The role of “snacks” in the diets of 5-year old children in Dunedin, New Zealand

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Abstract

Children have high energy requirements for growth and activity so they may not be able to meet their nutritional requirements through main meals alone due to their small stomach capacity. Hence, children rely on snacks to meet their nutritional needs. However, little is known about the snack consumption of New Zealand children. The aim of this project was to determine the nutrient and food group intakes from snacks of a sample of 5-year-old children living in Dunedin, New Zealand, and the extent to which snacks help them meet the Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2 to 18 years) (1).

A weighed diet record was collected on three non-consecutive days over a month in a sample of 44 children aged 5-6 years living in Dunedin, New Zealand. The diet records were analysed using the Department of Human Nutrition’s web-based dietary analysis program, Kai-culator. Snacks were defined as food and drink items consumed between main meals, with main meals defined as the highest energy eating occasions within specified time periods. Frequency of snacking was determined, and the nutrient intakes from snacks on each snacking occasion were identified. The contribution of snacks to meeting the four major food groups listed in the first Food and Nutrition Guideline for Healthy Children and Young People (Aged 2 to 18 years): 1) ‘vegetables and fruit’, 2) ‘breads and cereals’, 3) ‘milk and milk products or suitable alternatives’, and 4) ‘lean meat, poultry, fish, shellfish, eggs, legumes, nuts and seeds’ was also determined.
On average, children were consuming 5.0 snacks per day, and this did not vary by sex, weight status, or socio-economic status. Snacks accounted for 27% of children’s average total daily energy intake, with the highest energy intake (790kJ per day) from snack, consumed as afternoon snacks. The children obtained at least 20% of their daily nutrient intakes for carbohydrate, dietary fibre, protein, fat, iron, zinc and vitamin C from snacks. However, children also obtained 25% of fat, 27% of saturated fat, 43% of available sugars, and 22% of sodium intake from snacks. The food group recommended in the first Food and Nutrition Guideline for Healthy Children and Young People (Aged 2 to 18 years) that snacks contributed to most strongly was the ‘vegetables and fruit’ food group (37% of intake from the food group was provided by snacks). The food group least contributed to by snacks was the ‘breads and cereals’ food group (15% of intake from the food group was provided by snacks).

In conclusion, snacks made an important contribution to energy and nutrient intakes in 5-year old New Zealand children. Snacks also assisted children in meeting the Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2 to 18 years), although they also provided substantial amounts of saturated fat, sugars and sodium. Hence, snacks play an important role in influencing the nutritional quality of the diets of young children. Snack consumption in children offers an opportunity to achieve optimal nutrition in early life, potentially reducing future risks of developing nutrition-related diseases.
Preface

This research project was developed and completed under the supervision of Dr Anne-Louise Heath in the Department of Human Nutrition and Associate Professor Rachael Taylor in the Department of Medicine.

As part of this thesis, the Candidate, Li Kee Chee:

• Modified recruitment posters and flyers
• Updated protocols: advertising and recruitment
• Developed tracking sheets: advertising, recruitment, data collection
• Put up advertisement posters and distributed flyers
• Wrote the recruitment cover letter and created a map to find the appointment room
• Recruited participants (including providing further details about the study, checking eligibility, obtaining contact details and verifying participant’s interest in taking part)
• Posted study information pack (including the recruitment cover letter, an information sheet and a consent form – one set for parent and one set for child, and a map to find the appointment room)
• Modified the demographic questionnaire
• Developed data sheets: anthropometric measurements, dates assigned to participants according to weighed diet record pattern code
• Booked appointments with participants (including arranging booking times and room, and sending a reminder before the appointment)

• Assigned study number and weighed diet record pattern code of each participant

• Conducted first and second appointment:
  o First appointment: Collected completed consent form and demographic questionnaire, administered food frequency questionnaire (FFQ), measured child’s height and weight, and provided instructions on how to complete the three non-consecutive days of weighed diet record
  o Second appointment: Administered FFQ and collected completed diet record booklet

• Entered weighed diet record data into dietary assessment software, Kai-culator under the guidance of Liz Fleming

• Assigned meal occasions to weighed diet record data, including records collected by a previous Master of Dietetics (MDiet) student

• Contacted participants from the previous Eating Assessment in Toddlers (EAT)-5 study to obtain postal address for deriving the New Zealand Index of Deprivation 2013 (NZDep2013) score

• Created data analysis worksheet

• Performed data and statistical analysis, under the guidance of Dr Jillian Haszard

• Wrote participant results letter including growth measurements and nutrient analysis and posted these to participants who were interested in the results
Acknowledgements

I would like to express my gratitude to everyone who has supported me in completion of the thesis.

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Jill Haszard, for your time and expertise in statistical analysis.

University of Otago and all Department of Human Nutrition staff in the university, who provided resources and facilities throughout my study.

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Renee Yu, for providing your data from the EAT-5 Fruit and Vegetable study, and additional information so that I could follow what you did for the study.

Dietetic classmates of 2014-2015, especially Group 4 – Sarah, Leanne and Kendall, for being my helping hand when I needed it.
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<th>Description</th>
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<tr>
<td>AI</td>
<td>Adequate intake</td>
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<tr>
<td>ANOVA</td>
<td>Analysis of variance</td>
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<td>CCHS</td>
<td>Canadian Community Health Survey</td>
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<tr>
<td>CDC</td>
<td>Centers for Disease Control and Prevention</td>
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<tr>
<td>EAR</td>
<td>Estimated average requirements</td>
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<tr>
<td>EAT</td>
<td>Eating Assessment in Toddlers</td>
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<tr>
<td>ESPGHAN</td>
<td>European Society for Paediatric Gastroenterology, Hepatology, and Nutrition</td>
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<tr>
<td>FFQ</td>
<td>Food frequency questionnaire</td>
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<td>MDiet</td>
<td>Master of Dietetics</td>
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<tr>
<td>NHANES</td>
<td>National Health and Nutrition Examination Survey</td>
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<td>NZDep2013</td>
<td>New Zealand Index of Deprivation 2013</td>
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<tr>
<td>POI</td>
<td>Prevention of Overweight in Infancy</td>
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<td>USDA</td>
<td>United States Department of Agriculture</td>
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1 Introduction

Healthy eating in children and young people is essential not only for their immediate growth and development, but also for the long term effects that track into adulthood. Due to their small stomach capacity and high energy requirements for growth and activity, children may not obtain adequate energy and nutrients from their main meals alone (1). Hence, children rely on snacks to help meet their nutritional needs (1). This has been supported by a series of studies showing that snacks provide a significant proportion of their daily energy and nutrient needs (2-7).

The increase in the prevalence of snacking among children has led to growing interest in the potential impact of snacking on children’s diets. For instance, children aged 2-18 years living in the United States of America had a higher frequency of meal and snack occasions (5.1 per day) in 2005-2010, than in 1977-1978 (3.9 per day) (8). Snacks appear to play an important role in the diet. The Canadian Community Health Survey (CCHS) – Nutrition 2004 (9) reported that snacks accounted for 27% of calories in children aged 4-8 years, which was more than a typical breakfast meal and comparable to a lunch meal.

In the New Zealand Children’s Nutrition Survey 2002, analysis of the diets of a subset of 2,247 school children aged 5-14 years suggested that energy intake at morning snacks was similar to breakfast, but that morning snacks were less nutritious (4). Snacks increase the number of eating occasions during the day and provide nutrients in addition to those from main meals, and this raises topics of public health interest, such as whether snacks contribute to obesity in children. The literature exploring the relationship between
snacking and demographic characteristics such as sex, body mass index, and socio-economic status has been mixed (10-13). This is probably largely due to the lack of consensus on a definition for snacks (6, 14-19).

While a consensus on a snack definition has yet to be reached, several recommendations (20-22) have been developed to encourage appropriate snacking behaviour and choices, particularly because snacks marketed towards children are usually energy-dense and nutrient-poor (1, 23). In New Zealand, three Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2 to 18 years) that are relevant to snacks have been developed: 1) four major food group recommendations — ‘vegetables and fruit’, ‘breads and cereals’, ‘milk and milk products or suitable alternatives’, ‘lean meat, poultry, fish, shellfish, eggs, legumes, nuts and seeds’, 2) desirable number of snacks — two to three snacks over a day, and 3) advice around healthy snack choices — snacks that are low in fat, especially saturated fat; sugar, especially added sugar; and salt (1, 24). However, the contribution of snacks to meeting these recommendations among New Zealand children is still unclear.

Earlier studies on the diets of New Zealand children have focused on main meals i.e. breakfast, lunch and evening meal (25, 26), specific food groups and nutrient intakes (4), or intake differences between school and non-school days (11). To date, little is known about snack consumption in New Zealand children.
2 Literature Review

2.1 Literature review methods

A literature search was conducted to identify studies that included the key words listed in Table 2.1. All studies were identified using electronic databases MEDLINE Pending (8 September 2014), Ovid MEDLINE (R) 1996 to present with daily updates (8 September 2014), CINAHL (9 September 2014), Embase (1980 to 9 September 2014), Embase Classic (1947 to 1979), and PubMed (10 September 2014). The search was limited to published articles in English. The reference lists of the published studies were also reviewed to ensure that all relevant studies were included.

Table 2.1 Search strategies and search terms used to identify studies

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2.2 Food and nutrition recommendations for school children

The New Zealand Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2-18 years) has nine key recommendations to ensure that people in this age group have sufficient intake for growth and development while taking into account their daily activities, for the maintenance of healthy body size (1). Of these, three are related to snacks. The first guideline that is related to snacks states that children should consume a wide range of foods from each of the four major food groups every day (1). The four major food groups are ‘vegetables and fruits’ of all forms, including various colours and textures — fresh, frozen, tinned, juice and dried (only up to one serving of vegetables or fruit juice, or dried fruit contributes to the number of servings); ‘breads and cereals’ — increasing wholegrain products as age increases; ‘milk and milk products or suitable alternatives’ — choosing reduced or low-fat options; and ‘lean meat, poultry, fish, shellfish, eggs, legumes, nuts and seeds’ (1). By consuming a variety of foods from these four major food groups, children are able to obtain extensive sources of essential nutrients, and snacks could provide the opportunity for this.

The second guideline states that children should eat adequately for growth and physical activity to achieve a healthy body size (1). It is worth noting that children have high energy requirements due to their high energy expenditure and small stomach capacity in relation to body size (1). Hence, children are encouraged to eat regularly during the day. It is suggested that even if a child cannot eat much at one occasion, their appetite will adjust as long as a set routine is maintained (1). In general, the New Zealand Ministry of Health recommends having three main meals, which are breakfast, lunch and main meal
(i.e. evening meal) as well as two to three small snacks over a day (1). Overall, children are advised to limit their meals and snacks to a total of six eating occasions a day (1). One reason for this is that continuous eating or ‘grazing’ could affect their oral health (1, 27). Conversely, the Committee on Nutrition of the European Society for Paediatric Gastroenterology, Hepatology, and Nutrition (ESPGHAN) did not specify a maximum number of meals and snacks, instead emphasising that children should consume no less than four meals per day, including breakfast, and should choose healthy snacks options (28). Similarly, the Canada Food Guide does not have a specific number of meals and snacks recommended for children. However, they suggest consumption of “small nutritious meals and snacks” over the day (22).

Countries such as the United Kingdom, United States of America and Australia have focused on choosing healthy snacks options, which are rich in micronutrients and low in energy, fat, sugar and salt (29). This is reflected in the third New Zealand Food and Nutrition Guideline for Healthy Children and Young People (Aged 2-18 years) (1), which states that low-fat, especially saturated fat, low-sugar, especially added sugar, and low-salt (preferably iodised salt if used) foods, snacks and drinks should be preferred for children and young people (1). All this information will guide children towards healthy eating while meeting their energy and nutrient needs. Accordingly, “the ideal snacks [should] provide energy, protein, carbohydrate, vitamins, minerals, dietary fibre and a good balance of dietary fats” (1). There are a few healthy and nutritious snacks proposed by the New Zealand Ministry of Health, including “fruit, yoghurt, vegetable sticks with a low-fat dip (e.g. hummus or yoghurt-based dips), mini-sandwiches, mini homemade
‘pizzas’, ‘mousetraps’ (toasted cheese and yeast extract spread on bread), milk, nuts and seeds, fresh fruit smoothie, plain popcorn and unsweetened breakfast cereal with milk” (1). A combination of raw and cooked vegetables and fruit, and wholegrain varieties of bread and cereals, are also good snack foods for school children (24). The guidelines also point out that portion size and snacking time should be taken into consideration as it may affect children’s appetites, which could lead to displacement of their main meals (1).

2.3 Snacking patterns of school children

Most research on New Zealand children’s diets has focused on how many children consume the three main meals — breakfast, lunch and main meal (i.e. evening meal) (25, 26), specific food groups and nutrient intakes (4), or intake differences during school and non-school days (11). However, there are limited data that have specifically reported the snacking patterns of children in New Zealand. Detailed information is needed on snacking patterns as the information can be used to determine trends in snacking, factors that influence children’s snacking behaviour, and the contribution of snacks to the diet.

A key study that examines the meal and snacking patterns of children is that of Macdiarmid et al. (12), where 156 Scottish children aged 5-17 years from the national Survey of Sugar Intake 2006 completed an estimated diet record for four days. In this study, a meal is described as an eating occasion that included at least one ‘core’ foods and any ‘non-core’ foods or drinks consumed with the meal, whereas a snack is characterised as an eating occasion that consists of solely ‘non-core’ foods or drinks (12). It was found that 78% of children had 2.5 to 3.5 meals per day, while a large
proportion of children (98%) had at least one snack per day (12). The median number of meals and snacks consumed was 3.3 and 2.0 per day respectively (12). In addition, as the number of snacks consumed increased, the number of meals consumed decreased (12). Moreover, the number of snacks was greater in lower socio-economic groups than higher socio-economic groups, but no difference was found when sex, age or body mass index groups were compared (12). Furthermore, no difference was found in the number of meals and snacks eaten between term-time and holidays, and weekdays versus weekends during term-time in these Scottish children (12, 13).

Studies in the United States of America have indicated a significant increase in snacking frequency among children. An analysis of 2,183 children aged 2-5 years combined three nationally representative surveys and reported an increase in the number of snacks from 1.7 to 2.3 per day from 1977 to 1996 (6). The prevalence of snacking in this age group was 15% greater in 1996 (94%) compared to 1977 (79%) (6). Likewise, Piernas and Popkin (30) found an increase in snacking consumption over a two-day period among American children aged 2-18 years from 74% in 1977-1978 to 98% in 2003-2006 (approximately 1.1 events more). The highest frequency of snack consumption was seen in children aged 2-6 years, with around 1.4 more snacks per day during the study period (30). Both studies agreed with the latest National Health and Nutrition Examination Survey (NHANES) 2009-2010, which discovered a high proportion (97% of boys and 97% of girls) of children living in the United States of America aged 2-5 years consumed snacks (31).
It is difficult to compare the snacking patterns seen in the studies in Scotland and the United States of America, as the definition of a ‘snack’ is different. The study in Scotland used the ‘core’ and ‘non-core’ food classification method, while studies in the United States of America identified a ‘snack’ occasion based on the participant’s report on the first food item identified as a ‘snack’ and anything that was consumed up to 15 minutes after. Although valuable information can be obtained from these studies, the results must be interpreted and used with caution when drawing conclusions for practical implementation due to the different criteria used to define a snack.

### 2.4 What is a “snack”? 

Snack is a term frequently used in the literature. Unfortunately, “snack” remains a poorly defined term. As Gregori and Maffeis (17) point out, this concept should not be left undefined as it plays a significant role in epidemiology and nutritional research, and can influence the reliability of the findings and the validity of the conclusions.

Multiple methods have been used to define a snack in research studies. Common ways of defining snacks include: i) time of day (32), ii) food-based classifications into ‘core’ and ‘non-core’ foods (12), and iii) classifications based on participants’ perceptions of what a snack is (32). Meanwhile, the New Zealand Ministry of Health describes a snack as iv) “‘mini meals [sic]’ (meal) that make[s] a valuable contribution to energy and nutrient intake between main meals” (1). Each approach has its advantages and disadvantages. For instance, using the time of day (i) as a definition provides high precision as this method does not involve ambiguous food characteristics such as nutrient profiles, but is
prone to error in populations with diverse cultures and eating behaviour (32). Food-based classifications into ‘core’ and ‘non-core’ foods (ii) are not influenced by what participants consider to be snacks (12). However, defining foods as ‘core’ or ‘non-core’ is, of course, subjective (12). Self-reported snack consumption by participants (iii) could provide informative qualitative measures, but this relies on their perceptions of what a snack is (32). The New Zealand Ministry of Health definition (iv) is not affected by time-varying eating patterns. However, it relies on an arbitrary cut-off in terms of portion size in separating a snack from a main meal. This leads to a related issue — how to define a main meal. Some studies have defined a main meal based on the characteristics and composition of a meal (33), while some define it by the time of day (34).

Historically, main meals in New Zealand referred to evening meals, but it is now clear that most people eat three main meals over a day i.e. breakfast, lunch and evening meal (1). This view is supported by Gatenby (18) and Miller et al. (29), who describe meals as the consumption of a larger volume of food, usually taking place in a structured manner i.e. in the “morning (breakfast), middle of the day (lunch) and evening (evening meal)”.

The definition of a snack could influence the outcome of a study (16). For instance, the time of day approach is likely to result in over- or under-estimating the reports on snacking. This is because this approach is based on the assumption that a participant has a fixed eating pattern. However, this is not necessarily the case. Eating occasions differ within and between individuals, depending on lifestyle (e.g. shift workers), and living environment (e.g. food availability and access) (16). The lack of clarity about the definition of a snack is a major concern in studies on snack consumption because it can
substantially alter the data. For instance, should beverages be included in the criteria to define snacks? Johnson and Anderson (16) claim that beverages need to be examined separately and should be excluded from the general definition of a snack due to their considerable contribution to the diet, but different characteristics in terms of satiety, nutrient-energy profile and psychological factors compared to solid foods. Further studies are required to assess the effect of beverage inclusion as snacks on findings. These various definitions of the term snack make it difficult to search for relevant information, and in some studies the absence of a definition make interpreting and analysing studies complicated, and restricts the ability to compare results between studies (16).

Currently, as described above, there is no consensus on how to define a snack. However, in this thesis we will define a snack following the New Zealand Ministry of Health definition — “‘mini meals [sic]’ (meal) that make[s] a valuable contribution to energy and nutrient intake between main meals” (1). Unlike the criteria proposed by Johnson and Anderson (16), food group-related beverages will be included in the definition of snacks in this study. After all, milk falls into one of the four major food groups i.e. ‘milk and milk products or suitable alternatives’, as referred to in the first New Zealand Food and Nutrition Guideline for Healthy Children and Young People (Aged 2-18 years) (1). This definition will then allow a fair comparison of New Zealand children’s diets with the New Zealand recommendations for children. In addition, this definition covers a wide scope of meals and snacks while allowing flexibility to include items as snacks, and provides opportunities for snack consumption to play a favourable role in children’s
diets. Correspondingly, the Canadian Community Health Survey (CCHS) – Nutrition 2004 used the same method to define snacks in their study (9). The work by Chapli and Smith (15) is also largely in agreement with the definition in their studies that investigated how students and the general public define a snack. They recruited 136 participants with a mean age of 37 years, and found that the majority of participants (71%) considered that a snack was best defined as any “food or drink eaten between main meals” (15).

Using the New Zealand Ministry of Health definition allows us to analyse and compare the data on snack consumption collected in New Zealand children with the recommendations around snacks. This then allows explicit study of the role of snacks in the diets of New Zealand children.

2.5 Composition and nutritional contribution of “snack” meals

At present, there are no studies in New Zealand that have specifically examined snacks. However, the studies by Regan et al. (4) and Rockell et al. (11) are worth mentioning as they briefly discussed snack foods consumed by New Zealand children. Regan et al. (4) found that the most popular food items consumed in the morning (0900-1159) during school hours among 2,247 school children aged 5-14 years are crisps and snacks (28.6%), fruit including dried fruit and fruit ‘leather/roll ups’ (22.3%), sweet biscuits, muesli bars and crackers (21.3%), sandwiches (8.7%), sweetened beverages (7.3%), lollies and chocolate based confectionaries (6.1%), cakes/pudding (4.9%), yoghurt (4.3%), pies and sausage rolls (1.7%), flavoured milk (0.8%), and fruit and vegetable
juice (0.4%). These data suggest that New Zealand school children consume a high proportion of undesirable snack foods between breakfast and lunch. On the other hand, Rockell et al. (11) investigated whether nutrients and foods consumed by New Zealand children differed between school days and non-school days. Data from 2,572 children aged 5-14 years in the National Children’s Nutrition Survey 2002 were analysed and suggested that a higher proportion of children consumed fruits, snack foods, sandwiches, biscuits/crackers, and snack bars (only in normal weight children) during school days (11). During non-school days, more children consumed hot chips (only among New Zealand European and Māori children), bread and confectionaries (11). Unfortunately, they did not provide the proper definition of snacks used in their study, although they provided a description of food items included in a snack food group, which included corn chips, popcorn, extruded snacks (burger rings etc.) and grain crisps (11). The available studies in New Zealand do, however, provide an overview of possible snacking choices among New Zealand children, and suggest that snacks are an important contributor of nutrients to children’s diets.

Similarly, the study by Macdiarmid et al. (12) collecting four day estimated diet records from Scottish children aged 5-17 years supports the finding by Regan et al. (4), suggesting that snack choices among children are not ideal. Crisps and savoury snacks were more likely to be eaten on a snack occasion rather than on a meal occasion (100%) (12). This was followed by confectionary (80%), biscuits, cakes and pastries (66%), fruits excluding fruit juice (50%), ice-cream (50%), soft drinks (33% not diet and not
lower sugar; 29% diet and lower sugar), milk and cream (17%), and fruit juice including smoothies (6%) (12).

The study by Nicklas et al. (10) seems to be consistent with other researchers, in indicating poor snack choices among children. Snacking patterns among 14,220 children aged 2-18 years from the 2001-2008 NHANES were examined using cluster analysis (10). This particular method provided a more detailed list of food and drink items eaten as snacks. They found that 16.2% of children snacked on cakes/cookies/pastries, followed by miscellaneous snacks (13.3%), crackers/salty snacks (10.4%), milk desserts (9.8%), sweets (8.9%), other grains (8.8%), low fat milk (7.1%), vegetables/legumes (6.3%), soft drinks (5.2%), whole fruit (3.1%) and fruit drinks (2.5%) (10). There were only a small percentage of children who did not snack (8.4%). Interestingly, this study proved an important point that snacking patterns are not homogenous (10).

The role of snacks and their impact on children’s nutritional status can be further explored by assessing nutrient contribution from snacks. The CCHS – Nutrition 2004 (9) determined the composition of snack calories based on four major food groups. A 24-hour diet recall in 35,107 people aged 4 years and over indicated that most of the calories obtained from snack meals came from “other foods” (41.5%), rather than foods from the four major food groups — grain products (21.2%), milk products (15.8%), vegetables and fruit (13.0%), and meat and alternatives (8.5%) (9). This finding provided an insight into the contribution of snacks to the four major food groups, which are also stated in the first New Zealand Food and Nutrition Guideline for Healthy Children and Young People
The most surprising aspect of the finding was that snacks accounted for more calories than breakfast and about the same as lunch (i.e. 27% of calories in children aged 4-8 years in both sexes) (9).

In the same way, Regan et al. (4) found that the food intake from 0900-1159 contributed a similar amount of energy (11.1% of total energy intake) to breakfast, but was less nutritious. They revealed that snacks made the highest contribution to sugar intake (12.9%) followed by saturated fatty acids (12.6%), fat (12.0%), carbohydrate (11.8%), iron (8.6%) and protein (7.7%) (4). These findings confirm that the snack choices by children are poor as they are high in fat and sugar while being low in vitamins and minerals.

Macdiarmid et al. (12) reported that 20% of the average total daily energy intake of 156 Scottish children aged 5-17 years came from snacks regardless of age, sex, body mass index, socio-economic status and number of snacks consumed. In addition, snacks contributed 20% of the total fat intake and 25% of saturated fatty acids to children’s diets (12).

In the United States of America, a combination of nationally representative surveys (1977-1996) of 2,183 children aged 2-5 years found that in 1996, 24% (378 kcal) of total daily energy intake was obtained from snacks (6). This study highlighted a similar point to the CCHS – Nutrition 2004 (9), where the energy density of snacks was greater than that of meals (6). The United States of America study (6), however, did not mention
specific meals. Snacks were also found to have contributed 7.7g/1000kcal of fibre (6). Other key nutrients were analysed but the data were not reported. The latest results from the 2009-2010 NHANES analysed nutrients based on age and sex. In their comprehensive survey, they demonstrated that self-defined snacks in children aged 2-5 years accounted for 28% of total daily energy intake in boys and 29% in girls (31). Food and beverages consumed during snacking occasions contributed to intakes of carbohydrate (32% in boys, 33% in girls), total sugar (39% in boys, 42% in girls), dietary fibre (25% in boys, 28% in girls), protein (19% in boys, 21% in girls), total fat (25% in boys and 27% in girls), saturated fatty acids (26% in boys, 30% in girls), sodium (18% in both boys and girls), iron (18% in boys, 19% in girls), zinc (19% in boys, 22% in girls) and vitamin C (34% in boys, 37% in girls) (31). One of the nutrients that need to be interpreted with caution is sodium. Underreporting of sodium intake is common in research. However, this error is inevitable as sodium intake is difficult to estimate due to the problem of measuring, and reporting, salt addition accurately during cooking and at the table. There is also the added complication of identifying the remaining salt left on the plate (35). The most accurate measurement of sodium intake would be to use a 24-hour urine collection, but multiple measures are needed to reflect usual sodium intake (35), and even this method would not be able to distinguish sodium intake from snacks versus meals.

With the definition of a snack yet to be agreed on, it is almost impossible to accurately assess the role of snacks in children’s diets. In general, studies have consistently shown that snacks contributed a significant amount of energy and nutrient intakes to children’s
diets. An implication of this is the possibility that snacks may provide nutrients that are not met from the consumption of main meals. Yet, the snack choices of children are not always ideal, and may be high in fat, sugars and salt. So far, however, there has been little focus on the role of snacks in New Zealand children’s diets. Since the New Zealand Ministry of Health has included snacks in their Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2-18 years) (1), snack intake needs to be assessed.
3 Objective Statement

The aim of the present study is to determine in a sample of 5-year old children living in Dunedin, New Zealand:

a) nutrient intakes from snacks, and

b) the extent to which snacks help 5-year olds meet the Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2 to 18 years).

The specific objectives were to:

1. determine the number of snacks eaten per day.

2. determine the nutrient contribution of snacks to intakes of energy, carbohydrate, available sugars, dietary fibre, protein, fat, saturated fat, sodium, iron, zinc and vitamin C.

3. evaluate the extent to which snacks contribute to meeting the food-related Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2 to 18 years).
4 Participants and Methods

4.1 Study design

Dietary intake data were obtained by the Candidate for 19 children aged 5 years living in Dunedin, New Zealand from a weighed diet record collected on three non-consecutive days over a one-month period. A food frequency questionnaire (FFQ) was also collected for a validation study for the Prevention of Overweight in Infancy (POI) study. However, the FFQ data are not part of this thesis. The weighed diet record data collected by the Candidate were then combined with those collected in the Eating Assessment in Toddlers (EAT)-5 Fruit and Vegetable study (36), resulting in 44 participants in the final analysis.

4.2 Participants and recruitment

Participants were primary caregivers and their 5-year old child. Participants living in Dunedin, New Zealand, were recruited between July to September 2015 based on advertising (Appendix A) and recruitment (Appendix B) protocols. The study was advertised using posters (Appendix C), flyers (Appendix D) and emails on various platforms. Full details of the advertising platform can be found in Table 4.1. Advertising tracking sheets were developed to record information such as location and number of posters placed (Appendix E and F).

Those who expressed interest in participating were contacted by the Candidate via email or telephone to receive further information about the study and invited to participate.
Contact was attempted up to three times on different days and at different times for a follow-up phone call after participants had accepted the study invitation. In a follow-up phone call, participants were asked to provide their contact details including phone number and postal address, and their eligibility details to participate in the study. Exclusion criteria were: 1) children who were not aged 5 years at the point of contact, 2) children who had health conditions that could affect eating and growth, or 3) those who had already participated in the EAT-5 Fruit and Vegetable study (36). Of the 28 participants who had expressed interest in the study, 21 participated, six could not be contacted, two were not eligible and one subsequently refused due to family issues. Recruitment was stopped at the end of September 2015 to allow timely completion of the thesis.

When a participant agreed to take part and was confirmed to be eligible, he/she was sent an information pack, consisting of a recruitment cover letter (Appendix G), an information sheet and a consent form (one set for adult participant (Appendix H and I) and one set for child (Appendix I and J)), and a map to the appointment room (Appendix K). A tracking sheet was developed to allow tracking of participants at the recruitment stage (Appendix L). Participants were compensated with grocery vouchers worth up to $25 ($5 for each completed FFQ and $5 for each completed day of weighed diet record) for their participation in the study. At the end of the study, the result of nutrient analysis of the child’s diet was posted to those who were interested in the results (Appendix M).
### Table 4.1 Recruitment activities in Dunedin, New Zealand from July to September 2015

<table>
<thead>
<tr>
<th>Advertising Platform</th>
<th>Details</th>
</tr>
</thead>
</table>
| Emails               | 57 primary schools in Dunedin City  
                      | All participants enrolled in the Prevention of Overweight in Infancy (POI) study  
                      | All University of Otago staff and postgraduate students based at the Dunedin campus |
| Flyers               | 38 flyers in primary schools in Dunedin City  
                      | 15 flyers in children’s clothing stores  
                      | 10 flyers at local cafes |
| In person            | 15 flyers distributed at St Clair playground |
| Internet webpages    | Circles of Mom website  
                      | Department of Human Nutrition, University of Otago Facebook page  
                      | Dietetics 2014 Facebook group page  
                      | Dunedin Kindergarten Facebook page  
                      | Dunedin Mummy and Daddy Talk Facebook group page |
Table 4.1 continued

<table>
<thead>
<tr>
<th>Advertising Platform</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internet webpages</td>
<td>Dunedin Parents Centre Facebook page</td>
</tr>
<tr>
<td></td>
<td>EAT-5 Study Facebook page</td>
</tr>
<tr>
<td></td>
<td>Economical &amp; Sustainable Dunedin Families Facebook group page</td>
</tr>
<tr>
<td></td>
<td>Kidspot NZ Facebook page</td>
</tr>
<tr>
<td></td>
<td>Semester 2 Thesis Club Facebook group page</td>
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<tr>
<td></td>
<td>Student Job Search Facebook page</td>
</tr>
<tr>
<td></td>
<td>Student Job Search website</td>
</tr>
<tr>
<td></td>
<td>OMSA - Otago Malaysian Students' Association Facebook group page</td>
</tr>
<tr>
<td></td>
<td>Otago Bulletin Board Notices website</td>
</tr>
<tr>
<td></td>
<td>Otago Flatting Goods Facebook group page</td>
</tr>
<tr>
<td></td>
<td>Taieiri Parents Centre Facebook group page</td>
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<tr>
<td></td>
<td>Taieiri Parents Centre Facebook page</td>
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</table>
Table 4.1 continued

<table>
<thead>
<tr>
<th>Advertising Platform</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newspaper</td>
<td>The Star (delivered free to more than 47,000 homes on Thursday)</td>
</tr>
<tr>
<td>Posters</td>
<td>15 posters in local cafes and takeaway shops</td>
</tr>
<tr>
<td></td>
<td>11 posters in Dunedin Public Hospital</td>
</tr>
<tr>
<td></td>
<td>9 posters in dairies</td>
</tr>
<tr>
<td></td>
<td>8 posters in local supermarkets</td>
</tr>
<tr>
<td></td>
<td>4 posters in local General Practitioner’s Practices</td>
</tr>
<tr>
<td></td>
<td>2 posters in Moana Pool</td>
</tr>
<tr>
<td></td>
<td>1 poster in Department of Chemistry and Human Nutrition common area, University of Otago</td>
</tr>
<tr>
<td></td>
<td>1 poster in Chipmunks Playland &amp; Cafe Dunedin</td>
</tr>
<tr>
<td></td>
<td>1 poster in Dunedin City Library</td>
</tr>
<tr>
<td></td>
<td>1 poster in Health 2000 Sunray</td>
</tr>
<tr>
<td></td>
<td>1 poster in Student Dietitian Clinic, University of Otago</td>
</tr>
</tbody>
</table>
4.3 Data collection

A data collection tracking sheet was developed to monitor each participant’s progress (Appendix N). Participants were asked to attend two sessions (prior to starting the weighed diet record and after completing the weighed diet record) at the appointment room. Both sessions were conducted following the visit protocols (Appendix O and P). All participants were given a study number, so that information could be stored maintaining anonymity and confidentiality.

At the first session, the Candidate obtained consent from both adult participant and child. Participants then completed a demographic questionnaire and anthropometric measurements of the child were taken. Furthermore, participants received a diet record booklet (Appendix Q), a set of scales (Salter Electronic Kitchen Scale with Silicone Platform Model 1017) and two spare lithium batteries CR2032 to record dietary data for three non-consecutive days over the next three to four weeks, including two weekdays and one weekend day. Participants completed day 1 of the diet record on the day following the first session. In order to achieve approximately even proportions across different days of the weeks, each participant was assigned a weighed diet record pattern code (Appendix R).

At the second session, participants returned the diet record booklet and scales. This session also allowed for the checking of information on the diet record booklet and clarifying further information with participants if required.
As the data collection phase exceeded the allocated timeframe, a courier bag was posted to some participants for returning the diet record booklet and scales in order to complete the data analysis within a timely manner. For this reason, participants received a follow-up phone call for checking of information provided on the diet record booklet. Alternatively, the Candidate made a home visit after gaining permission from the participant, to collect the diet record booklet and scales.

### 4.3.1 New Zealand Index of Deprivation score

All participants’ postal addresses were obtained at first point of contact. The postal address was then used to determine their New Zealand Index of Deprivation 2013 (NZDep2013) score (37). The EAT-5 Fruit and Vegetable study (36) did not collect this information so the Candidate contacted those participants through email or phone to obtain their postal addresses.

### 4.3.2 Demographic questionnaire

The demographic questionnaire (Appendix S) obtained information on the adult participant’s relationship to the child, the number of children that the adult participant had, child’s sex, date of birth and ethnicity of both adult participant and child.

### 4.3.3 Anthropometric data

Height was measured using a Leicester wall stadiometer and weight by a Tanita WB-100 MA/WB-110 MA weighing scale at the first session, following the measurement protocol (Appendix T). All equipment was regularly calibrated. The trained Candidate
repeated both measurements, and a third measurement was taken if the measurements fell outside the maximum allowable difference of 0.7cm for height and 0.1kg for weight. The mean for both height and weight were calculated using the two closest values. Body mass index was calculated as weight (in kilograms) divided by the square of height (in metres). All measurements were recorded in the anthropometric data sheet (Appendix U).

4.3.4 Weighed diet record

On the days assigned, the adult participant weighed and recorded everything that their child ate and drank at the time of consumption. The participant was instructed to weigh the empty plate or mug, and then weigh the food or drink on the plate or mug without taring the scales in between. The participant was then asked to weigh any leftovers on the plate or mug, and to provide a description of the leftovers (e.g. 1/8 leftover of fries, 1/3 leftover of McDonald’s lemonade, half the potato, no peas). The weighing technique was demonstrated by the trained Candidate and was repeated by the participant to ensure the correct technique was applied. All food and drinks were measured in grams. The participant also recorded information on the location and time of food or drink consumption, and the name, brand and cooking method of the food or drink consumed by their child. In addition, the participant had to complete questions on whether the child was unwell on the day of recording, and if unwell, whether the child’s appetite was affected (i.e. No, Yes – increased appetite, Yes – decreased appetite). Supplementary pages were provided in the diet record booklet to aid the participant in estimating the portion sizes of takeaway foods using colour photographs, a ruler for estimating length,
width and thickness of food items, and a set of circles for estimating the diameter of food items. All adult participants were asked not to alter their child’s diet while recording the data. They were also informed that the Candidate was available for contact at any time if they had any questions while completing the diet record booklet.

4.4 Data analysis

Information obtained from the demographic questionnaire, anthropometric measurements and the NZDep2013 score were entered into a Microsoft Excel spreadsheet (Microsoft Excel 2010; 14.0.6123.5001; Microsoft Corporation, Redmond, Washington, United States) according to participant study number. All diet records were entered into Kai-culator (Version 1.12), a web-based dietary analysis program developed by the Department of Human Nutrition, University of Otago, New Zealand. All data were then combined with data from the EAT-5 Fruit and Vegetable study (36) to increase sample size.

4.4.1 Entering weighed diet records

Dietary data were entered according to participant study number, days of the study period, and dates of the data collected. All food and drinks consumed were entered by selecting from a list of items available on Kai-culator that matched the actual item consumed. The list of items available on Kai-culator was based on the composition of foods available and consumed in New Zealand (New Zealand Plant and Food Research FOODfiles 2010 version 02). If the food or drink items consumed were not found on the list, the Candidate chose the best item that matched most closely to the actual item
consumed by comparing it with the nutritional information. If no suitable item was found, the Candidate created a new item and entered its nutritional information. Water was entered into Kai-culator but is not included in the analysis for this thesis.

Amounts eaten were calculated from the diet record booklet and entered into Kai-culator in grams or as household measurements (e.g. one teaspoon of salt) or volume (e.g. 100mL of water). Kai-culator contains density information to translate this information to weight in grams. When a recipe was provided, the ingredients used in the recipe were entered alongside with the amount in grams, and a retention factor for each ingredient based on United States Department of Agriculture (USDA) Moisture Retention Factors (38). Then, moisture retention of the whole recipe, cooking method used, time taken to cook, and cooking temperature were entered for overall analysis of the recipe. Following that, the weight of recipe consumed by the child was entered into their respective records.

All food and drink items consumed were entered as meal or snack occasions. Since the data in the EAT-5 Fruit and Vegetable study (36) were entered based on 24-hour time, the Candidate reviewed each diet record booklet to assign meal and snack occasions for each participant on Kai-culator. Finally, all diet records were checked and recalculated by the Candidate for accuracy and consistency of data entry.
4.4.2 Defining meal and snack occasions

For the purpose of this thesis, the Candidate has identified three meal occasions (i.e. breakfast, lunch and evening meal) and four snack occasions [i.e. pre-breakfast snacks (before breakfast), morning snacks (between breakfast and lunch), afternoon snacks (between lunch and evening meal) and evening snacks (after evening meal)]. This method was derived based on literature reviews and a previous thesis (39). All diet records were reviewed and checked for the applicability of this method.

The breakfast meal occasion was defined as the highest energy-containing eating occasion before 0900 hours. Corresponding times were 1200-1400 for the lunch meal and 1700-2000 for the evening meal. Any food or drink items that did not fall under a meal occasion (i.e. breakfast, lunch or evening meal) were defined as snack occasions. An eating occasion was defined as all items consumed within 30 minutes after the first item was identified as a meal or snack occasion. For example, Child A consumed weetbix with milk at 0830, an apple at 0845, cheese and crackers at 1000, and a lollipop at 1100. Using the definition, the weetbix with milk and an apple consumed by Child A would be classified as the breakfast meal occasion, the cheese and crackers as morning snack occasion 1, and the lollipop as morning snack occasion 2.

4.4.3 Categorising food and drink items on Kai-culator

The Candidate created eight food groups in Kai-culator — ‘vegetables’, ‘vegetable juice’, ‘fruit’, ‘fruit juice’, ‘breads and cereals’, ‘milk and milk products’, ‘meat, poultry, fish, shellfish, eggs, legumes, nuts and seeds’, and ‘others’. The Candidate went through
all the food and drink items that were entered into Kai-culator to assign appropriate food
groups to each item. The categorisation of food or drink items was relatively clear except
for a small number of items. Some items can be categorised into more than one food
group e.g. sausage rolls can be categorised as ‘breads and cereals’ and ‘meat, poultry,
fish, shellfish, eggs, legumes, nuts and seeds’. In this case, the item was categorised into
the food group that was less likely to be met by children (Appendix V) so that the food
group would appear in the data. Using the example, sausage rolls would be categorised
as ‘meat, poultry, fish, shellfish, eggs, legumes, nuts and seeds’. When a recipe was
provided, the Candidate looked into the ingredients in the recipe and assigned a food
group to the recipe using the same approach. For instance, a vegetarian pizza recipe
would be categorised under ‘vegetables’. This system of categorisation was agreed by a
consensus of both supervisors.

4.4.4 Categorising food and drink items into food groups based on the first Food
and Nutrition Guideline for Healthy Children and Young People (Aged 2 to
18 years)

The Candidate used the food groups created on Kai-culator as described in Section 4.4.3,
except the ‘other’ food group was excluded. Although there are four major food groups
listed in the first Food and Nutrition Guideline for Healthy Children and Young People
(Aged 2 to 18 years) — ‘vegetables and fruit’, ‘breads and cereals’, ‘milk and milk
products or suitable alternatives’, ‘lean meat, poultry, fish, shellfish, eggs, legumes, nuts
and seeds’ (1), the Candidate looked at seven food groups to allow better differentiation
of the food and drink items consumed as snacks by food groups.
The Candidate reviewed each diet record booklet to identify food and drink items consumed on snack occasions and categorised them into their respective food groups on each assigned day. In order to investigate whether the snack consumed by the child met the guideline, the Candidate scored the items based on three food categories — Green (everyday foods), Orange (sometimes foods) and Red (occasional foods) developed from the Food and Beverage guidelines for schools, Ministry of Health 2007 (Appendix W). Food groups contributed by snacks met the guideline if the food or drink items consumed on snack occasions were in the Green or Orange category. A list of items from the Red category was recorded and kept separately (Appendix X). An excel worksheet was developed to conduct this system of classification (Appendix Y). Each food and drink item consumed as a snack was given a score according to their respective food groups and day, where “1” stands for snack consumed and guideline was met, “0” for snack consumed and guideline was not met, and “-” for no snack consumed. Unlike Section 4.4.3, the food and drink items could be classified into more than one food group e.g. fruit smoothie could be classified as ‘fruit’ and ‘milk and milk products’.

Finally, on each assigned day, the Candidate indicated a “Yes” if snacks contributed all four food groups in the guideline, “No” if one or more food groups was not contributed by snacks, or “N/A” if not applicable as no snack was consumed. Since the guideline has a combined ‘vegetables and fruit’ food group, the guideline was met if vegetables were consumed but not fruit and vice versa. Therefore, the final decision was decided based on the four major food groups listed in the first Food and Nutrition Guideline for Healthy
Children and Young People (Aged 2 to 18 years) — ‘vegetables and fruit’, ‘breads and cereals’, ‘milk and milk products or suitable alternatives’, ‘lean meat, poultry, fish, shellfish, eggs, legumes, nuts and seeds’ (1). Using this information, the proportion of days with a “Yes” was determined for the whole sample and entered into an excel worksheet (Appendix Y).

4.5 Statistical analysis

All data were analysed using Microsoft Excel (Microsoft Excel 2010; 14.0.6123.5001; Microsoft Corporation, Redmond, Washington, United States) and Stata 13.1 (StataCorp, Texas).

The difference in the mean number of snacking occasions per day by sex, weight status and NZDep2013 subgroups was analysed using a one-way analysis of variance (ANOVA) with an F-test. Weight status was determined as healthy weight, or overweight or obese using body mass index value based on the Centers for Disease Control and Prevention (CDC) cut-offs (40). The NZDep2013 score, which was derived from the residential address of the child based on ten dimensions of deprivation, were combined to form three subgroups i.e. 1-3 (least deprived), 4-7, and 8-10 (most deprived). A child with missing NZDep2013 information was excluded (n=1) from the analysis. Results were considered significant at p<0.05.

The nutrient analysis focused on the intake of energy, carbohydrate, available sugars, dietary fibre, protein, fat, saturated fat, sodium, iron, zinc and vitamin C as they have
been associated with health issues, such as dental caries and obesity. The mean and percentage of total energy and selected nutrient intakes were calculated separately for all snacks, pre-breakfast snacks, morning snacks, afternoon snacks and evening snacks. Nutrient Reference Values for Australian and New Zealand children aged 4-8 years (41) were used to compare with the results. Adequate intake (AI) values for this age group were 18g for dietary fibre, 300-600mg for sodium, 4mg for iron and 3mg for zinc (41). Estimated average requirements (EAR) were 16g for protein and 25mg for vitamin C (41). There are no recommended values set for energy, carbohydrate, available sugars, fat or saturated fat for this age group (41).

Food groups referred to in the first Food and Nutrition Guideline for Healthy Children and Young People (Aged 2-18 years) (1) were used for the analysis, keeping ‘vegetables’ and ‘fruit’ separate, resulting in six food groups — ‘vegetables and fruit’ combined, ‘vegetables’, ‘fruit’, ‘breads and cereals’, ‘milk and milk products or suitable alternatives’ and ‘lean meat, poultry, fish, shellfish, eggs, legumes, nuts and seeds’. The mean and standard deviation of total weight of each food group and of the snack contribution to the individual food groups was calculated, and expressed as a percentage of the mean total weight of each individual food group and of all food groups.
5 Results

5.1 Demographic profile of adult participants and children

Initially, there were 21 participants who agreed to participate in the study but only 19 participants (90%) completed the weighed diet record. One participant returned a blank weighed diet record and another participant withdrew from the study due to the burden of completing the weighed diet record. Therefore, a final sample size of 44 participants was obtained after including the data from the Eating Assessment in Toddlers (EAT)-5 Fruit and Vegetable study (36).

The characteristics of children who completed the study are described in Table 5.1. The mean age of the children at first visit was 5.6 years (SD=0.3), with two children aged below 5 years (4.93 and 4.98 years old respectively) and one child aged just over 5 years of age (6.04 years old).

The mean age of the adult participants at first visit was 36.8 years (SD=6.6) and at child’s birth was 31.2 years (SD=6.8). Most of the adult participants were mothers of the children (n=42, 95.5%), while one of the adult participants was the father (n=1, 2.3%), and one was the grandmother of the child (n=1, 2.3%). On average, each adult participant had two children (SD=1) including the child who was enrolled in the study. The majority of the adult participants were New Zealand European (n=37, 84%), and small proportions were Māori (n=2, 5%), Pasifika (n=1, 2%) and Asian (n=1, 2%). One adult participant enrolled two of their children in the study (a pair of siblings who were
both aged 5-6 years) and one adult participant enrolled one of their children in the present study, and had another child who was involved in the previous EAT-5 study.

All participants (n=44) included in the study completed three non-consecutive days of weighed diet record, resulting in a total of 132 days in the analysis. Of the 132 days, children were sick on 20 of the days (15%). Participants reported that their child had decreased appetite on 11 of these sick days (55%), whereas appetite was not affected on 9 of the days (45%). Weighed diet records for all days, sick or not, were included in the final analysis because children are unwell sometimes so excluding them would lead to unrepresentative data.
Table 5.1 Characteristics of child participants who completed the study (n=44)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Mean (SD)</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age of child (years)</td>
<td>5.6 (0.3)</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boy</td>
<td>18 (41)</td>
<td></td>
</tr>
<tr>
<td>Girl</td>
<td>26 (59)</td>
<td></td>
</tr>
<tr>
<td>Height (cm)</td>
<td>112 (4)</td>
<td></td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>20.4 (2.0)</td>
<td></td>
</tr>
<tr>
<td>Body mass index (kg/m$^2$)</td>
<td>16.2 (1.1)</td>
<td></td>
</tr>
<tr>
<td>Weight status$^1$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Healthy weight</td>
<td>37 (84)</td>
<td></td>
</tr>
<tr>
<td>Overweight or Obese</td>
<td>7 (16)</td>
<td></td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New Zealand European</td>
<td>26 (59)</td>
<td></td>
</tr>
<tr>
<td>Māori</td>
<td>7 (16)</td>
<td></td>
</tr>
<tr>
<td>Pasifika</td>
<td>4 (9)</td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>2 (5)</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>5 (11)</td>
<td></td>
</tr>
<tr>
<td>NZDep2013 Index of Deprivation$^2,^3$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-3 (least deprived)</td>
<td>13 (30)</td>
<td></td>
</tr>
<tr>
<td>4-7</td>
<td>18 (42)</td>
<td></td>
</tr>
<tr>
<td>8-10 (most deprived)</td>
<td>12 (28)</td>
<td></td>
</tr>
</tbody>
</table>

$^1$ Classified based on BMI-for-age weight status using the Centers for Disease Control and Prevention (CDC) Growth Charts (40).

$^2$ NZDep2013 Index of Deprivation gives a score from 1=least deprived to 10=most deprived for small geographical areas defined by Statistics New Zealand (37).

$^3$ Data were available for 43 participants (one missing value).
5.2 Snacking patterns of 5-year old children living in Dunedin

Table 5.2 shows the number of snacking occasions per day in these New Zealand children by sex, weight status and New Zealand Index of Deprivation. Overall, the mean number of snacking occasions for all children (n=44) was 5.0 (SD=2.4) per day. Children consumed, on average, more afternoon snacks (Mean=2.3, SD=1.5), followed by morning snacks (Mean=1.8, SD=1.2) and evening snacks (Mean=1.0, SD=1.0). Only a small number of children (n=2; a normal weight girl from NZDep2013 score of 4-7 and an overweight boy from NZ Dep2013 score of 4-7) consumed pre-breakfast snacks, hence the data on pre-breakfast snacks were not reported in Tables 5.2 and 5.3. No snacks were consumed on 5.3% of the days.

There were no significant differences in number of snacks consumed by sex (p=0.575), weight status (p=0.067), or NZDep2013 Index of Deprivation (p=0.665).
<table>
<thead>
<tr>
<th>All participants</th>
<th>All snacks</th>
<th>Morning snacks</th>
<th>Afternoon snacks</th>
<th>Evening snacks</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.0 (2.4)</td>
<td>1.8 (1.2)</td>
<td>2.3 (1.5)</td>
<td></td>
<td>1.0 (1.0)</td>
</tr>
</tbody>
</table>

### Sex

- **Boy**
  - All snacks: 4.8 (2.5)
  - Morning snacks: 1.5 (1.3)
  - Afternoon snacks: 2.2 (1.7)
  - Evening snacks: 1.0 (1.1)

- **Girl**
  - All snacks: 5.2 (2.3)
  - Morning snacks: 1.9 (1.2)
  - Afternoon snacks: 2.3 (1.4)
  - Evening snacks: 0.9 (0.9)

### Weight status

- **Healthy weight**
  - All snacks: 4.7 (2.2)
  - Morning snacks: 1.7 (1.1)
  - Afternoon snacks: 2.1 (1.3)
  - Evening snacks: 0.9 (0.9)

- **Overweight or Obese**
  - All snacks: 6.5 (3.0)
  - Morning snacks: 1.9 (1.9)
  - Afternoon snacks: 3.0 (2.3)
  - Evening snacks: 1.5 (1.0)

### NZDep2013 Index of Deprivation

- **1-3 (least deprived)**
  - All snacks: 4.8 (2.0)
  - Morning snacks: 1.7 (1.1)
  - Afternoon snacks: 2.2 (0.7)
  - Evening snacks: 0.9 (1.1)

- **4-7**
  - All snacks: 5.4 (2.5)
  - Morning snacks: 1.7 (1.2)
  - Afternoon snacks: 2.8 (1.9)
  - Evening snacks: 0.9 (0.8)

- **8-10 (most deprived)**
  - All snacks: 4.7 (2.7)
  - Morning snacks: 2.0 (1.4)
  - Afternoon snacks: 1.6 (1.3)
  - Evening snacks: 1.1 (1.1)

---

1. Classified based on BMI-for-age weight status using the Centers for Disease Control and Prevention (CDC) Growth Charts (40).
2. NZDep2013 Index of Deprivation gives a score from 1=least deprived to 10=most deprived for small geographical areas defined by Statistics New Zealand (37).
3. Data were available for 43 participants (one missing value).
5.3 Nutrient contribution from snacks

Table 5.3 presents the average daily energy and nutrient intakes from foods consumed as snacks in 5-year old New Zealand children. Overall, the average energy intake for all snacks consumed was 1602kJ per day, which comprised 27% of average total daily energy intake. On average, children obtained 13% of their daily energy intake from snacks at afternoon snacks, morning snacks made up another 10%, and 7% was consumed as evening snacks. As might be expected, the data from this table are comparable to data in Table 5.2, with energy and nutrient intakes from snacks being higher from the more common snacking occasions.

Snacks provided 50% of the adequate intake (AI) for zinc, 45% of the AI for iron, and 27% of the AI for dietary fibre. With only 27% of energy intake obtained from snacks, sodium intake of 350mg per day already fell within the range of AI (300-600mg per day). Snacks provided the estimated average requirements (EAR) for vitamin C for 45% of children in the current study and the EAR for protein for 16% of children. There are no recommended values set for energy, carbohydrate, available sugars, fat, or saturated fat for this age group.
Table 5.3 Average energy and selected nutrient intakes from snacks. Data presented as mean amount (mean % of total intake).

<table>
<thead>
<tr>
<th></th>
<th>All snacks</th>
<th>Morning snacks</th>
<th>Afternoon snacks</th>
<th>Evening snacks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy (kJ)</td>
<td>1602 (27%)</td>
<td>541 (10%)</td>
<td>790 (13%)</td>
<td>416 (7%)</td>
</tr>
<tr>
<td>Carbohydrate (g)</td>
<td>57 (31%)</td>
<td>19 (11%)</td>
<td>28 (15%)</td>
<td>15 (8%)</td>
</tr>
<tr>
<td>Available sugars (g)</td>
<td>36 (43%)</td>
<td>11 (14%)</td>
<td>18 (21%)</td>
<td>11 (12%)</td>
</tr>
<tr>
<td>Dietary fibre (g)</td>
<td>4.8 (28%)</td>
<td>1.9 (11%)</td>
<td>2.5 (14%)</td>
<td>0.9 (5%)</td>
</tr>
<tr>
<td>Protein (g)</td>
<td>10.6 (21%)</td>
<td>3.6 (7%)</td>
<td>4.9 (9%)</td>
<td>3.1 (6%)</td>
</tr>
<tr>
<td>Fat (g)</td>
<td>12.9 (25%)</td>
<td>4.3 (9%)</td>
<td>6.5 (12%)</td>
<td>3.3 (6%)</td>
</tr>
<tr>
<td>Saturated fat (g)</td>
<td>5.9 (27%)</td>
<td>2.0 (10%)</td>
<td>2.9 (13%)</td>
<td>1.6 (7%)</td>
</tr>
<tr>
<td>Sodium (mg)</td>
<td>350 (22%)</td>
<td>144 (9%)</td>
<td>168 (10%)</td>
<td>66 (4%)</td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>1.8 (20%)</td>
<td>0.6 (7%)</td>
<td>0.8 (9%)</td>
<td>0.5 (5%)</td>
</tr>
<tr>
<td>Zinc (mg)</td>
<td>1.5 (21%)</td>
<td>0.5 (8%)</td>
<td>0.6 (9%)</td>
<td>0.4 (6%)</td>
</tr>
<tr>
<td>Vitamin C (mg)</td>
<td>28.0 (36%)</td>
<td>8.9 (12%)</td>
<td>15.9 (21%)</td>
<td>5.2 (6%)</td>
</tr>
</tbody>
</table>
5.4 Contribution of snacks to meeting the Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2-18 years)

There are three Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2-18 years) that are relevant to snacks (1). The first Food and Nutrition Guideline for Healthy Children and Young People (Aged 2-18 years) refers to the four major food group recommendations. On average, children were consuming 37% of their ‘vegetables and fruit’ intake as snacks, followed by ‘milk and milk products or suitable alternatives’ (36%) (Table 5.4). Lower proportions of ‘lean meat, poultry, fish, shellfish, eggs, legumes, nuts and seeds’ (28%) and ‘breads and cereals’ (15%) were consumed as snacks by the children in the study. When items from the food groups listed in the recommendations were considered, on average, children consumed 844g of items per day that met the recommendations, with an average of 239g of items per day from snacks. Therefore, children consumed 28% of the recommended food groups (by weight) as snacks. Children consumed snack items from all of the food groups listed in the first Food and Nutrition Guideline for Healthy Children and Young People (Aged 2-18 years) on 9.8% of the days (1).

The second Food and Nutrition Guideline for Healthy Children and Young People (Aged 2-18 years) refers to the desirable number of snacks over a day (1). On average, 5-year old children were having 5.0 snacks per day (Table 5.2).

The third Food and Nutrition Guideline for Healthy Children and Young People (Aged 2-18 years) provides advice around healthy snack choices, in particular fat,
especially saturated fat; sugar, especially added sugar; and salt (1). Snacks contributed 25% of fat, 27% of saturated fat, 43% of available sugars, and 22% of sodium intake in the children’s diets (Table 5.3).
Table 5.4 Contribution of snacks to meeting the first guideline (food group recommendations) in the Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2-18 years)

<table>
<thead>
<tr>
<th>Food group</th>
<th>Weight from total food group (g)&lt;sup&gt;1&lt;/sup&gt;</th>
<th>Weight from snacks (g)&lt;sup&gt;1&lt;/sup&gt;</th>
<th>% total food group by weight from snacks&lt;sup&gt;2&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vegetables and fruit</td>
<td>325 (114)</td>
<td>117 (75)</td>
<td>37 (22)</td>
</tr>
<tr>
<td>Vegetables&lt;sup&gt;3&lt;/sup&gt;</td>
<td>123 (67)</td>
<td>14 (26)</td>
<td>13 (21)</td>
</tr>
<tr>
<td>Fruit&lt;sup&gt;4&lt;/sup&gt;</td>
<td>202 (103)</td>
<td>103 (71)</td>
<td>52 (29)</td>
</tr>
<tr>
<td>Breads and cereals</td>
<td>169 (90)</td>
<td>26 (28)</td>
<td>15 (13)</td>
</tr>
<tr>
<td>Milk and milk products or suitable alternatives</td>
<td>232 (135)</td>
<td>88 (88)</td>
<td>36 (29)</td>
</tr>
<tr>
<td>Lean meat, poultry, fish, shellfish, eggs, legumes, nuts and seeds</td>
<td>117 (68)</td>
<td>8 (16)</td>
<td>28 (28)</td>
</tr>
<tr>
<td><strong>All recommended food groups</strong></td>
<td><strong>844 (204)</strong></td>
<td><strong>239 (134)</strong></td>
<td><strong>28 (12)</strong></td>
</tr>
</tbody>
</table>

<sup>1</sup> Data presented as Mean (SD).

<sup>2</sup> Data presented as Mean (SD) percent by weight from snacks daily.

<sup>3</sup> A total of 422.8g of vegetable juice was consumed on two days.

<sup>4</sup> A total of 675.7g of fruit juice was consumed on four days.
6 Discussion and Conclusion

6.1 Snacking patterns of 5-year old children living in Dunedin

This study demonstrated that, on average, these New Zealand children aged 5 years consumed 5.0 snacks per day. Macdiarmid et al. (12) reported a much lower median number of snacks (2.0 per day) consumed by Scottish children aged 5-17 years in 2006 based on a ‘core’ and ‘non-core’ food classification method. Jahns et al. (6) also reported a smaller mean number of snacking occasions (2.3 per day) based on self-reports by children aged 2-5 years living in the United States of America in 1996. The reason for these differences in numbers remain unclear, but it is likely that the different approaches used in defining snacking occasions was at least partly responsible. Furthermore, there appears to have been an increase in the prevalence of snacking in recent years (6, 30).

There has always been an interest in whether there is an association between snacking and obesity in children. Our study did not find a significant association between snacking frequency and weight status. Similarly, the study by Macdiarmid et al. (12) did not find any association between number of snacking events and weight status. On the other hand, four reviews (3, 28, 29, 32) have reported a mixed association between snacking frequency and obesity. One possible explanation for this discrepancy may be that the impact of snacks on obesity in children could be related to the types of snack consumed rather than the frequency of snacking.
6.2 Nutrient contribution from snacks

Previous research in New Zealand children has not studied snacks in detail. An important finding from the current study is that snacks accounted for approximately a quarter (27%) of average total daily energy intake. Among snacking occasions, afternoon snacks contributed the highest energy intake (13%), followed by morning snacks (10%), and evening snacks (7%). This finding, while preliminary, suggests that improving food choices at afternoon snacks could be a useful starting point for establishing healthy eating patterns. Although snack definition varies across studies, our findings appear to be consistent with a number of other studies. The Canadian Community Health Survey (CCHS) – Nutrition 2004 study found that snacks contributed 27% of total energy intake (9), slightly higher than the study by Macdiarmid et al. (12) which reported 20% of total energy intake coming from snacks. Correspondingly, the National Health and Nutrition Examination Survey (NHANES) in the United States of America reported that 28% and 29% of total daily energy intake came from snacks in boys and girls respectively (31). The study by Jahns et al. (6) also found that children obtained 24% of total daily energy intake, which was 1582kJ per day, from snacks – which was very similar to our finding of 1602kJ per day from snacks. Studies in New Zealand thus far have not investigated snacks specifically, yet it is worth noting that the energy intake from morning snacks reported in this study (10%), is comparable with that reported in the study by Regan et al. (4) (11.1% of energy intake in the morning). A possible explanation for this is that morning snacks in the present study were defined as any eating occasion between 0900 and 1159, so aligns with the time period reported by Regan et al. (4).
Our findings also highlighted that snacks contributed at least a fifth of the daily intake of carbohydrate, available sugars, dietary fibre, protein, fat, saturated fat, sodium, iron, zinc and vitamin C. These results matched the data observed in other studies on snack consumption in children aged 5 years (12, 31). When compared with the Nutrient Reference Values for Australian and New Zealand children aged 4-8 years (41), our findings showed that mean nutrient intakes from snacks accounted for 50% of the adequate intake (AI) for zinc, 45% of the AI for iron and 27% of the AI for dietary fibre. In addition, 16% and 45% of children in the current study obtained protein and vitamin C intake from snacks that met the estimated average requirements (EAR) respectively. It can thus be suggested that snacks play a meaningful role in contributing to the nutrient contents of children’s diets, and may therefore impact on the overall quality of their diets.

6.3 Contribution of snacks to meeting the Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2-18 years)

There are three snack-related recommendations in the Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2-18 years): 1) food group recommendations, 2) desirable number of snacks, and 3) advice around healthy snack choices. Our study found that snacks contributed 28% of the children’s intake of foods from the four major food groups listed in guideline one (1). Snacks made the highest contribution to ‘vegetables and fruit’ followed by ‘milk and milk products or suitable alternatives’, ‘lean meat, poultry, fish, shellfish, eggs, legumes, nuts and seeds’ then ‘breads and cereals’. These results describe, for the first time in New Zealand, the contribution of snacks to meeting the guideline. While the guideline also
provides recommendations for serving sizes for each food group, it was difficult to measure the extent to which snacks met the serving size recommendation due to the following constraints: (i) not all foods were listed in the guideline with recommended serving sizes, (ii) there was a large difference in weight for foods within each food group, and (iii) there was not sufficient time within the constraints of an MDiet, to assign serving sizes to all the data.

The second guideline statement is discussed in detail in Section 6.1. Our study revealed that, on average, 5-year old children were having 5.0 snacks per day, which is more than the recommendation to have two to three small snacks over a day (1). Taking main meals into account, children are likely to exceed the maximum total number of six meals per day, which includes main meals and snacks (1). The high frequency of snacking occasions may place a child at risk of developing dental caries, indicating that snacks could potentially impact their oral health (1, 27).

The third guideline statement refers to food choices relevant to nutrients of public health interest, in particular fat, especially saturated fat; sugar, especially added sugar; and salt (1). Children in the current study were obtaining 25% of fat and 27% of saturated fat from snacks. These results are similar to the recent study in children aged 5-6 years living in the United States of America, where 25% and 27% of fat from snacks were reported in boys and girls respectively, and 26% and 30% of saturated fat from snacks were found in boys and girls respectively (31). Conversely, the fat intake from snacks reported in our study was higher than that reported by Macdiarmid et al. (12) (20%), although similar for saturated fat (25%). In terms of sugar intake from snacks, our study found a similar intake (43%) to the NHANES
study (31), where 39% and 42% of sugar intake from snacks were reported in boys and girls respectively. However, it is likely to in fact be lower, because the report on sugar intake in the current study also includes sugar from foods such as fruits and milk, therefore, we could not distinguish between natural sugar and added sugar from snacks in children’s diets. With regard to sodium, our study reported a higher proportion of sodium intake from snacks (22%) than the NHANES study (18% in both boys and girls) (31). It is worth noting that our findings showed that the sodium intake from snacks (350mg per day) has already met the recommendation (AI of 300-600mg per day) for the whole day, even though snacks only provided 27% of energy intake. Therefore, overall sugar and sodium intakes from children’s diets exceed the nutrient recommendations and snacks make a substantial contribution to this.

6.4 Strengths and limitations of the study

The key strengths of this study include the implementation of ‘gold standard dietary assessment’ (i.e. a weighed diet record) for three non-consecutive days, including two weekdays and one weekend day, which should accurately reflect a child’s dietary intake for the days when data were collected. Furthermore, the inclusion of data from a previous study increased the sample size, and therefore increased the ability of our study sample to represent the true population. Although there is no consistent definition of a snack, we adopted a snack definition that is consistent with the New Zealand Ministry of Health definition in the Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2-18 years) (1) — “mini meals that make a valuable contribution to energy and nutrient intake between main meals”. This allows us to compare intakes in a consistent manner with the New Zealand recommendations for school children.
The main limitation, however, was the need to categorise eating occasions as meals or snacks, and to group foods into food groups: ‘vegetables and fruit’, ‘breads and cereals’, ‘milk and milk products or suitable alternatives’, and ‘lean meat, poultry, fish, shellfish, eggs, legumes, nuts and seeds’. The assumption was made that all children consumed main meals within specified time periods, which may have misclassified some meals as snacking occasions. It was challenging to use this approach when some of the adult participants could not accurately report the time of food and drink consumption by their child at school. Also, foods are not always eaten as single foods. This made it difficult to categorise mixed food items to a single food group and may have led to under- or over-reporting of intake from different food groups. However, when a mixed dish was consumed, the dish was categorised according to a list of food groups so that food groups that were less likely to be met by children were prioritised. This conservative approach meant that the less commonly eaten food groups appeared in the food group data. Finally, due to the study’s small sample size, these findings should be interpreted with caution when generalising them to the 5-year old New Zealand population.

6.5 Implications for future research

In future, a universal snack definition would allow better comparison between studies. Notably, whether beverages should be included in the definition of a snack. As an example, milk is included in the dairy food group as stated in the first Food and Nutrition Guideline for Healthy Children and Young People (Aged 2-18 years) (1), however this can be confusing if the definition of a snack does not include beverages. In this study, we only looked at nutrient and food group intakes
specifically but another area for future studies would be to investigate the types of snacks eaten by New Zealand children. Snack choices should be more extensively studied in order to develop proper strategies that can promote healthier snack options. It would also be interesting to examine variations in the snacking pattern (whether snack intake differs between weekdays and weekends, or between school days and non-school days) to further characterise snacking behaviour.

6.6 Conclusion

Our study has shown that New Zealand children aged 5 years consumed a high number of snacks, which accounted for 27% of their average total daily energy intake. Particular attention should be paid to the nutrient quality of snacks due to the fact that nutrients from snacks made up approximately one-fifth of carbohydrate, available sugars, dietary fibre, protein, fat, saturated fat, sodium, iron, zinc and vitamin C intakes per day respectively. This proved that snacks made a considerable contribution to energy and nutrient intakes of children’s diets. The results of this study suggest that snacks also assist children in meeting the Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2-18 years) (1) to an extent. This indicates that improving the quality of snacks consumed by children could further enhance their nutritional status, and would be an effective way to promote health. To conclude, snacks play a significant role in affecting the diet quality of children. Therefore, improvements in snacking behaviour offer an opportunity for children to achieve optimal nutrition, and potentially prevent the onset of nutrition-related diseases.
7 Application to Dietetic Practice

This study provides valuable information about snacking patterns among New Zealand children and the contribution of snacks to their energy and nutrient intakes. Dietitians could use this information to implement strategies that can improve childhood nutrition in order to reduce future risks of developing nutrition-related diseases such as obesity and hypertension.

Since energy and nutrient intakes among New Zealand children are higher in the more common snacking occasions (i.e. afternoon snacks), strategies to support healthy eating at that time of the day may be worthwhile in establishing healthy eating habits early in life. Offering nutritional education to school teachers, parents and caregivers on after school snacks could be a valuable approach to encourage healthy snacking in children.

While this study demonstrated that snacks made an important contribution to children’s energy and nutrient intakes, sugar and sodium intakes from snacks were of high concern. It is strongly recommended that healthier snack options that are lower in sugar and sodium are encouraged for young school-age children. This is because dietary patterns and behaviours established in childhood often track into adulthood (1, 42), it is therefore important to lower sugar intake, which may be linked to obesity (43), and to limit sodium intake, which is associated with hypertension (44). Some of the healthier snack alternatives include replacing party mix lollies with fresh fruit to restrict added sugars in diet, and to snack on vegetables sticks and hummus dips rather than salted chips to prevent addition of sodium to diet. Further nutrition and
dietetic research into the types of snacks eaten by children would be useful to establish effective strategies.

Another issue that emerges from our finding is that children have a high frequency of snacking (5.0 snacks per day), which may affect their oral health. Advice on limiting snack intake to two to three times a day should be emphasised to allow time for tooth remineralisation between eating occasions (1).

For the first time in New Zealand, this study shows that snacks play an important role in children’s diets, and assisted them in meeting the Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2-18 years) (1). Therefore, dietitians could optimise children’s use of snacks to create lifelong healthy eating habits, and positively impact on their immediate and long-term health.
8 References


# Appendices

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Appendix A Advertising protocol

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<th>P1. Advertising protocol</th>
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<tr>
<td>Objectives:</td>
</tr>
<tr>
<td>1. To identify locations for recruitment advertising that parents of five-year old (59-72 months) children are likely to see</td>
</tr>
<tr>
<td>2. To gain permission to advertise in these locations</td>
</tr>
<tr>
<td>3. To distribute posters and emails</td>
</tr>
<tr>
<td>4. To arrange meetings in person with mothers and parenting groups</td>
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<tr>
<th>Step – Before</th>
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<tr>
<td>Equipment required:</td>
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<td>- Posters</td>
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<td>- Blue tack</td>
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<tr>
<td>- Drawing pins</td>
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<tr>
<td>- Cellotape</td>
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<th>Step – During</th>
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<tr>
<td>a) Putting up posters in public spaces</td>
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<td>Permission is to be obtained, and posters are to be distributed to the following public spaces:</td>
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<td>- Dunedin City Library</td>
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<td>- Dunedin Hospital</td>
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<tr>
<td>- Local cafes and take-away stores</td>
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<tr>
<td>- Local supermarket</td>
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<td>- Centre City: New World, Countdown, Pac N’ Save</td>
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<tr>
<td>- Gardens: New World</td>
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<tr>
<td>- Roslyn: New World, Fresh Choice</td>
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<td>- St Clair: Four Square</td>
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<td>- Anderson Bay: Woolworths</td>
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<td>- Dairy</td>
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<td>- Moana pool</td>
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<td>- Chipmunks (<a href="http://www.chipmunks.co.nz/stores/dunedin/">http://www.chipmunks.co.nz/stores/dunedin/</a>)</td>
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<tr>
<td>- Children clothing stores</td>
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</table>
b) Putting up a notice on public Facebook pages and online websites

- Economical & Sustainable Dunedin Families
- Dunedin mummy and daddy talk
- Student job search
- Kidspot social

Ask permission to advertise:

In person:

Hi, my name is Renee Yu, I’m a Master’s student at the University of Otago. I’m studying the food intake of five-year olds (59-72 months) and I need to recruit 30 parents to take part in the study.

Would it be possible to put a recruitment poster in/on (name specific locations of place)? Thank you.

By email:

To Whom It May Concern (or Dear name if known):

My name is Renee Yu. I am a student dietitian doing my master’s degree through the University of Otago. I am studying the food intake of five-year olds (59-72 months), and I need to recruit 30 parents to take part in the study.

I am hoping it would be possible to put up recruitment posters (see attached) in (name specific locations) of your (practice, library etc.). I would very much appreciate it if you could let me know whether this would be acceptable, and whether you have any rules about poster placement that I should follow.

Thank you for your time. Please do not hesitate to contact me by email or phone if you have any questions.

Kind regards,

Renee Yu

Student Dietitian, Department of Human Nutrition

yure1721@student.otago.ac.nz

021 142 3657
Follow-up phone call:

If emails have not been replied to after three-days, ring the respective settings to see if they got my email enquiry.

c) Email sent to all University of Otago staff and postgraduate students based at the Dunedin campus

See recruitment protocol page...

---

Steps - After

a) Complete Advertising Tracking Sheet I (posters)
- Person giving permission
- Number of posters put up and where
- Date put up, date to check/replace

b) Complete Advertising Tracking Sheet II (emails/phone call recruitment)
- Person emailed/called/visited
- Contact details
- Date contact made, date of next attempt (if contact unable to be made)
- Outcome
- Date and venue of meeting
- Comments
Appendix B Recruitment protocol

P2. Recruitment Protocol

Objectives:
1. To ensure uniform recruitment procedures among participants
2. To ensure the safety of the participants throughout the study
3. To distribute information sheets, consent forms, letter, and map within one week of first contact
4. To make the first appointment

Steps – Before
Recruitment participants:

Parents of five-year old (59-72 months) children (n = 25-30)

Equipment required:

- Tracking sheet
- Information and consent forms
- Diary

Check student email account twice a day from Monday to Friday and check cell phone regularly

Steps – During

a) Email response:
- Respondents will email me at yure1721@student.otago.ac.nz if they are interested in being part of the study.
- Respondents will receive a reply email giving them further details about the study and attaching the information sheet and consent form.
- Respondents will be asked to reply to the email with phone number and postal address.
- Respondents will be expected:
  a) To receive a phone call (not more than two days after they replied) from me to check their eligibility and arrange a time for the first appointment.
  b) To receive a hard copy of the information and consent forms, cover letter, and map within one week of first contact.
- If all participant positions have been occupied, further respondents will receive a reply email that will explain that they are on a waiting list.
Responding to email enquiries:

Dear (name),

Thank you for your interest in taking part in the EAT5 study.

Attached is an information sheet and consent form with further details about the study and what is involved.

Please reply to this email with your:

Phone number -

Postal address –

Best time to call -

I will then call you to confirm whether you would like to take part, and if so, to check your eligibility and arrange a time to meet. I will also post a hardcopy of the information sheet and consent forms for you to fill out once your participation in the study is confirmed.

Please do not hesitate to contact me if you have any questions.

Kind regards,

Renee Yu

Student Dietitian, Department of Human Nutrition

yure1721@student.otago.ac.nz

021 142 3657
If all participant positions have been occupied,

Dear (name),

Thank you for your interest in taking part in the EAT5 study. Unfortunately all our participant positions are full at the moment; however we will keep your name on our waiting list if a position becomes available.

Thank you very much.

Kind regards,

Renee Yu

Student Dietitian, Department of Human Nutrition

yure1721@student.otago.ac.nz

021 142 3657

Follow up phone call:

Hi I’m Renee Yu calling from the EAT5 Study. Thank you for your interest in taking part in the study. Is now a good time for you to talk?

If NO - when would be a good time for me to call back?

If YES - would you like me to explain some more about the study?

I am looking at the food intake of five-year olds (59-72 months) as part of my master’s degree.

Would you like me to tell you very briefly what would be involved in taking part?

• Before our first meeting I will post you the information sheet and consent forms and ask you to read them and fill them out.
• At our first meeting I will ask you to fill out a food questionnaire about what your child has eaten over the past month, and ask some brief questions about you and your family. I will also measure your child’s weight and height. This appointment will take about an hour at the most.
• I also show you how to weigh and write down what your child eats for three days over the next month.
Protocol is based on the EAT-3 Advertising protocol, prepared by Jia Yun Fam

- At the second meeting I’ll collect the food diary, and ask you to fill in the food questionnaire for a second time. This second appointment should take about half an hour of your time.

We will be giving parents a grocery voucher of up to $25 dollars as a thank-you for taking part.

Does that all sound alright with you?

If NO – Thank you for your time today

If YES – can I ask you a few questions to check that you are eligible to take part?

- When is your child’s birth date?

  If your child was born before 25/02/2009 – unfortunately you are not able to participate because your child is outside our age range. Thank you very much for your interest though.

  If your child was born between 01/04/2010-01/09/2011 - unfortunately you are not able to participate at the moment because your child is too young. We are going to be recruiting later on this year and next year – is it OK if I take your details now and someone will contact you after your child’s 5th Birthday? Thank you very much for your interest in the study.

  If you child was born between 25/02/2009- 01/04/2010 – Thank you.

- Is your child affected by any health condition that would affect his eating and growth?

  If YES – unfortunately you are not able to participate. Thank you very much for your interest though.

  If NO – you are eligible to take part

  - Ask if have any questions
  - Ask if want to participate

  If NO – Thank you for your time today

  If YES –

  - Arrange time for first appointment
• Tell them that a copy of the information sheets, and consent forms will be posted to them shortly
• Ask them to read the information sheet and read the child information sheet to their child, sign the consent forms if they are willing to participate and bring them to the first appointment.
• Do you mind me asking what your child’s name is?

If MAYBE – follow-up with a phone call within a week

• Thank them for their interest

b) Phone response:
• Respondents will reach me at 021 142 3657 if they are interested in being part of the study
• I will:
  a) Explain study in more detail
  b) Check respondent’s eligibility
  c) Ask for respondent’s email address, postal address, and phone number
  d) Arrange a time for the first appointment
• Respondents will be expected to receive a hard copy of the information and consent forms within one week of first contact

Picking up phone calls

Hi, thank you for calling and showing an interest in our study.

My name is Renee Yu. I’m doing The EAT5 Study looking at the food intake of 5 year olds (59-72 months) as part of my master’s degree.

Would you like me to tell you very briefly what would be involved in taking part?

• Before our first meeting I will post you the information sheet and consent forms and ask you to read them and fill them out.
• At our first meeting I will ask you to fill out a food questionnaire about what your child has eaten over the past month, and ask some brief questions about you and your family. I will also measure your child’s weight and height. This appointment will take about an hour at the most.
• I also show you how to weigh and write down what your child eats for three days over the next month.
• At the second meeting I’ll collect the food diary, and ask you to fill in the food questionnaire for a second time. This second appointment should take about half an hour of your time.
We will be giving parents a grocery voucher of up to $25 dollars as a thank-you for taking part.

Does that all sound alright with you?

If **NO** – Thank you for your time today

If **YES** – can I ask you a few questions to check that you are eligible to take part?

- When is your child’s birth date?

  If your child was born before 25/02/2009 – unfortunately you are not able to participate because your child is outside our age range. Thank you very much for your interest though.

  If your child was born between 01/04/2010-01/09/2011 - unfortunately you are not able to participate at the moment because your child is too young. We are going to be recruiting later on this year and next year – is it OK if I take your details now and someone will contact you after your child’s 5th Birthday? Thank you very much for your interest in the study.

  If you child was born between 25/02/2009- 01/04/2010 – Thank you.

- Is your child affected by any health condition that would affect his eating and growth?

  If **YES** – unfortunately you are not able to participate. Thank you very much for your interest though.

  If **NO** – you are eligible to take part

- Ask if have any questions
- Ask if want to participate

  If **NO** – Thank you for your time today

  If **YES** –

  - Arrange time for first appointment
  - Tell them that a copy of the information sheets, and consent forms will be posted to them shortly
  - Ask them to read the information sheet and read the child information sheet to their child, sign the consent forms if they are willing to participate and bring them to the first appointment.
Protocol is based on the EAT-3 Advertising protocol, prepared by Jia Yun Fam

• Do you mind me asking what your child’s name is?

If MAYBE – follow-up with a phone call within a week

• Thank them for their interest

c) Recruit through University email

Dear all,

My name is Renee Yu and I am a student dietitian from the Department of Human Nutrition at the University. I am currently doing the EAT5 study as part of my Master’s of Dietetics degree. The EAT5 study is looking at the food intake of five-year old (59-72 months) school children in Dunedin.

I am writing to ask you if you would be interested in participating in my research study. You are eligible to be in the EAT5 study if you have a five-year old (59-72 months) child who is healthy.

If you decide to participate in this study, you will be asked to fill out some questionnaires and to weigh and record what your child eats for three days over the next month. We will lend you some scales to do this. I will also measure your child’s height and weight at our first appointment. Attached are our information sheets and consent forms with further details about the study and what it would involve.

If you’d like to participate, or have any questions about the study, please email or call me at vure1721@student.otago.ac.nz or 021 142 3657.

Thank you very much.

Kind regards,

Renee Yu

Student Dietitian, Department of Human Nutrition

vure1721@student.otago.ac.nz

021 142 3657
a) **After email reply:**
   - Record on participant tracking sheet next to appropriate ID number
     - Parent’s name
     - Email address, postal address and phone number
     - Date of reply
     - Date of giving a phone call (not more than two days)

b) **After phone reply:**
   - Record on participant tracking sheet next to appropriate ID number
     - Parent and child’s name
     - Date, time and outcome of attempt at making contact – allow three attempts
     - Participate (Yes/No/Maybe)
     - Date for first appointment
     - Date to follow up if maybe
     - Eligibility
     - Print sheet of sticker labels of all reminders/appointments to put in diary

   - Post information and consent forms no more than two days after phone reply.

c) **After recruiting in person:**
   - Record on participant tracking sheet next to appropriate ID number
     - Parent and child’s name
     - Participate (Yes/No/Maybe)
     - Date for first appointment
     - Documents given (information and consent form)
     - Date to follow up if maybe
     - Eligibility
     - Print sheet of sticker labels of all reminders/appointments to put in diary
Appendix C Posters

EAT5 – What are New Zealand 5 year olds eating?

The aim of the EAT5 research study is to find out what New Zealand 5 year olds are eating, and at the same time to develop a new, and much quicker, way of measuring what they eat.

We are looking for parents who have a 5 year old child who would like to know more about what their child is eating.

Participants will be reimbursed up to $25 as a grocery voucher at the end of the study. Participation will take a maximum of about 3½ hours over a month.

If you are interested or would like further information please contact:
Name: Li Kee Chee
Email: cheli159@student.otago.ac.nz
Phone: 03 4798369

This project has been reviewed and approved by the University of Otago Human Ethics Committee (Health).
Appendix D Flyers

The aim of the EATS research study is to find out what New Zealand 5 year olds are eating, and at the same time to develop a new, and much quicker, way of measuring what they eat.

We are looking for parents who have a 5 year old child who would like to know more about what their child is eating.

Participants will be reimbursed up to $25 as a grocery voucher at the end of the study. Participation will take a maximum of about 3½ hours over a month.

If you are interested or would like further information please contact:
Name: Li Kee Chee
Email: che1159@student.otago.ac.nz
Phone: 03 4798369

This project has been reviewed and approved by the University of Otago Human Ethics Committee (Health).
Appendix E Advertising tracking sheet I

EAT-5 Advertising Tracking Sheet I (posters)

<table>
<thead>
<tr>
<th>Location</th>
<th>Number of posters</th>
<th>Date put up</th>
<th>Date to check/replace</th>
<th>Person giving permission</th>
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# Appendix F Advertising tracking sheet II

## EAT-5 Advertising Tracking Sheet II (emails/phone call recruitment)

<table>
<thead>
<tr>
<th>Person emailed/called/visited</th>
<th>Contact details</th>
<th>Date and time of contact made</th>
<th>Comments</th>
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Appendix G Recruitment cover letter

(Street)
(Suburb)
(Dunedin)

Dear (name),

Thank you for your interest in taking part in the EAT-5 study. I am Li Kee Chee, and I will be the person you meet when you come in. I am writing to remind you about our first appointment:

Date:

Time:

Location: 5 Leithbank, Dunedin North, 9016 (please find the map in the information pack)
Parking: There are two car parks available for your use, number 33 and 37 (directly behind the building). Please note that Leithbank is a one-way street, which can be accessed from the Forth Street side. If the allocated car parks are in use, there is one-hour parking available along Forth Street.

Along with this letter, I have enclosed an information pack with two information sheets (one for you and one for your child), a consent form, and a map to the appointment room.

Before you come to our first appointment, it would be very helpful if you could:

1. Read the information sheets
2. If you and your child would like to take part, sign the consent form.

Please bring the documents with you when you come to your appointment. Please feel free to ask any questions about the study by email or phone, or when we meet.

Thank you very much for your interest in the study. I look forward to meeting you.

Kind regards,

Li Kee Chee
Student Dietitian, Department of Human Nutrition
cheli159@student.otago.ac.nz
03 479 8369
Appendix H Participant information sheet

EAT5 - What are New Zealand 5 year olds eating?

Participant Information Sheet
Thank you for your interest in the EAT5 study. Please read this information sheet carefully and take time to think about whether you would like to participate. You might also want to talk with relatives or friends before making your decision.

If you decide to take part we thank you. If you decide not to take part there will be no disadvantage to you and we thank you for considering our request.

Why?
The aim of this study is to find out what New Zealand 5 year olds are eating, and at the same time to develop a new, and much quicker, way of measuring what they eat, called a "food frequency questionnaire". The study is being carried out by Master of Dietetics students who are being supervised by University staff.

Who is funding the project?
The EAT5 study is being paid for by University funds.

Who can participate?
We are seeking 100 parents of healthy 5-year olds.

What will I be asked to do?
We will ask you to:
- Fill out a short questionnaire about yourself and your child, and a food frequency questionnaire about how often your child has different types of foods. We will post these out so that you can complete them at home. This will take about 30 minutes of your time.
- Then we’ll ask you to come to a meeting at our research rooms where we will measure your child’s height and weight, and show you how to complete a weighed food record. This will take about an hour of your time.
- We’ll ask you to fill out a weighed food record over the next 3-4 weeks – recording what your child eats and drinks on 3 different days. We will lend you some electronic scales to make this easier. This will take about 30 minutes of your time on each of the days.
- Finally, we will ask you to come back to our research rooms to fill out another food frequency questionnaire. This will take about 30 minutes of your time.

We estimate that the EAT5 study will take a maximum of 3½ hours of your time over about a month. We are able to reimburse you at the end of the study for costs associated with taking part up to $25 (approximately $5 for each of the 5 components of the study).

What will happen to my information?
We keep the information from the study for 10 years past the end of the study, following University guidelines.

What about anonymity and confidentiality?
All your information is identified by a number rather than by your name. This keeps all the information anonymous so that you cannot be identified. We keep all the information and questionnaires in locked offices. Group results of the project will be published but you will not be identified.

If I agree to participate, can I change my mind?
You may withdraw from participating in the project at any time and without any disadvantage to yourself.

Any questions?
If you have any questions now or in the future, please feel free to contact us:

Name: Dr Anne-Louise Heath
Position: Co-Principal Investigator
Department: Human Nutrition
Contact phone number: 479 8379
Email: anne-louise.heath@otago.ac.nz

Name: Associate Professor Rachael Taylor
Position: Co-Principal Investigator
Department: Medicine
Contact phone number: 021 479 556
Email: rachael.taylor@otago.ac.nz

This study has been approved by the University of Otago Human Ethics Committee (Health). If you have any concerns about the ethical conduct of the research you may contact the Committee through the Human Ethics Committee Administrator (phone +64 3 479 8256 or email gary.watts@otago.ac.nz). Any issues you raise will be treated in confidence and investigated and you will be informed of the outcome.
Appendix I Consent form for participants
Appendix J Information sheet for children

EAT5: What are New Zealand 5 year olds eating?

Information Sheet for Children

What is the EAT5 study all about?
We are doing a study to find out what New Zealand kids just like you are eating. This will also help us create a better and faster way of measuring what children are eating.

What do I have to do?
Not a lot – mum and dad will do most of it!
If you want to be in EAT5, we will ask you to come and visit us so that we can
- Measure how much you’ve grown
- Teach your mum or dad how to weigh and write down what you eat and drink
- Ask you to help your mum and dad when they are filling out your food diary over the next 3 or 4 weeks

Who will I be talking to?
_______________ is the person you will meet when you come in to see us.

Do I have to be in the study?
No you don’t. You are only in the study if you want to and your mum or dad are keen too. It’s OK if you change your mind at any time – even during the measurements.

Only the people who are running the study will be able to see the information you give us.

Any questions?
If you have any questions now or in the future, please feel free to contact us:

Name: Dr Anne-Louise Heath
Position: Co-Principal Investigator
Department: Human Nutrition
Contact phone number: 479 8379
Email: anne-louise.heath@otago.ac.nz

Name: Associate Professor Rachael Taylor
Position: Co-Principal Investigator
Department: Medicine
Contact phone number: 021 479 556

This study has been approved by the University of Otago Human Ethics Committee (Health). If you have any concerns about the ethical conduct of the research you may contact the Committee through the Human Ethics Committee Administrator (phone +64 3 479 8255 or email perry@otago.ac.nz). Any issues you raise will be treated in confidence and investigated and you will be informed of the outcome.
Appendix K Map to the appointment room

Map to the appointment room

Please contact me if you have any questions: Li Kee – 03 479 8369 / cheli159@student.otago.ac.nz
Appendix L Recruitment tracking sheet

EAT-5 Study Recruitment Tracking Sheet

Parent’s name: __________________
Child’s name: ___________________
Recruitment method: Email response

Tracking list:

- Date email received: ______________
- Date email replied: ______________
- Further details about the study
- Information sheet attached
- Consent form attached
- Date response received: ______________
- Contact details:
  - Email address: ___________________________
  - Phone number: __________________________
  - Postal address: ___________________________________________________
  - ___________________________________________________
- Date to call participant (no more than two days after they reply):
  - _________ (1st attempt)
  - _________ (2nd attempt)
  - _________ (3rd attempt)
- Check eligibility (child’s birth date dd/mm/yy and health conditions): YES/NO
- Participate: YES/NO/MAYBE
- Arrange a time for the first appointment: ______________
- Date to call participant (within a week if MAYBE):
  - _________ (1st attempt)
  - _________ (2nd attempt)
  - _________ (3rd attempt)
- Post hard copy of the information and consent forms, cover letter and map (within one week of first contact)
- Send a reminder the day before the first appointment
EAT-5 Study Recruitment Tracking Sheet

Parent’s name: ______________________
Child’s name: ______________________
Recruitment method: Phone response

Tracking list:
☐ Date and time phone call received: __________________________
☐ Date and time to call (if missed the call): _____________ (1st attempt)
☐ _____________ (2nd attempt)
☐ _____________ (3rd attempt)
☐ Further details about the study
☐ Check eligibility (child’s birth date dd/mm/yy and health conditions): YES/NO
☐ Participate: YES/NO/MAYBE
☐ Contact details:
  o Email address: ____________________________
  o Phone number: ____________________________
  o Postal address:
  ________________________________
  ________________________________
☐ Arrange a time for the first appointment: ___________
☐ Date to call participant (within a week if MAYBE): ______ (1st attempt)
☐ ______ (2nd attempt)
☐ ______ (3rd attempt)
☐ Post hard copy of the information and consent forms, cover letter and map (no more than two days after phone reply)
☐ Send a reminder the day before the first appointment
EAT-5 Study Recruitment Tracking Sheet

Parent’s name: __________________________
Child’s name: __________________________
Recruitment method: In person

Tracking list:
- [ ] Further details about the study
- [ ] Check eligibility (child’s birth date dd/mm/yyyy and health conditions): YES/NO
- [ ] Participate: YES/NO/MAYBE
- [ ] Contact details:
  - [ ] Email address: __________________________
  - [ ] Phone number: __________________________
  - [ ] Postal address: ___________________________________________________
    ___________________________________________________
- [ ] Arrange a time for the first appointment: __________
- [ ] Information sheet given
- [ ] Consent form given
- [ ] Date to contact participant (within a week if MAYBE):
  - [ ] __________ (1st attempt)
  - [ ] __________ (2nd attempt)
  - [ ] __________ (3rd attempt)
- [ ] Send a reminder the day before the first appointment
Appendix M Participant results letter

Dear [Name],

Thank you for being a part of the EAT-5 study.

Please find attached [child’s name] growth measurements and nutrient analysis results for your information.

The nutrient reference values included in the letter are based on the Nutrient Reference Values for Australia and New Zealand children aged 4-8 years. These values can be used as a guide taking into account that the food diary you kept reflects the usual intake of [child’s name]. For further information, please visit http://www.nhmrc.gov.au/_files_nhmrc/publications/attachments/n36.pdf

Adequate intake – above the RDI\(^1\)
The results from the food diary you have provided show that your child is having a well-balanced diet, with all value of nutrients analysed falling within the recommended ranges.

OR, Possibly an adequate intake – between the RDI\(^1\) and EAR\(^2\)
The results from the food diary you have provided show that your child is having a well-balanced diet, with most value of nutrients analysed falling within the recommended ranges. [Child’s name] may have a low intake of [nutrients] but this is not a concern as these recommendations are set at a level where it covers every child of aged 4-8 years. Each child has a different set of requirements where some nutrient values may be higher for some children. I have provided a list of some good sources of specific nutrients on page x for your reference.

OR, Low intake – below the EAR\(^2\)
The results from the food diary you have provided show that your child may be having a low intake of [nutrient]. I have provided a list of some good sources of specific nutrients on page x for your reference.

We hope that you find the information useful for you and your family. Once again, thank you for taking the time to participate in this important health study. We absolutely could not do it without you!

\(^1\) RDI refers to the Recommended Daily Intake
\(^2\) EAR refers to the Estimated Average Requirement
Kind regards,

Li Kee Chee, Student Dietitian
Department of Human Nutrition, University of Otago
cheli159@student.otago.ac.nz
Growth Measurements

[Child's name] anthropometric measurement on (dd/mm/yy):

Height (cm): __________
Weight (kg): __________
BMI (kg/m$^2$): __________

Please plot the measurements appropriately in the Well Child Tamariki Ora My Health Book for your use. If you have any concerns regarding the measurements, please check with your General Practitioner at your next visit.
Nutrient Analysis

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Estimated Average Requirement, EAR (per day)</th>
<th>Recommended Dietary Intake, RDI (per day)</th>
<th>Adequate Intake, AI (per day)</th>
<th>[Child’s name] Average Daily Intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy (kJ)&lt;sup&gt;3&lt;/sup&gt;</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Total Carbohydrate&lt;sup&gt;4&lt;/sup&gt;</td>
<td>-</td>
<td>45-65% of energy intake</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Protein (g)</td>
<td>16</td>
<td>20</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Total Fat&lt;sup&gt;5&lt;/sup&gt;</td>
<td>-</td>
<td>20-35% of energy intake</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Sodium (mg)</td>
<td>-</td>
<td>-</td>
<td>300-600</td>
<td></td>
</tr>
<tr>
<td>Dietary fibre (g)</td>
<td>-</td>
<td>-</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Iron (mg)</td>
<td>4</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zinc (mg)</td>
<td>3</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin C (mg)</td>
<td>25</td>
<td>35</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>3</sup> No reference value was established for energy intake in children as every child has different set of requirement and influenced by many factors such as physical activity

<sup>4</sup> No reference value was established for total carbohydrate intake in children aged 4-8 years

<sup>5</sup> No reference value was established for total fat intake in children aged 4-8 years
Interpreting the Results

What can this nutrient analysis tell me?
This nutrient analysis shows your child’s average intake of nutrients over the three days of the food diary, which you have kept. From this, you can find out the likelihood of your child in getting sufficient amount of each nutrient. Please note that if your child has a low intake of a nutrient, it does not necessarily mean that they are deficient in that nutrient. The only way to diagnose a nutrient deficiency is by taking tests such as blood tests.

What is the “Recommended Dietary Intake” (RDI)?
The Recommended Dietary Intake (you may have seen it labelled as “RDI” on food packets) is the daily intake of a nutrient, which meets the needs of almost every child aged 4-8 years. If your child has a nutrient intake that is the same as, or above the RDI, it is very likely that they are getting sufficient amount of that nutrient.

What is the “Estimated Average Requirement” (EAR)?
The Estimated Average Requirement (EAR) is the daily intake of a nutrient, which meets the needs of half of all children aged 4-8 years. If your child has a nutrient intake that is the same as, or above the EAR, there is a good chance that they are getting sufficient amount of that nutrient.

What is the “Adequate Intake” (AI)? (used when RDI value cannot be determined)
The Adequate Intake (AI) is the average daily nutrient intake observed in healthy children aged 4-8 years. If your child has a nutrient intake that is the same as, or above the AI, that nutrient intake is assumed to be sufficient.

What does it mean if my child has a nutrient intake below the RDI?
If your child has a nutrient intake below the RDI, but above the EAR, there is still a good chance that they are getting sufficient amount of that nutrient. If you are concerned, you could try offering more foods that contain the nutrient(s) concerned.

What does it mean if my child has a nutrient intake below the EAR?
If your child has a nutrient intake below the EAR, it could be possible that they are not getting sufficient amount of that nutrient. See the page attached for some ideas about what foods to offer to boost their intake of the nutrient(s) concerned.

What does it mean if my child has a nutrient intake below the AI?
Unfortunately, it is not possible to find out whether your child is getting sufficient amount of that nutrient using this value. To illustrate, if your child’s fibre intake is less than the AI, and they are not constipated, they could be having enough fibre in their diet.
**How accurate is this nutrient analysis?**

The accuracy of this nutrient analysis depends upon the accuracy of the details on the food diary provided. Other factors can also affect the accuracy of the nutrient analysis. For example, if your child was unwell and had a decreased appetite while you were keeping the food diary. Their nutrient intake may in fact be higher than the nutrient analysis shown.

Another possibility is that the three days of recording were not representative of what your child usually eats. For example, on the three days when you kept the food diary, your child did not eat any of a particular food that they usually eat. The analysis then may not be an accurate reflection of their nutrient intake.
Examples of Specific Nutrient-Rich Foods

<table>
<thead>
<tr>
<th>Good sources of protein are:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat, chicken, fish, eggs, milk, cheese, yoghurt, beans (e.g. baked beans), lentils and tofu</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Good sources of fibre are:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wholegrain breads and cereals, legumes, vegetables and fruits</td>
</tr>
</tbody>
</table>

It is recommended to introduce foods high in fibre gradually along with adequate fluids to avoid any abdominal discomfort.

<table>
<thead>
<tr>
<th>Good sources of iron are:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef, lamb, other meats, chicken, fish, shellfish, eggs, beans (e.g. baked beans), lentils, tofu, and breakfast cereals (see ingredient lists on food packets to find out if they have added iron)</td>
</tr>
</tbody>
</table>

Eating vitamin C-containing foods (see list below) at the same time as iron-containing foods increases iron absorption in the body.

<table>
<thead>
<tr>
<th>Good sources of zinc are:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Beef, lamb, other meats, chicken, fish, shellfish, eggs, cheese, milk and other dairy, beans (e.g. baked beans), lentils and tofu</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Good sources of vitamin C are:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruits such as oranges, mandarins, kiwifruits, berries, apples, bananas, pineapples and colourful vegetables such as tomatoes, capsicum (e.g. red pepper), broccoli, cauliflower, cabbage and kumara</td>
</tr>
</tbody>
</table>

For more information, please visit the Ministry of Health website at [www.health.govt.nz](http://www.health.govt.nz)
Appendix N Data collection tracking sheet

EAT-5 Study Data Collection Tracking Sheet

Parent’s name: __________________
Child’s name: ___________________
WDR pattern code: _____
Scale ID Number: ______

First visit tracking list:

☐ Date of first meeting: _______________
☐ Text/call/email participant the day before to confirm time and place of meeting
☐ Collect consent forms
☐ Collect completed demographic questionnaire
☐ Complete first FFQ
☐ Measure weight _____ kg and height _____ m of child
☐ Give blank diet food record, scales and batteries
☐ Record dates for diet record to be completed according to diet record plan
☐ Arrange a time for second FFQ and collection of records: _______________
☐ (If not) Record a reminder to contact them in the third week of food recording

Second visit tracking list:

☐ Date of second meeting: ______________
☐ Text/call/email participant the day before to confirm time and place of meeting
☐ Complete second FFQ
☐ Collect completed diet food record, scales and batteries
☐ Give grocery voucher
Appendix O First visit protocol

### P3a. First Visit protocol

#### Objectives:

1. To obtain consent to participate, and collect consent forms
2. To have demographic questionnaire filled out by participant
3. To administer FFQ to participant for the first time
4. To explain and demonstrate to participant how to complete the three day weighed diet record
5. To measure the height and weight of the participant’s child
6. To leave diet record, scales and batteries with participant
7. To arrange a time to come back for second FFQ and collection of records

#### Steps – Before

**Equipment required:**

- Dairy for appointments
- Demographic questionnaire
- FFQ
- Blank diet food record
- Plate, two food items
- Dietary scales and batteries
- Calibrated scales
- Calibrated Stadiometer
- Pens

- Text/call/email participant the day before to confirm time and place of meeting
- Ensure you are similar and comfortable with this protocol
- Record ID number on FFQ and diet record
- Record dates for diet record to be completed according to diet record plan

#### Step – During

1. **Introduction**
   - Introduce yourself/ if first contact was not made face to face
   - Thank participant for taking the time to meet today
   - Check they have read and understood the information sheet and whether there are any questions
2. Consent forms
   - Collect forms and put away in a file

3. Demographic questionnaire
   - Give parent demographic questionnaire to fill out. Collect questionnaire and put away in file.

4. Administering Food Frequency Questionnaire
   - Explain that I will ask the questions and fill it in
   - Explain that there are no right or wrong answers
   - Complete the FFQ according to the instructions preceding the FFQ

5. Take weight and height of child
   - Refer to P3b, Measurement Protocol

6. Teach Participant to use the three day weighed diet records and scales
   - Show participants the food diary
   - Get the scales out, show them where the batteries are, and how to use the scales. Let them know the batteries may go flat, so they may need to change them. Show them how to change batteries if they do go flat.

   Explain:

   - The instruction in the weighed diet records
   - Demonstrate with the food items; sequential recording and leftovers
   - To fill in the record for three days over the next three weeks. These are the days written on the front of the diet record
   - Explain why it is important to record on these days
   - How to contact me with any questions while filling in the record

Finally, that while I realise it may take some time to record what your child eats, it is very important that we get a picture of their normal eating patterns, so please don’t change what your child would normally eat because of it, and please record everything your child eats on the days you’re recording- even if they only have a bite or sip of a food or drink.

7. Any Questions?

8. Wrap up
   I would like to arrange a time in one month to meet up with you again, to collect the food dairy, and to ask you to complete the FFQ for the second time. Do you know a day and time that would be suitable for you then, or would you like me to ring you close to the time?
(If they know a time and day, write collection date on their food record for them, and record time, date, name in my dairy. If not, then record a reminder to contact them in dairy during the third week of food recording)

Thank parent for their time today- their participation is extremely helpful to this valuable research and is very much appreciated.

Leave contact details with parent in case they have further questions

**Steps– After**

- Filling FFQ, demographic questionnaire and consent forms
- Record reminder dates in dairy according to diet record plan
- Record next appointment date and reminder
Appendix P Second visit protocol

Study: EAT-5
Prepared by: Renee Yu

Protocol is based on The Validation Study Second Visit protocol, prepared by Emily Olivia Watson

P5. Second Visit Protocol

Objectives:

1. To Administer FFQ to participant for second time
2. To collect food record and scales from participant
3. To check answers in food record

Steps – Before

Equipment required:

- Pens
- FFQ
- Participant file
- Diary

Ensure you are familiar and comfortable with this protocol and how to complete FFQ

Steps – During

1. Introductions
   - Introduce yourself
   - Thank participant for taking time to come in and meet today
   - Briefly explain what will happen today:
     - Firstly I will fill out questionnaire again by asking you questions about what foods and how much of them you think your child has eaten over the past month
     - After this is completed, I’ll go through the diet record with you to ensure everything is OK and collect the scales from you

2. Administering Food Frequency Questionnaire
   - Explain that I will ask the questions and fill it in
   - Explain that there are no right or wrong answers
   - Complete the FFQ according to the instructions preceding the FFQ

3. Check Diet record
   - Ask to see food diary and scales. Check to see all columns have been filled in correctly. Ask if anything is missing or difficult to understand ask for clarification

4. Wrap up
Appendix Q Diet record booklet

EAT5 Food Diary

Please read through these pages before starting your food diary.

We would like you to please:

- Write down **everything** your child eats and drinks, when s/he eats it. Please don’t rely on your memory at the end of the day.
- Write down any supplements you give your child.
- Weigh your child’s food and drink using the scales provided.

On these days:

1. ...........................................
2. ...........................................
3. ...........................................

Please try not to change what you give your child just because you are keeping a diary!

Thank you very much for your help.
How to fill out your Diet Record:

- Record the amount and description of **ALL foods and drinks consumed** — all meals and all snacks.
- **Begin each new day on its labelled page** (for example, Day 1) and please fill in all the information at the top of the page (the date, day of the week and the questions about your child’s health).
- Use a **new line for each food or drink**. (You can use more than one line for a food or drink, but please start each new food or drink on a separate line).
- Also please remember to **include any additions to foods** (for example, tomato sauce, salad dressing, gravy).

How to fill out each column

<table>
<thead>
<tr>
<th>Where</th>
<th>Time of day</th>
<th>Name, brand and cooking method of food or drink</th>
<th>Weight of plate or mug</th>
<th>Weight of food or drink + plate or mug</th>
<th>Weight of leftover + plate or mug</th>
<th>Description of leftovers</th>
<th>Amount eaten</th>
</tr>
</thead>
<tbody>
<tr>
<td>Please write down <strong>where</strong> your child ate each meal, snack or drink.</td>
<td>Please write down the <strong>time</strong> your child had something to eat or drink, including am or pm.</td>
<td><strong>Name:</strong> Describe the food or drink. <strong>Brand:</strong> Name the brand. <strong>Cooking method:</strong> If the food was cooked, write down how it was cooked (roasted, steamed, fried). If the food was coated in something or you added things like sauce or butter please record this. <strong>If a recipe</strong> was used to make a dish please write &quot;see recipe&quot; and write out the recipe on the page labelled &quot;Recipes&quot;.</td>
<td>1) <strong>Weigh an empty plate or mug</strong> using the scales provided. 2) Write down the weight.</td>
<td>1) Place the first food or drink on the plate/mug on the scales. 2) Write down the weight. 3) If you add several foods to the same plate you will need to write down the <strong>weight of each food</strong> as you add it. 1) After your child has eaten their meal place the <strong>same plate or mug</strong> with all the leftovers on the scales and write down the total weight of the food or drink and the plate or mug.</td>
<td>1) Estimate how much of each food was left over (for example, half the potato). “Leftovers” are <strong>everything</strong> that your child didn’t eat so please try and scrape everything your child didn’t eat back on to the plate and weigh.</td>
<td>Office use</td>
<td></td>
</tr>
</tbody>
</table>
An example filled out by the parents of a 5 year old child

Day 1  Date: 9 March 2015  Day of week: Monday  Is your child unwell? YES  NO
If unwell, did this influence your child’s appetite? No

<table>
<thead>
<tr>
<th>Where</th>
<th>Time of day</th>
<th>Name, brand and cooking method of food or drink</th>
<th>Weight of plate or mug</th>
<th>Weight of food or drink + plate or mug</th>
<th>Weight of leftover + plate or mug</th>
<th>Description of leftovers</th>
<th>Amount eaten</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home</td>
<td>7:30am</td>
<td>2 slices white bread toast slice, Tip Top, toasted Butter, Mainland salted Marmite, Sanitarium</td>
<td>115g</td>
<td>165g</td>
<td>127g</td>
<td></td>
<td>Office use</td>
</tr>
</tbody>
</table>
| At Café with Gram | 10am        | Fruit cake  
Bobby banana  
Water                                                                                           |                        |                            |                               |                          |              |
|                |             | Please write down if you have toast or sandwich slice bread.                                               |                        |                            |                               |                          |              |
| McDonal’s      | 12pm        | Cheeseburger  
Medium fries (from supplementary page)  
McDonald’s lemonade  
See page 21 of this diary for takeaway foods size guide.                                               | 1                      | 45g small                  | 1/8 leftover                  | 1/3 leftover             |              |
| Home           | 3pm         | Toasty muffin bar - choc vanilla                                                                            | 20g                    |                                         |                               |                          |              |
| Home           | 6pm         | Home-made mince (see recipe)  
Potato, boiled  
Butter  
Peas, frozen, boiled  
Just Juice, Orange and mango fruit juice                                                                 | 175g                   | 144 of recipe              | 215g                          | (half the potato, no peas) |              |

*Please weigh the total amount of food left over + weight of plate or mug.*

*Then of the total amount that is left over please tell us how much there is of each food (for example, half the potato, no peas).*
Example

Recipes – Day 1

Please write down:

1. Name of the recipe(s) (ie. the name you used in the diary)
2. Amount of each ingredient (for example, 3 medium carrots, 500g lean beef mince etc)
3. Any water added.
4. The proportion of the whole recipe that your child was served in the diary (for example, write “Home-made mince” in the “name, brand and cooking method of food or drink” column, and “one quarter (1/4)” in the “weight of food or drink” column).

Name of recipe: Home-made mince

300g standard beef mince (browned in 1 tablespoon olive oil)
50g onion, diced
60g carrot, diced
1 clove garlic, minced
60g beef stock (Campbells)
30g tomato sauce (Watties)
60g diced potatoes
40g diced kumara
40g frozen mixed vegetables (Watties)
60g water
5g white flour

Cooking method: Mince was stewed in a small pot with lid on.

One quarter (1/4) of the recipe was served to my child at dinner.
Important things to remember
We are NOT looking for a “healthy” diet. We need to know what children actually eat.
- Always record food eaten at the time it is eaten.
- Please give us as much information as possible about the food.
- Estimate foods if you can’t weigh them.
- Record all leftovers.

Remember all information that you give us is strictly confidential.

How to estimate amounts of food when you can’t weigh them
Please record an estimated amount in the “weight of food or drink” column.
- HOUSEHOLD MEASURES – Household measures like cups, tablespoons and teaspoons can be useful. Please tell us whether it was a heaped or level amount.
- WEIGHTS MARKED ON PACKAGES – Use the weight marked on canned or packet foods e.g., quarter of a 420g can of baked beans, one 60g bottle of yoghurt.
- RULER – Foods such as cheese, cakes and meat can be measured using a ruler, e.g., slice of luncheon sausage 8cm x 4cm x 1mm (remember to give length, width and depth!).
- BREAD – Tell us the number and the size of the slices e.g., sandwich, medium, or toast slice.
- FRUIT – Tell us whether the piece of fruit is small, medium or large.

TAKEAWAY FOODS
The supplementary page provided has photographs of commonly eaten takeaway foods. Please write down the weight from the photograph that best describes the amount of food your child was served and write it in the “Weight of food or drink” column. Your child might not have exactly the amount in the photos so feel free to tell us if she had “two x 40g pizza”.
Day 1

Date:  
Day of week:  
Is your child unwell?  YES / NO

If unwell, did this influence your child's appetite?  No

Yes – decreased appetite    Yes – increased appetite

<table>
<thead>
<tr>
<th>Where</th>
<th>Time of day</th>
<th>Name, brand and cooking method of food or drink</th>
<th>Weight of plate or mug</th>
<th>Weight of food or drink + plate or mug</th>
<th>Weight of leftover + plate or mug</th>
<th>Description of leftovers</th>
<th>Amount eaten</th>
</tr>
</thead>
</table>

Office use
## Day 1 continued

<table>
<thead>
<tr>
<th>Where</th>
<th>Time of day</th>
<th>Name, brand and cooking method of food or drink</th>
<th>Weight of plate or mug</th>
<th>Weight of food or drink + plate or mug</th>
<th>Weight of leftovers + plate or mug</th>
<th>Description of leftovers</th>
<th>Amount eaten</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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Office use
Day 1 continued

<table>
<thead>
<tr>
<th>Where</th>
<th>Time of day</th>
<th>Name, brand and cooking method of food or drink</th>
<th>Weight of plate or mug</th>
<th>Weight of food or drink + plate or mug</th>
<th>Weight of leftover + plate or mug</th>
<th>Description of leftovers</th>
<th>Amount eaten</th>
</tr>
</thead>
</table>
Supplement Use – Day 1

(a) Did your child take any supplements today? Include anything you consider to be a supplement to your child’s diet (e.g., multi-vitamin, etc.).
   No ☐ (please go to page 10)
   Yes ☐

(b) If yes, please record the following:
   Type of supplement (e.g., cod liver oil):
   Brand name (e.g., Smith’s):
   Amount (number of mls, drops, tablets, capsules, etc.) taken (e.g., 5mls, 2 x 1000mg tablets):

(c) If yes, does the supplement contain iron or zinc? (check the label)
   No ☐
   Yes ☐

If yes, please record the type of iron (e.g., ferrous fumarate, ferrous sulphate and anything else with the words “iron”, “ferric” or “ferrous”) or “zinc” (e.g., zinc sulfate) and the amount of iron or zinc per tablet (e.g., 10mg, etc.):

Type of iron (e.g., ferrous sulphate): ___________________________ Amount per dose (e.g., 7mg in 5ml):

Type of zinc (e.g., zinc sulfate): ___________________________ Amount per dose (e.g., 7mg in 5ml):

THE INTERVIEWER WILL HELP YOU FILL IN THIS PAGE IF YOU ARE NOT SURE - please keep the bottle or packet
Recipes – Day 1

Please write down:

1. Name of the recipe(s)
2. Amount of each ingredient (for example, 3 medium carrots, 500g lean beef mince, 1 onion, etc.)
3. Record the amount of water added.
4. The proportion of the whole recipe that your child was served in the diary (for example, write “Home-made mince” in the “name, brand and cooking method of food or drink” column, and “one quarter (1/4)” in the “weight of food or drink” column).
Day 2

<table>
<thead>
<tr>
<th>Date:</th>
<th>Day of week:</th>
<th>Is your child unwell?</th>
<th>YES / NO</th>
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<tbody>
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</table>

If unwell, did this influence your child’s appetite?

- Yes – decreased appetite
- Yes – increased appetite

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<thead>
<tr>
<th>Where</th>
<th>Time of day</th>
<th>Name, brand and cooking method of food or drink</th>
<th>Weight of plate or mug</th>
<th>Weight of food or drink + plate or mug</th>
<th>Weight of leftovers + plate or mug</th>
<th>Description of leftovers</th>
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Office use
### Day 2 continued

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<th>Where</th>
<th>Time of day</th>
<th>Name, brand and cooking method of food or drink</th>
<th>Weight of plate or mug</th>
<th>Weight of food or drink + plate or mug</th>
<th>Weight of leftover + plate or mug</th>
<th>Description of leftovers</th>
<th>Amount eaten</th>
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## Day 2 continued

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<thead>
<tr>
<th>Where</th>
<th>Time of day</th>
<th>Name, brand and cooking method of food or drink</th>
<th>Weight of plate or mug</th>
<th>Weight of food or drink + plate or mug</th>
<th>Weight of leftover + plate or mug</th>
<th>Description of leftovers</th>
<th>Amount eaten</th>
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</tbody>
</table>

Office use
Supplement Use – Day 2

(a) Did your child take any supplements today? Include anything you consider to be a supplement to your child’s diet (e.g., multi-vitamin, etc.).

No ☐ (please go to page 15)

Yes ☐

(b) If yes, please record the following:

Type of supplement (e.g., cod liver oil): ____________________________

Brand name (e.g., Smith’s): ____________________________

Amount (number of mls, drops, tablets, capsules, etc.) taken (e.g., 5mls, 2 x 1000mg tablets): ____________________________

(c) If yes, does the supplement contain iron or zinc? (check the label)

No ☐

Yes ☐

If yes, please record the type of iron (e.g., ferrous fumarate, ferrous sulphate and anything else with the words “iron”, “ferric” or “ferrous”) or “zinc” (e.g., zinc sulfate) and the amount of iron or zinc per tablet (e.g., 10mg, etc.):

Type of iron (e.g., ferrous sulphate): ____________________________ Amount per dose (e.g., 7mg in 5ml): ____________________________

Type of zinc (e.g., zinc sulfate): ____________________________ Amount per dose (e.g., 7mg in 5ml): ____________________________

THE INTERVIEWER WILL HELP YOU FILL IN THIS PAGE IF YOU ARE NOT SURE - please keep the bottle or packet
Recipes – Day 2

Please write down:

1. Name of the recipe(s)
2. Amount of each ingredient (for example, 3 medium carrots, 500g lean beef mince, 1 onion, etc.)
3. Record the amount of water added.
4. The proportion of the whole recipe that your child was served in the diary (For example, write “Home-made mince” in the “name, brand and cooking method of food or drink” column, and “one quarter (1/4)” in the “weight of food or drink” column).
<table>
<thead>
<tr>
<th>Day 3</th>
<th>Date:</th>
<th>Day of week:</th>
<th>Is your child unwell?</th>
<th>Yes / No</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Yes – decreased appetite</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Yes – increased appetite</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Where</th>
<th>Time of day</th>
<th>Name, brand and cooking method of food or drink</th>
<th>Weight of plate or mug</th>
<th>Weight of food or drink + plate or mug</th>
<th>Weight of leftovers + plate or mug</th>
<th>Description of leftovers</th>
<th>Amount eaten</th>
<th>Office use</th>
</tr>
</thead>
<tbody>
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<td></td>
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</tr>
</tbody>
</table>
Day 3 continued

| Where | Time of day | Name, brand and cooking method of food or drink | Weight of plate or mug | Weight of food or drink + plate or mug | Weight of leftover + plate or mug | Description of leftovers | Amount eaten | Office use |
|-------|-------------|-----------------------------------------------|------------------------|----------------------------------------|---------------------------------|--------------------------|--------------|------------|------------|


Day 3 continued

<table>
<thead>
<tr>
<th>Where</th>
<th>Time of day</th>
<th>Name, brand and cooking method of food or drink</th>
<th>Weight of plate or mug</th>
<th>Weight of food or drink + plate or mug</th>
<th>Weight of leftover + plate or mug</th>
<th>Description of leftovers</th>
<th>Amount eaten</th>
</tr>
</thead>
</table>
Supplement Use – Day 3

(a) Did your child take any supplements today? Include anything you consider to be a supplement to your child’s diet (e.g., multi-vitamin, etc.).
   No  □  (please go to page 20)
   Yes □

(b) If yes, please record the following:
   Type of supplement (e.g., cod liver oil):
   Brand name (e.g., Smith’s):
   Amount (number of mls, drops, tablets, capsules, etc.) taken (e.g., 5mls, 2 x 1000mg tablets):

(c) If yes, does the supplement contain iron or zinc? (check the label)
   No  □
   Yes □

If yes, please record the type of iron (e.g., ferrous fumarate, ferrous sulphate and anything else with the words “iron”, “ferric” or “ferrous”) or “zinc” (e.g., zinc sulfate) and the amount of iron or zinc per tablet (e.g., 10mg, etc.):

Type of iron (e.g., ferrous sulphate):  Amount per dose (e.g., 7mg in 5ml):
Type of zinc (e.g., zinc sulfate):  Amount per dose (e.g., 7mg in 5ml):

THE INTERVIEWER WILL HELP YOU FILL IN THIS PAGE IF YOU ARE NOT SURE - please keep the bottle or packet
Recipes – Day 3

Please write down:

1. Name of the recipe(s)
2. Amount of each ingredient (for example, 3 medium carrots, 500g lean beef mince, 1 onion, etc.)
3. Record the amount of water added.
4. The proportion of the whole recipe that your child was served in the diary (For example, write “Home-made mince” in the “name, brand and cooking method of food or drink” column, and “one quarter (1/4)” in the “weight of food or drink” column).
Supplementary Pages – Takeaway Foods Estimation Guide

Hawaiian Pizza

Fries

Battered Fish

Chips
Thank you!

Remember if you have any questions please contact us. You can email or call us and we'll get back to you.
## Appendix R Weighed diet record patterns

### WDR patterns for EAT5

**Criteria:**
- 3 non-consecutive days (i.e., need to use one of these days each week over 3 weeks)
- 1 weekend day and 2 weekdays
- Start on the day after the interview
- Approximately equal numbers of each day of the week

**To use:**
- Find the "WDR Handout" day that applies to the day the 1st interview is completed
- Use the next unused pattern for that "handout" day

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>T</th>
<th>W</th>
<th>Th</th>
<th>F</th>
<th>Sat</th>
<th>Sun</th>
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<tbody>
<tr>
<td><strong>W1</strong></td>
<td>1</td>
<td>1</td>
<td>1</td>
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<td><strong>W3</strong></td>
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</table>

**Mondays WDR Handout**

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<tbody>
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<td><strong>M1</strong></td>
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<td><strong>M2</strong></td>
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**Tuesdays WDR Handout**

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<tbody>
<tr>
<td><strong>T1</strong></td>
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<td><strong>T2</strong></td>
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**Wednesdays WDR Handout**

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**Thursdays WDR Handout**

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**Fridays WDR Handout**

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**Total**

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<td><strong>Should be</strong></td>
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<td>17</td>
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</tbody>
</table>

**Total Days** = 63

**Total Patterns** = 21
Appendix S Demographic questionnaire

**EAT5 Demographic Questionnaire**

1. How are you related to the child in this study? __________

2. What is your date of birth? __________ day/month/year

3. How many children do you have? __________

4. To which ethnic group(s) do you belong? Please tick all the boxes that apply
   - NZ European
   - Maori
   - Samoan
   - Tongan
   - Cook Island Maori
   - Niuean
   - Chinese
   - Indian
   - Other
   If other, please state: __________

5. If Maori, please provide your tribal affiliations ______

6. What is your child’s date of birth? __________ day/month/year

7. What is your child’s sex?: Male / Female (please circle)

8. To which ethnic group(s) does your child belong?
   - NZ European
   - Maori
   - Samoan
   - Tongan
   - Cook Island Maori
   - Niuean
   - Chinese
   - Indian
   - Other
   If other, please state: __________

9. If Maori, please provide the tribal affiliations for your child __________

10. Is your child descended from Maori (that is do they have a Maori birth parent, grandparent or great-grandparent etc)? Yes / No / Don’t know (please circle)
Appendix T Measurement protocol

P3b. Measurement Protocol

Objectives:

1. To undertake anthropometric measurements (weight, and height) of five-year old children
2. Record measurements immediately in the anthropometry data sheet.
3. Enter the measurements into Excel.

Equipment requirement

Measurement Protocol
Anthropometric data sheet
Tracking sheet containing child’s name parents’ names and their addresses
Stadiometer
Equipment Bag:
  Scale
  Hand sanitizer
  Pencil (for recording results on data sheet) Eraser
  Wipes
  A measurement Card (to copy child measurements to mother).

Measuring equipment

1) Tanita WB-100 MA/WB -110 MA weighing scale: portable electronic scale that have taring capability and calibrated to 0.1kg.

2) Leicester wall stadiometer: to measure child’s height to the nearest 0.1 cm.
  - All measuring equipment must be highly accurate, precise, sturdy and portable.
  - Scales and stadiometers should be calibrated before measurement.
  - Stadiometers should be calibrated with a standard length rod.
  - Scales should be calibrated with standard weights.

Steps- Before

1) All equipment should be checked prior to first measurement of the day.
2) Confirm that all supplies needed for the measurements are available and accessible.

3) Information should be entered on data sheet including:

1- Date  2- Measure’s Name.  3- Child’s Name

**Remember**

1) Measurements should be taken and recorded twice.

2) It is important to follow the same technique and protocol during successive measurements.

3) Any measurements falling outside the maximum allowed differences should be repeated and entered in designated boxes on the data sheet.

4) Data should be entered on the sheet using a pencil.

5) Immediately record the measurement after it is read, it helps to have your pencil and data sheet near you.

6) Record the measurement directly onto the data sheet. The more times the measurement is copied, the more chances of error there are.

7) Record measurements clearly and neatly, the same way every time.

---

**Steps- During**

1) Introduce yourself

2) Thank for taking time to meet today

3) Ensure that the parent and the child understand what is happening and they are comfortable with the process.

4) Go over what will be covered in today’s session:
   - Child height and weight.

**General Guidelines for Measuring and Recording**

1) **Always tell the participant what you are going to do before you do it.** Explain what you are doing and why, such as before adjusting the pants down to measure the waist circumference. Remain unaffected by tattoos, piercings, etc. and **do not comment** about the participant’s body. Maintain professionalism at all times.
2) **Avoid parallax when taking measurement readings.** Parallax describes the phenomenon where an observer reads a different value on a measuring device depending on the angle from which it is viewed. Parallax is a common cause of data error especially for measurements obtained using the height equipment. The examiner should read the measurement with his or her line of sight directly in front of the value rather than at an angle or from even slightly off to the side.

3) Exam staff must carefully **watch children at all times** because they can quickly and easily hurt themselves.

**Child Measurements**

1) Explain to the mother that information will only be used for this study.

2) Confidentiality of information must be assured.

3) The anthropometrist’s confidence and poise is important for reassuring both the mother and child, and includes maintaining eye contact and talking to the child in calm, reassuring voice.

**The best order to carry out the measurements is:**

1. **Ask the mother to undress the child up to a singlet and underwear.**

2. **Child’s weight 1.**

3. **Child’s height 1.**

4. **Child’s weight 2.**

5. **Child’s height 2.**

6. **If the child refused to stand on the scale alone, record the weight of the mother, tare the scale and ask the mother to hold the child and record his/her weight.**

7. **Check that differences between measurements 1 and 2 are acceptable. If not, then repeat measurement a third time now.**

8. **Now child can get dressed**

*The following table shows the maximum allowable differences between the two measurements*

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Maximum allowable difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>0.1kg</td>
</tr>
<tr>
<td>Length</td>
<td>0.7cm</td>
</tr>
</tbody>
</table>
Weight

Place the scale on a flat, hard, even surface. Be sure there is adequate light to read measurement.

1) Explain to the participant the procedure for weighing.
2) Ask the mother to remove all the child’s clothes up to under wear.
3) Turn on the power key, wait until (0.0) is displayed.
4) Ask the mother to help the child to stand with his/her feet slightly apart in the centre of the scale.
5) Immediately record the measurement to the nearest 0.1kg.
6) Repeat steps 4&5.

Height

Explain to the mother the procedure for measuring the child’s height, the mother will be required to help with measurement and to soothe and comfort the child.

1. Place the measuring board on a hard flat surface against a wall. Make sure the board is not moving.
2. Check that shoes, socks and hair ornaments have been removed.
3. Working with the mother, and kneeling in order to get down to the level of the child.
4. Help the child to stand on the baseboard with feet slightly down to the level of the child.
5. Ask the mother to hold the child’s knees and ankles to help keep the legs straight and flat, with heels and calves touching the vertical board. Ask her to focus the child’s attention, soothe the child as needed, and help you to keep the child in position.
6. Position the child’s head so that a horizontal line from the ear canal to the lower border of the eye socket runs parallel to the base board (Frankfurt Plane). To keep the head in this position, hold the bridge between your thumb and forefinger over the child’s chin.
7. If necessary, push gently on the tummy to help the child stand to full height.
8. Still keeping the head in position use your other hand to pull down the headboard to rest firmly on top of the head and compress the hair.
9. Read the measurement and record the child’s height in centimeters to the last completed 0.1 cm
   This is the last line that you can actually see. (0.1 cm = 1mm).
Appendix U Anthropometry data sheet

EAT-5 Anthropometry Data Sheet

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Appendix V Snack priority food group

1. Vegetables
2. Vegetable juice
3. Meat, poultry, fish, shellfish, eggs, legumes, nuts and seeds
4. Milk and milk products
5. Fruit
6. Fruit juice
7. Breads and cereals
8. Others
Appendix W  Food and Beverage guidelines for schools
Appendix X Food items in the Red category

Food items in the Red category

1. Berry muffin recipe
2. Biscuit, arrowroot
3. Biscuit, basic, nz recipe
4. Biscuit, chocolate base, thin
5. Biscuit, chocolate coated
6. Biscuit, chocolate coated, mallowpuff
7. Biscuit, chocolate coated, mint
8. Biscuit, cookie, chocolate chip
9. Biscuit, griffins choc krispie
10. Biscuit, hokey pokey, homemade
11. Biscuit, iced, hundred&thousands
12. Biscuit, krispie
13. Biscuit, plain, cream
14. Biscuit, shortbread, retail
15. Biscuit, wafer, chocolate & vanilla
16. Biscuit, wafer, raspberry, cream filled
17. Butter cut out cookies recipe
18. Butter, salted
19. Butter, unsalted, mainland
20. Cake, carrot, cream cheese icing
21. Cake, chocolate, standard
22. Cake, cupcake, chocolate, no iced topping
23. Cake, cupcake, plain, iced topping
24. Cake, sponge, 1 layer, iced topping
25. Candy coated chocolate
26. Chocolate bar, plain
27. Chocolate chunk cookie recipe
28. Chocolate drink recipe
29. Chocolate weetbix slice
30. Chocolate, cadbury caramello, bite size
31. Chocolate, cadbury dairy milk
32. Chocolate, cadbury, moro bar, peanut
33. Chocolate, cadburys, turkish delight
34. Chocolate, dark
35. Chocolate, drinking, powder
36. Chocolate, egg, caramel filling
37. Chocolate, whittakers slabs, hazel nut
38. Chocolate, whittakers, rum and raisin
39. Chocolate, with filling, chocolate fudge
40. Cinnamon pinwheel scone recipe
41. Coco pops kelloggs
42. Cocoa, powder
43. Cordial concentrate, syrup, lime
44. Cordial, orange&barley syrup, baker-halls
45. Corn snacks, cheese flavour
46. Cracker, assorted flavour
47. Cracker, cheese
48. Cracker, meal mates, griffins
49. Croissant
50. Crunchie bar, cadbury
51. Drink flavour, assorted, powder, raro
52. Drink flavour, navel orange, powder
53. Drink flavour, raspberry, diluted
54. Drink powder, diet
55. Fruit bar, strawberry
56. Fruit bar/roll, strawberry
57. Fruit gums
58. Fruit leather/roll up, plain
59. Hard candy chupa chups, asstd flavours
60. Homemade jelly
61. Honey
62. Hotdog, american, with sauce(s)
63. Ice block
64. Jam, berry frt, asst berries, premium
65. Jam, berry fruit
66. Jam, regular (sugar sweetened)
67. Jelly, made up, regular, plain
68. Lollies, hard (boiled/sugary)
69. Lollies, jelly/gum, plain
70. Margarine
71. Margarine spread, mono canola, 70% fat
72. Margarine spread, proactiv, flora, fortified a&d
73. Margarine, meadowlea original
74. Margarine, mono olive bld, 75% fat, Olivani
75. Margarine, mono, 55% fat, Olivani lite
76. Margarine, poly, 60% fat, sunrise
77. Marmite
78. Mars, bar
79. Marshmallows, pink and white
80. Milo, powder, fortified09
81. Muesli bar
82. Muesli bar, chocolate coated, snacker
83. Muesli bar, chocolate coated, wrapps
84. Muesli bar, magic muesli, asst flavours
85. Muesli bar, three fruits
86. Muesli bar, yoghurt coated, assorted
87. Muffin, banana, jam filling
88. Muffin, chocolate
89. Muffin, lemon
90. Nut bar ANS08 recipe l- chocolate nice & natural/tasti
91. Nutella
92. Oil, canola
93. Pepper, black
94. Potato chips, krispa
95. Potato crisps, chicken
96. Potato crisps, flavoured
97. Potato crisps, kettle, salted
98. Potato crisps, lites
99. Potato crisps, natural, eta
100. Potato crisps, plain
101. Potato crisps, salt and vinegar
102. Potato crisps, slims, eta
103. Pudding, apple crumble, baked
104. Rice bubbles kelloggs
105. Rice dish, risotto (from packet), composite flavours, with oil – other (polyunsaturated)
106. Rice, mochi (Japanese rice cake)
107. Salt, iodised, table
108. Salt, table
109. Sauce, simmer, sweet & sour, heated
110. Slice, brownie, with nuts
111. Slushy, frozen soft drink (e.g. coke, lemonade)
112. Smoothie recipe
113. Soft drink, coca-cola
114. Soft drink, lemonade
115. Soft drink, soda water
116. Sugar, icing
117. Sugar, white
118. Syrup, maple
119. Table spread, canola, 60% fat
120. Topping, real fruit-based, sweetened, sugar
121. Vegemite, kraft
122. Wheat biscuits signature range
Appendix Y Categorising food and drink items into food groups based on the first Food and Nutrition Guideline for Healthy Children and Young People (Aged 2 to 18 years)

Each food group contributed by snacks for each participant

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Variables:
Food Group 1 = vegetables and fruit
Food Group 2 = breads and cereals
Food Group 3 = milk and milk products or suitable alternatives
Food Group 4 = lean meat, poultry, fish, shellfish, eggs, legumes, nuts and seeds