon et al., 1997) it is possible that the effects of missing breakfast on cognitive performance may be more pronounced in undernourished children (Dickie & Bender, 1982; Simeon & Grantham-McGregor, 1989).

1.11.2 Breakfast, cognition, and behaviour in undernourished subjects

In Jamaica, researchers Simeon and Grantham-McGregor (1989) conducted a study to investigate the effects of skipping breakfast in three groups of 30 children (aged 9-10.5 years) of differing nutritional status (stunted, previously severely malnourished, and non-stunted controls). Subjects were admitted to a metabolic ward overnight on two occasions one week apart. Following dinner and an overnight fast, at 8:00 am subjects received either a standard breakfast (providing 590 kcal of energy) or a cup of tea. Half of the subject group received breakfast the morning of their first visit and the tea on the morning of their next visit. The treatment order was reversed for the other half of the subject group. At 11:00 am a battery of seven tests of various aspects of cognitive function was administered. Results from the cognitive function tests showed that missing breakfast detrimentally affected the cognitive function of undernourished children (stunted and previously malnourished), but not the cognitive function of the adequately nourished children in the control group.

Powell, Walter, Chang, and Grantham-McGregor (1998) conducted a randomised trial of giving breakfast to an equal number of undernourished (n = 407) and adequately nourished (n = 407) children attending schools in rural Jamaica. Both groups were randomly assigned to breakfast or control groups and were given a Wide Range Achievement Test (WRAT) before and after the intervention, which lasted one school year. The WRAT assessed reading, spelling, and arithmetic. While there was no effect of breakfast consumption on WRAT results for the undernourished and adequately nourished groups, results showed that compared to the control group (who were only given one quarter of an orange), height, weight, and school attendance improved significantly in the breakfast groups. In children who received breakfast a small but significant improvement in nutritional status was observed compared to those in the control group. Both groups showed poor progress in WRAT scores; however younger children in the breakfast group showed improvement in arithmetic scores.

Simeon and Grantham-McGregor (1989) state that missing breakfast could be a serious contributor to poor school achievement in undernourished children. The

above studies conducted on undernourished children; both in the laboratory and the school environment, show that consumption of breakfast before school positively affects cognitive function, as well as nutritional status.

1.12 Barriers to breakfast consumption

Skipping breakfast is most common in children and adolescents between 13 and 16 years of age (Ruxton & Kirk, 1997). Studies by Shaw (1998) and Siega-Riz et al. (1998) have indicated that breakfast skipping may be a personal choice rather than a demographic or socioeconomic issue. Children and adolescents reported that they skip breakfast because they are not hungry, don't feel like eating in the mornings, and do not like breakfast foods. Being on a diet and wanting to lose weight are other reasons reported by adolescents as to why they skip breakfast in the morning. Determining the reasons why children and adolescents skip breakfast may assist parents, schools, and public health professionals to promote breakfast consumption.

The convenience of breakfast and eating with other family members has been shown to reduce breakfast skipping (Hill, 1995). Older children and adolescents may be more inclined to skip breakfast in the mornings if their parents/caregivers are working and are unavailable to prepare and supervise breakfast. Therefore, children and adolescents may have to eat alone, and are responsible for preparing their own breakfast, and possibly their siblings' breakfast.

Another reason why children and adolescents skip breakfast in the mornings could be due to lack of time as they have to leave for school or be dropped off at school by their parents/caregivers earlier in the morning. Parents/caregivers may provide snacks to eat on the way to school or money to spend at a bakery or fast food outlet in place of a healthy breakfast. Children and adolescents from low socioeconomic households may skip breakfast as there is less money to spend on food and therefore less breakfast foods available.

In the Australian study by Shaw (1998), subjects were interviewed via the telephone as to why they skip breakfast in the mornings. The most common reasons for skipping breakfast were; a lack of time in the morning (52%), not being hungry (22%), and not feeling like it (14%). When subjects were provided with a checklist of possible reasons for skipping breakfast (subjects could indicate more than one) the majority of respondents chose '*not being hungry*' (n = 40), '*no time to eat breakfast*' (n = 35), and '*do not like to eat in the mornings*' (n = 20). Only eleven female subjects indicated that they skipped breakfast because they wanted to lose weight or were on a weight-loss diet. The author therefore concluded that in this sample, subjects skipped breakfast due to personal choice and convenience rather than dieting and concern over body shape. However, it is possible that many adolescents when interviewed via telephone may not have admitted to the interviewer that they skipped breakfast as a weight-control strategy.

1.13 Nutritional surveys of New Zealand children and adolescents

In the CNS and in nutrient intake studies by Brinsdon et al. (1992, 1993) on Form one, and Forms three and four students, it was concluded that poor breakfast habits were more common among older children studied compared to younger children. One of the main findings from the CNS was that among New Zealand children, the younger children surveyed had better food and nutrient intakes compared to the older children who participated in the survey. The younger children were also less likely to be overweight or obese. This study concluded that if older children followed similar breakfast eating habits, snack choices, and activity patterns of the younger children in the survey, their nutritional health status could be improved (Ministry of Health, 2003).

The dietary survey by Brinsdon et al. (1992), of a sample of 260 Form one students from ten schools throughout New Zealand, was conducted on behalf of the Department of Health.

The purpose of this study was to;

- Determine the food consumption and nutrient intake patterns of a nationwide sample of Form one children (10 and 11 year olds).
- Identify areas of possible nutrition concern.

Combinations of 24-hour food records and recalls, as well as food models to estimate portion sizes, were used to obtain dietary intake information. Results from this research project showed that there was a wide variation in energy intake; for example, for boys, energy intake ranged from 5,154 kJ (10^{th} percentile) to 12,290 kJ (90^{th} percentile). Calcium and vitamin B6 intakes were found to be inadequate for a proportion of the study sample. Forty-five percent of girls and 30% of boys had a calcium intake below 70% of the RDI, and 49% of boys and 40% of girls had a vitamin B6 intake below 70% of the RDI. Sucrose intakes were generally too high, especially in snacks, which provided approximately half the daily sucrose intakes. The mean percentage of energy contribution from total sugars was 25% for boys and 27% for girls. The authors hypothesised that the high sucrose intake may be due to inappropriate choices of snack food and the frequency with which soft drinks were consumed (Brinsdon et al., 1992).

Additionally, Brinsdon et al. (1993) conducted a dietary survey of a nationwide sample of Form three and four adolescents (13-15 years of age). Three hundred and sixty-six students participated in the study which followed a similar protocol to the 1992 survey. As found in the previous study, sucrose intakes were high, with sucrose providing approximately 57% of the daily total sugar intake. Furthermore, in this study sample, calcium intakes were low with 59% of girls and 55% of boys showing calcium intakes below 70% of the recommended dietary intake.

The Form one and Forms three and four surveys assessed dietary intake on a single weekday only, which does not take into consideration the variation in eating habits and dietary intakes that occur between weekdays and weekend days. Assessing a single day of dietary intake is a suitable method for

estimating the nutrient intake of groups; however, one day's intake may not be representative of an individual's normal daily intake.

The CNS was the first large-scale nationwide survey of the nutritional status of New Zealand children aged 5-14 years. The primary aim of the survey was to provide information that could be used to improve, promote, and protect the health status of New Zealand children (Ministry of Health, 2003). The survey was funded by the Ministry of Health and conducted by the University of Auckland, Massey University, and the University of Otago.

The study was a cross-sectional population survey providing information on food and nutrient intakes, eating patterns, food security, and frequently eaten foods, physical activity patterns, dental health, anthropometric measures, and nutrition-related clinical measures. The study sample of 3,275 children, who provided both parental and personal consent, was randomly selected from a random sample of schools across the country. When nutrient intakes were analysed according to ethnic group, it was observed that New Zealand European children had the lowest levels of prevalence of inadequate dietary intakes compared with Maori and Pacific Island children.

1.14 Breakfast intervention programmes

Breakfast intervention programmes and breakfast clubs have been implemented in both developed countries and developing countries as a means to educate schoolchildren regarding the importance of having a healthy breakfast and to provide a healthy meal to children who regularly miss breakfast before coming to school in the mornings.

1.14.1 School breakfast programmes in the United States

The School Breakfast Programme (SBP) in US, implemented by the United States Department of Agriculture (USDA), originated from the Child Nutrition Act of 1966 and was initially a pilot programme targeting children from low income school areas. The SBP provides schools with assistance in creating breakfast programmes with the aim to provide a nutritious breakfast to children who might

otherwise not receive one and to ensure that children do not begin their school day hungry (Briefel et al., 1999; Kennedy & Davis, 1998).

Currently all public and non-profit elementary and secondary schools in the US are eligible to participate in the SBP. The USDA subsidises school breakfasts, with the amount of subsidy determined by family income and size (Kennedy & Davis, 1998). Requirements of the SBP are to meet the recommendations of the Dietary Guidelines for Americans and to provide a quarter of the recommended dietary allowances (RDA) for energy and selected nutrients - protein, calcium, iron, vitamin A, vitamin C, and energy (Kennedy & Davis, 1998).

The meal pattern requirements of the SBP contain the following food components:

- A serving (240 ml) of milk (whole or low-fat) served as a beverage or on cereal or both.
- A serving (1/2 cup) of fruit, vegetables, or both, or undiluted fruit juice or vegetable juice.
- Two servings (any combination) of the bread and meat groups.

To evaluate the effectiveness of SBP in the US, Hanes, Vermeesch, and Gale (1984) measured the difference in energy and nutrient intakes of participants and non-participants in school breakfast programmes. Over six thousand schoolchildren participated in a 24-hour dietary recall where they described the types and amount of food consumed during the 24-hours immediately preceding the interview. The authors reported that almost all schools in the US offer School Lunch to students but only about 33% offer School Breakfast. Results from this study demonstrated that students who have the breakfast programme available at their school are significantly more likely ($P < 0.05$) to eat breakfast than students who do not have the SBP at their school. In school districts where the SBP is available, approximately 85% of students eat some type of breakfast, compared to 81.5% of students in school districts without the SBP (Hanes et al., 1984).

Gleason (1995) examined participation in the SBP and found that the availability of the programme did not influence the likelihood of students eating breakfast. In this study it was observed that among students attending schools offering the SBP, the participation rate was 19%. However, observations from the Bogalusa Heart Study data has shown that with the introduction of school breakfast into schools in Bogalusa, Los Angeles in 1981-1982, the number of students in the study population who skipped breakfast fell dramatically compared to survey periods in the 1970s (Nicklas et al., 1998).

In a review of the United States Department of Agriculture's SBP, Kennedy and Davies (1998) concluded that school breakfast contributes significantly to nutrient consumption, and that studies reviewed showed a significantly higher intake of vitamin C, calcium, riboflavin, and vitamin A in SBP participants. This finding is consistent with the consumption of food components, such as milk and fruit, which are offered as part of the SBP. The authors reviewed two studies which directly examined the influence on the SBP on aspects of school performance and concluded that children from low income families, who participated in the SBP, showed improved school performance (measured by the Comprehensive Test of Basic Skills) and reduced rates of absenteeism and lateness.

1.14.2 School breakfast programmes in the United Kingdom

In the UK the Department of Health introduced a scheme in 1999 to support the development of breakfast clubs in schools. The aims of the initiative were to provide a breakfast to children who might not have eaten before school, to establish a positive relationship at the start of the day with the students, and to offer children a choice of healthier foods (Belderson et al., 2003).

As part of a national evaluation project investigating the effects of breakfast club attendance on dietary intake, Belderson and colleagues (2003) compared the energy and nutrient intakes of school children who attended breakfast clubs and those who did not. A total of 111 children aged between 9 and 15 years from three schools participated in the study. Subjects completed a 3-day weighed food record and height and weight measurements were taken.

Researchers found that the children who attended breakfast clubs had significantly greater intakes of fat as a percentage of energy, saturated fat as a percentage of energy, and sodium compared to the control subjects who did not attend breakfast clubs. This finding correlates with the types of foods offered at the breakfast clubs of school 2 who provided fried sausage sandwiches and tea for breakfast, and school 3 who offered snacks, for example, cereal bars, crisps, sausage rolls, and doughnuts which children purchased for later consumption during the school day. The foods offered at the breakfast club at school 1, however, were consistent with the guidelines set by the Department of Health. This school offered cereals with semi-skimmed milk and sugar, white bread, with margarine, Marmite, peanut butter, and jam. A choice of fruit drink or hot chocolate was also provided.

At schools 2 and 3, the food and beverages provided by the breakfast clubs were not consistent with Department of Health Guidelines for food provision at breakfast clubs. The breakfast clubs at these two schools may have provided popular foods which the children will eat rather than more healthy options, which may be refused, to increase the number of children attending breakfast clubs and to minimise wastage of food. Even though these clubs may not provide healthy breakfast options compared to school 1, children are at least attending breakfast clubs and are having something to eat before they start the school day, however, healthier menu options would be preferable. A limitation of this study was that only three schools were surveyed, and schools were not randomly chosen. Therefore the results from the schools surveyed may not be a representative of breakfast clubs in the UK.

An evaluation of school breakfast clubs in the UK found that as well as providing breakfast to students, breakfast clubs accommodated a social environment where relationships between staff and students, and students across age groups improved. Teachers reported increased self-esteem and improved behaviour among children attending breakfast clubs. Additionally, parents reported that breakfast clubs provided safe before school care and improved the household's morning routine (University of East Anglia, 2002).

1.14.3 Breakfast programmes in New Zealand

In New Zealand, the Nutrition Foundation launched the first school breakfast campaign in the 1980s, targeting low decile schools. The campaign operated for two years and was sponsored by eight food companies. The programme's objective was to increase the awareness of the message that 'breakfast is the most important meal of the day' (Liu, 2002).

The *Get Going with Breakfast* campaign was initiated in 1997 and was designed to heighten the public's awareness of the importance and the benefits of eating breakfast every day. Five leading New Zealand food manufacturers sponsored the campaign as a marketing strategy, providing breakfast products to schools across the country. As well as providing a free breakfast to students, the campaign included an in-class nutrition education component, radio, and television advertisements and appearances at school assemblies by sporting celebrities. Schools were provided with breakfast resource packs which contained a teaching plan, visual and interactive resources, an interactive board game, and a three dimensional food pyramid (Liu, 2002). An informative website was also available to be used by students.

The effectiveness of the *Get Going with Breakfast* campaign was evaluated in a small research project completed by a postgraduate student in 2001 (Liu, 2002). The aim of the project was to assess the impact of the programme in relation to increasing school children's' awareness of the importance of breakfast and thus contributing to a change in breakfast eating behaviour. Thirty-four children, from two different schools, aged between 6-13 years participated in focus groups, and the researcher interviewed six teachers and four health professionals.

From the summary of the results it was found that 97% of the children and all of the teachers and health professionals acknowledged that breakfast was important, and the majority of children (70%) reported consuming breakfast every day. Six children reported that they would sometimes have breakfast and 18% reported that they never have breakfast (Liu, 2002). Participants reported skipping breakfast due to parent's time constraints, or that their parents were too lazy, tired, or unwell to make breakfast. Participants also reported that they

miss breakfast because they can't be bothered making breakfast, do not feel like breakfast, are too tired, or are in a hurry to leave the house (Liu, 2002).

From those children who participated in the focus groups it was found that there was a high recall rate of the previous breakfast campaign, and of the programme's aims. As a result of the programme, 71% of participants reported that they made changes to their usual eating habits, while 29% reported no changes to their usual eating habits. There were multiple limitations of this study; for example, it must be considered that this was a small study that involved only 34 children and 10 teachers and health professionals. There was a large reliance on the recall ability of the children to remember the breakfast campaign that occurred the previous year. Also, changes to eating habits were self-reported and no dietary analysis or evaluation of the participant's eating habits was performed before or after the *Get Going with Breakfast* campaign was implemented.

It is essential that school breakfast programmes and other nutrition interventions are appropriately evaluated to ensure that guidelines are followed and the objectives of the programme are achieved. The implementation of school breakfast programmes may help to increase the consumption of a healthy breakfast and therefore improve the dietary intake of children and adolescents who would otherwise miss breakfast in the mornings.

The objective of the current study is to investigate dietary intake, breakfast habits, choices and preferences of 12-13 year old Auckland school children and to determine the factors that influence breakfast consumption. The information gained from this study may facilitate the implementation of nutrition education and intervention programmes designed to improve eating patterns (in particular breakfast consumption) and the dietary intake of children and adolescents.

2 Aims

The aims of this study are:

- To investigate the breakfast consumption of students attending intermediate schools in Auckland.
- To determine the factors which influence breakfast consumption.
- To describe the range of foods eaten for breakfast by this age group.
- To investigate the impact of breakfast consumption on total dietary intakes and eating patterns throughout the day.
- To determine the effect of breakfast consumption on risk of nutritional inadequacy.
- To characterise breakfast abstainers according to demographic and behavioural factors.

The study objectives were:

- To develop a questionnaire to investigate the dietary patterns and eating behaviours of Year 8 students attending two decile six intermediate schools.
- To assess in detail the nutrient intakes of a subset group within the study population using dietary assessment methods.

3 Methodology

3.1 School and subject recruitment

Two schools, Birkdale Intermediate School and Northcote Intermediate School in North Shore City, Auckland, were selected to participate in this study. The schools were selected due to their geographic proximity to each other, the size of their school rolls, and the broad range of ethnicities enrolled at each school (see Table 3.01). Additionally, the two intermediate schools are both decile six schools, which draw children from two regions of relatively low socioeconomic communities. These two North Shore intermediate schools represent an understudied group, as they are often associated with the North Shore area, which is considered a high socioeconomic region.

Table 3.01 Number of students enrolled and the ethnic composition at both schools

BIRKDALE INTERMEDIATE		**NORTHCOTE INTERMEDIATE**	
Number of Year 8 Students Enrolled 2004: 308		Number of Year 8 Students Enrolled 2004: 196	
Total School Roll:	597	Total School Roll:	334
Ethnic Composition[1]		*Ethnic Composition*[2]	
Pakeha	54%	Pakeha	46%
Maori	17%	Maori	11%
Asian	8%	Korean	12%
Samoan	5%	Tongan	8%
South East Asian	4%	Samoan	3%
Tongan	3%	Indian	2%
Indian	3%	Other	18%
Cook Island	1%		
Other	5%		

[1] Ethnic group statistics from Education Review Office Report (14 March 2003)
[2] Ethnic group statistics from Education Review Office Report (21 May 2002)

The Principal Teachers of the two schools were contacted by telephone and letter (Appendix D) to arrange a meeting to invite the participation of their school in the study. The Principal at each school provisionally agreed to participate. An information pack containing a letter to the Board of Trustees (Appendix E), and a copy of the questionnaire (Appendix F) was sent to the schools. Once the Board of Trustees had approved the study, meetings were arranged with the teaching staff to explain the study and to arrange a time for the administration of the questionnaire and the collection of height and weight measurements. Class lists were obtained and folders containing an information sheet and consent from for each student and their parent/caregiver were delivered to each class teacher at both schools.

3.2 Subjects

All Year 8 students at each school were eligible to take part in the study, on the provision that they had provided written consent and parental written consent, and were present at school on the day the questionnaire was administered.

3.3 Ethical approval

This study was approved by Massey University's Human Ethics Committee – MUAHEC 04/040 (Appendix A).

3.4 Informed consent

The format of the consent form was devised so that the pupils and parents/caregivers were given the option to consent to either Part A of the study only (questionnaire and height and weight measurements), Part A and Part B (food records), or not to consent to either Part A or Part B. Information sheets and consent forms for both pupils and their parents/caregivers were distributed in class to each Year 8 student (Appendices B and C). To distinguish between the forms they were colour coded: the pupils' forms were printed on yellow paper and the parents/caregivers' forms were on green paper. The children were asked to take all forms home to read and discuss the study with their

parent/caregivers. Children were asked to return all forms to their teacher as soon as possible.

Initially the teaching staff from both schools suggested awarding House Points as an incentive for encouraging students to return their signed consent forms to class within a certain time frame. However, monitoring the House Point system was too time-consuming for the teachers, who instead reminded their pupils to bring back their forms each day. Other methods used to encourage the return of the consent forms were reminders in the school daily notices and verbal reminders during class.

3.5 Data collection Part A: Questionnaire and height and weight measurements

3.5.1 Questionnaire development

The general format of the questionnaire was adapted from the Day in the Life Questionnaire (DILQ) developed by Edmunds and Ziebland (2002). The DILQ is used as a classroom exercise to measure children's consumption of fruit and vegetables and is based around a school day. The DILQ uses words and pictures to encourage children to recall their food intake and to describe activities performed from the previous day.

The validity, reliability, and sensitivity of the DILQ was tested in a study of 255 children aged 7-9 attending four schools in England (Edmunds and Ziebland, 2002). Researchers conducted observations of the foods and beverages consumed by individual children during school lunch and break times and compared these findings to the results of the DILQ. The authors found that the questionnaire performed well or acceptably on all validity, reliability, and sensitivity tests, and they recommended the use of the questionnaire as a method of collecting fruit and vegetable data from children aged 7-9 years within a classroom setting.

The questionnaire in this study also included adapted questions on breakfast consumption from a questionnaire and test booklet used in The Breakfast Programme Study in South Australia, funded by the National Health Promotion Programme (Robinson, 1993). Additional questions were original questions developed by the researcher.

3.5.2 Pilot

The questionnaire was piloted to determine understanding, time required to complete, and ease of use, in 27 Year 8 pupils attending an intermediate school in Auckland. The pilot school was separate to the study schools and had not been selected to participate in the main study. The age and gender distribution of the pilot group were similar to the study group, however, the distribution of ethnicity differed with few Maori/Pacific Island students and more Asian students in the pilot group. The questionnaire was administered by the researcher going through each question with the students as a class. It was found after the first few questions, that the students had little difficulty with the questionnaire, and were able to continue answering questions individually. The questionnaire took approximately 30 minutes to complete.

3.5.3 Changes made to the questionnaire following the pilot

After piloting the questionnaire and receiving feedback from the students, changes were made to the format, the wording of questions, and instructions to improve the ease of use for children in the study age group. Comments from the teachers from the pilot school regarding the administration of the questionnaire within the classroom were also taken into consideration.

3.5.4 Administration of the questionnaire

The questionnaire was administered to consenting participants in class during the school week. The researcher was present to introduce the study, to explain how to complete the questionnaire, monitor progress, and to answer any questions. On completion, questionnaires were collected and checked by the researcher for missing or incomplete answers. Anthropometric measurements were performed in a separate area of the classroom or in another room to maintain subject privacy, while the remainder of the class completed work set by their teacher.

3.5.5 Height and weight measurement protocol

All subjects who consented to take part in the project had their height and weight measured either on the day that they completed the questionnaire, or within the same school week (depending on class time constraints). Subjects were informed that the height and weight measurements were voluntary and that information regarding their height and weight would remain confidential. None of these subjects refused to have their height and weight measured.

All height and weight measurements were performed by the researcher who has a level 1 trained anthropometrist accreditation from the International Society for the Advancement of Kinanthropometry (ISAK).

3.5.6 Weight

Weight was measured using Tanita digital platform scales (Model 1609N) on a hard level wooden board. Before each class was measured, the scale was calibrated with a known weight. All subjects were asked to remove their shoes and were wearing light clothing only. Subjects were asked to stand still on the scale with their weight evenly distributed over the centre of the scales. They were asked to look straight ahead and let their arms hang naturally by their sides. Weights were recorded to the nearest 0.1 kg.

3.5.7 Height

Standing height was measured using a portable stadiometer that was used by Massey University researchers in the CNS in 2002. The subjects, with their shoes removed, were asked to stand erect against the measuring wall with their heels together, knees straight, and their arms hanging naturally by their sides, palms facing their thighs. The heels, buttocks, and shoulder blades were in contact with the wall. The subjects were then instructed to look straight ahead and take a deep breath in. The stadiometer bar was then lowered onto the subject's head and levelled. The subject was then asked to step away whilst the stadiometer bar was held into position and a measurement was taken using the attached measuring tape. Height measurements were recorded to the nearest 0.1 cm.

3.5.8 Protocol variation

The original protocol for measuring height and weight involved measuring the subject's weight followed by height, and then a second reading was to be taken, and the results averaged. If the second readings differed greatly from the first, a third reading would be taken. This protocol was followed for the first class at the first school, with negligible differences between measurements. The maximum difference between weight measurements taken for one subject was 0.1 kg, and the maximum difference between height measurements was 0.8 cm. In subsequent classes during data collection however the researcher had difficulty fitting the duplicate measures into the time available and the protocol was varied to include only one height and weight measurement. Therefore, due to a very small difference in measurements and study time constraints, height and weight measurements were only taken once for each subject during the remainder of the study.

3.6 Measurement of dietary intake

3.6.1 Dietary assessment

The collection of reliable and accurate data when assessing the nutritional status of individuals or groups is a difficult task. This is mainly due to errors involved in the methodology and the large number of confounders that occur when assessing nutrient intake, for example, under reporting and under eating. The measurement of food and nutrient intakes in children and adolescents is particularly challenging due to the many different respondent and observer considerations which occur from early childhood to late adolescence (Livingstone & Robson, 2000; Livingstone et al., 2004).

Young children (less than 7 years old) have a limited ability to participate in dietary assessments as they have not developed the cognitive abilities to accurately self-report their food intake. Children of this age have limited knowledge of food and food preparation, have difficulty recalling and estimating food intake, and co-operating in dietary assessment procedures (Baranowski, Sprague, Baranowski, & Harrison, 1991; Lytle et al., 1993). Therefore parents may be more reliable reporters of their child's dietary intake, and are often

included in the dietary assessment of children younger than 10 years of age (Devaney, Gordon, & Burghardt, 1995).

A study by Baranowski and colleagues (1991) compared the amount of time mothers and their preschool children were together during the day on the accuracy of the mother's recall of the child's dietary intake. Findings from this study showed that mothers of preschool children who were away from home more than four hours a day were less able to report on their children's food intake compared to the stay-at-home mothers. However, when the away-from-home mothers were able to report, they were as accurate as the mothers who spent most of their time at home.

A concern when parents or caregivers report their child's food intake is that they do not always know what their child is eating when they are away from the home. A consensus recall where both the child and a parent or caregiver participates in the dietary interview often provides a better estimate of dietary intake (Domel, 1997).

The direct observation method to measure what children eat during school lunch breaks is considered the 'gold standard' when assessing dietary intake in school children (Simons-Morton et al., 1992). However, this method requires trained researchers and is expensive and time-consuming for the majority of studies. In addition, the child's usual dietary practices may be affected by the presence of researchers observing their food and beverage consumption (Simons-Morton & Baranowski, 1991).

In older children and adolescents it is more feasible and appropriate to use self-report measures to assess dietary intake, such as 24-hour recalls, food records, and questionnaires. At approximately 7-8 years old children have reached the developmental stage when they are more aware of their food intake and can begin to conceptualise time. Children in this age group, as well as older children, are able to participate in unassisted recalls, and can self-report their dietary intake (Livingstone et al., 2004).

3.6.2 Dietary assessment methods

Different methods that are used to assess nutritional status are selected for different study outcomes. It is important that the choice of dietary assessment method be customised to the particular population and research purpose. Table 3.02 illustrates the advantages and disadvantages of different dietary assessment methods and their uses.

Table 3.02 Advantages and disadvantages of different dietary assessment methods

Dietary Assessment Methods	Uses	Advantages	Disadvantages
24-Hour Recall	Assesses average usual intakes of foods and nutrients of a population	Inexpensive, easy, and quick Low respondent burden, high subject compliance Can be used with illiterate subjects Less likely to alter eating patterns	Single 24-hour recalls likely to omit infrequently consumed foods Relies on memory Requires accurate estimation of portions Requires trained interviewer
Repeated 24-Hour recalls	Estimates usual intakes of individuals' food consumption patterns Estimates prevalence of inadequate intakes	Decreases the occurrence of day of the week and seasonal changes in food intake patterns	Relies on memory Requires accurate estimation of portion size Reduced response rates as subjects tire of participating in recalls
Estimated Food Record	Estimates actual or usual nutrient intakes of individuals	Can categorise meal patterns Collects accurate information of individual dietary intake and foods	Under reporting is common Requires accurate estimation of portions Requires literate and motivated subjects Substantial subject burden
Weighed Food Records	Measures actual or usual nutrient intake of individuals	Can categorise meal patterns Collects accurate information on individual dietary intake and foods	Subjects may change usual eating patterns Requires literate and motivated subjects Expensive and requires the use of scales Substantial subject burden
Diet History	Estimates the usual food intakes of individuals over a relatively long period Estimates prevalence of inadequate intakes	Relatively short, single interview (60-90 minutes) Measures habitual intake versus single day intake Shows comparisons between seasons, weekdays/weekends	Requires experienced interviewer Requires complex cognitive skills Relies on memory Unsuitable for erratic meal patterns
Food Frequency Questionnaire	Pattern/average use of foods and food groups for a group and/or individual	High response rate, low respondent burden Quick, inexpensive, a large number of subjects can be studied	Relies on memory and requires complex cognitive skills Must be study and population specific

Note. From: Black (2001) and Gibson (1998)

3.6.3 Weighed and estimated food records

For weighed and estimated food records, subjects are asked to record at the time of consumption, all food and beverages consumed over a specified time period (Gibson, 1998). The portions consumed may be weighed using scales or measured with household measures (e.g., cups and spoons) or estimated using food models or pictures. Information on food preparation and descriptions of foods and brand names are also recorded.

3.6.4 24-hour dietary recall

The 24-hour dietary recall method is a snapshot of an individual's food intake. For this method the respondent is asked to recall the actual food and beverages consumed during the previous 24-hour period (Black, 2001). The 24-hour recall is conducted by a trained interviewer and food and beverage quantities are estimated in household measures using two-dimensional foods models and memory aids such as food photographs. The multiple-pass recall is structured in stages, with the interviewer asking specific probing questions to aid subject's memory. The first stage retrieves a 'quick list' of foods and beverages consumed, the second stage gathers more detailed information of foods previously listed such as amounts, cooking methods, and food brands, and during the final stage the list is reviewed to clarify portion sizes and to add any forgotten items or other additions to foods, for example, sauces and dressings (Johnson, Driscoll, & Goran, 1996; Watson et al., 2000).

If habitual dietary intakes of individuals are required, multiple 24-hour recalls should be used to gain dietary information from different days of the week, holidays, and different seasons during the year.

A validation study comparing the use of multiple-pass 24-hour recalls to estimate energy intake with the doubly labelled water method in young children measurements of energy intake, as the correlation between individual measures of intake and total energy expenditure was not statistically significant ($r = 0.25$, $P = 0.24$). However, for the total subject group, this method accurately estimated the childrens' energy intake, and it was concluded that this method is

a useful, easily applied, practical measure of usual and typical energy intake of a group of young children (Johnson et al., 1996).

3.6.5 Food frequency questionnaire

A food frequency questionnaire is designed to obtain information about usual food consumption patterns by assessing the frequency with which certain food items or food groups are consumed during a specified time period, for example, weekly, monthly, or yearly (Gibson, 1998). A food frequency questionnaire can be self-administered or completed face-to-face during a standardised interview.

3.6.6 Diet history

The diet history method is a one-on-one interview conducted by a trained interviewer to investigate the subject's past food intake. The diet history records dietary habits and the amount and frequency of foods consumed over varying periods of time (Rockett & Colditz, 1997). The diet history includes 24-hour recall interviews, the collection of general information on meals and overall eating patterns, a questionnaire on the frequency of specific food items, and food records (Gibson, 1998).

3.6.7 Methods chosen and reasons why

Three 24-hour recalls were chosen as the method of dietary assessment in the current study as children in this age group (12-13 years of age) are able to participate in unassisted dietary recalls, and because dietary recalls require lower respondent burden, compared to 3-day food records.

3.7 Data collection Part B: 24-hour recalls and food records

3.7.1 Selection of subjects for Part B

From the participants who consented to both Parts A and B of the project, a subset of pupils (n = 52) was selected to provide detailed information on their nutrient intake. Twenty-six pupils (13 girls and 13 boys) randomly selected from each school completed two 24-hour recalls (Appendix G) during the school week, and completed a food diary on a Saturday (Appendix H).

To minimise day of the week effects on food intake, the weekend food record was used to gain food intake information from a weekend day. A Saturday

weekend day was chosen instead of a Sunday due to the cultural influences on food intake within the Pacific Island community such as the Sunday tonai. The Sunday tonai is a meal or feast held every Sunday after church at home with the family (Fuamatu, 1996). Large amounts of foods are often consumed at these social gatherings, which could possibly lead to overestimation of dietary intakes.

3.7.2 24-hour recall protocol

Each subject completed two 24-hour recalls with the researcher during a school week from Tuesday to Friday. Subjects were called from their classrooms one at a time to an interview room. Interviews took 10 to 15 minutes to complete.

The multiple-pass procedure (Gibson, 1998; Watson et al., 2000) was used during each of the 24-hour recalls.

1. The first pass, involved the subject listing all of the foods and beverages consumed the previous day, from the time they woke up to the time they went to bed.

2. The second pass involved a detailed description of the foods previously listed. The amount eaten, cooking method, brand of product, and additions to foods were included. Food models and a book containing food shapes and photographs of food and beverage products (Appendix J) was used to aid memory and assist the subject in assessing portion sizes of listed foods. To assess the portion sizes of foods consumed such as cereals, subjects were asked to pour dried beans from a container into a bowl to indicate the amount of cereal they consumed the previous day. The amount was then poured into a measuring cup and recorded.

3. The final pass of the recall was to review the listed foods, provide added detail, for example, including sauces and dressings added to foods, and to check if there were any foods and beverages that had

been forgotten. At this stage subjects were also asked if they had taken vitamin or mineral supplements during the preceding day.

3.7.3 Weekend food record

Food diaries were handed out to each subject in the subset group at the second 24-hour recall. Subjects were asked to take the diary home, to read the instructions, and record all the food and beverages they consumed from the time they woke up to the time they went to bed on Saturday. To minimise recall difficulties, subjects were asked to record meals as close as possible to eating times. The weekend food records completed by the subjects were used as a memory aid during the interview with the researcher the following Monday and were reviewed in the same way as steps 2 and 3 of the 24-hour recall multiple pass procedure detailed above.

In a study validating the 24-hour recall method assisted by food records in young children, Lytle, et al. (1993) found that the food record helped the children to remember what they ate during the previous 24-hour period.

3.7.4 Menstrual status

On completion of the first 24-hour recall interview, the female subjects were asked to answer two questions regarding their menstrual status to assess the developmental stage of the female subjects within the subset group (Appendix I). The questions were carefully chosen to minimise harm to subjects and to maintain subject privacy.

The optimal measure to assess physiological development within the study population would be to use Tanner Scales (Spear, 1996) or sexual maturity ratings. Sexual maturity ratings are based on the development of secondary sexual characteristics and are on a scale from 1 (pre-pubertal) to 5 (adult) (Spear, 1996). Advice was sought from a paediatrician regarding the use of Tanner Scales to assess physiological development of the study population. It was advised that the use of Tanner Scales in the present study was unnecessary and considered inappropriate due to the sensitive nature of the assessment, especially within certain cultural groups.

3.8 Response rate

A total of 504 Year 8 students were eligible to participate in the study, defined as Year 8 children on the roll of the two schools approached in 2004. Of those students, 233 (46.2%) students participated in the study.

3.9 Data input and processing

i. Part A – Questionnaire and height and weight measurements

All responses to the questionnaire were coded and every tenth questionnaire was checked for coding errors. The data was then entered into SPSS version 12.0 for Windows spreadsheets (SPSS, Inc., Chicago, IL, USA). The results of the anthropometric measurements were directly entered into a SPSS spreadsheet.

ii. Part B – Food records – nutrient intake analysis

The dietary data for each subject in the subgroup was entered into the FoodWorks Professional Version 4 (2004, Xyris Software Australia Pty Ltd) for analysis. The New Zealand Food Composition Database (NZFCD) was used as the basis of the foods reported in the recalls.

Some foods did not appear on the FoodWorks databases and in this case, the closest alternative was used. For example, when a brand of muesli bar did not appear in the database an alternative muesli bar that was already in the database was used. Once the nutrient intake results were entered into FoodWorks they were exported into Microsoft Excel.

3.10 Statistical analysis

i. Part A – Questionnaire and height and weight measurements

The SPSS spreadsheets were checked for missing variables and errors in the data. Descriptive statistics were used to summarise questionnaire variables. Because the distributions of these data were skewed (i.e., non-parametric) the data were expressed as medians, with the 25^{th} and 75^{th} percentiles included as a measure of variation, and appropriate non-parametric tests applied.

ii. Part B – Food records – nutrient intake analysis

Nutrient intakes were checked for errors in the data and corrections made accordingly. The FoodWorks output was exported into Microsoft Excel via Microsoft Access, and then exported to SPSS for the statistical analysis. Estimates of daily intake were determined by averaging the intakes derived from the 3-day records. Because the distribution of each nutrient intake was skewed, summary statistics are expressed as medians, with the 25^{th} and 75^{th} percentiles included as a measure of variation.

Non-parametric statistical tests were used because demographic and nutrient intake data did not follow a normal distribution. Chi squared tests or Mann-Whitney U tests were used to investigate between group differences. To assess the effect of day of the week and breakfast consumption on nutrient intakes, selected nutrient data were normalised by square root and log transformation and included as dependent variables in a General Linear Model (multivariate analysis). Day of the week and breakfast consumption were included as fixed factors.

4 Results

Part A - Questionnaire

4.1 Subject demographics

4.1.1 Gender and age

A total of 233 subjects (159 from Birkdale Intermediate School and 74 from Northcote Intermediate School) participated in Part A of the study. Within the study population there were 116 boys (49.8%) and 117 girls (50.2%), all aged 12-13 years with an average age of 12.3 years.

4.1.2 Ethnicity

Table 4.01 shows the ethnic distribution of the study group. The largest ethnic group within the study population was NZ European/Pakeha (59.2%), followed by Asian (13.3%). Students were able to choose more than one ethnic group that they associate themselves with. These combinations of ethnic groups included NZ European/Pakeha with NZ Maori, and NZ Maori with Pacific Islander. These combinations are presented in the grouping 'Mixed Ethnicities' in Table 4.01.

Table 4.01 Ethnic composition of study population

Ethnicity	Frequency	Percentage (%)
Asian	31	13.3
NZ European/Pakeha	138	59.2
NZ Maori	20	8.6
Pacific Island	12	5.2
Other Ethnicities	11	4.7
Mixed Ethnicities	21	9

4.1.3 Subject height, weight, and BMI

Anthropometric measurements are presented in Table 4.02. The median weight of the study group was 50.5 kg (25^{th} percentile 43.8 kg, 75^{th} percentile 58.3 kg). Boys and girls had similar median weight (boys 50.6 kg, girls 50.5 kg). Older children (>13 years, 53.4 kg) tended to be slightly heavier than younger children (<13 years, 49.4 kg).

The median height of the study group was 156.5 cm (25th percentile 152.3 cm, 75th percentile 162.0 cm). As with the weight measurement there was a very small difference between the median height measurements of the gender groups, with 156.1 cm the median measurement for boys and 156.9 cm the median measurement for girls.

The median BMI value for the study group was 20.1 kg/m^2 (25th percentile 18.2 kg/m^2, 75th percentile 22.6 kg/m^2). Girls had a slightly greater median BMI value than the boys (girls 20.7 kg/m^2, boys 19.5 kg/m^2).

There was no significant difference in weight, height, and BMI measurements according to gender or the ethnic grouping presented in Table 4.01 (all $P > 0.05$). However, there was a significant difference in weight ($P = 0.001$) and BMI ($P = 0.001$) measurements between subjects of Maori/Pacific Island ethnicity and non-Maori/non-Pacific Island subjects.

Table 4.02 Anthropometric measurements of the total subject group stratified by gender

ANTHROPOMETRY	Total ($N = 233$)	Boys ($n = 116$)	Girls ($n = 117$)
Weight (kg)	50.5 (43.8, 58.3)	50.6 (42.6, 58.5)	50.5 (45.6, 58.2)
Height (cm)	156.5 (152.3, 162.0)	156.1 (152.3, 163.9)	156.9 (152.2, 161.4)
BMI (kg/m^2)	20.1 (18.2, 22.6)	19.5 (17.9, 22.8)	20.7 (18.6, 22.4)

Note. Figures are presented as median (25th, 75th percentile) values

4.2 Breakfast consumption

On the day that the questionnaire was completed, 15% of subjects reported that they did not consume any food and/or beverage before leaving for school. Of those subjects who did not have breakfast 47% were boys and 53% were girls, There was no significant difference in breakfast consumption according to gender ($P = 0.731$). The median BMI of subjects who missed breakfast (21.6 kg/m^2) was significantly higher than the median BMI of subjects who consumed breakfast (19.8 kg/m^2) ($P = 0.033$). A statistically significant difference in breakfast consumption ($P = 0.001$) was found between subjects of Maori/Pacific

Island ethnicity (62% consumed breakfast) and non-Maori/non-Pacific Island subjects (92% consumed breakfast) in the study group.

4.2.1 Usual breakfast intake

Figure 4.01 shows the number of mornings during the week that subjects reported usually having something to eat and/or drink for breakfast, stratified by gender. Over half of the subjects (57%) surveyed reported that they have something to eat and/or drink for breakfast every morning. Only 4% of students reported that they rarely or never have a breakfast meal or beverage. There was no significant difference in usual breakfast consumption patterns according to gender ($P = 0.736$).

Figure 4.01 Frequency of subjects' usual breakfast consumption by gender

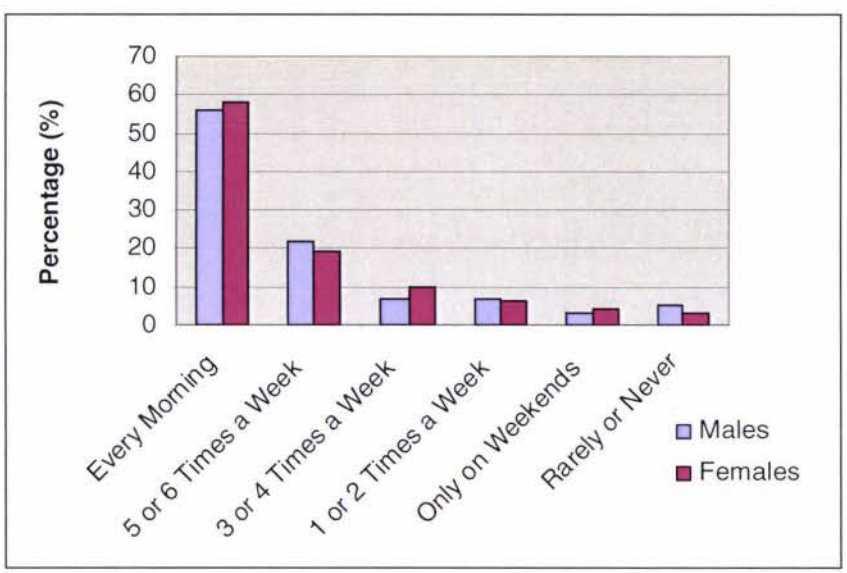
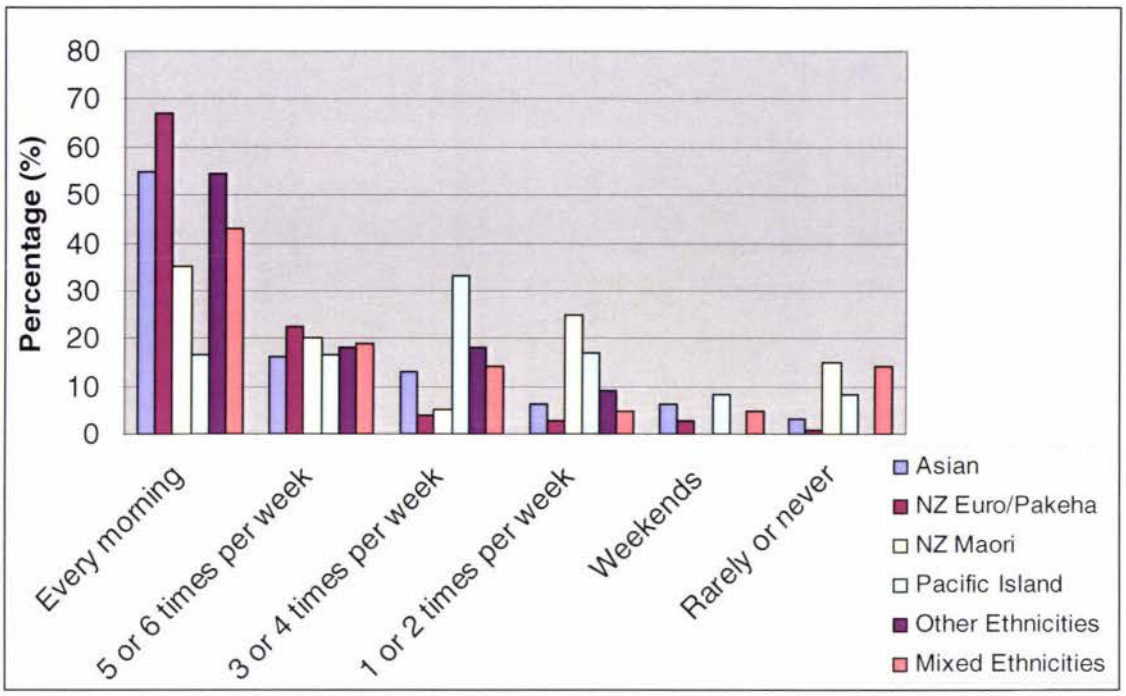


Figure 4.02 shows the number of mornings during the week subjects of each ethnic grouping reported usually having something to eat and/or drink for breakfast. The majority of NZ European/Pakeha (67%), Asian (54.8%), and subjects from Other Ethnicities (54.5%) and Mixed Ethnicities (43%) reported that they usually have breakfast every morning. By comparison, the majority of Pacific Island subjects (33%) reported that they usually have breakfast three or four mornings per week. Seventeen percent of Pacific Island subjects usually have breakfast once or twice per week, and 16.7% habitually eat breakfast every morning. For NZ Maori, 35% reported usually eating breakfast every

morning, and 25% reported that they usually have breakfast one or two mornings per week.

Figure 4.02 Frequency of subjects' usual breakfast consumption by ethnicity



4.2.2 Who makes breakfast?

Regardless of breakfast consumption habits all subjects answered the question; '*When you do have breakfast who usually makes it for you?'* Sixty-five percent of subjects reported that they make breakfast for themselves, 20% reported that their parents/caregivers make breakfast for them, and 12% reported that either they and/or their parents/caregivers make breakfast. Only three subjects (1.3%) reported that another family member such as a sibling or a grandparent makes breakfast for them. Two subjects (0.9%) reported that they usually buy their breakfast from a shop.

4.2.3 Who did you eat breakfast with?

The majority of subjects (51.3%) who had something to eat and/or drink for breakfast ate alone on the day questioned. From the remainder of subjects, 47.2% ate with at least one other family member and, a small proportion of subjects reported that they ate their breakfast with members from their sports teams.

4.2.4 Why do you think it is important to eat breakfast?

Subjects were asked to respond to statements regarding the reasons why they think it is important to eat breakfast in the mornings (Table 4.03). The statements that were most frequently selected by subjects were: '*Breakfast gives you energy*' (70.4%) and '*Breakfast helps you concentrate and do well at school*' (54.9%). Only 24% of subjects agreed with the statement '*Breakfast is good for you*' as a reason to eat breakfast.

Table 4.03 Number of subjects who agreed with statements regarding the importance of consuming breakfast

Statements	Frequency ($N = 233$)	Percentage (%)
Breakfast gives you energy	164	70.4
Breakfast helps you concentrate and do well at school	128	54.9
Breakfast stops you from being hungry	85	36.5
Breakfast is good for you	56	24.0
Breakfast gives you energy for sport	65	27.9

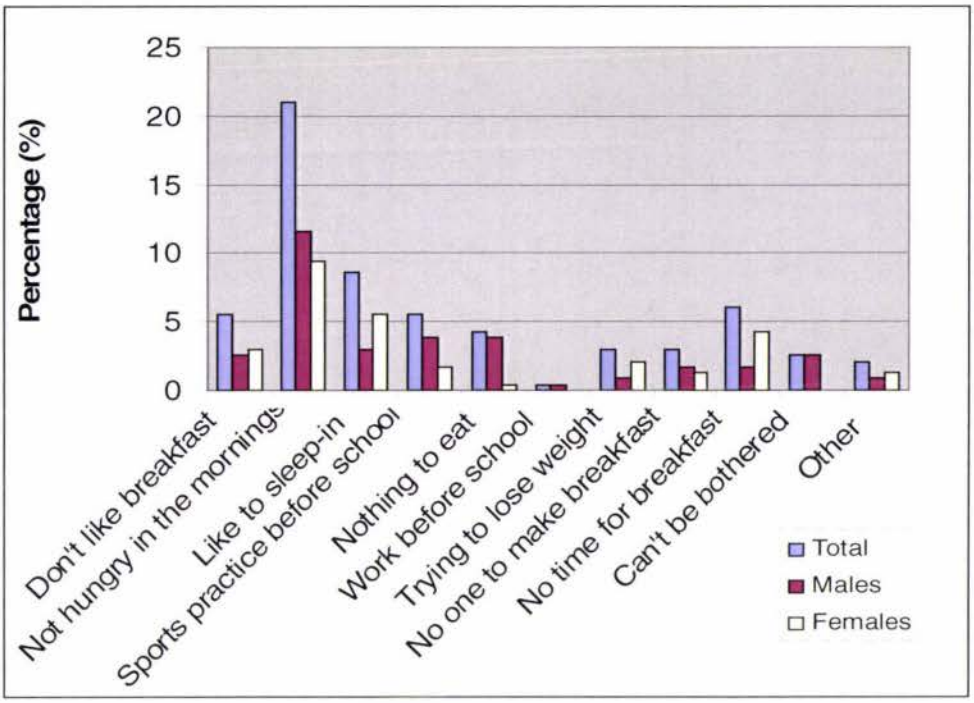
4.2.5 Reasons for skipping breakfast

Subjects who reported that they do not have breakfast every morning ($n = 100$) where asked why they skipped breakfast. Possible reasons for skipping breakfast were listed and subjects circled the statement/s that applied to them.

Not being hungry in the morning was the most frequently selected reason for skipping breakfast, with almost half (49%) of the subjects who skip breakfast selecting this reason. Other common reasons selected included '*I like to sleep-in in the mornings*' (20%) and '*No time for breakfast*' (14%). Figure 4.03 illustrates the main reasons subjects skip breakfast in the mornings.

More girls than boys reported skipping breakfast because there is no time in the mornings, they like to sleep-in, and because they are trying to lose weight, although these differences were not statistically significant. Significantly more boys compared to girls reported that they skip breakfast because there is nothing to eat (Fisher's Exact Test; $P = 0.031$) and because they can't be bothered (Fisher's Exact Test; $P = 0.044$).

Figure 4.03 Reasons subjects skip breakfast in the mornings



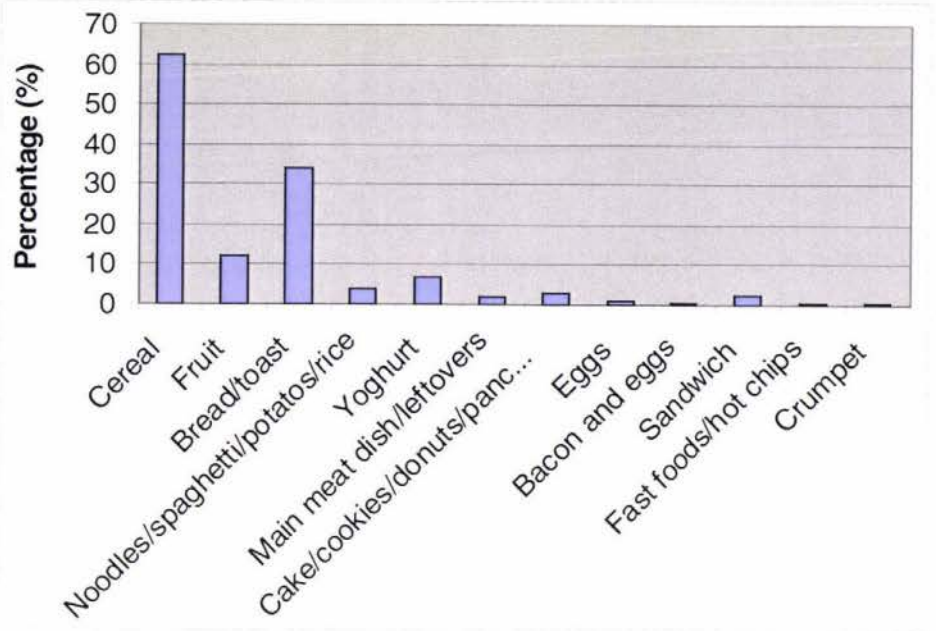
4.2.6 First meal of the day

Of the 34 students who did not have a breakfast meal on the day questioned, the majority (47%) had their first meal of the day during morning break. Eleven students (32%) ate on the way to school, and four students (11.8%) had their first meal during lunch break. Two students (6%) who skipped breakfast did not have any food or beverages on the day questioned until after they arrived home from school, and one student (2.9%) reported that their first meal of the day was their evening meal.

4.2.7 Foods and beverages consumed at breakfast

Figure 4.04 illustrates the types of breakfast foods consumed at the breakfast meal, on the day questioned. Of those 199 students who reported having something to eat for breakfast, 62% had a type of cereal, 34% had bread/toast, and 12% reported that they had a piece of fruit for breakfast.

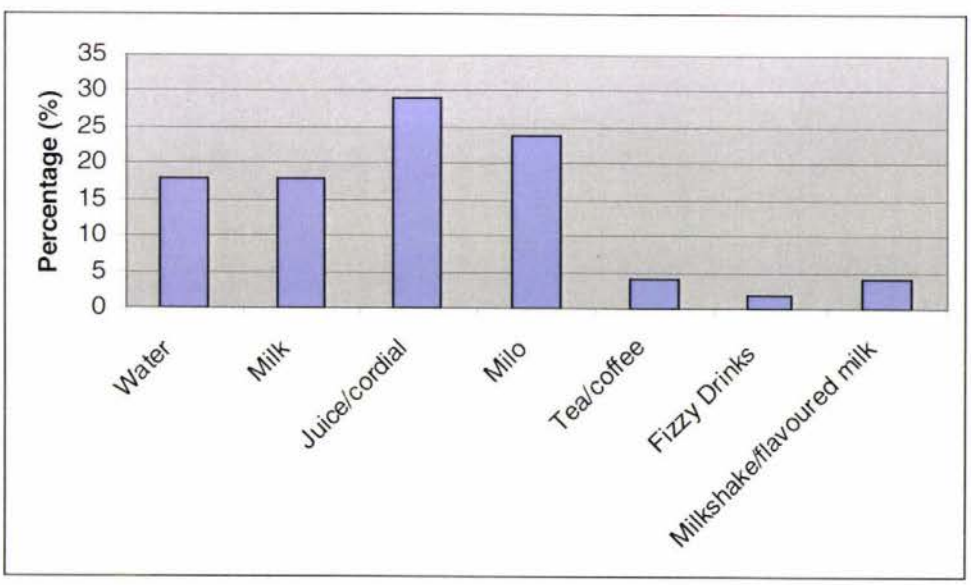
Figure 4.04 Foods consumed at breakfast



Note. Bars represent the percentage of children who reported consuming specified foods for breakfast on the day questioned

The majority of subjects (84%) consumed a type of beverage on its own or combined with their breakfast meal. Figure 4.05 shows that the most common beverage consumed was juice/cordial (29%), followed by Milo (24%), milk (18%), and water (18%).

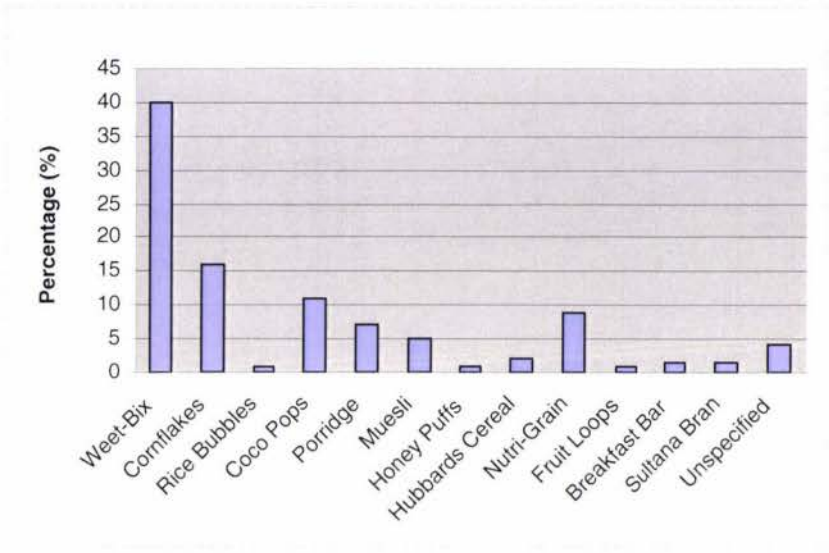
Figure 4.05 Beverages consumed at breakfast



Note. Bars represent the percentage of children who reported consuming specified beverages for breakfast on the day questioned

Figure 4.06 illustrates the most common breakfast cereal brands consumed at breakfast. Weet-Bix (40%) was by far the most popular breakfast cereal followed by Corn Flakes (16%), Coco Pops (11%), and Nutri-Grain (9%).

Figure 4.06 Brands of breakfast cereals consumed at breakfast



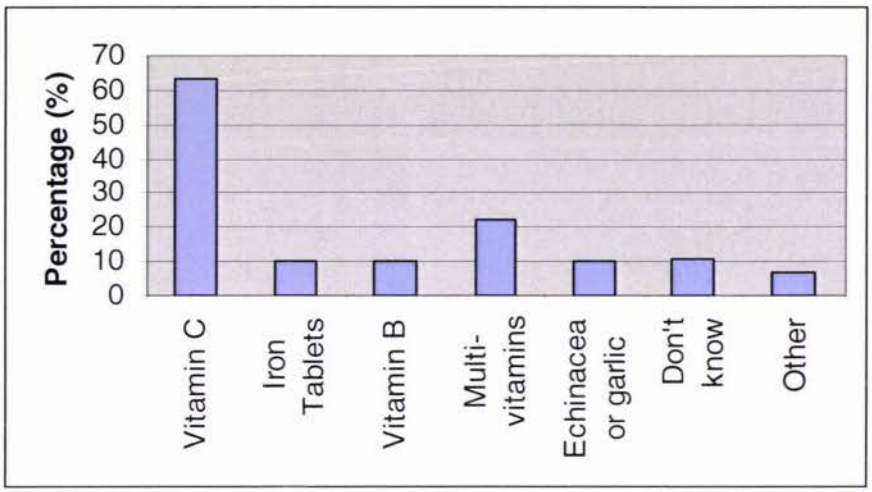
Note. Bars represent the percentage of children who reported consuming specified cereals for breakfast on the day questioned

4.3 Vitamin and mineral supplementation

Forty-five percent of subjects reported that they take a vitamin or mineral supplement, of these, 31.4% take supplements daily and 16.2% take supplements twice a day. Thirty subjects reported taking supplements less than once a day and 21.9% of subjects take them rarely or inconsistently. Self-supplementation of vitamins and minerals was not influenced by gender (P = 0.549) or ethnic grouping (P = 0.110), as described in Table 4.01.

Figure 4.07 shows the types of vitamin and mineral supplements that subjects reported taking. Vitamin C was the most common supplement taken, with 63% of subjects selecting this supplement when questioned. The next most frequently consumed type of supplement was multivitamin supplements (22%).

Figure 4.07 Reported types of vitamin and mineral supplements taken by subjects

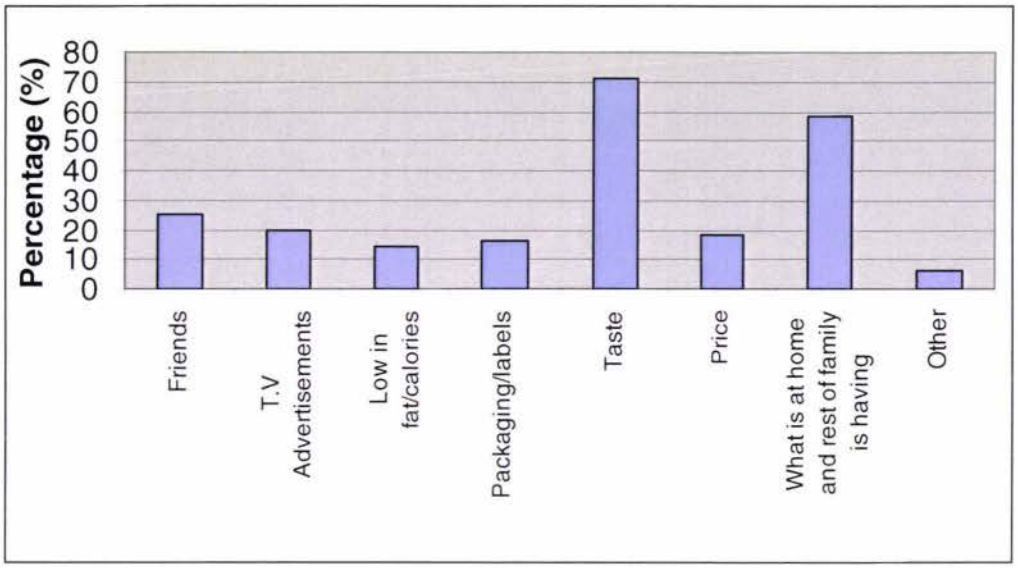


Subjects who reported taking vitamin and mineral supplements were asked why they take them. Forty-nine percent of subjects reported taking supplements because a family member told them to, and 53% take them because they make them feel healthy. Thirty-three percent reported that supplements make them feel good and provide energy. Only 10% of subjects reported that they take supplements because they were prescribed by their doctor.

4.4 Food Influences

The factors that determine subjects' food and beverage choices are shown in Figure 4.08. Just over 70% of subjects selected *taste* as the major influence on food choices. Fifty-eight percent of subjects reported that they are influenced by '*What is at home and what the rest of the family' is having* when it comes to making food and beverage choices. Only 1.7% reported that they do not eat any type of meat (are vegetarian).

Figure 4.08 Reported factors that influence food and beverages choice



4.5 Preferred breakfast foods and beverages

When subjects were given a list of breakfast foods that they could choose to have for breakfast on most days of the week, most subjects selected at least one type of cereal (89%), milk (88%), bread (87%), or fruit (88%). Slightly fewer subjects (79%) selected a type of hot food (e.g., pie, eggs, noodles) and 68% of subjects selected bakery foods (e.g., cakes, donuts, muffins.) For each food category subjects were allowed to make more than one choice.

4.5.1 Preferred cereals for breakfast

Subjects who selected cereal (n = 208) were asked to indicate the types of cereals that they would prefer. The most commonly selected cereals were Coco Pops (46%) and Weet-Bix (43%), followed by Nutri-Grain (38%) and Corn Flakes (35%). Porridge was selected by 28% of subjects and a small percentage (6%) chose a rice dish, for example congee.

4.5.2 Preferred milk for breakfast

The most common milk selected was full-fat milk, with 63% of subjects who chose milk (n = 206), preferring this type of milk. Low-fat milk was selected by 31%, Mega Milk was selected by 18%, and Calci Kids milk was selected by 15% of subjects. Flavoured milk was selected by 16% of students and only 4% of subjects chose soy milk.

4.5.3 Preferred breads for breakfast

White bread was selected by 77% of subjects who chose bread (n = 203), with brown bread selected by only 20% of subjects. Higher fibre breads, such as multi-grain bread and wholegrain bread, were chosen by 17% and 30% of subjects respectively. Twenty percent of subjects selected muffin splits and 32% selected crumpets.

4.5.4 Preferred bakery foods for breakfast

Bakery foods were selected by 67% of subjects (n = 158) as a preferred breakfast food, with donuts and muffins the most popular choices for 55% and 54% of subjects respectively. Cakes and biscuits were selected as the preferred choice for breakfast by 27% and 30% of subjects respectively.

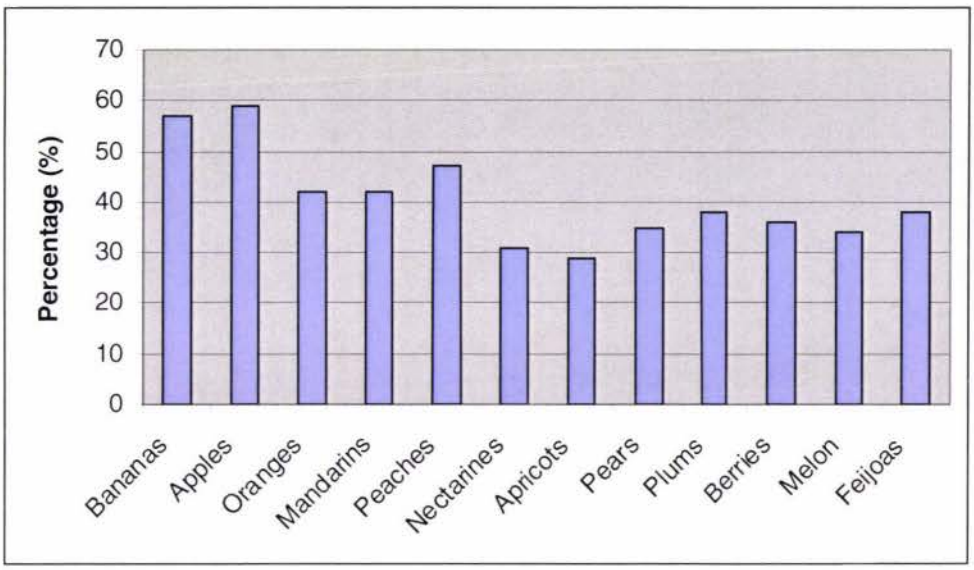
4.5.5 Preferred hot foods for breakfast

Pancakes and pikelets (64%) were the most common hot foods chosen by subjects who chose hot foods (n = 185), followed by pies (44%), eggs (38%), noodles (28%), and spaghetti/baked beans (22%). Left over dinner was selected by 10% and bacon was selected by 5% of subjects.

4.5.6 Preferred fruits for breakfast

A large number of subjects (88%, n = 206) selected at least one type of fruit as a preferred breakfast choice. Apples, bananas, and peaches were the most commonly selected fruits, as shown in Figure 4.09.

Figure 4.09 Preferred fruits selected by subjects to have for breakfast

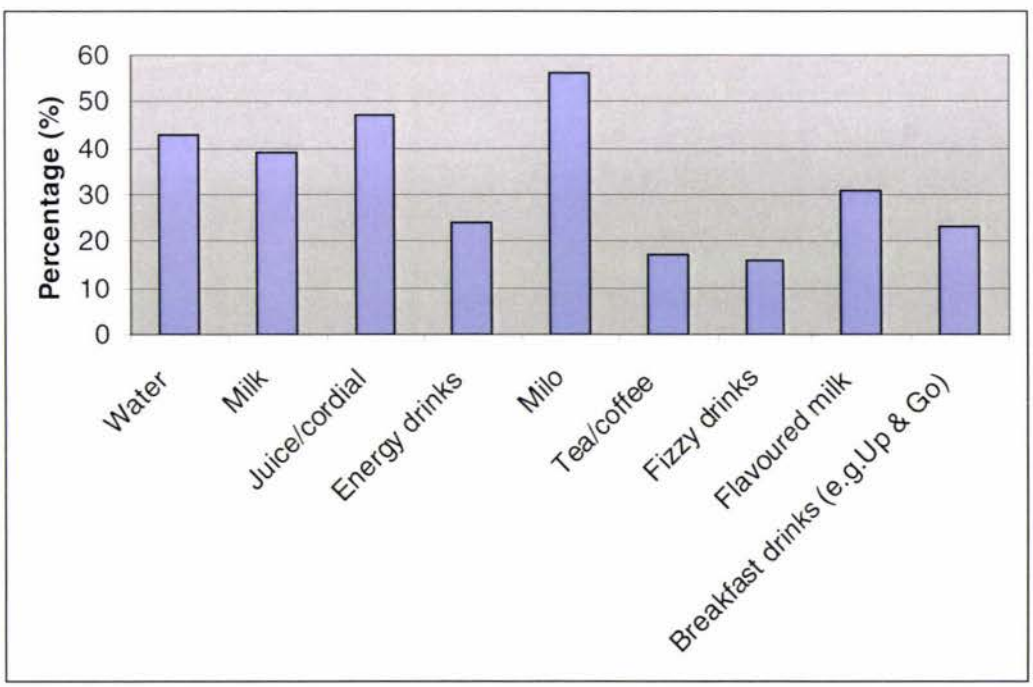


Note. $n = 206$

4.5.7 Preferred drinks for breakfast

Figure 4.10 shows that Milo (56%) was the most popular breakfast drink chosen by the subjects who selected drinks for breakfast (n = 220). Other commonly selected beverages were juice/cordial (47%), water (43%), and milk (39%). Tea/coffee was chosen by 17% of subjects and 16% chose fizzy drinks.

Figure 4.10 Preferred drinks selected by subjects to have for breakfast



Note. $n = 220$

4.6 Meal patterns

4.6.1 Meal patterns from the preceding day

Table 4.04 shows the number of subjects who consumed foods and/or beverages during set meal times during the previous day. Thirteen percent of subjects had something to eat or drink on the way to school. Children who ate on the way to school were significantly more likely to have missed breakfast, than children who consumed breakfast before leaving for school ($P = 0.001$).

The majority of subjects had something to eat or drink at morning break, lunch, after school, and for their evening meal. Approximately half of the subjects reported that they had something to eat or drink after their evening meal and before going to bed. More boys (90.6%) than girls (77.6%) had something to eat or drink after school, however, the difference between the gender groups was not significant ($P = 0.157$).

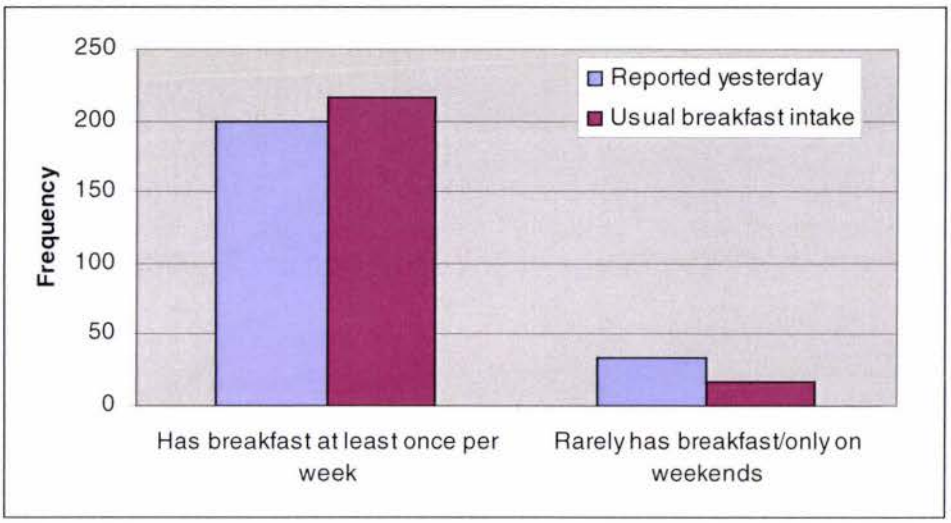
Table 4.04 Reported subject meal patterns from the preceding day

MEAL	TOTAL ($N = 233$)		MALE (n = 116)		FEMALE (n = 117)	
	n	%	n	%	n	%
BREAKFAST	199	85.4	100	86	99	84.6
WAY TO SCHOOL	30	12.9	16	13.8	14	12
MORNING BREAK	212	91	102	88	110	94
LUNCH	216	92.7	105	90.5	111	95
AFTER SCHOOL	196	84.1	90	77.6	106	90.6
EVENING MEAL	222	95.3	112	96.6	110	94
BEFORE BED	121	51.9	56	48.3	65	55.6

4.6.2 Usual meal patterns

As well as reporting their meal patterns from the preceding day, subjects were asked to report their 'usual' breakfast patterns. Figure 4.11 shows that there was little difference in responses from the two types of questions asked, therefore a crude comparison of the two questions indicates that subjects' usual breakfast patterns were found to reflect meal patterns reported the preceding day.

Figure 4.11 Subjects' usual meal patterns during the week



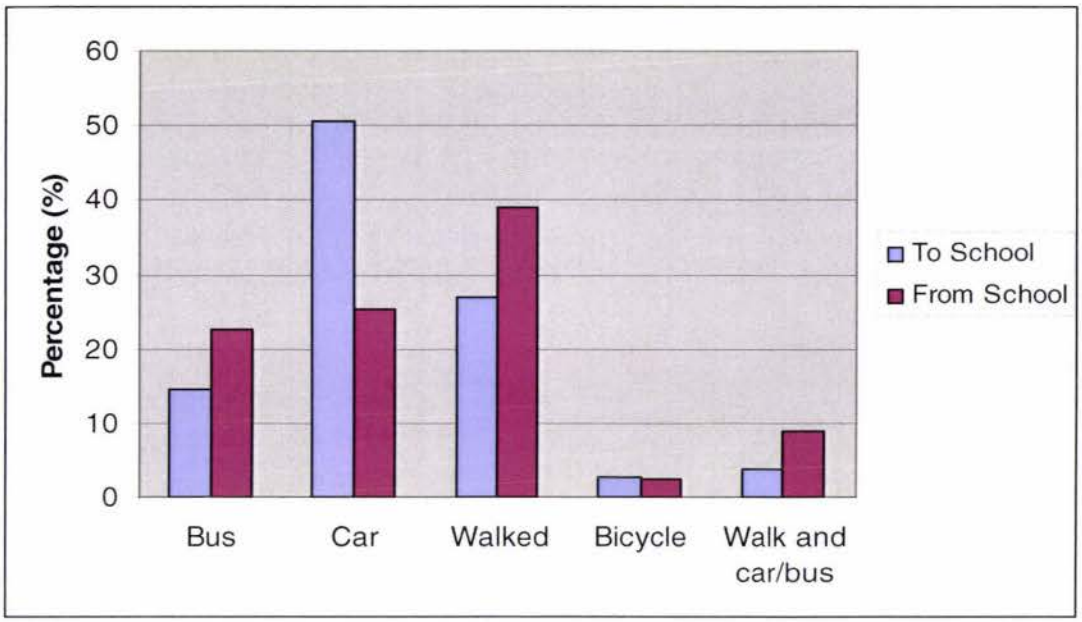
4.7 School day

4.7.1 Travel to and from school

Three subjects who completed the questionnaire had been absent from school on the preceding day and therefore did not answer this section of the questionnaire.

Figure 4.12, shows that half of the subjects (50.6%) reported that they arrived to school by car on the day questioned. However, on the way home from school only 25% of subjects reported that they travelled by car. Therefore, on the way home from school an increased number of subjects caught the bus and/or walked.

Figure 4.12 Transport to and from school

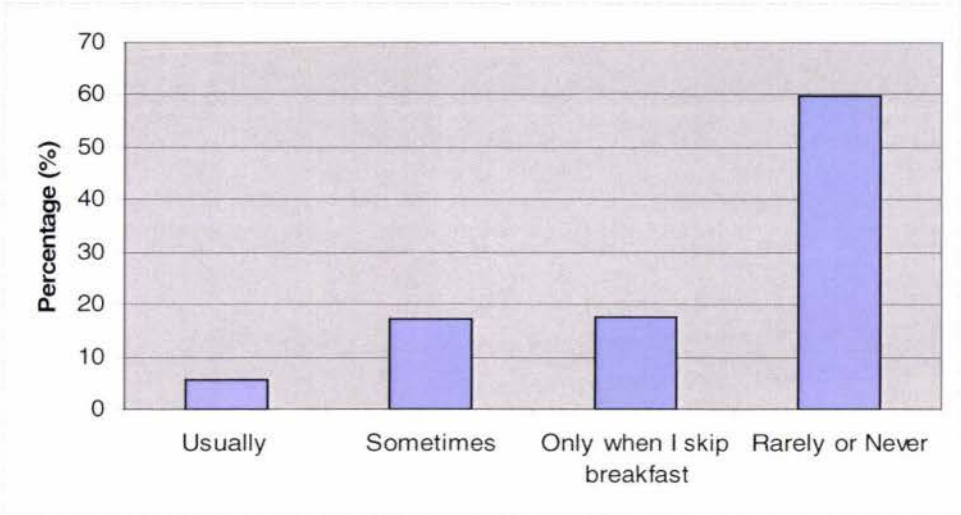


4.7.2 Arriving at school

When asked what time they arrived to school the preceding day, the majority of subjects (58.4%) reported that they arrived between 8:00 am and 8:30 am. Thirty-eight (16.7%) subjects arrived to school between 8:30 am and 9:00 am, and only two (0.9%) subjects surveyed arrived to school after 9:00 am. Fifty-three (22.7%) subjects reported that they arrived to school between 7:00 am and 8:00 am. On the morning questioned, subjects who arrived before 8.00 am were significantly more likely to have missed breakfast ($P = 0.013$).

Figure 4.13 illustrates the answers given to the question '*Do you usually feel hungry in the mornings when you arrive at school?*' More than half of the subjects (59.7%) reported that they rarely or never feel hungry in the mornings. Only 5.6% of subjects reported that they usually feel hungry in the mornings when they arrive to school. No significant difference was found in reported feelings of hunger between breakfast eaters and breakfast skippers ($P = 0.646$).

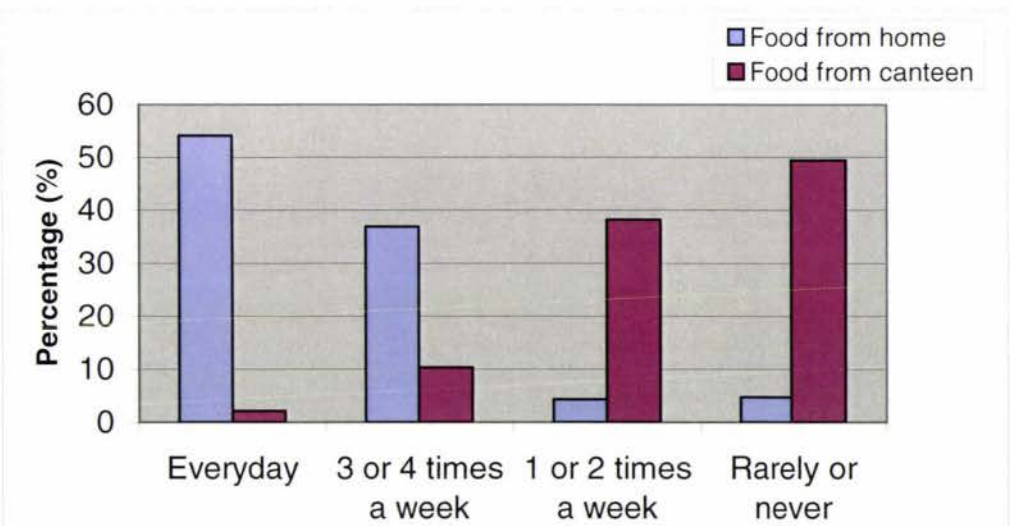
Figure 4.13 Percentage of students feeling hungry in the morning when they arrive at school



4.8 Food and beverage purchases

Figure 4.14, shows the frequency subjects bring food and beverages from home, and the frequency subjects buy food and beverages from the school canteen. Just over half of the subjects (54%) reported that the food and beverages they consume at school every day are brought from home. Only a small percentage (5%) of subjects reported that they rarely or never bring to school food and beverages from home.

Figure 4.14 Frequency of subjects bringing food from home or buying from the school canteen



Subjects were also asked how often they buy foods and beverages from shops or takeaways outside of school time. Thirty-six percent of subjects bought foods/beverages one or two times a week and 25% reported that they only buy foods and beverages on the weekend. One quarter of subjects (25.8%) reported that they rarely or never bought foods and beverages from shops or takeaways

Part B - Detailed Dietary Analysis

4.9 Subject demographics

4.9.1 Gender and age

From the subjects who consented to participate in both Parts A and Part B of the study, 52 subjects were randomly selected, 26 from each of the two participating schools. All subjects within the subgroup were aged 12-13 years with the average age 12.3 years.

4.9.2 Ethnicity

Table 4.05 shows the ethnic distribution of the subgroup, which was similar to the main group shown in Table 4.01. The largest ethnic group within the subgroup was NZ European/Pakeha (57.7%), followed by Asian (17.3%), NZ Maori (9.6%), and Pacific Island (5.8%). The remainder of the subgroup was made up of 5.8% of subjects from mixed ethnicities (e.g., NZ Euro/NZ Maori and NZ Maori/Pacific Island) and subjects from other ethnic groups which included one subject from India and one subject from the Middle East.

Table 4.05 Ethnic composition of subgroup

Ethnicity	Frequency	Percentage (%)
Asian	9	17.3
NZ European/Pakeha	30	57.7
NZ Maori	5	9.6
Pacific Island	3	5.8
Other Ethnicities	2	3.8
Mixed Ethnicities	3	5.8

4.9.3 Subject height, weight and BMI

Anthropometric measurements for the subgroup are presented in Table 4.06. The median weight of these subjects was 50.2 kg (42.7 kg, 58.5 kg). The median weight of the boys was 49.5 kg (43.1 kg, 63.0 kg), and the median weight of the girls was 51.4 kg (42.6 kg, 56.3 kg). There was no significant difference in weight measurements according to gender ($P = 0.905$).

The median height of subjects in the subgroup was 157.4 cm (152.2 cm, 164.3 cm). The median height of the boys was 159.1 cm (153.5 cm, 165.1 cm), and the median height of girls was 156.7 cm (151.6 cm, 161.0 cm). There was no significant difference in height measurements according to gender ($P = 0.256$).

The median BMI value for the subgroup was 20.1 kg/m^2 (18.2 kg/m^2, 23.9 kg/m^2). Female subjects in the subgroup had a greater median BMI (21.0 kg/m^2) than the males (18.6 kg/m^2), however, there was no significant difference in BMI between genders ($P = 0.621$).

Table 4.06 Anthropometric measurements of the subgroup

ANTHROPOMETRY	Total ($n = 52$)	Boys ($n = 26$)	Girls ($n = 26$)
Weight (kg)	50.2 (42.7, 58.5)	49.5 (43.1, 63.0)	51.4 (42.6, 56.3)
Height (cm)	157.4 (152.2, 164.3)	159.1 (153.5, 165.1)	156.7 (151.6, 161.0)
BMI (kg/m^2	20.1 (18.2, 23.9)	18.6 (18.1, 23.9)	21.0 (18.6, 22.9)

Note. Figures are presented as median (25th, 75th percentile) values

4.9.4 Menstrual status

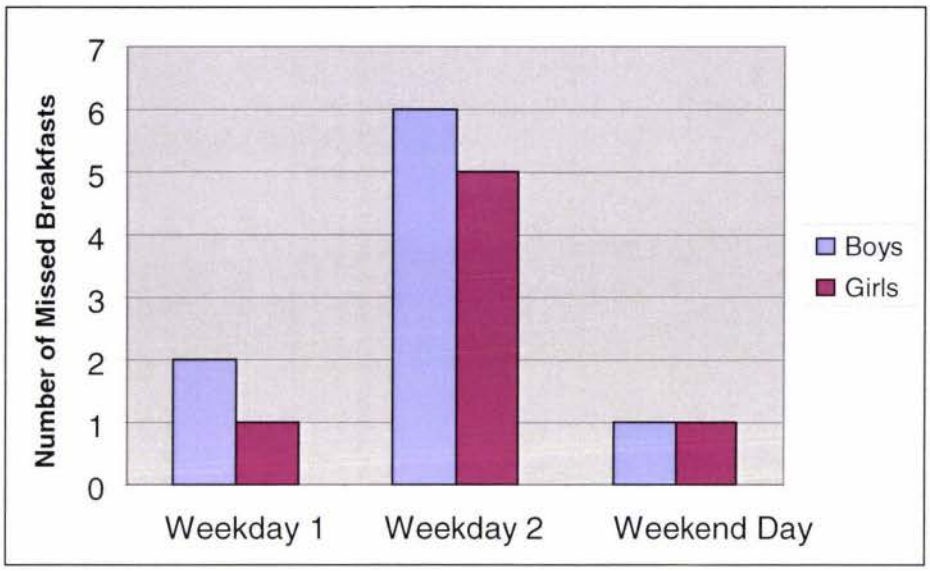
All 26 girls were asked if they had had their first period and age of menarche was recorded. Seventy-three percent of girls reported that they had already had their first period. The average age of menarche was 11.7 years. Due to the small numbers involved, no comparisons were made in respect of menstrual status.

4.10 Breakfast consumption

In total, over the three days measured, 16 (10%) out of 156 possible breakfasts were missed by subjects in the subgroup (see Figure 4.15). Boys missed nine breakfasts and girls missed seven breakfasts. Of the subjects who missed breakfast, two boys and one girl missed breakfast more than once. On the first weekday of dietary analysis, 6% of subjects missed breakfast and 4% consumed a beverage only. On the second weekday, 21% missed breakfast and 8% consumed a beverage only. On the weekend day of dietary analysis,

which was always a Saturday, only 4% of subjects in the subgroup missed breakfast and 4% consumed a beverage only.

Figure 4.15 Number of missed breakfasts per day stratified by gender



4.10.1 Foods and beverages consumed at breakfast

Figure 4.16 illustrates the types of breakfast foods and beverages consumed by subjects at the breakfast meal, for each of the three days of dietary analysis. During the week over half of the breakfast eaters within the subgroup reported having a cereal for breakfast. In contrast, the percentage of subjects who had a cereal for breakfast on the weekend was 38%. On the weekend day compared to weekdays, a greater percentage of subjects consumed bread/toast, noodles/spaghetti/pasta/rice, a main meat dish/leftovers, and bacon and eggs. These foods sometimes replaced cereals on the weekend day.

Figure 4.16 Percentage of subjects consuming foods and beverages at breakfast

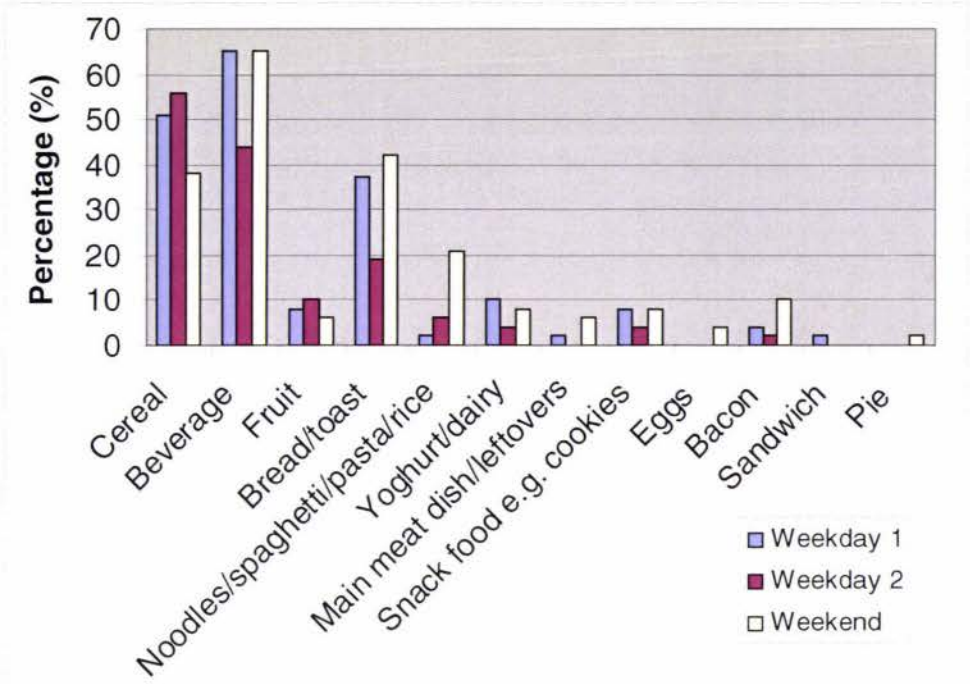
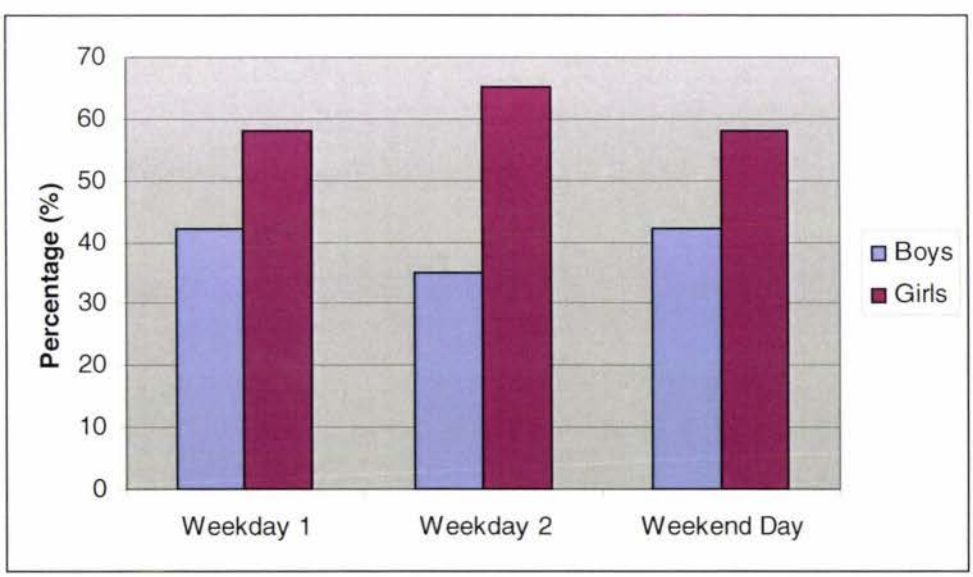


Figure 4.17 shows by gender, cereal consumption at breakfast during the three days of dietary analysis. At breakfast on weekday one, and on the weekend day, 58% of cereal consumers were girls, while 42% were boys. On weekday 2, 65% of cereal consumers were girls and only 35% were boys.

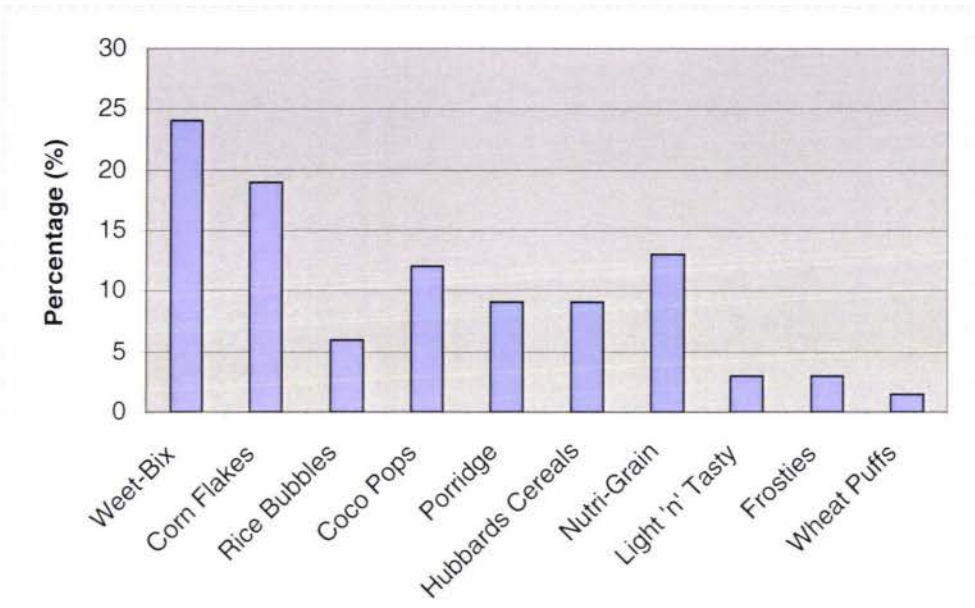
Figure 4.17 Cereal consumption at breakfast, stratified by gender



Note. Bars represent the percentage of boys and girls who reported consuming a cereal for breakfast during the three days of dietary analysis

Figure 4.18 shows the most common breakfast cereals consumed at breakfast over three days of dietary analysis. Weet-Bix (24%) was the most frequently reported brand of breakfast cereal followed by Corn Flakes (19%), Nutri-Grain (13%), and Coco Pops (12%).

Figure 4.18 Brands of breakfast cereals consumed at breakfast from combined 3-day dietary recall interviews



4.11 Reported nutrient intakes – Part B subgroup

4.11.1 Reported macronutrient intake

Average intakes of nutrients over the three days of records were calculated for each subject. There was no significant difference in macronutrient intakes between genders (Table 4.07). The median daily energy intake was 8842.7 kJ for boys and 8987.2 kJ for girls. Daily energy intakes in this study were within the New Zealand recommended daily intake (NZ RDI) for energy, which are between 9200-11,800 kJ per day for boys (12-15 years) and between 8100-9800 kJ per day for girls (12-15 years). The daily protein intake was 84.5 g for boys, which is above the NZ RDI of between 42-60 g per day. The daily protein intake for girls (80.1 g) was also above the NZ RDI of between 44-55 g per day.

Table 4.07 Reported energy and macronutrient intakes of male and female subgroup subjects

NUTRIENT	BOYS (n = 26)		GIRLS (n = 26)	
	Median	25th, 75th Percentile	Median	25th, 75th Percentile
Energy (kJ)	8842.7	7767.0, 11075.4	8987.2	7297.3, 10126.5
Protein (g)	84.5	67.5, 96.4	80.1	63.5, 93.7
Total CHO (g)	272.2	239.5, 346.2	267.4	234.0, 354.7
Sugars (g)	140.1	98.8, 191.9	130.1	99.3, 182.0
Fibre (g)	18.1	15.5, 22.9	17.2	14.6, 20.2
Total fat (g)	75.9	64.3, 102.3	79.0	64.2, 88.3
SFA (g)	33.3	27.2, 44.4	32.1	26.5, 37.5
MUFA (g)	26.6	21.0, 34.8	24.9	20.0, 28.0
PUFA (g)	8.9	7.1, 12.2	9.3	7.5, 12.3

Note. Between gender comparisons for each nutrient determined by Mann Whitney tests, all $P > 0.05$

4.11.2 Contribution of macronutrients to total energy intake

The estimated percent contribution of macronutrients to total energy intake from dietary recall interviews and the corresponding guidelines are shown in Table 4.08. There was no significant difference in percentage contribution of macronutrient intakes to total energy intake between gender groups.

Currently there are no NZ recommendations specific to children and adolescents for percent energy from macronutrients, therefore recommendations based on adult guidelines are used. The median contribution of carbohydrates, total fat, and monounsaturated fatty acids (MUFA) to total energy intake for both boys and girls fall within the recommended guidelines set by the NZ Nutrition Taskforce (Department of Health, 1991). The contribution of protein and saturated fatty acids (SFA) is slightly over the guidelines for both boys and girls, and the contribution of polyunsaturated fatty acids (PUFA) (boys, 3.5%, girls, 4.2%) to total energy intake is below the 8% guideline.

Table 4.08 Percentage contribution of macronutrients to total energy intake stratified by gender

NUTRIENT	NZ Nutrition Taskforce Guidelines*	BOYS (n = 26)	GIRLS (n = 26)
		Median	Median
% Energy from protein	12-14 %	14.7	14.9
% Energy from CHO	At least 50-55%	50.9	51.5
% Energy from total fat	30-35%	32.1	31.6
% Energy from SFA	No more than 12%	13.9	13.5
% Energy from MUFA	Up to 20%	10.9	10.0
% Energy from PUFA	Approximately 8%	3.5	4.2

Note.
* From *Food and Nutrition Guidelines for Healthy Adolescents* (Ministry of Health, 1998)
Between gender comparisons for each nutrient determined by Mann Whitney tests, all $P > 0.05$

4.11.3 Reported micronutrient intake

Selected micronutrient intakes for both male and female subjects are shown in Table 4.09. The NZ RDI for adolescents 12-15 years of age are included for comparison. The median calcium intakes of male and female subgroup subjects (669.2 mg and 826.8 mg respectively) were lower than current New Zealand guidelines for adolescents aged 12-15 years. Median iron, zinc, and folate intakes met recommended intakes, while median sodium and vitamins B12 and C intakes were above the RDI for male and female adolescents aged 12-15 years. There was no significant difference in micronutrient intakes according to gender.

Table 4.09 Reported intake of selected micronutrients of male subjects

NUTRIENTS	BOYS (n = 26)			GIRLS (n = 26)		
	Median	25th, 75th Percentile	NZ RDI Males 12-15 Years*	Median	25th, 75th Percentile	NZ RDI Females 12-15 Years*
Iron (mg)	12.1	10.2, 13.7	10-13	11.4	9.2, 14.7	10-13
Calcium (mg)	669.2	592.7, 892.9	1,200	826.8	647.3, 1049.3	1,000
Sodium (mg)	3078.4	2470.7, 3665.5	920-2300	2729.1	2080.9, 3771.7	920-2300
Zinc (mg)	11.8	10.3, 13.1	12	11.1	8.5, 12.7	12
Vitamin A Eq. (µg)	564.8	445.6, 869.7	725	569.5	484.6, 853.7	725
Folate (µg)	257.0	190.6, 319.2	200	238.4	182.8, 324.3	200
Vitamin B6 (mg)	1.5	1.2, 1.8	1.4-2.1	1.3	0.9, 1.6	1.2-1.8
Vitamin B12 (µg)	3.9	2.5, 5.6	2.0	4.2	2.9, 5.9	2.0
Niacin Eq. (mg)	35.5	29.0, 39.1	19-21	32.6	26.1, 37.9	17-19
Riboflavin (mg)	1.8	1.5, 2.0	1.8	1.7	1.2, 2.2	1.8
Thiamin (mg)	1.5	1.1, 1.7	1.2	1.2	1.0, 1.7	1.0
Vitamin C (mg)	107.6	81.6, 196.5	30	143.9	62.9, 213.5	30
Vitamin E (mg)	6.8	5.4, 9.2	10.5	7.6	5.9, 9.6	9.0

Note.
* From Food and Nutrition Guidelines for Healthy Adolescents (Ministry of Health, 1998)
Between gender comparisons for each nutrient determined by Mann Whitney tests, all $P > 0.05$

4.11.4 Weekday and weekend reported nutrient intake

Day of the week effect on nutrient intake

A multivariate analysis examining the effect of day of the week on nutrient intake in all subgroup subjects, and controlling inter-subject variability, gender, and breakfast consumption, showed significant effects on protein (P = 0.045), fibre (P = 0.001), niacin (P = 0.042), vitamin C (P = 0.002), and folate intakes (P = 0.001). For the majority of nutrients, the weekday intake was different to the weekend day intake, however some variation between weekdays was also observed. Table 4.10 shows the results of the post hoc test to determine between which days the significant difference in intakes of the above nutrients occurred.

Table 4.10 Nutrient intakes between weekdays and weekend day

NUTRIENT	WEEKDAY	WEEKEND DAY	*P* VALUE
Protein (g)	Weekday 1	Weekend day	0.032*
	Weekday 2	Weekend day	0.560
Fibre (g)	Weekday 1	Weekend day	0.001*
	Weekday 2	Weekend day	0.005*
Niacin Eq. (mg)	Weekday 1	Weekend day	0.039*
	Weekday 2	Weekend day	0.188
Vitamin C (mg)	Weekday 1	Weekend day	0.005*
	Weekday 2	Weekend day	0.015*
Folate (µg)	Weekday 1	Weekend day	0.001*
	Weekday 2	Weekend day	0.003*

Note. * Mean difference is significant at the $P \leq 0.05$ level, as determined by Dunnett's post hoc test

Day of the week effect on nutrient intake according to gender group

The average weekday dietary intake compared to the weekend intake for boys within the subgroup is shown in Table 4.11. All intakes shown in Table 4.11, except for fat intake, are higher on weekdays compared to the weekend day. The nutrients which were significantly higher on weekdays were carbohydrate (P = 0.018), fibre (P = 0.04), vitamin B6 (P = 0.006), niacin (P = 0.008), and vitamin C (P = 0.028).

Table 4.11 Weekday and weekend reported intakes of male subjects

NUTRIENT	WEEKDAY INTAKE (n = 26 Days**)		WEEKEND INTAKE (n = 26 Days)	
	Median	25^{th}, 75^{th} Percentile	Median	25^{th}, 75^{th} Percentile
Energy (kJ)	8963.7	8380.7, 12062.7	8549.5	6673.8, 10149.8
Protein (g)	87.1	72.4, 98.7	67.8	55.2, 88.8
Carbohydrate (g)*	291.6	259.2, 375.2	224.8	190.6, 328.5
Fat (g)	76.5	62.8, 106.8	83.3	45.5, 101.4
Fibre (g)*	20.7	15.8, 24.6	16.6	12.1, 20.9
Sugars (g)	152.3	118.8, 180.2	107.6	63.6, 179.3
Iron (mg)	12.1	9.5, 14.7	11.0	8.0, 13.6
Calcium (mg)	764.6	621.4, 941.7	610.9	469.5, 947.5
Sodium (mg)	3243.7	2332.4, 4070.5	2485.6	2099.7, 3328.3
Zinc (mg)	11.7	9.8, 14.2	9.7	7.4, 15.8
Vitamin A Eq. (µg)	660.0	434.8, 853.0	534.6	313.2, 858.1
Folate (µg)	253.4	188.4, 351.2	209.4	140.1, 288.7
Vitamin B6 (mg)*	1.6	1.3, 2.0	1.1	0.8, 1.5
Vitamin B12 (µg)	3.9	2.1, 6.0	2.9	2.0, 4.5
Niacin Eq. (mg)*	38.5	30.4, 43.4	26.9	19.6, 37.9
Riboflavin (mg)	1.8	1.3, 2.4	1.4	0.9, 2.2
Thiamin (mg)	1.4	1.1, 1.8	1.1	0.9, 2.0
Vitamin C (mg)*	136.3	82.4, 247.0	70.1	29.2, 177.2
Vitamin E (mg)	7.1	5.1, 10.2	5.6	4.1, 9.4

Note.
* Indicates significance at the $P \leq 0.05$ level, determined by Mann Whitney tests
** Weekday intakes for each subject were averaged over the two days of weekday records

The average weekday dietary intake compared to the weekend intake for girls within the subgroup is shown in Table 4.12. The energy intakes on the weekend day (9138.2 kJ per day) were higher than the weekdays (8775.6 kJ), although

this difference was not statistically significant. Carbohydrate intakes were similar between weekdays and the weekend day. Protein intake was higher on the weekdays (79.7 g per day) compared to the weekend day (66.9 g per day), however, fat and sugar intakes were higher on the weekend day. The nutrients which showed a statistically significant difference between weekday intakes and weekend intake were fibre (P = 0.004) and folate (P = 0.004), with weekday intakes significantly higher than weekend intakes.

Table 4.12 Weekday and weekend reported intakes of female subjects

NUTRIENT	WEEKDAY INTAKE (n = 26 Days**)		WEEKEND INTAKE (n = 26 Days)	
	Median	25th, 75th Percentile	Median	25th, 75th Percentile
Energy (kJ)	8775.6	7711.2, 10753.9	9138.2	5742.7, 11464.7
Protein (g)	79.7	65.6, 97.5	66.9	50.7, 90.5
Carbohydrate (g)	276.9	232.8, 374.1	270.7	187.0, 395.4
Fat (g)	75.6	59.3, 85.3	82.2	44.7, 100.2
Fibre (g)*	18.6	15.7, 21.7	12.7	10.3, 18.1
Sugars (g)	127.9	90.5, 183.2	155.3	92.5, 214.1
Iron (mg)	11.3	9.0, 13.8	10.7	7.5, 14.3
Calcium (mg)	812.6	638.3, 1149.0	692.5	449.5, 1003.0
Sodium (mg)	2789.3	2030.5, 4087.1	2739.7	1638.6, 3834.0
Zinc (mg)	11.0	8.4, 13.6	9.3	6.3, 14.3
Vitamin A Eq. (µg)	680.1	456.9, 862.2	408.9	256.6
Folate (µg)*	262.9	212.5, 366.4	179.6	126.7, 254.0
Vitamin B6 (mg)	1.2	1.0, 1.6	1.2	0.9, 1.6
Vitamin B12 (µg)	4.7	2.5, 6.9	3.2	1.9, 4.8
Niacin Eq. (mg)	32.8	28.5, 42.8	26.2	23.6, 35.9
Riboflavin (mg)	1.8	1.2, 2.5	1.4	1.0, 1.9
Thiamin (mg)	1.3	1.0, 2.0	1.1	0.7, 1.5
Vitamin C (mg)	138.1	73.1, 243.3	85.1	880.1
Vitamin E (mg)	6.6	5.7, 9.9	6.2	3.9, 11.5

Note.
* Indicates significance at the $P \leq 0.05$ level, determined by Mann Whitney tests
** Weekday intakes for each subject were averaged over the two days of weekday records

4.12 Nutrient intake at breakfast meals

Reported energy and nutrient intakes at breakfast are shown in Table 4.13. All subgroup subjects reported eating breakfast on at least one of the study days. For subjects who consumed breakfast on more than one occasion, average intakes of nutrients at breakfast over the three days of dietary analysis were calculated. The energy intake of the breakfast meals was 1585.5 kJ for boys and 1564.1 kJ for girls. Nutrient intakes at breakfast were not significantly affected by gender.

Table 4.13 Reported intakes of selected nutrients at breakfast of male and female subjects

NUTRIENT	BOYS (n = 26)		GIRLS (n = 26)	
	Median	25^{th}, 75^{th} Percentile	Median	25^{th}, 75^{th} Percentile
Energy (kJ)	1585.5	1030.8, 2102.0	1564.1	1177.0, 1857.1
Protein (g)	13.3	9.4, 19.2	16.0	10.8, 18.1
Carbohydrate (g)	53.4	40.1, 70.4	52.5	42.8, 63.5
Fat (g)	8.6	4.7, 14.9	9.8	4.5, 13.1
Fibre (g)	2.3	1.0, 5.3	3.0	1.7, 4.5
Sugars (g)	27.6	20.7, 32.5	26.0	17.1, 36.4
Iron (mg)	3.3	1.6, 4.5	3.4	1.9, 4.4
Calcium (mg)	309.9	206.0, 410.4	240.9	183.3, 322.4
Sodium (mg)	412.9	238.4, 773.6	466.2	321.2, 712.6
Zinc (mg)	2.2	1.2, 2.9	2.0	1.4, 2.9
Vitamin A Eq. (µg)	91.9	48.9, 185.3	80.1	53.1, 133.5
Folate (µg)	58.5	36.0, 126.0	93.8	29.3, 129.4
Vitamin B6 (mg)	0.2	0.1, 0.5	0.2	0.1, 0.4
Vitamin B12 (µg)	0.9	0.5, 1.4	1.0	0.3, 1.3
Niacin Eq. (mg)	6.0	2.7, 8.8	6.5	4.8, 7.2
Riboflavin (mg)	0.7	0.4, 1.0	0.7	0.4, 1.0
Thiamin (mg)	0.4	0.2, 0.7	0.4	0.3, 0.7
Vitamin C (mg)	9.1	1.8, 25.5	22.4	5.7, 43.1
Vitamin E (mg)	0.6	0.3, 0.9	0.6	0.4, 1.1

Note. Between gender comparisons for each nutrient determined by Mann Whitney tests, all $P > 0.05$

4.12.1 Contribution of macronutrients to energy intake at breakfast

Table 4.14 shows the median percentage contribution of macronutrients to energy intake at breakfast. For boys, 63.4% of energy at breakfast is provided by carbohydrate, and for girls, 58.7% of energy at breakfast is provided by carbohydrate. Fat contributes 20% to energy intake at breakfast for boys and 21% for girls. Protein contributes 14.1% for boys and 16.3% for girls. No significant difference in percentage contribution of macronutrient to energy intake at breakfast was found according to gender.

Table 4.14 Percentage contribution of macronutrients to energy intake at breakfast for boys and girls

NUTRIENT	BOYS (n = 26)	GIRLS (n = 26)
	Median	Median
% Energy from protein	14.1	16.3
% Energy from CHO	63.4	58.7
% Energy from total fat	20.0	21.0
% Energy from SFA	9.1	9.6
% Energy from MUFA	5.4	5.5
% Energy from PUFA	1.6	2.1

Note. Between gender comparisons for each nutrient determined by Mann Whitney tests, all $P > 0.05$

4.12.2 Percentage contribution of breakfast

The median percentage contribution of energy intake at breakfast to total daily intakes was 17.9% for boys and 17.4% for girls (Table 4.15). For boys, protein at the breakfast meal contributed 15.7% to the total daily protein intake, which was lower (although not significantly lower) than the girls' protein intake at breakfast, which contributed 20% to the total daily protein intake. The percentage contribution of carbohydrate at breakfast to total daily carbohydrate intake was 19.6% for both boys and girls. From the selected micronutrients in Table 4.15, breakfast provided over a quarter of the total daily intake of iron, calcium, folate, riboflavin, and thiamin for both boys and girls in the subgroup. For boys in particular, the breakfast meal provided a large percentage (46.3%) of daily calcium intake.

Table 4.15 Percentage contribution of the breakfast meal to total daily energy, macronutrient, and selected micronutrient intake for boys and girls

NUTRIENT	BOYS (n = 26)	GIRLS (n = 26)
	Median	Median
% Energy	17.9	17.4
% Protein	15.7	20.0
% CHO	19.6	19.6
% Total fat	11.3	12.4
% SFA	12.9	13.4
% MUFA	7.5	10.8
% PUFA	6.7	8.6
% Fibre	12.7	17.4
% Sugars	19.7	20.0
% Iron	27.3	29.8
% Calcium	46.3	29.1
% Sodium	13.4	17.1
% Zinc	18.6	18.0
% Vitamin A	16.3	14.1
% Folate	22.8	39.3
% Vitamin B6	13.3	15.4
% Vitamin B12	23.0	23.8
% Niacin Eq.	16.9	19.9
% Riboflavin	38.9	41.2
% Thiamin	26.7	33.3
% Vitamin C	8.4	16.6
% Vitamin E	8.8	7.9

Note. Between gender comparisons for each nutrient determined by Mann Whitney tests, all $P > 0.05$

4.12.3 Weekday and weekend reported nutrient intake at breakfast

Weekday breakfast intakes compared to weekend breakfast intakes for boys are shown in Table 4.16, and for girls in Table 4.17. For boys, intakes of nutrients at breakfast on the weekdays were higher for all nutrients except for sodium, vitamin A, and folate, which were higher on the weekend day. In contrast, girls' carbohydrate, fat, sodium, vitamin A, and vitamin E intakes were higher at breakfast on the weekend day, compared to weekdays. Whilst calcium, iron, folate, vitamin B12, and vitamin C intakes were higher at breakfast on weekdays compared to the weekend day. Although variations in intakes were observed for each gender between weekday and weekend breakfasts, these differences were not found to be statistically significant.

A noticeable difference between the two genders was for folate intake. Girls' weekday folate intake at breakfast (96.7 µg) was more than twice the boys' intake (43.3 µg). The opposite result occurred on the weekend day, with the boys' folate intake at breakfast (62.4 µg) almost twice the girls' intake (36 µg). However, statistical tests showed no significant difference between the two genders for weekday and weekend day folate intakes. This is likely due to the large within-group variations in folate intakes and the small sample size.

Table 4.16 Comparison of nutrient intakes from weekday and weekend breakfasts for male subjects

NUTRIENT	WEEKDAY BREAKFAST INTAKE (n = 24 Breakfasts*)		WEEKEND BREAKFAST INTAKE (n = 25 Breakfasts**)	
	Median	25^{th}, 75^{th} Percentile	Median	25^{th}, 75^{th} Percentile
Energy (kJ)	1371.4	1077.4, 1949.1	1332.8	1097.5, 1753.2
Protein (g)	13.3	8.6, 21.4	12.3	6.0, 17.5
Carbohydrate (g)	49.1	39.0, 72.3	52.0	39.8, 70.9
Fat (g)	9.4	3.2, 13.2	7.1	2.3, 15.6
Fibre (g)	2.2	1.0, 4.6	2.0	1.2, 5.2
Sugars (g)	28.3	16.5, 34.5	20.4	12.2, 31.9
Iron (mg)	3.0	1.4, 5.0	2.4	1.5, 3.9
Calcium (mg)	315.3	129.0, 423.1	314.7	85.8, 422.8
Sodium (mg)	394.7	209.1, 659.4	425.2	240.8, 871.8
Zinc (mg)	2.1	1.3, 2.8	1.6	1.1, 3.0
Vitamin A Eq. (µg)	79.0	22.6, 162.7	98.8	21.4, 174.6
Total Folate (µg)	43.3	22.1, 103.7	62.4	21.4, 174.6
Vitamin B6 (mg)	0.1	0.1, 0.6	0.1	0.05, 0.3
Vitamin B12 (µg)	1.0	0.3, 1.8	0.9	0.004, 1.7
Niacin Eq. (mg)	5.8	3.2, 8.6	5.0	2.8, 7.6
Riboflavin (mg)	0.7	0.3, 1.1	0.5	0.1, 0.9
Thiamin (mg)	0.4	0.2, 0.9	0.4	0.1, 0.5
Vitamin C (mg)	5.7	0.9, 16.8	3.9	1.7, 18.8
Vitamin E (mg)	0.8	0.2, 1.1	0.4	0.2, 0.8

Note.
Between gender comparisons for each nutrient determined by Mann Whitney tests, all $P > 0.05$

Subjects excluded from this analysis:
* Two male subjects missed breakfast on both weekdays
** One male subject missed breakfast on the weekend day

Table 4.17 Comparison of nutrient intakes from weekday and weekend breakfasts for female subjects

NUTRIENT	WEEKDAY BREAKFAST INTAKE (n = 25 Breakfasts*)		WEEKEND BREAKFAST INTAKE (n = 25 Breakfasts**)	
	Median	25th, 75th Percentile	Median	25th, 75th Percentile
Energy (kJ)	1446.2	1065.1, 1798.8	1365.4	996.0, 2383.3
Protein (g)	14.3	10.1, 18.2	14.2	9.3, 20.9
Carbohydrate (g)	48.5	39.7, 64.7	55.4	35.5, 73.1
Fat (g)	7.1	4.2, 12.6	9.0	4.1, 16.8
Fibre (g)	3.2	2.3, 5.0	2.0	1.1, 3.8
Sugars (g)	26.3	15.5, 39.2	22.4	8.6, 34.6
Iron (mg)	3.5	2.2, 4.3	2.7	1.4, 4.5
Calcium (mg)	288.7	169.9, 383.3	200.3	123.6, 309.7
Sodium (mg)	375.5	241.7, 570.6	488.3	312.3, 1094.2
Zinc (mg)	2.1	1.2, 2.9	1.8	1.0, 2.3
Vitamin A Eq. (µg)	63.0	29.4, 130.2	77.0	51.0, 158.0
Folate (µg)	96.7	31.8, 131.8	36.0	25.5, 107.6
Vitamin B6 (mg)	0.2	0.1, 0.5	0.1	0.09, 0.4
Vitamin B12 (µg)	0.8	0.3, 1.3	0.4	0.2, 1.6
Niacin Eq. (mg)	5.7	4.3, 7.1	5.5	4.0, 7.7
Riboflavin (mg)	0.6	0.4, 1.1	0.5	0.2, 0.8
Thiamin (mg)	0.4	0.3, 0.9	0.4	0.2, 0.6
Vitamin C (mg)	9.3	0.9, 56.9	5.4	0.3, 35.3
Vitamin E (mg)	0.5	0.4, 0.9	0.7	0.1, 1.4

Note:
Between gender comparisons for each nutrient determined by Mann Whitney tests, all $P > 0.05$

Subjects excluded from this analysis:
* One female subject missed breakfast on both weekdays
** One female subject missed breakfast on the weekend day

4.12.4 Breakfast eaters and non-breakfast eaters

Table 4.18 shows the total daily intake of days when subjects consumed breakfast (n = 52) compared to the total daily intake of days when subjects did not consume breakfast (n = 13). Although there were only 13 subjects who missed breakfast at least once over the three days of dietary recording, a multivariate analysis showed a significant difference in protein (P = 0.023), thiamin (P = 0.002), riboflavin (P = 0.010), Vitamin C (P = 0.041), zinc (P = 0.031,) and folate (P = 0.001) intakes between days when breakfast was consumed and days when breakfast was missed (controlling for inter-subject variation, gender, and day of the week effects).

Table 4.18 Reported total daily intake of subjects who consumed breakfast versus subjects who did not consume breakfast (boys and girls combined)

NUTRIENTS	BREAKFAST CONSUMED (n = 52**)		NO BREAKFAST CONSUMED (n = 13**)	
	MEDIAN	25^{th}, 75^{th} Percentile	MEDIAN	25^{th}, 75^{th} Percentile
Energy (kJ)	8929.8	7753.6, 10914.1	8376.1	5960.8, 10833.4
Protein (g)*	81.5	67.1, 95.6	55.9	36.5, 73.9
Carbohydrate (g)	274.9	238.9, 341.6	313.5	162.3, 369.5
Fat (g)	78.7	64.7, 92.1	65.3	55.5, 99.4
Fibre (g)	17.5	14.7, 20.6	16.2	12.7, 19.1
Sugars (g)	134.2	100.1, 177.8	118.4	65.0, 184.7
Iron (mg)	12.2	9.4, 14.4	8.5	7.1, 10.7
Calcium (mg)	795.1	625.2, 1028.0	578.2	343.1, 1092.9
Sodium (mg)	3076.6	2211.3, 3544.1	2348.0	1370.8, 4327.2
Zinc (mg)*	11.2	9.2, 13.0	7.0	5.6, 10.9
Vitamin A Eq. (µg)	560.8	446.4, 870.6	416.5	193.0, 807.9
Total Folate (µg)	250.4	191.4, 321.2	191.3	134.2, 260.0
Vitamin B6 (mg)	1.4	1.0, 1.7	1.5	0.6, 2.0
Vitamin B12 (µg)	4.1	2.6, 6.0	2.4	0.7, 4.6
Niacin Eq. (mg)	33.3	27.5, 39.1	23.5	18.5, 41.7
Riboflavin (mg)*	1.8	1.5, 2.2	1.3	0.6, 2.0
Thiamin (mg)*	1.4	1.1, 1.7	0.9	0.6, 1.2
Vitamin C (mg)*	119.2	75.0, 213.6	66.1	35.4, 132.9
Vitamin E (mg)	7.3	5.2, 9.2	5.9	3.9, 10.3

Note.
* Indicates significance at the $P \leq 0.05$ level, determined by a General Linear Model (multivariate analysis)
** The total daily intake was averaged for each subject

Breakfast skippers according to gender group

Table 4.19 shows the total daily intake on days when subjects did not consume breakfast, stratified by gender. Nutrient intakes of subjects who missed breakfast on more than one day (2 boys and 1 girl) were averaged. Boys who missed breakfast had significantly greater intakes of fat (P = 0.015), fibre (P = 0.022), thiamin (P = 0.001), iron (P = 0.022), and zinc (P = 0.022) intakes, than girls. Boys also tended to have greater energy intakes than girls; however this difference was not statistically significant. Due to the small number of missed breakfasts, these results are only indicative of possible gender differences.

Table 4.19 Reported total daily intake on no breakfast days, stratified by gender

NUTRIENTS	BREAKFAST MISSED - BOYS (n = 7**)		BREAKFAST MISSED - GIRLS (n = 6**)	
	MEDIAN	25th, 75th Percentile	MEDIAN	25th, 75th Percentile
Energy (kJ)	8830.9	7694.3, 13248.8	6636.1	4097.5, 9123.0
Protein (g)	65.4	36.8, 96.3	45.7	25.7, 56.1
Carbohydrate (g)	320.8	206.6, 406.9	218.0	129.2, 334.0
Fat (g)*	84.9	65.3, 130.1	55.5	44.8, 66.3
Fibre (g)*	18.3	16.2, 22.2	12.7	10.5, 16.7
Sugars (g)	130.4	116.6, 187.0	73.5	41.5, 197.2
Iron (mg)*	10.2	8.5, 11.8	7.5	5.6, 8.3
Calcium (mg)	625.4	383.4, 1347.0	489.1	275.2, 1013.6
Sodium (mg)	2605.5	2086.9, 4754.4	1751.8	856.4, 3593.4
Zinc (mg)*	10.1	7.0, 12.8	6.2	4.0, 6.8
Vitamin A Eq. (µg)	561.3	407.3, 738.5	287.3	187.0, 1288.4
Folate (µg)	209.8	178.3, 282.3	134.2	74.5, 271.0
Vitamin B6 (mg)	1.7	1.5, 2.1	0.6	0.5, 4.8
Vitamin B12 (µg)	2.7	1.2, 4.6	1.0	0.1, 6.9
Niacin Eq. (mg)	24.1	21.9, 45.8	18.5	11.1, 36.4
Riboflavin (mg)	1.7	1.0, 2.2	0.7	0.4, 2.4
Thiamin (mg)*	1.1	0.9, 1.6	0.6	0.3, 0.8
Vitamin C (mg)	117.7	35.4, 247.9	39.4	20.2, 71.4
Vitamin E (mg)	8.5	5.5, 14.0	4.1	3.3, 7.0

Note.
* Indicates significance at the $P \leq 0.05$ level, determined by Mann Whitney test
** Total daily intake was averaged for subjects who missed breakfast more than once

5 Discussion

This research aimed to collect detailed information on dietary intake, breakfast habits, choices, and preferences of 12-13 year old children from two intermediate schools in North Shore City, Auckland. The findings from this study indicate that breakfast consumption, defined as any food or beverage consumed at home before leaving for school, was part of the daily routine for the majority of these North Shore school children. However, several factors which affect breakfast consumption, and therefore dietary intake, were identified and are discussed below. In addition, overall conclusions from this investigation and recommendations for future research are presented.

5.1 Selection of the participating schools

The two schools were selected to participate in the study because of their geographic proximity to each other, the size of their school rolls, and the broad range of ethnicities enrolled at each school. Additionally, the two intermediate schools are both decile six schools, which draw children from two regions of relatively low socioeconomic areas in North Shore City. The main rationale for selecting these two schools was that they represent an understudied group, as they are often associated with the North Shore area, which is considered a high socioeconomic region. Of the five other public intermediate schools in the area, two were rated decile eight, and four were decile ten, therefore, the two participating schools are often left out of public health considerations.

Almost half (46.2%) of the 504 Year 8 students enrolled at the two selected intermediate schools in 2004, participated in Part A of the study. An even distribution of gender groups was observed, and a similar distribution of ethnic groups within the school was replicated in the study population. Therefore, it can be assumed that the study population was representative of students attending the participating schools. Results from this sample population may be comparable to other decile six schools throughout New Zealand.

5.2 Breakfast consumption

5.2.1 Consumption patterns

The majority of subjects (85%) reported consuming food and/or a beverage before leaving for school in the morning. Over half of the students reported that they usually eat breakfast every morning, and only 4% of subjects reported that they never have breakfast. The majority of subjects regularly make their own breakfast, which implies that they do not have to rely on other family members to prepare their breakfast for them. However, there was some evidence that the daily commitments of other family members may influence breakfast eating habits. For example, working parents impact on the time available for breakfast in the mornings, as children have to leave for school earlier, which therefore may explain why children who arrive early to school are more likely to skip breakfast.

In contrast to findings from previous international studies (Aranceta et al., 2001; Currie & Todd, 1992; Hackett et al., 2002; Nicklas et al., 2000; Ortega et al., 1996; Shaw, 1998; Siega-Riz et al., 1998; Videon & Manning, 2003), the current study found no significant association between breakfast consumption and gender, with 86% of boys, and 84% of girls consuming breakfast. There was also no significant difference in usual frequency of breakfast consumption between the gender groups. This result differs from the CNS, which found that males 11-14 years were more likely to usually eat or drink at home before school (81.3%) compared to females (69.1%). The discrepancy in gender differences in breakfast consumption between the current study and the 11-14 year old subject group in the CNS may be due to the greater age range of subjects in the CNS, the larger sample size of the CNS, and the variation in the SES and ethnic groups, between the two studies.

The disparities in breakfast consumption between Maori/Pacific Island children and New Zealand European children reported in the CNS were observed in the current study. Of the Maori/Pacific Island subjects, 62% consumed breakfast on the day questioned, compared to 92% of non-Maori/non-Pacific Island subjects within the study group. Further investigation into the factors causing this

discrepancy, may lead to the identification of the most appropriate methods to promote breakfast consumption in these ethnic groups.

Subjects who participated in the more detailed dietary analysis, reported missing only 16 from 156 possible breakfasts. Three subjects missed breakfast on more than one day, and more breakfasts were missed on the second weekday of dietary analysis, compared to the first weekday and the weekend day. The reason why more subjects missed breakfast on the second weekday of analysis is unknown and there are many possibilities for this outcome. The dietary intake interview for the second weekday generally occurred during the second half of the school week and it is possible that towards the end of the school week, subjects had less time before school to eat breakfast, or they skipped breakfast because they had sports practice before school. Additionally, subjects may have been more likely to miss breakfast because there were limited breakfast foods available towards the end of the week. Although food security was not assessed in the current study, food insecurity may have been an issue for some subgroup subjects.

5.2.2 Breakfast skippers

Interestingly, within the total subject group, breakfast skippers had a significantly higher median BMI (21.6 kg/m^2) compared to breakfast eaters (19.8 kg/m^2). Although this difference was statistically significant (P = 0.033), this result needs to be interpreted with caution as breakfast consumption measured in this study may not reflect habitual breakfast patterns for these subjects.

Previous studies investigating the relationship between breakfast consumption and body weight and BMI, have reported that overweight or obese children and adolescents are more likely to skip breakfast than their normal weight peers (Dwyer et al., 2001; Keski-Rahkonen, Kapiro, Rissanen, Virkkunen, & Rose, 2003; Rampersaud, Pereira, Girard, Adams, & Metzl, 2005; Siega-Riz et al., 1998). Additionally, from longitudinal data of the Children of Nurses' Study II participants in the US, it was discovered that the BMI of normal weight breakfast skippers tended to increase over the course of the study, compared to breakfast

consumers. This difference however was not statistically significant (Berkey, Rockett, Gillman, Field, & Colditz, 2003).

Compared to subjects who ate breakfast at home, breakfast skippers were more likely to have something to eat on the way to school. Possibly, these subjects either took food from home to eat or bought food/drinks from shops while travelling to school. While the majority of breakfast skippers first had something to eat or drink at morning tea, it is of concern that there were some subjects (although only a small number) who did not have anything to eat or drink until lunch time or after school that day. In this case, subjects would not have anything to eat for half, or the whole school day, which may lead to hunger, low concentration levels, and tiredness (Hill, 1995). If this occurs on a regular basis, the subject's nutritional status, learning and behaviour, and school performance may be affected.

Although there are numerous studies investigating the prevalence of breakfast skipping, few have investigated why children and adolescents skip breakfast. In this study, the most commonly reported reasons for skipping breakfast were; '*not being hungry in the morning*', followed by '*preferring to sleep-in*', and '*lack of time*'. Similar findings were reported by Shaw (1998) who found that among a sample of 13 year old Australian children, lack of time in the morning was the most commonly cited reason for skipping breakfast, followed by not being hungry and not feeling like having breakfast. Lack of time and not being hungry in the morning were also found to be the most reported perceived barriers to consuming breakfast among US elementary school students (Reddan, Wahlstrom, & Reicks, 2002).

In the current study, significantly more boys than girls reported skipping breakfast because '*there is nothing to eat*' and because they '*can't be bothered*'. From these responses it is difficult to ascertain whether nothing to eat refers to having no food at home, or whether subjects do not like the breakfast foods available, or do not want to put the effort into preparing breakfast. Further research is required to determine the interaction between food availability, food preferences, and attitudes to food preparation.

Breakfast skipping has been associated with health compromising behaviours such as smoking, infrequent physical activity, and dieting or concerns about body weight (Keski-Rahkonen et al., 2003; Nowark, 1998; Rampersaud et al., 2005). In the present study only a small proportion (3%) of subjects reported skipping breakfast to lose weight. Anecdotal reports from a teacher at one of the schools indicated that some girls were concerned about their body weight, and were dieting. During data collection, it was observed that although great care was taken by the researcher to ensure that anthropometric measurements were made discretely, a number of girls were reluctant to be weighed and to discuss measurements with classmates.

5.2.3 Foods and beverages consumed at breakfast

The New Zealand Nutrition Foundation states that a balanced breakfast means choosing foods mainly from the bread, cereals, and fruit and vegetable food groups, including some dairy foods for calcium and protein, and choosing high fibre foods to satisfy hunger. According to these criteria, on the days surveyed, the majority of breakfast consumers chose foods and beverages that contributed to a balanced breakfast.

In the current study, cereals were a popular breakfast choice, with 62% of breakfast consumers in Part A having a type of cereal for breakfast. Weet-Bix, Corn Flakes, Coco Pops, and Nutri-Grain were the top four cereals consumed by subjects in both Parts A and B of the study. Table 5.01 illustrates the nutrient composition and cost per 100 g, of the top four cereals consumed.

Table 5.01 Nutrient composition* and cost per 100g of the top four cereals consumed**

Nutrient (per 100 g)	Weet-Bix	Corn Flakes	Coco Pops	Nutri-Grain
Energy (kJ)	1290.0	1540.0	1660.0	1420.0
CHO (g)	62.2	84.8	87.1	62.7
Protein (g)	12.7	7.8	5.4	21.9
Fat (g)	1.46	0.2	1.9	0.6
Sugars (g)	0	8.7	36.5	8.28
Sodium (g)	270.0	1020.0	751.0	687.0
Fibre (g)	15.2	3.2	0.6	8.9
Calcium (mg)	45.0	4.0	31.0	69.0
Iron (mg)	13.0	10.0	10.0	10.0
Zinc (mg)	2.6	6.0	6.0	1.4
Folate (µg)	100.0	333.0	167.0	167.0
Vitamin B6 (mg)	0.09	1.8	1.8	1.81
Vitamin B12 (µg)	0.0	2.0	2.0	2.0
Riboflavin (mg)	1.56	1.4	1.4	1.4
Thiamin (mg)	4.14	0.92	0.92	1.83
Vitamin C (mg)	0	0	33.3	33.3
Vitamin E (mg)	1.39	0.4	0	3.2
Cost ($) Per 100 g	*0.58*	*0.60 – 0.75*	*1.10*	*1.40*

Note.
* FoodWorks Version 2.10
** Prices from Foodtown Online www.foodtown.co.nz (accessed 20th January 2006).

The finding that cereals were a popular breakfast choice among subjects is a positive outcome as breakfast cereals are often fortified with vitamins and minerals and make a significant contribution to children and adolescents' daily nutritional requirements (Hill, 1995; Subar et al., 1998; Webster, 1995). Barton et al. (2005) suggest that the beneficial effect of breakfast cereal consumption may be due to the nutritional qualities of the cereal itself, as well as the fact that cereals are often consumed with milk, which positively affects nutrient intake. Additionally, it is thought that the consumption of a cereal in the morning displaces less healthy breakfast food choices (Barton et al., 2005).

In both Parts A and B of the study, Weet-Bix was the most frequently consumed breakfast cereal as reported by subjects. Likewise, Weet-Bix type cereals were the most frequently eaten breakfast cereal among subjects in the CNS (Ministry of Health, 2003). The popularity of Weet-Bix among New Zealand children and adolescents may be a result of extensive brand marketing by Sanitarium Health Food Company, who manufacture Weet-Bix. Sanitarium proclaim that '*Kiwi-kids are Weet-Bix kids'* and use sporting figures, such as the All Blacks and Olympic triathlete Hamish Carter, to endorse their products. Free give-aways and

competitions are other marketing tools utilised by Sanitarium to ensure that Weet-Bix remains New Zealand's biggest selling breakfast cereal.

As shown in Table 5.01, Weet-Bix, compared to the other three most consumed breakfast cereals, is lower in sugar and sodium, and higher in fibre, iron, thiamin, and riboflavin. Corn Flakes, the second most frequently consumed cereal, is low in fat and high in folate, however the sodium content is the highest amongst the four cereals. Both Weet-Bix and Corn Flakes are cost-effective cereal choices, which may contribute to their popularity within the study population. It was observed that the more expensive cereals such as Nutri-Grain were generally not as frequently consumed as the more cost-effective brands. When feeding a family, and in particular growing children, price is an important factor to consider when purchasing cereals.

Interestingly, the top four cereals consumed were the top four brands selected in the preferred cereals section of the questionnaire, suggesting that when breakfast is skipped it is not due to a lack of availability of preferred breakfast foods. The availability of breakfast foods that these children like may be a key motivator for them to eat breakfast on a regular basis. Further research is required to determine what motivates children and their families when choosing breakfast cereals.

The data collected in Part A of this study indicate that in addition to breakfast cereals, toast was also a popular choice for breakfast (34%), and the majority of breakfast eaters (84%) reported having something to drink with their breakfast meal. The most common beverages consumed were; juice/cordial (29%), followed by Milo (24%), milk (18%), and water (18%).

For the subgroup, breakfast cereals were also a popular choice for breakfast consumers, particularly on weekdays. On the two weekdays, over 50% of breakfast eaters consumed a breakfast cereal. On the weekend day, the number of cereal consumers dropped to 38%, although the number of breakfast eaters remained high. This may be due to the greater amount of time available for breakfast on the weekend, resulting in the choice of foods that take longer to

prepare, such as bacon and eggs, and toast. The greater percentage of cereal consumed on the two weekdays possibly contributed to the higher nutrient intakes observed at breakfast on weekdays. This was especially true for boys, whose intakes of the majority of nutrients at breakfast were higher on weekdays compared to the weekend day, although this variation was not found to be significant.

In place of having breakfast at home, less traditional breakfast foods, such as mince pies and potato chips were consumed by a small number of subjects on their way to school. McKinley et al. (2005) also reported this result from the findings of focus groups with 11-12 year old children in Northern Ireland and England. In both Parts A and B of the current study, there were subjects who consumed breakfast foods specific to their culture. For example, the breakfast meal for some Korean subjects consisted of foods such as seaweed soup, rice, vegetables, and fish. Also, a Pacific Island subject in the subgroup consumed Samoan cocoa rice pudding for breakfast.

5.3 Vitamin and mineral supplementation

In the current study, just over 30% of subjects in Part A reported taking a vitamin or mineral supplement daily, with vitamin C reported as the most frequently consumed supplement, followed by multivitamin supplements. Detailed dietary analysis of the subgroup found only a small number of subjects (7.7%) who reported taking a vitamin or mineral supplement on at least one of the three days of analysis. Supplement use could be described as sporadic within the subgroup as only two subjects took a supplement on all three days of analysis. Likewise, the CNS found that only 5.2% of males, and 4.9% of females aged 11-14 years, reported taking a dietary supplement in the previous 24-hours. As with the present study, the most frequently reported supplements taken by subjects in the CNS were multivitamins and minerals, and vitamin C.

The disparity between the higher percentage of subjects who reported taking dietary supplements daily in Part A, and the percentage of subgroup subjects who took supplements during the three days of dietary analysis in Part B, could

be due to reporting bias. In Part A subjects may have reported that they take supplements daily, as they know they are supposed to take them daily, but in fact they only take supplements sporadically, as seen in Part B. Additionally, the percentage of subjects in Part A who reported taking supplements daily might be high compared to the CNS data due to sample selection bias. Subjects enrolled in the current study may be more health conscious, as opposed to the CNS sample, and therefore more likely to take dietary supplements on a regular basis.

Over half of the subjects in Part A reported taking supplements because they make them feel healthy, and 33% reported that supplements make them feel good and provide energy. In relation to this finding, Nicklas et al. (2000) hypothesised that children and adolescents who take supplements may be more health conscious, and therefore make more appropriate dietary choices (Nicklas et al., 2000). The same authors observed that adolescents who reported taking a supplement with breakfast had lower dietary intakes of fat and higher intakes of CHO, vitamins B6 and C, riboflavin, magnesium, and iron, when compared to adolescents who did not consume a supplement (Nicklas et al., 2000). In the current study there were too few subjects who actually took supplements to confirm Nicklas et al. (2000) findings; however the reported reasons for taking supplements make it seem unlikely that supplements were taken in place of a healthy diet, or because of a poor diet, as may be the case with some adults (Ministry of Health, 1999b).

5.4 Dietary preferences and food influences

The majority of subjects (71%) reported that taste is an important factor when making food and beverage choices. This finding supports the results by McKinley et al. (2005), who found that children 11-12 years of age reported taste as the main deterrent from choosing a healthy diet. In the current study, a large number of subjects (58%) reported that their food and beverage choices are influenced by what is at home and what the rest of the family is having. This finding indicates that for these subjects, parents/caregivers and families play

important roles in determining their dietary intake, however at the same time, it is likely that these children also influence what the parents buy in the first place.

5.4.1 Preferred breakfast foods and beverages

In the questionnaire, subjects were asked to choose from lists, the foods and beverages they would like to have for breakfast on most days of the week. In answer to this question, the majority of subjects misunderstood this question and selected all foods and beverages that they like, instead of just the foods and beverages they would prefer to have for breakfast in one sitting. This interpretation of the question was not apparent during pre-testing of the questionnaire. From this question, however, it was interesting to note subjects' preferred foods in the different breakfast categories. For example, the most popular breakfast cereal was Coco Pops (46%), while on the preceding morning, only 11% of subjects reported eating Coco Pops for breakfast. Additionally, the top four preferred cereals were the also the top four cereals consumed for breakfast on the day questioned. As with preferred cereals, the top four breakfast drink choices selected by subjects were also the top four drinks consumed by subjects at breakfast in Part A. The most popular preferred breakfast drink was Milo, followed by juice/cordial, water, and milk. After determining subjects' preferred breakfast food choices and foods consumed at breakfast, findings indicate that the availability of preferred breakfast foods may influence breakfast consumption among study subjects.

In the present study, the most preferred type of milk was full-fat (dark blue) milk (63%), and the most popular bread was white bread, which was selected by 77% of subjects. In the CNS, a similar proportion of children in the 11-14 year old age group (69% boys, and 64% girls) usually drank standard milk (full-fat) with low-fat (light blue) milk the second most consumed milk. Additionally, white bread was the type of bread usually eaten by 11-14 year old children in the CNS, with 79% of boys and 80% of girls choosing white bread over wholemeal or mixed grain (Ministry of Health, 2003). In the current study, the least popular breakfast foods selected were from the hot foods category (e.g., pancakes, eggs, and pies) and the bakery foods category (e.g., cakes and donuts). It is possible that subjects did not select foods from these categories as they do not

have these items for breakfast on a regular basis, or do not associate these foods with the breakfast meal.

Eighty-eight percent of subjects selected at least one type of fruit to have for breakfast. This number is very high considering only 12% of subjects reported having had a piece of fruit for breakfast on the preceding day. This finding implies that the majority of subjects would like to eat fruit as part of their breakfast meal, however only small percentages actually have fruit for breakfast. Increasing fruit consumption at breakfast could therefore positively affect the nutrient intake of this subject group. It should be noted that there is a possibility that subjects selected the fruits that they like from the list, without considering if they would actually eat these fruits at breakfast. Trialling the selection of specific foods at a breakfast club may be a more appropriate method to determine what foods are selected when they are actually made available. From the current results, it is recommended that future interventions to promote breakfast and/or fruit consumption should focus on promoting fruit as part of the daily breakfast meal.

5.5 School day

An interesting finding from this study was that on the morning questioned, subjects who arrived to school early (before 8:00 am) were significantly more likely to have missed breakfast compared to subjects who arrived later. For these subjects, arriving to school early would limit the time available to have breakfast at home in the morning, therefore affecting breakfast consumption habits.

When subjects were asked to rate their usual feelings of hunger when they arrived to school, more than half reported they rarely or never feel hungry in the morning. Surprisingly, no association was found between reported feelings of hunger in the morning and usual breakfast consumption. However, it is likely that feelings of hunger when arriving at school would depend on the time children had breakfast and what they had for breakfast that morning.

The majority of subjects reported that they brought their lunch from home on most school days. There were, however, a small percentage of subjects who reported that they buy their lunch from the canteen every school day. Carter and Swinburn (2004) analysed the food environment in New Zealand primary and intermediate schools and found that less healthy foods and beverage choices dominated sales at school canteens surveyed. The most commonly available food items for sale were pies, juice, and sausage rolls. Therefore, if this observation was also found in participating schools, children who regularly buy their lunch from the canteen are likely to purchase unhealthy foods and beverages with a high fat and sugar content. In this study, no data was collected on foods and beverages available in participating schools.

Since Carter and Swinburn's (2004) publication, an increasing number of schools are modifying their food policies. Schools are becoming more aware of the food and beverage options they provide their students through the school canteen, and some are taking measures to ensure healthier options are available. In 2005, the Waitemata District Health Board, in conjunction with The National Heart Foundation of New Zealand, formulated beverage guidelines based on a 'traffic light' system which indicates the healthiest drinks schools can stock for their students. Some schools have taken the healthy beverage issue further by implementing a school policy to ensure that only bottled water is sold in their canteens.

The Wellbeing in Schools Project, which was also initiated by the Waitemata District Health Board, is a programme developed to aid schools to create and promote a healthy school environment, with the aim of improving the health of school children. The project is a combination of nutrition, physical activity, and teacher professional development packages. By developing food and nutrition policies and creating a healthy environment, schools can work towards providing students with healthy food and beverage options. This could positively affect the dietary intake of students, particularly those who regularly purchase foods and beverages from the school canteen.

5.6 Nutrient intake

In the present study the average daily energy intake of subgroup subjects was within the recommended range for New Zealand boys and girls, 12-15 years of age. The daily energy intake was 8842.7 kJ for boys and 8987.2 kJ for girls, with no significant difference in nutrient intakes occurring between genders. Although there are no specific guidelines for New Zealand children and adolescents, the percentage contribution of carbohydrates, total fat, and MUFA to total energy intake were within the adult guidelines, which are recommended for use by adolescents by the NZ Nutrition Taskforce (Department of Health, 1991). The contribution of protein and SFA however, was slightly above guidelines. Median folate, zinc, and iron intakes from the three days of dietary analysis, met the daily recommended intakes for New Zealand adolescents 12-15 years of age. Median sodium and vitamins B12 and C intakes were above the recommended daily intake, for both male and female subgroup subjects.

An important finding from the three days of dietary analysis was that the median calcium intake of the subgroup was considerably lower than the recommended intake. Therefore, subjects may not be meeting adequate daily calcium intakes to facilitate the production of peak bone mass, placing them at risk of developing osteoporosis in later life (Fisher et al., 2004; Martin et al., 1997; Spear, 2002). The median daily calcium intakes of 11-14 year olds in the CNS were also lower than current guidelines, with the daily calcium intake of male and female subjects, 888 mg and 733 mg respectively (Ministry of Health, 2003). Interestingly, in contrast to the CNS results, female subjects in the current study had a higher median calcium intake (826.8 mg per day), compared to male subjects (669.2 mg per day). With median total energy intakes similar between genders, female subjects may have consumed a greater proportion of foods higher in calcium than males, such as milk, yoghurt, and calcium fortified cereals, over the three days of dietary analysis.

Previous research has shown that the consumption of the breakfast meal plays an important role in the supply of milk products and calcium in the diet (Hanes, 1984; Ortega, 1998). Promoting breakfast consumption, in particular, milk

drinks, yoghurt, and cereals fortified with calcium (with milk added), may help to increase daily calcium intake.

5.7 Weekday intake compared to weekend day intake

The majority of studies investigating dietary intake of children and adolescents occur in the school setting, and do not include dietary intake information on weekend days. There are only a limited number of studies that have investigated the influence of day of the week on dietary intakes in children and adolescents.

In the current study, dietary intake information was obtained for two weekdays as well as a weekend day, and differences in intakes between weekdays and weekend day were assessed. Saturday dietary intakes were chosen to represent weekend intakes, as it was a concern that on a Sunday, the dietary intake of Pacific Island subjects may be overestimated due the Sunday tonai. In retrospect, this concern may have not affected results due to the small number of Pacific Island subjects within the subgroup. It should be noted that there were subgroup subjects who attended a birthday party on the Saturday their dietary intake information was recorded. These subjects consumed 'party foods' such as sausage rolls, pizza, lollies, and soft drink, which they may not otherwise have eaten on an ordinary weekend day.

When the effect of day of the week on nutrient intake was examined, a significant difference occurred between weekdays and weekend day intakes of fibre, vitamin C, and total folate. Also, a significant difference was found in protein and niacin intakes between weekday 1 and the weekend day. A longitudinal study by Post, Kemper, and Storm-Van Essen (1987) assessed the changes in nutrition habits of a Dutch adolescent population, 12-17 years of age. Differences in intakes between schooldays and weekend days were assessed and it was found that overall, higher nutrient intakes were seen on weekend days compared to schooldays, particularly for energy and macronutrients. For male subjects in the current study, the opposite result occurred to those of the Dutch study, with intakes of all nutrients (except for fat)

higher on the weekdays compared to the weekend day. However, only CHO, fibre, vitamin B6, niacin, and vitamin C intakes were significantly different between weekdays and the weekend day. For female subjects, the only nutrients that were significantly different between the weekdays and weekend day were fibre and folate, with higher intakes recorded on the weekend day.

A study which examined the variability in dietary intakes between weekend days and Sunday, in 10 year old children from the Bogalusa Heart Study, found mean intakes of mixed protein, PUFA, MUFA, dietary cholesterol, and total sugar differed on Sunday compared to weekdays. Also, intakes were more variable on Sunday than on weekdays, possibly due the large number of children who consume a standardised school lunch and breakfast during the school week (Nicklas, Farris, Bao, Webber, & Berenson, 1997).

The variation in results observed in the above studies, and in the current study, may be explained by the differences in age, socioeconomic status, eating patterns, day of the week studied, and the different dietary methodologies employed.

5.8 Nutrient intake at breakfast meals

Overall, nutrient intakes at the breakfast meal were similar for male and female subgroup subjects, with 1585.5 kJ the median energy intake for boys, and 1564.1 kJ the median energy intake for girls. In contrast, the results from Ruxton et al. (1996), who investigated breakfast consumption in a sample of Scottish children 7-8 years of age, found some significant differences between boys and girls in the amounts of energy and nutrients consumed at breakfast. However, it appeared that differences were due to the amount of food eaten at breakfast rather than the actual composition of the breakfast meals (Ruxton et al., 1996).

In the current study, dietary analysis showed that a large proportion of the energy intake at breakfast was provided by CHO, for both male (63.4% from CHO) and female (58.7% from CHO) subgroup subjects. This result is to be

expected as in general subjects consumed breakfasts that contained foods high in CHO such as cereals, toast, and orange juice. The proportion of energy intake at breakfast supplied by CHO fell within the range of intakes reported in studies by Morgan et al. (1981), Ruxton et al. (1996), Preziosi et al. (1999), Aranceta et al. (2001), and Dwyer et al. (2001), who found that CHO supplied between 51% and 62% of breakfast energy.

For female subgroup subjects, the percentage of energy at the breakfast meal supplied by protein (14.1%) was slightly higher than the proportions reported by Morgan et al. (1981), Ruxton et al. (1996), Preziosi et al. (1999), and Dwyer et al. (2001) in their respective studies, and was the same as the proportion reported by Aranceta et al. (2001) in a population of Spanish children and young people 2-24 years of age. At 16.3%, the contribution of protein to breakfast energy for boys was higher than the girls' intakes, and also higher than the percentages reported in the studies mentioned above.

In the current study, the percentage of energy at breakfast supplied by fat (20% boys, 21% girls) was lower than the percentages reported by Morgan et al. (1981), Ruxton et al. (1996), Preziosi et al. (1999), and Aranceta et al. (2001), who found that in their respective studies, fat supplied between 25 and 34.7% of energy at the breakfast meal. Dwyer et al. (2001) reported a similar result to that of the present study, with 21% of energy at breakfast supplied by total fat. Subjects in the Dwyer et al. (2001) study were approximately 13-16 years of age, and were involved in the Child and Adolescent Trial for Cardiovascular Health (CATCH) in the US.

While a disparity in some intakes of nutrients was observed between breakfasts on weekdays versus the weekend day, differences were not found to be statistically significant. For example, median folate intakes varied according to gender and day of the week, however the differences in intakes were not found to be significant due to the large within-group variations in folate intakes and the small sample size.

5.9 Contribution of the breakfast meal to total daily intakes

Breakfast is often referred to as the most important meal of the day and the significant contribution of the breakfast meal to energy and nutrient intakes in children and adolescents has been frequently reported in the literature (Morgan et al., 1981; Schlundt et al., 1992; Siega-Riz et al., 1998). In the current study, the contribution of the breakfast meal to total daily intakes was assessed among subjects who consumed breakfast, by expressing intakes at breakfast as a percentage of overall daily intakes. There were no significant differences between male and female breakfast eaters in the contribution of the breakfast meal to overall dietary intakes. The energy contribution of breakfast to total daily energy intake was 17.9% and 17.4% of daily energy intake for boys and girls respectively.

In comparison, lower proportions of energy at the breakfast meal were reported by Brinsdon et al. (1992, 1993), who found from their two studies of Form one and Forms three and four New Zealand students that breakfast supplied between 13.9% (girls, 13-15 years) and 16.5% (boys, 10-11 years) of overall daily energy intake. In the current study, for both boys and girls in the subgroup, breakfast was found to provide over a quarter of the total daily intake of iron, calcium, folate, riboflavin, and thiamin. The large contribution at the breakfast meal to the total daily intake of these micronutrients is likely due to the consumption of breakfast foods such as cereals, milk, and toast, which represent major sources of folate, iron, calcium, riboflavin, and thiamin.

For boys in the subgroup, almost half (46.3%) of the overall calcium intake was supplied by the breakfast meal, which implies that breakfast is a very important source of calcium for this group. This finding has significant implications for boys who skip breakfast, as they may not be able to make up for the missed calcium during the remainder of the day.

5.10 Breakfast eaters and non-breakfast eaters

Research has shown that breakfast eaters are more likely to have overall more adequate dietary intakes than breakfast skippers (Morgan et al., 1986; Nicklas et al., 1993; Nicklas et al., 2000; Sjoberg et al., 2003). In the present study, there was a trend towards higher intakes of energy and all nutrients (except CHO) on the days when breakfast was consumed compared to when breakfast was missed. Median protein, thiamin, riboflavin, vitamin C, zinc, and folate intakes were found to be significantly higher on days when breakfast was consumed. Similar findings were reported by Nicklas et al. (2000) who examined the contribution of breakfast consumption to total daily intake of students aged 15 years, in the US. Researchers found that compared to breakfast eaters, breakfast skippers tended to have lower daily intakes of energy, macronutrients, fibre, and vitamins and minerals, and a higher daily percentage of energy from fat (Nicklas et al., 2000).

Female subjects who skipped breakfast in the present study had significantly lower daily intakes of fat, fibre, thiamin, iron, and zinc than male subjects who skipped breakfast. Additionally, although not significant, there was a large difference in total daily energy intake between male breakfast skippers (8830.9 kJ) and female breakfast skippers (6636.1 kJ). The small number of subgroup subjects who missed breakfast during dietary analysis may be at risk of nutritional inadequacy, as their daily nutrient intakes do not always meet recommended intakes. In particular, the low energy and nutrient intakes of female breakfast skippers is of concern as mean intakes of fibre, iron, calcium, zinc, folate, riboflavin, thiamine, and vitamins A, B6, B12, and vitamin E were all below the daily intakes recommended for NZ female adolescents.

5.11 Limitations of the study

There are a number of limitations that should be considered when interpreting the results of this study. One of these limitations is the influence of respondent bias. Students who participated in the study were those who volunteered, by returning both student and parental consent forms, and were also present at

school on the day the questionnaire was administered. Students who volunteered may have been more motivated to participate in the study due to an interest in the study topic, and health and well-being in general. Therefore, lifestyle patterns such as dietary intake and eating patterns may differ between participants and non-responders.

A systematic selection bias may have occurred in the present study as the return of both consent forms by students depended largely on their teacher's influence. At both schools there were classes where all or the majority of consent forms were returned, and in others, only a small number of forms were returned despite the researcher's efforts to remind students to return forms. Teachers may have been too busy with other class activities to remind students to return forms to school. Additionally, students and their parents may have thought the study was not important or necessary, or did not agree to be measured and have their dietary intake and behaviours assessed.

In both Parts A and B of the study, comparisons between breakfast eaters and non-breakfast eaters were limited due to the small proportion of breakfast skippers within the study group. Comparisons between ethnicities were also limited due to the small number of subjects across the various ethnic groups. Examining a larger group of known habitual breakfast skippers, and comparing findings to those of habitual breakfast eaters, may be a possible solution for future investigations.

Limitations associated with the collection of dietary intake information should be considered when interpreting results. The collection of reliable and accurate data when assessing the nutritional status of individuals or groups is a difficult task. Measuring food and nutrient intakes in children and adolescents is particularly challenging due to the number of confounders that occur when assessing nutrient intake, such as under and over reporting (Livingstone et al., 2004). The 24-hour dietary recall method employed in the current study was considered to be appropriate as students in this age group have sufficient cognitive skills to participate in unassisted recalls and can self-report their dietary intake (Livingstone et al., 2004). Furthermore, students of this age are

not too far into adolescence to be inhibited from participating and discussing their dietary intake and eating behaviours (McKinley et al., 2005).

To minimise reporting errors, food models and photographs were used during the dietary recall interviews to aid memory and assist subjects to describe foods and portion sizes. Additionally, to ensure eating patterns were not disrupted during the course of the study, subjects and their parents/caregivers were not informed of the exact dates when data collection was to take place. Also, information sheets and consent forms gave no reference to breakfast or breakfast consumption patterns. It was hoped that this would result in minimal changes to the childrens' breakfast consumption patterns during the data collection period.

6 Conclusion

This research provided detailed information on the dietary intake, breakfast habits, and preferred breakfast food choices of students attending two decile six intermediate schools in North Shore City, Auckland. Additionally, this research provides important information regarding the reasons why students skip breakfast, as few studies have investigated barriers to breakfast consumption, especially among New Zealand children.

Both male and female students reported high levels of breakfast consumption, with the majority of breakfast consumers choosing foods and beverages which contributed to a balanced breakfast. The high level of breakfast consumption may be associated with the age group assessed, as previous literature has determined that breakfast omission is more common in older adolescents, and in particular, female adolescents. In addition, high levels of breakfast consumption may be associated with the availability of preferred breakfast foods at home. Breakfast consumption played an important role in contributing to the daily nutrient intakes of breakfast consumers, especially if breakfast cereals were consumed. The breakfast meal made a significant contribution to the total daily intake of nutrients such as iron, calcium, folate, riboflavin, and thiamin, for both male and female breakfast eaters.

6.1 Recommendations

Recommendations for future research include:

- Extending this study to include schools from all deciles and regions throughout New Zealand. Also, comparing a wider range of age groups to assess the age related decline in breakfast consumption observed in the literature. Examining a range of age groups may also expose gender differences in breakfast consumption patterns.
- Further investigation is required into the associations between ethnicity and breakfast consumption, and the relationship between BMI and habitual breakfast consumption.
- Investigate prospectively the effect of breakfast consumption/omission on body composition, nutritional status and eating patterns, in New Zealand children and adolescents.
- Examining a larger group of known habitual breakfast skippers, and comparing findings to those of habitual breakfast eaters, may provide more robust evidence in relation to differences in nutrient intakes between breakfast eaters and breakfast skippers.
- Investigating qualitatively, the interaction between breakfast consumption and food availability, food preferences, and attitudes to food preparation. In addition, focus groups may provide important information regarding the motivators and barriers to breakfast consumption.
- Investigating the effect of breakfast omission on school attendance and school performance of New Zealand children and adolescents.

Recommendations for improving breakfast consumption and nutrient status of children and adolescents:

- Regular consumption of a healthy breakfast should be encouraged in groups who are more likely to skip breakfast. Promotions and interventions targeted at primary and intermediate school-aged students are required in order to slow or halt the decline in breakfast consumption which occurs with age.

- When promoting breakfast, it is important not only to endorse breakfast consumption, but to promote the consumption of a healthy breakfast that includes a variety of food groups such as cereals, dairy products, and whole grains.
- Interventions to promote breakfast and/or fruit consumption should focus on promoting fruit as part of the daily breakfast meal.
- Breakfast provides a good opportunity to increase daily calcium intake by including foods that are high in calcium, such as dairy products, and breakfast cereals and juices fortified with calcium.
- Children and adolescents who skip breakfast at home in the morning due to lack of time, should be encouraged to eat foods such as fruit, cereal bars, and yoghurt drinks on the way to school.
- Ensure that children and adolescents who are active before school (e.g., participate in sport practice) are provided with an adequate breakfast to meet daily energy requirements.
- Regular breakfast consumption should be promoted to children and adolescents who are dieting, and who skip breakfast to aid weight loss.

References

Adamson, A. J., Rugg-Gunn, A. J., Butler, T. J., & Appleton, D. R. (1996). The contribution of foods from outside the home to the nutrient intake of young adolescents. *Journal of Human Nutrition and Dietetics, 9*, 55-68.

Albertson, A.M., Harvey Anderson, G., Crockett, S.J., & Goebel, M.T. (2003). Ready-to-eat cereal consumption: Its relationship with BMI and nutrient intake of children aged 4 to 12 years. *Journal of the American Dietetic Association, 103,* 1613-1619.

Anderson, A. S., MacIntyre, S., & West, P. (1994). Dietary patterns among adolescents in the west of Scotland. *British Journal of Nutrition, 71*, 111-122.

Aranceta, J., Serra-Majem, L., Ribas, L., & Perez-Rodrigo, C. (2001). Breakfast consumption in Spanish children and young people. *Public Health Nutrition, 4*(6A), 1439-1444.

Baranowski, T., Sprague, D., Baranowski, J. H., & Harrison, J. A. (1991). Accuracy of maternal dietary recall for preschool children. *Journal of the American Dietetic Association, 91*(6), 669-674.

Barton, B. A., Eldridge, A. L., Thompson, D., Affenito, S. G., Striegel, R. H., Franko, D. L., et al. (2005). The relationship of breakfast and cereal consumption to nutrient intake and body mass index: The national heart, lung, and blood institute growth and health study. *Journal of the American Dietetic Association, 105*, 1389-1389.

Belderson, P., Harvey, I., Kimbell, R., O'Neill, J., Russell, J., & Barker, M. E. (2003). Does breakfast-club attendance affect schoolchildren's nutrient intake? A study of dietary intake at three schools. *British Journal of Nutrition, 90*, 1003-1006.

Berkey, C. S., Rockett, H. R. H., Gillman, M. W., Field, A. E., & Colditz, G. A. (2003). Longitudinal study of skipping breakfast and weight change in adolescents. *International Journal of Obesity, 27*, 1258-1266.

Black, A. E. (2001). *Dietary assessment for sports dietetics.*

Briefel, R., Murphy, M. J., Kung, S., & Devaney, B. (1999). *Universal-free school breakfast programme evaluation design project: Review of literature on breakfast and learning.* Princeton, NJ: Mathematica Policy Research, Inc.

Brinsdon, S., George, J., & Paulin, J. (1992). *Survey of the nutrient intakes of a sample of form one children*: A report for the Personal and Public Health Policy Section. Wellington: Health Research and Analytical Services, Department of Health.

Brinsdon, S., George, J., Paulin, J., & McFarlane, J. (1993). *A survey of the nutrient intakes of a sample of form three and four students.* A report prepared for the Public Health Policy Commission. Wellington: Health Research and Analytical Services, Department of Health.

Carter, M. A., & Swinburn, B. (2004). Measuring the 'obesogenic' food environment in New Zealand primary schools. *Health Promotion International, 19*(1), 15-20.

Cereal Institute. (1962). *A complete summary of the Iowa breakfast studies.* Chicago: Cereal Institute Inc.

Consumer. (2003, July). Breakfast candy. *Consumer,* 10-16.

Currie, C., & Todd, J. (1992). *Health behaviours of Scottish schoolchildren. Report 1: National and regional patterns.* Edinburgh: Health Research Board for Scotland.

Department of Health. (1991). *Food for health. Report of the Nutrition Taskforce.* Wellington: Author.

Devaney, B. L., Gordon, A. R., & Burghardt, J. A. (1995). Dietary intakes of students. *American Journal of Clinical Nutrition, 61(suppl),* 205S-215S.

Dickie, N. H., & Bender, A. E. (1982). Breakfast and performance in schoolchildren. *British Journal of Nutrition, 48,* 483-496.

Domel, S. B. (1997). Self-reports of diet: How children remember what they have eaten. *American Journal of Clinical Nutrition, 65(suppl),* 1148S-1152S.

Dwyer, J. T., Evans, M., Stone, E. J., Feldman, H. A., Lytle, L., Hoelscher, D., et al. (2001). Adolescents' eating patterns influence their nutrient intakes. *Journal of the American Dietetic Association, 101*(7), 798-802.

Edmunds, L. D., & Ziebland, S. (2002). Development and validation of the Day in the Life Questionnaire (DILQ) as a measure of fruit and vegetable questionnaire for 7-9 year olds. *Health Education Research, 17*(2), 211-220.

Fisher, J. O., Mitchell, D. C., Smiciklas-Wright, H., Mannino, M. L., & Birch, L. L. (2004). Meeting calcium recommendations during middle childhood reflects mother-daughter beverage choices and predicts bone mineral status. *American Journal of Clinical Nutrition, 79,* 698-706.

Fuamatu, N., Thetadig, R, & Casswell, S. (1996). *Influences on the eating patterns and food choices of Samoan teenagers in Auckland.* Auckland: Alcohol & Public Health Research Unit.

Gibson, R. S. (1998). *Dietary assessment* (1st Edition ed.). Oxford: Oxford University Press.

Gift, W. H., Washbon, M. B., & Harrison, G. G. (1972). *Nutrition, behaviour and change*. Englewood Cliffs, NJ: Prentice-Hall.

Gleason, P. M. (1995). Participation in the national school lunch program and the school breakfast program. *American Journal of Clinical Nutrition, 61(suppl)*, 213S-220S.

Gordon, F. K., Ferguson, E. L., Toafa, V., Henry, T. E., Goulding, A., Grant, A. M., et al. (2003). High levels of childhood obesity among 3-7 year old New Zealand Pacific children is a public health concern. *Journal of Nutrition, 133*, 3456-3460.

Hackett, A. F., Gibbon, M., Sratton, G., & Hamill, L. (2002). Dietary intake of 9-10 year old and 11-12 year old children in Liverpool. *Public Health Nutrition, 5*(3), 449-455.

Hanes, S., Vermeersch, J., & Gale, S. (1984). The national evaluation of school nutrition programmes: Program impact on dietary intake. *The American Journal of Clinical Nutrition, 40*, 390-413.

Harnack, L., Stang, J., & Story, M. (1999). Soft drink consumption among us children and adolescents: Nutritional consequences. *Journal of the American Dietetic Association, 99*, 436-441.

Hill, G. M. (1995). The impact of breakfast especially ready-to-eat cereals on nutrient intake and health of children. *Nutrition Research, 15*(4), 595-613.

Jahns, L., Siega-Riz, A. M., & Popkin, B. M. (2001). The increasing prevalence of snacking among US children from 1977 to 1996. *Journal of Pediactrics, 138*, 493-498.

Johnson, R. K., Driscoll, P., & Goran, M. I. (1996). Comparison of multiple-pass 24-hour recall estimates of energy intake with total energy expenditure determined by the doubly labelled water method in young children. *Journal of the American Dietetic Association, 96*, 1140-1144.

Kennedy, E., & Davis, C. (1998). US Department of Agriculture school breakfast programme. *American Journal of Clinical Nutrition, 67 (Suppl)*, 798S-803S.

Keski-Rahkonen, A., Kapiro, J., Rissanen, A., Virkkunen, M., & Rose, R. J. (2003). Breakfast skipping and health-compromising behaviours in adolescents and adults. *European Journal of Clinical Nutrition, 57*, 842-853.

Levine, A. L., Tallman, J.R., Grace, M.K., Parker, S.A., Billington, C.J., & Levitt, M.D. (1989). Effect of breakfast cereals on short-term food intake. *American Journal of Clinical Nutrition, 50*, 1303-1307.

Liu, A. (2002). *Evaluating the "Get going with breakfast" programme* (Submitted in partial fulfilment of the requirements for the Postgraduate Diploma in Dietetics at the University of Otago, Dunedin, New Zealand). Dunedin: University of Otago.

Livingstone, M. B. E., & Robson, P. J. (2000). Measurement of dietary intake in children. *Proceedings of the Nutrition Society, 59*(2), 1-25.

Livingstone, M. B. E., Robson, P. J., & Wallace, J. M. W. (2004). Issues in dietary intake assessment of children and adolescents. *British Journal of Nutrition, 92*(Suppl. 2), S213-S222.

Ludwig, D.S., Peterson, K.E., & Gortmaker, S.L. (2001). Relation between consumption of sugar-sweetened drinks and childhood obesity. A prospective, observational analysis. *Lancet, 357*, 505-508.

Lytle, L. A., Milton, N. Z., Obarzanek, E., Glovsky, E., Montgomery, D., Nicklas, T., et al. (1993). Validation of 24-hour recalls assisted by food records in third-grade children. *Journal of the American Dietetic Association, 93*(12), 1431-1436.

Martin, A. D., Bailey, D. A., McKay, H. A., & Whiting, S. (1997). Bone mineral and calcium accretion during puberty. *American Journal of Clinical Nutrition, 66*, 611-615.

Matkovic, V., Fontana, D., Tominac, C., Goel, P., & Chestnut, C. H. (1990). Factors that influence peak bone mass formation: A study of calcium balance and the inheritance of bone mass in adolescent females. *American Journal of Clinical Nutrition, 52*, 878-888.

Mays, R. M., & Orr, D. P. (1996). *Psychosocial development.* New York: Chapman & Hall.

McKinley, M. C., Lowis, C., Robson, P. J., Wallace, J. M. W., Morrissey, M., Moran, A., et al. (2005). It's good to talk: Children's views on food and nutrition. *European Journal of Clinical Nutrition, 59*, 542-551.

McNulty, H., Eaton-Evans, J., Cran, G., Woulahan, G., Boreham, C., Savage, M. J., et al. (1996). Nutrient intakes and impact of fortified breakfast cereals in schoolchildren. *Archives of Disease in Childhood, 75*(6), 474-481.

Ministry of Health. (1998). *Food and nutrition guidelines for healthy adolescents - a background paper.* Wellington: Author.

Ministry of Health. (1999a). *Folate, folic acid and health.* Wellington: Author.

Ministry of Health. (1999b). *NZ food NZ people: Key results of the 1997 national nutrition survey.* Wellington: Author.

Ministry of Health. (2003). *NZ food NZ children: Key results of the 2002 national children's nutrition survey.* Wellington: Author.

Ministry of Health. (2004). *Tracking the obesity epidemic.* Wellington: Author.

Morgan, K. J., Zabik, M. E., & Leveille, G. A. (1981). The role of breakfast in nutrient intake of 5- to 12-year-old children. *The American Journal of Clinical Nutrition, 34*, 141-1427.

Morgan, K. J., Zabik, M. E., & Stampley, G. L. (1986a). Breakfast consumption patterns of US children and adolescents. *Nutrition Research, 6*, 635-646.

Morgan, K. J., Zabik, M. E., & Stampley, G. L. (1986b). The role of breakfast in diet adequacy of the US adult population. *Journal of the American College of Nutrition, 5*, 551-563.

Must, A. (1996). Morbidity and mortality associated with elevated body weight in children and adolescence. *American Journal of Clinical Nutrition, 63*, 445S-447S.

New Zealand Nutrition Foundation. (1993). *Break into breakfast.* Author.

Nicklas, T. A., Bao, W., Webber, L. S., & Berenson, G. S. (1993). Breakfast consumption affects adequacy of total daily intake in children. *Journal of the American Dietetic Association, 93*(8), 886-891.

Nicklas, T. A., Farris, R. P., Bao, W., Webber, L. S., & Berenson, G. S. (1997). Differences in reported dietary intake of 10-year-old children on weekdays compared to Sunday: The Bogalusa heart study. *Nutrition Research, 17*(1), 31-40.

Nicklas, T. A., Myers, L., & Berenson, G.S. (1995). Total nutrient intake and ready-to-eat cereal consumption of children and young adults in the Bogalusa heart study. *Nutrition Reviews, 53*(9), S39-S45.

Nicklas, T. A., O'Neil, C. E., & Berenson, G. S. (1998). Nutrient contribution of breakfast, secular trends, and the role of ready-to-eat cereals: A review of data from the Bogalusa heart study. *American Journal of Clinical Nutrition, 67(suppl)*, 757S-763S.

Nicklas, T. A., Reger, C., Myers, L., & O'Neil, C. (2000). Breakfast consumption with and without vitamin-mineral supplement use favourably impacts daily nutrient intake of ninth-grade students. *Journal of Adolescent Health, 27*, 314-321.

Nowark, M. (1998). The weight-conscious adolescent: Body image, food intake, and weight-related behaviour. *Journal of Adolescent Health, 26*(6), 389-398.

O'Dea, J. A., & Caputi, P. (2001). Association between socioeconomic status, weight, age and gender, and the body image and weight control practices of 6- to 10-year-old children and adolescents. *Health Education Research, 16*(5), 521-532.

Ohlson, M. A., & Hart, B. P. (1965). Influence of breakfast on total day's food intake: Studies with adolescent girls. *Journal of the American Dietetic Association, 47*, 282-286.

Ortega, R. M., Requejo, A. M., Redondo, R., Lopez-Sobaler, A. M., Andres, P., Ortega, A., et al. (1996). Breakfast habits of different groups of Spanish schoolchildren. *Journal of Human Nutrition and Dietetics, 9*, 33-41.

Ortega, R. M., Requejo, A.M., Lopez-Sobaler, A.M., Andres, P., Quintas, M.E., Navia, B., et al. (1998). The importance of breakfast in meeting daily recommended calcium intake in a group of schoolchildren. *Journal of the American College of Nutrition, 17*(1), 19-24.

Papamandjaris, A. (2000). *Breakfast and learning in children: A review of the effects of breakfast on scholastic performance.* Ontario: Breakfast for Learning Canadian Living Foundation.

Paulus, D., Saint-Remy, A., & Jeanjean, M. (2001). Dietary habits during adolescence - results of the Belgian Adolux study. *European Journal of Clinical Nutrition, 55*, 130-136.

Pollitt, E. (1995). Does breakfast make a difference in school? *Journal of the American Dietetic Association, 95*(10), 1134-1139.

Pollitt, E., Leibel, R. L., & Greenfield, D. (1981). Brief fasting, stress, and cognition in children. *American Journal of Clinical Nutrition, 34*, 1526-1533.

Post, B., Kemper, H.C.G., & Storm-Van Essen, L. (1987). Longitudinal changes in nutritional habits of teenagers: Differences in intake between schooldays and weekend days. *British Journal of Nutrition, 57*, 161-176.

Powell, C.A., Walter, S.P., Chang, S.M., & Grantham-McGregor, S.M. (1998). Nutrition and education: A randomised trial of the effects of breakfast in rural primary school children. *American Journal of Clinical Nutrition, 68*, 879-879.

Preziosi, P., Galan, O., Deheeger, M., Yacoub, N., Drewnowski, A., & Hercberg, S. (1999). Breakfast type, daily nutrient intakes and vitamin and mineral status of French children, adolescents and adults. *Journal of the American College of Nutrition, 18*(2), 171-178.

Rampersaud, G. C., Pereira, M. A., Girard, B. L., Adams, J., & Metzl, J. (2005). Breakfast habits, nutritional status, body weight, and academic performance in children and adolescents. *Journal of the American Dietetic Association, 105*, 743-760.

Reddan, J., Wahlstrom, K., & Reicks, M. (2002). Children's perceived benefits and barriers in relation to eating breakfast in schools with or without universal school breakfast. *Journal of Nutrition Education and Behaviour, 34*(1), 47-52.

Robinson, Y. (1993). *Assessment of school based breakfast programmes: Report of a study funded under the National Health Promotion Programme.* South Australia

Rockett, H. R. H., & Colditz, G. H. (1997). Assessing diets of children and adolescents. *American Journal of Clinical Nutrition, 65(suppl)*, S1116-S1122.

Ruxton, C. H. S., & Kirk, T. R. (1997). Breakfast: A review of associations with measures of dietary intake, physiology and biochemistry. *British Journal of Nutrition, 78*, 199-213.

Ruxton, C. H. S., O'Sullivan, K. R., Kirk, T. R., & Belton, N. R. (1996). The contribution of breakfast to the diets of a sample of 136 primary-schoolchildren in Edinburgh. *British Journal of Nutrition, 75*, 419-431.

Schlundt, D. G., Hill, J. O., Sbrocco, T., Pope-Cordle, J., & Sharp, T. (1992). The role of breakfast in the treatment of obesity: A randomized clinical trial. *American Journal of Clinical Nutrition, 55*, 645-651.

Shaw, M. E. (1998). Adolescent breakfast skipping: An Australian study. *Adolescence, 33*(132), 851-861.

Siega-Riz, A. M., Popkin, B. M., & Carson, T. (1998). Trends in breakfast consumption for children in the United States from 1965 to 1991. *American Journal of Clinical Nutrition, 67(suppl)*, 748S-756S.

Simeon, D. T., & Grantham-McGregor, S. (1989). Effects of missing breakfast on the cognitive functions of school children of differing nutritional status. *American Journal of Clinical Nutrition, 49*, 646-653.

Simons-Morton, B. G., & Baranowski, T. (1991). Observation in assessment of children's dietary practices. *Journal of School Health, 64*(5), 204-207.

Simons-Morton, B. G., Forthofer, R., Huang, I. W., Baranowski, T., Reed, D. B., & Fleishman, R. (1992). Reliability of direct observation of schoolchildren's consumption of bag lunches. *Journal of the American Dietetic Association, 92*(2), 219-221.

Sjoberg, A., Hallberg, L., Hoglund, D., & Hulthen, L. (2003). Meal pattern, food choice, nutrient intake and lifestyle factors in the Goteborg adolescence study. *European Journal of Clinical Nutrition, 57*, 1569-1578.

Spear, B. A. (1996). *Adolescent growth and development.* New York: Chapman & Hall.

Spear, B. A. (2002). Adolescent growth and development. *Journal of the American Dietetic Association, 102*, S23-S29.

Stanton, J.L., & Keast, D.R. (1989). Serum cholesterol, fat intake and breakfast consumption in the United States adult population. *Journal of the American College of Nutrition, 8*, 1-6.

St-Onge, M. P., Keller, K. L., & Heymsfield, S. B. (2003). Changes in childhood food consumption patterns: A cause for concern in light of increasing body weights. *American Journal of Clinical Nutrition, 78*, 1068-1073.

Story, M., & Resnick, M. D. (1986). Adolescents' views on food and nutrition. *Journal of Nutrition Education, 18*(4), 188-192.

Subar, A. F., Krebs-Smith, S. M., Cook, A., & Kahle, L. (1998). Dietary sources of nutrients among US children 1989-91. *Pediactrics, 102*(4), 913-923.

Tanner, J. M. (1981). Growth and maturation during adolescence. *Nutrition Reviews, 39*(2), 43-55.

Taylor, R.W., Jones, I.E., Williams, S.M., & Goulding, A. (2000). Evaluation of waist circumference, waist-to-hip ratio, and the conicity index as screening tools for high trunk fat mass, as measured by dual-energy X-ray absorptiometry, in children aged 3-19 years. *American Journal of Clinical Nutrition, 72*, 490-495.

Todd, J., Currie, C., & Smith, R. (2000). *Health behaviours of Scottish schoolchildren: Technical report 3: Eating patterns and physical activity in the 1990s.* Edinburgh: RUHBC and HEBS.

University of East Anglia. (2002). *A national evaluation of school breakfast clubs*: University of East Anglia. School of Social Work and Psychosocial Studies.

Videon, T. M., & Manning, C. K. (2003). Influences on adolescent eating patterns:The importance of family meals. *Journal of Adolescent Health, 32*, 365-373.

Walker, A. R. P., Walker, B. F., Jones, J., & Ncongwane, J. (1982). Breakfast habits of adolescents in four South African populations. *The American Journal of Clinical Nutrition, 36*, 650-656.

Watson, P., Rush, E., Wall, C., O'Brian, M., McDonald, B., Stewart, E., et al. (2001). *Development and pretesting of methodologies for the children's nutrition survey*: Validation report 3. Uniservices Pilot CNS report to the Ministry of Health.

Webber, L. S., Srinivasan, S. R., Wattingey, W. A., & Berenson, G. S. (1991). Tracking of serum lipids and lipoproteins from childhood to adulthood: The Bogalusa heart study. *American Journal of Epidemiology, 133*, 884-899.

Webster, K. (1995). Breakfast cereals. *Nutrition and Food Science, 95*(5), 35-41.

Whitaker, R. C., Wright, J. A., Pepe, M. S., Seidel, K. D., & Dietz, W. H. (1997). Predicting obesity in young adulthood from childhood and parental obesity. *New England Journal of Medicine, 337*, 869-873.

Whitney, E. N., & Rolfes, S. R. (2002). *Life cycle nutrition: Infancy, childhood, and adolescence. In: Understanding nutrition* (Ninth ed.). Belmont, CA: Wadsworth.

World Health Organization. (1999). *Programming for adolescent health and development.* Report of a WHO/UNFPA/UNICEF Study Group on Programming for Adolescent Health. Geneva: Author.

World Health Organization. (2000). *Obesity: Preventing and managing the global epidemic.* Geneva: Author.

Wyon, D. P., Abrahamsson, L., Jartelius, M., & Fletcher, R. J. (1997). An experimental study of the effects of energy intake at breakfast on the test performance of 10 year old children in school. *International Journal of Food Science and Nutrition, 48*, 5-12.

Appendix A: Letter of ethical approval

Massey University
AUCKLAND

OFFICE OF THE
DEPUTY VICE-CHANCELLOR - AUCKLAND
Private Bag 102 904
North Shore MSC
Auckland
New Zealand
T Deputy Vice-Chancellor - Auckland
64 9 414 0800 extn 9517
Regional Registrar - Auckland
64 9 414 0800 extn 9516
F 64 9 414 0814
www.massey.ac.nz

22 July 2004

Claire Svendsen
C/- Dr Pauline Ashfield-Watt
College of Science
Massey University
Albany

Dear Claire

HUMAN ETHICS APPROVAL APPLICATION – [redacted]
"An investigation into the Dietary intake, Eating Patterns and Behaviours in regards to Breakfast Consumption in Year 8 New Zealand children"

Thank you for your application. It has been fully considered and approved by the Massey University, Albany Campus, Human Ethics Committee.

If you make any significant departure from the Application as approved then you should return this project to the Human Ethics Committee, Albany Campus, for further consideration and approval.

Approval is for three years. If this project has not been completed within three years from the date of this letter, a new application must be submitted at that time.

Yours sincerely

Associate-Professor Kerry Chamberlain
Chairperson,
Human Ethics Committee
Albany Campus

cc. Dr Pauline Ashfield-Watt
College of Science

Appendix B: Information sheets

- Parent/caregiver information sheet
- Student information sheet

Massey University

Dietary Patterns and Eating Behaviour Study

PARENTAL (GUARDIAN) INFORMATION SHEET

Who is doing this research?

My name is Claire Svendsen and I am a student at Massey University's Albany campus. I am conducting this research as part of my Master of Science degree from the Institute of Food, Nutrition and Human Health, under the supervision of Dr Pauline Ashfield-Watt.

About the project

The results of the recent national children's nutritional survey found that the nutritional status of the youngest children in the study (5-6 years of age) were better than that of the older children (11-14 years of age). This finding could be attributed to the fact that older children have more control over their eating habits and more access to food outside of the home.

The aim of this project is to gain a profile of the dietary patterns and intakes, eating behaviours and the day-to-day activities of intermediate school aged children. There will also be a focus on breakfast consumption, attitudes towards eating breakfast and consequent nutrient intake.

The Board of Trustees and teachers at your child's school have agreed to take part in this study. This information sheet has been sent home with your child to obtain your approval for your child to participate. Please sign the green consent form attached. Your child has also been provided with an information sheet and a yellow consent form to sign.

What will your child have to do?

PART A: QUESTIONNAIRE (All pupils)

Your child will be asked to complete a questionnaire about the kinds of foods he/she eats and when and why they eat these foods. They will also be asked questions regarding their activity during the day, and they can have their height and weight measured. The questionnaire will be filled out during school and I will be present to introduce the study and to help answer any questions that the children may have. If you and/or your child do not consent to take part in this project, your child will have the option of completing the questionnaire as part of a classroom activity; however his/her questionnaire will not be collected in and his/her answers will not be used as part of this project.

PART B: "TELL ME WHAT YOU ATE YESTERDAY" – Food Records (Pupils who volunteer)

Some children will be chosen at random to provide more detailed information about what they eat over the course of the day. Two short interviews (approximately 30 minutes for each interview) will be carried out at school during the term, to provide information on the children's usual dietary patterns. During the first interview, the female pupils will be asked a couple of questions regarding their menstrual status to give us some idea of their developmental stage. Also, a food diary sheet will be given to the children to take home and

record information about the foods they eat on a single weekend day (Saturday).

What do parents/caregivers have to do?

We need your consent to collect questionnaires and dietary information from your child. A consent form is attached; please sign and return the form to your child's teacher as soon as possible.

Who is taking part in this project?

All Year 8 pupils attending selected Auckland schools are being invited to take part in this project.

Why do we need your help?

This study will collect data on the dietary habits and factors that influence food choices of intermediate school children. This information may be used as a basis for dietary strategies and nutrition education programmes to improve certain aspects of the nutritional status of New Zealand children.

Does my child have to participate?

The participation of your child is entirely voluntary. You are under no obligation to accept this invitation. If you decide that your child can participate, he/she has the right to:

- decline to answer any particular question;
- withdraw from the study up until one week following completion of the questionnaire and up until the final food record session has been completed;
- ask any questions about the study at any time during participation;
- provide information on the understanding that his/her name will not be used in any publication of this study;
- be given access to a summary of the project findings when it is concluded.

Results of the project

The results of the project will be made available to each school that takes part. These results will be for the school as a whole. Analyses will not be reported on an individual basis. No information that could identify your child will be used in any report of this project. Children who take part in Part B will receive a short summary of their nutrient intakes.

Ethics Committee Approval This project has been reviewed and approved by the Massey University Human Ethics Committee, ALB Application 04/040. If you have any concerns about the conduct of this research, please contact Associate Professor Kerry Chamberlain, Chair, Massey University Campus Human Ethics Committee: Albany, telephone: 09 4140800 x9078, email: humanethicsalb@massey.ac.nz.

Researcher's contact details:

Claire Svendsen

(Phone)[redacted]

[redacted]

Dr Pauline Ashfield-Watt

[redacted]

Massey University

Dietary Patterns and Eating Behaviour Study

PUPIL INFORMATION SHEET

Who is doing this research?

My name is Claire Svendsen and I am a student at Massey University's Albany campus. I am conducting this research as part of my Master of Science degree from the Institute of Food, Nutrition and Human Health, under the supervision of Dr Pauline Ashfield-Watt.

About the project

The aim of this project is to find out the dietary patterns, food intakes, eating behaviours and the day-to-day activities of an intermediate school aged population.

The Board of Trustees and teachers at your school have agreed to take part in this project.

What will you have to do?

For this project we need you to tell us about the foods you usually eat and the sorts of activities you do during the day. There are two parts to the study, Part A and Part B;

PART A: QUESTIONNAIRE (All pupils)

For Part A, all Year 8 pupils at your school will be invited to fill out a questionnaire about the kinds of foods you eat and about when and why you eat these foods. There will be questions on the sorts of activities that you take part in and you can have your height and weight measured. The questionnaire will be filled out during class and I will also be there to help answer any questions that you may have.

PART B: "TELL ME WHAT YOU ATE YESTERDAY" – Food Records (Pupils who volunteer)

Out of the pupils who have volunteered to take part in Part B, a small group will be randomly chosen to provide more detailed information about what you eat over the course of the day. Part B involves telling me about all of the foods that you've eaten over the last 24 hours. These short sessions will take place on two separate school days and will last about 30 minutes each. You will also be given a food record sheet to take home and write down what you eat on a weekend day (Saturday).

During the first interview, the girls who take part in Part B will be asked a couple of questions regarding their menstrual status. Girls will not have to answer these questions if they don't want.

Who is taking part in this project?

All Year 8 pupils attending selected Auckland schools are being invited to take part in this project.

Why do we need your help?

This study will collect information on the dietary habits and factors that influence food choices of intermediate school children. This information may be used as a basis for dietary strategies and nutrition education programmes to improve certain aspects of the nutritional status of New Zealand children.

Do I have to take part?

Participating in this project is entirely voluntary. You are under no obligation to accept this invitation. If you decide to participate, you have the right to:

- decline to answer any particular question;
- withdraw from the study up until one week following completion of the questionnaire and up until the final food record session has been completed;
- ask any questions about the study at any time during participation;
- provide information on the understanding that your name will not be used in any publication of this study;
- be given access to a summary of the project findings when it is concluded.

Info Sheets & Consent Forms

To participate in this project you will need to read this information sheet and sign the yellow consent form handed out to you in class. Also, your parents/caregivers will need to read the information sheet that you have been given to take home to them, and also sign the green consent form. Please return both consent forms to your teacher as soon as possible.

If you and/or your parents/caregivers do not consent for you to take part in this project you can still fill out the questionnaire as part of the classroom activity, however I will not collect the questionnaire from you so that your answers will not be used as part of this project.

Your teacher will be able to help with any questions that you have.

Results of the project

The results of the project will be made available to each school that takes part. These results will be for the school as a whole. Analyses will not be reported on an individual basis. No information that could identify you will be used in any report of this project. Pupils who take part in Part B will receive a short summary of their nutrient intakes.

Ethics Committee Approval

This project has been reviewed and approved by the Massey University Human Ethics Committee, ALB Application 04/040. If you have any concerns about the conduct of this research, please contact Associate Professor Kerry Chamberlain, Chair, Massey University Campus Human Ethics Committee: Albany, telephone: 09 4140800 x9078, email humanethicsalb@massey.ac.nz.

Researcher's contact details:

Claire Svendsen

[redacted]

Dr Pauline Ashfield-Watt

[redacted]

Appendix C: Consent forms

- Parent/caregiver consent form
- Student consent form

Massey University

INSTITUTE OF FOOD,

AND HUMAN HEALTH
Private Bag 102 904
North Shore Mail Centre
Auckland
New Zealand
[redacted]

Dietary Patterns and Eating Behaviour Study
PARENTAL (GUARDIAN) CONSENT FORM

This consent from will be held for a period of five (5) years

I have read and understood the Information Sheet for children taking part in the study of dietary patterns and eating behaviour of Year 8 school pupils in the Auckland area.

I understand that taking part in this study is voluntary and that I/my child may withdraw from the study up until one week after completion of the questionnaire and up until the final food record session has been completed. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I understand that my/my child's participation in this study is confidential and that no material which could identify me or my child, or my child's school will be used in any reports of this study.

I have had time to consider whether to take part. I have been given appropriate contact details to obtain further information and to discuss the study.

CONSENT

You have three options regarding consent for you child (or child under your guardianship) to take part in this study:

- Consent to PART A – QUESTIONNAIRE only
- Consent to PART A – QUESTIONNAIRE and PART B – FOOD RECORDS
- Neither PART A nor PART B (do not want to take part at all)

There is a box for each option below. Please read and sign in one of the boxes below to indicate which option you consent to. ***(Please sign in one box only)***

CHILD'S NAME: _____ **ROOM:** _____

PART A ONLY

I _____

_____

(Full name, printed) hereby consent to my child (or child under my guardianship) taking part in this study.

Signature:

_____

Date: _____

PARTS A & B

I _____

_____

(Full name, printed) hereby consent to my child (or child under my guardianship) taking part in this study.

Signature:

_____

Date: _____

DO NOT WANT TO TAKE PART AT ALL

I _____

_____

(Full name, printed) hereby do not consent to my child (or child under my guardianship) taking part in this study.

Signature:

_____

Date: _____

Massey University

INSTITUTE OF FOOD,

AND HUMAN HEALTH
Private Bag 102 904
North Shore Mail Centre
Auckland
New Zealand
[redacted]

Dietary Patterns and Eating Behaviour Study
PUPIL CONSENT FORM

This consent from will be held for a period of five (5) years

I have read and understood the Information Sheet for children taking part in the study of dietary patterns and eating behaviour of Year 8 school pupils in the Auckland area.

I understand that taking part in this study is voluntary and that I may withdraw from the study up until one week after completion of the questionnaire and up until the final food record session has been completed. My questions have been answered to my satisfaction, and I understand that I may ask further questions at any time.

I understand that my participation in this study is confidential and that no material which could identify me or my school will be used in any reports of this study.

I have had time to consider whether to take part. I have been given appropriate contact details to obtain further information and to discuss the study.

CONSENT

You have three options when deciding to consent to take part in this study:

- Consent to PART A – QUESTIONNAIRE only
- Consent to PART A – QUESTIONNAIRE and PART B – FOOD RECORDS
- Neither PART A nor PART B (do not want to take part at all)

There is a box for each option below. Please read and sign in one of the boxes below to indicate which option you consent to. ***(Please sign in one box only)***

NAME: _____ **ROOM:** _____

PART A ONLY	PARTS A & B	DO NOT WANT TO TAKE PART AT ALL
I _____ _____ (Full name, printed) hereby consent to take part in this study. **Signature:** _____ **Date:** _____	I _____ _____ (Full name, printed) hereby consent to take part in this study. **Signature:** _____ **Date:** _____	I _____ _____ (Full name, printed) hereby do not consent to take part in this study. **Signature:** _____ **Date:** _____

Appendix D: Letter to the school Principal

Massey University

Institute of Food, Nutrition and Human Health
Massey University
Albany

Mr.
Address

Date

Dear Mr,

I am student at Massey University, Albany campus and I am carrying out a research project as part requirement for my Master of Science Degree within the Institute of Food, Nutrition and Human Health. I have a background in sport science, and an interest in children's nutrition, health and wellbeing.

I am writing to request the participation of the Year 8 pupils attending _____ in a study into the dietary patterns and eating behaviour of children in this age group. Pupils attending selected Auckland intermediate schools are being invited to take part in this project.

The recent child nutrition survey, 'New Zealand Food New Zealand Children', suggests poor intakes of certain nutrients by intermediate school aged children compared to children in younger age groups. This finding may be attributed to breakfast eating habits, as older children are less likely than other age groups to have breakfast.

The aim of my project is to gain a profile of the dietary patterns and intake, eating behaviours and the day-to-day activities of intermediate school children. Therefore, this study will focus on investigating breakfast consumption, attitudes towards eating breakfast and consequent nutrient intakes. I have selected your school for this study because of the ethnic and economic diversity of your pupils. I would be most grateful for your permission to include pupils attending your school in this study. To participate, the pupils will be required to complete a questionnaire in class, and to have their weight and height measured. A subset of pupils will then be randomly chosen to take part in two short interviews and to record their food intake over a weekend day, to provide more detailed information on their usual dietary patterns.

Data from this study will be used to characterise intermediate school aged children in terms of their breakfast eating habits and their nutrient intakes and to determine the factors associated with breakfast consumption. This information will be used as a basis for determining breakfast interventions designed to improve dietary and nutrient intakes in children of this age.

This project has received ethical approval from Massey University's Human Ethics Committee and will be supervised by Dr Pauline Ashfield-Watt. I have attached a copy of the Information Sheets and Consent Forms, as well as a copy of the questionnaire.

I will be in contact with you in the next few days to discuss this project further. If you have any questions please do not hesitate to contact either:

Claire Svendsen (researcher)
[redacted]

Dr Pauline Ashfield-Watt (supervisor)
[redacted]

The participation of your school in this project would be most appreciated.

Yours sincerely

Claire Svendsen

Appendix E: Letter to the Board of Trustees

Massey University

Institute of Food, Nutrition and Human Health
Massey University
Albany

Mr.
Address

Date

Dear,

I am student at Massey University, Albany campus and I am carrying out a research project as part requirement for my Master of Science Degree within the Institute of Food, Nutrition and Human Health. I have a background in sport science, and an interest in children's nutrition, health and wellbeing.

I am writing to request the participation of the Year 8 pupils attending _____, in a study into the dietary patterns and eating behaviour of children in this age group. Pupils attending selected Auckland intermediate schools are being invited to take part in this project.

The recent child nutrition survey, 'New Zealand Food New Zealand Children', suggests poor intakes of certain nutrients by intermediate school aged children compared to children in younger age groups. This finding may be attributed to breakfast eating habits, as older children are less likely than other age groups to have breakfast.

The aim of my project is to gain a profile of the dietary patterns and intake, eating behaviours and the day-to-day activities of intermediate school children. Therefore, this study will focus on investigating breakfast consumption, attitudes towards eating breakfast and consequent nutrient intakes. I have selected your school for this study because of the ethnic and economic diversity of your pupils. I would be most grateful for your permission to include pupils attending your school in this study. To participate, the pupils will be required to complete a questionnaire in class, and to have their weight and height measured. A subset of pupils will then be randomly chosen to

Data from this study will be used to characterise intermediate school aged children in terms of their breakfast eating habits and their nutrient intakes and to determine the factors associated with breakfast consumption. This information will be used as a basis for determining breakfast interventions designed to improve dietary and nutrient intakes in children of this age.

This project has received ethical approval from Massey University's Human Ethics Committee and will be supervised by Dr Pauline Ashfield-Watt. I have attached a copy of the Information Sheets and Consent Forms, as well as a copy of the questionnaire.

I have also written to Mr. _____, the school principal, and will contact him to discuss this project further. If you have any questions please do not hesitate to contact either:

Claire Svendsen (researcher)
[redacted]

Dr Pauline Ashfield-Watt (supervisor)
[redacted]

The participation of your school in this project would be most appreciated.

Yours sincerely

Claire Svendsen

Appendix F: Questionnaire

Massey University

Dietary Patterns and Eating Behaviour Study

Name: _____

School: _____

Age: _____

Male Female *(Please circle)*

Year Level: _____ Room Number: _____

Today's Date: _____ Morning Afternoon

BREAKFAST

1. What time did you get up **yesterday** morning? *(Please circle)*
   - **a.** 5:30 – 6:30 AM
   - **b.** 6:30 – 7:30 AM
   - **c.** 7:30 – 8.30 AM

2. Did you have anything to eat or drink for breakfast **yesterday** morning? *(Please circle)*

   Yes No

If yes, please list in the box below all the food and/or drink you had for breakfast yesterday morning.

Food:	Drink:

3. How often do you usually eat breakfast?
(Please circle the appropriate answer)

Every morning	5 or 6 times a week	3 or 4 times a week	1 or 2 times a week	I only have breakfast on the weekends	Rarely or never

4. If you **do not** have breakfast every morning, why do you skip breakfast?
(Please circle the letter/s that apply to you)

a. I don't like breakfast
b. I'm not hungry in the mornings
c. I like to sleep-in, so I don't have time for breakfast
d. I have sports practice before school and don't have time for breakfast/or don't feel like breakfast
e. There is nothing to eat at home
f. I skip breakfast because I work before school (e.g. paper round) and don't have time
g. I skip breakfast because I am trying to loose weight
h. No one in my family has breakfast
i. I skip breakfast because there is no one to make it for me
j. Other *(please list)*_____

5. Why do you think it is important to eat breakfast?
(Please circle the letter/s that apply to you)

a. Breakfast gives you energy
b. Helps you concentrate and do well at school
c. Stops you from being hungry
d. Breakfast is good for you
e. Breakfast gives you energy for sports

6. When you do have breakfast who **usually** makes it for you? *(Please circle)*

I do	Mother	Father
Step-parent	Grandparent	Aunty/Uncle
Brother/Sister	Other _____	

7. Do you **usually** make breakfast for anyone else other than yourself? *(Please circle)*

No

Yes (*please list who)* _____

8. If you **had breakfast yesterday** did you eat alone or with someone else? *(Please circle)*

Alone

Others (*please list who)* _____

9. If you **did not have breakfast** yesterday, when did you have your first meal of the day? *(Please circle the appropriate answer)*

On the way to school	At morning break	At lunch	After school	In the evening

ON YOUR WAY TO SCHOOL

10. How did you get to school **yesterday**? *(Please circle the appropriate answer)*

Bus Car

Walked Bicycle

Other _____

11. Do you **usually** get to school this way?

Yes ***If yes please go to question 13***

No

12. If you have answered **no**, how do you **usually** get to school?

Bus Car

Walk Bicycle

Other _____

13. Did you have anything to eat or drink on your way to school **yesterday**?

Yes No

If yes, please list in the box below all the food and/or drink you had on your way to school yesterday.

Food:	Drink:

14. Do you **usually** eat or drink anything on your way to school?
(Please circle the appropriate answer)

Yes, every morning	3 or 4 times a week	1 or 2 times a week	Rarely or never

AT SCHOOL

15. What time did you get to school **yesterday**?

Time _____ AM / PM

16. Do you **usually** feel hungry in the mornings when you arrive at school?
(Please circle the appropriate answer)

Yes, usually	Yes, sometimes	Only when I skip breakfast	Rarely or never

17. Did you have anything to eat or drink during morning break **yesterday**?
(Please circle)

Yes No

If yes, please list in the box below all the food and/or drink you had during morning break yesterday.

Food:	Drink:

18. Do you **usually** eat or drink anything during morning break?
(Please circle the appropriate answer)

Yes, every morning	3 or 4 times a week	1 or 2 times a week	Rarely or never

19. What did you do during morning break **yesterday**?

_____

_____

_____

LUNCH AT SCHOOL

20. Did you have anything to eat or drink at lunchtime **yesterday**?
(Please circle)

Yes No

If yes, please list in the box below all the food and/or drink you had for lunch yesterday.

Food: Drink:

Lunch from home / Bought lunch

21. Do you **usually** eat or drink anything at lunchtime?
(Please circle the appropriate answer)

Yes, every day	3 or 4 times a week	1 or 2 times a week	Rarely or never

22. What did you do during lunchtime **yesterday**?

23. Is the food and/or drink you have while you are <u>at school</u> brought from **home**?
(Please circle the appropriate answer)

Yes, every day	3 or 4 times a week	1 or 2 times a week	Rarely or never

24. How often do you buy the food and/or drink you eat <u>at school</u> from the **school cafeteria or tuckshop**? *(Please circle the appropriate answer)*

Every day	3 or 4 times a week	1 or 2 times a week	Rarely or never

25. When you buy food and/or drink from the **school cafeteria or tuckshop** how much do you **usually** spend?

$ _____

26. How often do you buy food and/or drink from a **shop, dairy or takeaway**?
(Please circle the appropriate answer)

Every day	5 or 6 times a week	3 or 4 times a week	1 or 2 times a week	Only during the weekends	Rarely or never

27. If you buy food and/or drink from a **shop, dairy or takeaway** how much do you **usually** spend?

$ _____

AFTER SCHOOL

28. How did you get home from school **yesterday**?
(Please circle the appropriate answer)

Bus	Car
Walked	Bicycle
Other _____	

29. Do you **usually** get home from school this way?

Yes ***If yes please go to question 31***

No

30. If you have answered **no**, how do you **usually** get home from school?

Bus	Car
Walk	Bicycle
Other _____	

31. Did you have anything to eat or drink after school, before your evening meal **yesterday**? *(Please circle)*

Yes No

If yes, please list in the box below all the food and/or drink you had after school, before your evening meal yesterday.

Food:	Drink:

32. Do you **usually** eat or drink anything after school, before your evening meal? *(please circle the appropriate answer)*

Yes, every day	3 or 4 times a week	1 or 2 times a week	Rarely or never

33. What did you do after school **yesterday**?

_____

_____

_____

34. What activities do you **usually** do **after school**?
(Please circle the letter/s that apply to you)

a. Play outside

b. Ride bike/skateboard/scooter

c. Watch T.V/movies

d. Homework

e. Clubs (e.g. Girls Guides, Scouts)

f. Visit/play with friends and family

g. Play video games (e.g. Playstation)

h. Read/draw

i. Dance/cultural group/drama/music lessons

j. Paper round/chores

k. Use the computer/Internet

l. Sport practice/sports games *(please list)*

_____

_____

_____

m. Other *(please list)*

_____

EVENING

35. Did you have anything to eat or drink for your evening meal **yesterday**?
(Please circle)

Yes No

If yes, please list in the box below all the food and/or drink you had for your evening meal yesterday.

Food:	Dessert:
Drink:	

36. Do you **usually** have anything to eat or drink for your evening meal?
(Please circle the appropriate answer)

Yes, every day	5 or 6 times a week	3 or 4 times a week	1 or 2 times a week	Rarely or never

37. What did you do after your evening meal **yesterday**?

38. Did you have anything to eat or drink after your evening meal and before you went to bed **yesterday**? *(Please circle)*

Yes No

If yes, please list in the box below all the food and/or drink you had after your evening meal and before your went to bed yesterday.

Food:	Drink:

39. Do you **usually** have anything to eat or drink after your evening meal and before you go to bed? *(Please circle the appropriate answer)*

Yes, every day	5 or 6 times a week	3 or 4 times a week	1 or 2 times a week	Rarely or never

WEEKEND ACTIVITIES

40. What activities do you **usually** do in the **weekends**?
(Please circle the letter/s that apply to you)

a. Play outside
b. Ride bike/skateboard
c. Watch T.V/movies/play video games
d. Go shopping
e. Visit/play with friends and family
f. Read/draw
g. Use the computer/Internet
h. Church
i. Sport practice/sports games *(please list)* _____
j. Other *(please list)*

_____

FOOD CHOICE

41. If you were given a choice, what **types of foods** would you like to have for **breakfast on most days of the week**? *(Please circle the appropriate letter/s)*

a. Cereal
b. Milk
c. Bread/toast
d. Bakery foods
e. Hot foods
f. Fruit
g. Drinks

42. If you would like to have cereal for breakfast, **which type/s** would you choose from the list below? (Please circle the appropriate letter/s)

***Cereals* for breakfast**

a. Weet-Bix
b. Cornflakes
c. Rice Bubbles
d. Coco-Pops
e. Muesli
f. Honey Puffs
g. Nutrigrain
h. Porridge
i. Rice dish (e.g. congee)

j. Other *(please list)* _____

43. If you would like to have **milk for breakfast** either on your cereal or as a drink, which type/s would you choose from the list below?

Milk for breakfast

a. Blue top milk
b. Light blue top milk
c. Trim (green top) milk
d. Calci-kids milk
e. Mega milk
f. Flavoured milk
g. Soy milk
h. Low-fat soy milk

44. If you would like to have **breads/toast for breakfast,** which type/s would you choose from the list below?

***Breads* for breakfast**

a. White bread
b. Brown bread
c. Multi-grain bread
d. Wholemeal bread (Vogels)
e. Muffin Splits
f. Crumpets

g. Other *(please list)* .....

45. If you would like to have **bakery foods for breakfast**, which type/s would you choose from the list below?

***Bakery Foods* for breakfast**

a. Cakes
b. Biscuits/cookies
c. Donuts
d. Muffins

e. Other *(please list)* .....

46. If you would like to have **hot foods for breakfast**, which type/s would you choose from the list below?

***Hot Foods* for breakfast**

a. Pies
b. Left over dinner
c. Spaghetti/baked beans
d. Pancakes/pikelets
e. Eggs
f. Noodles

g. Other *(please list)* .....

47. If you would like to have **fruit for breakfast**, which type/s would you choose from the list below?

***Fruit* for breakfast**

a. Bananas
b. Apples
c. Oranges
d. Mandarins
e. Peaches
f. Nectarines
g. Apricots
h. Pears
i. Plums
j. Berries
k. Melon
l. Feijoas

m. Other *(please list)* _____

48. If you would like to have a type of **drink for breakfast**, which would you choose from the list below?

Drinks for breakfast

a. **Water**
b. Milk
c. Juice/cordial
d. Energy drinks (e.g. V)
e. Milo
f. Tea/coffee
g. Fizzy drink
h. Flavoured milk (e.g. Primo)
i. Up & Go

j. Other *(please list)* _____

VITAMIN AND MINERAL SUPPLEMENTS

49. Do you ever take a vitamin or mineral supplement? *(Please circle)*

Yes No ***if no please go to question 53 on next page***

50. If **yes**, what supplement/s do you take?
(Please circle the letter/s that apply to you)

a. Vitamin C tablets
b. Iron tablets
c. Vitamin B tablets
d. Multi-vitamin tablets
e. Zinc tablets
f. Multi-Vitamins combined with iron
g. Echinacea or garlic tablets
h. Don't know
i. Other *(please list)*

_____

51. If you ever take vitamin or mineral supplements **how often** do you take them?
(Please circle the appropriate answer)

Twice a day	Once a day	3 or 4 days a week	1 or 2 days a week	Rarely or only when I remember

52. Why do you take vitamin or mineral supplements?
(Please circle the letter/s that apply to you)

a. A family member told me to
b. The doctor said that I have to take them
c. Because my friends take them
d. They make me healthy
e. They make me feel good and give me energy

ALLERGIES AND SPECIAL DIETS

53. Are you allergic to any foods? (e.g. dairy products, eggs, peanuts)

Yes *(please list)* _____

No Don't know

54. Do you eat meat? *(Please circle)*

Yes No Only chicken and/or fish

FOOD INFLUENCES

55. What **influences** you to have the types of foods/drinks that you eat?
(Please circle the letter/s that apply to you)

a. Friends
b. Promotions (e.g. free gifts)
c. T.V adverts
d. Low in fat or calories
e. Packets and labels of the food/drink
f. How they taste
g. Price
h. Family – I have whatever is at home or the rest of the family is having
i. Other *(please list)*

_____

---

56. Which **ethnic group/s** do you associate yourself? (*Please circle)*

a. Asian
b. European
c. New Zealand European/Pakeha
d. New Zealand Maori
e. Pacific Island
f. Other *(please specify)* _____

THE END, THANK YOU FOR YOUR TIME

Appendix G: Weekday 24-hour recall record sheet

Massey University

Dietary Patterns and Eating Behaviour Study

Weekday 1

Subject Name: _____

Subject Code Number: _____

School: _____ Room: _____

Date of Interview: _____

Time of Interview: _____

24 Hour Dietary Recall #1

Page Number of Diet:____

Subject Code Number: _____ Date: ___/___/___

Meal Type	Time	Food and beverage name, brand, description, preparation i.e. boiling, frying, microwave etc, and recipe if necessary.	Amount or volume consumed

Appendix H: Weekend record sheet and instructions

Massey University

Dietary Patterns and Eating Behaviour Study

Food Record: - Saturday

Name: _____

School: _____ Room: _____

Diary Date: _____

- Please record **ALL** food and drink consumed during the day
- Please record all foods/meals at the time of eating and not from memory at the end of the day.
- You should include all meals and snacks, plus sweets, drinks (including water) etc, you have from the time you wake up on Saturday till the time you go to bed.
- Remember to include any additions to foods already recorded such as: sauces, dressings or extras e.g. gravy, salad dressings, sugar, honey, syrups etc., butter or margarine (e.g. added to bread, crackers, vegetables).
- If you do not eat a particular meal or snack, please draw a line across the page at this point. This will show that you definitely have not eaten anything at this meal time.

INSTRUCTIONS FOR FILLING OUT THE FOOD RECORD SHEET

DESCRIBING FOOD AND DRINK - GUIDELINES

1. Please give details of the method of cooking all foods (e.g., fried, grilled, boiled, roasted, steamed, poached, stewed).

2. Give as many details as possible about the type of food that you eat e.g., brand name of food where applicable (e.g., Watties tomato sauce);
   Type of: Breakfast cereal (e.g., Weet-Bix)
   Milk (e.g., whole milk or trim milk)
   Cake or biscuit (e.g., fruit cake, chocolate chip biscuit)
   Fruit (e.g., fresh, canned, dried, stewed)
   Soft drink (e.g., regular or diet)

3. Name the type of cheese, fish or meat (e.g., cheddar, snapper, lamb chop).

RECORDING THE AMOUNTS OF FOODS THAT YOU EAT

It is very important that you record the quantity of each food and drink you consume.

Here are some suggestions on how to record amounts:

- IN HOUSEHOLD MEASUREMENTS
  For many foods such as vegetables, cereals and canned fruits, a household measurement is adequate.

  E.g., State the number of teaspoons (tsp), tablespoons (T), cups etc. State whether spoons are level, rounded or heaped. Butter and margarine and other spreads can be measured in teaspoons or tablespoons if you find this an easy method.

- WEIGHTS MARKED ON PACKAGES
  All convenience foods have their weight marked on the package and this can be quoted e.g. half a 425 g can of baked beans.

- BREAD – indicate the size of the slices (e.g. sandwich, medium, toast).

- CHEESE, MEAT AND FISH
  If possible, it would be helpful to weigh your portions of these foods if you have household scales, but this is not essential.

- USE COMPARISONS for describing portion sizes where this is easier e.g., potato – size of hen's egg, cheese – size of matchbox, chicken breast – child's palm size.

Food Record - Example

Meal/ Snack Type and Time	Quantity Eaten	Details of Food and Drink Food and beverage name, brand, description, preparation i.e. boiling, frying, microwave etc, and recipe if necessary.
Early Morning (7:30am)	1 glass	Water
Breakfast (8:30am)	2x ½ cup 1 tsp	Weet-Bix - light blue milk (on Weet-Bix) sugar (on Weet-Bix
Morning Tea (10:00am)	1 glass 1 small	Fruit juice (Just Juice – Orange and Mango) Apple
Lunch (12:30am)	1x 1x small packet 2x 1 glass	Sandwich - 2x slices of white sandwich bread - 1x slice of cheddar cheese - 1x tsp margarine - 1x tsp Vegemite Raisins Chocolate chip cookies (Griffins) Fruit juice (Just Juice – Orange and Mango)

Appendix I: Menstrual status assessment form

Massey University

Name: _____

Age: _____

School: _____ **Room:** _____

1. Have you had your first period yet? *(Please circle)*

   Yes No Not sure

2. If you answered **yes**, how old were you when you had your first period?

   _____ Years old

Appendix J: Food models and photograph book