EAT-3 Study: Fruit and vegetable intake of 3-year-old children living in Dunedin, New Zealand

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Abstract

**Background:** Fruit and vegetables are recommended as key components of a healthy diet because they provide essential vitamins and minerals, dietary fibre, and antioxidants. Previous studies have shown that fruit and vegetable intake decreases the risk of diet-related chronic diseases such as cardiovascular disease, and helps in weight management. Although fruit and vegetable consumption is important during the whole life course, it is particularly important in early childhood, since optimal nutrition is important at this crucial period for the normal growth and development of a child, and furthermore, eating habits and food preferences that are established in childhood continue into adult life. However, the fruit and vegetable intake of preschool children in New Zealand has not been extensively studied so little information is available. To date, no studies in New Zealand have used diet records (the “gold standard” dietary assessment method) to assess fruit and vegetable intake in preschool children.

**Objective:** The aim of this project was to determine the fruit and vegetable intake of a sample of preschool children aged 3 years, living in Dunedin using a weighed diet record, and to compare their fruit and vegetable intake with the New Zealand Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2 to 18 Years).

**Design:** Three-day weighed diet records were collected by parents and caregivers from 17 preschool children aged 3 years from Dunedin, New Zealand, between July and September 2014. Diet records were entered into a web-based dietary software program, Kai-culator™, to determine the fruit and vegetable intake of the preschool children. The weight of fruit and vegetables consumed by the children was converted into number of servings using the serving sizes described in the New Zealand Food and Nutrition Guidelines for children and
young people aged 2 to 18 years, and their fruit and vegetable intake was compared to these guidelines. The study also determined the most commonly eaten fruit and vegetables by comparing the weight of each fruit and vegetable consumed by the children. The strength of relationship between fruit and vegetable intake and fibre and vitamin C intake was assessed using the Pearson’s correlation coefficient.

**Results**: Daily average intakes of fruit and vegetables were 132.2g (SD 72.4) and 39.0g (SD 26.7) respectively. Only one child (6%) met the daily recommended intake for fruit, and no children met the daily recommended intake for vegetables. Potato and banana were the highest contributors to the total amount of vegetables consumed (21.6%) and to the total amount of fruit consumed (24.4%) respectively among the children. Total fruit and vegetable intake was strongly correlated with dietary fibre (r=0.634, p<0.006) and vitamin C (r=0.818, p<0.001) intake.

**Conclusion**: The present study found that the level of fruit and vegetable intake among preschool children in this sample was low. This suggests that greater efforts targeting improvements in fruit and vegetable consumption among New Zealand pre-schoolers are needed, both in quantity and variety, in order to achieve healthy eating in pre-schoolers, and to prevent diet-related diseases in our future adult population. Although the present study suggests that the fruit and vegetable guidelines are not achievable for 3 year olds, further study in a larger and more nationally representative sample is needed before we can be sure that the recommendations of fruit and vegetable intake for preschool children need to be revised.

**Keywords**: Fruit intake, Vegetable intake, Preschool children, New Zealand
Preface

As part of this thesis the candidate, Jia Yun Fam:

- Applied for ethical approval
- Modified protocols for advertising, recruitment, first visit, second visit, and anthropometry
- Designed the recruitment poster and flyers
- Modified the layout, questions, instructions, examples, and supplementary resources of the weighed diet record
- Developed the demographic questionnaire and anthropometry checklist sheet
- Recruited participants
- Posted or emailed study information pack (including information sheet, consent form, map to find the appointment room, demographic questionnaire, and EAT3 FFQ)
- Booked appointments with participants (including arranging appointment rooms, car parks, making follow-up phone calls, and sending reminder text messages)
- Conducted first and second visits
  - First visit: checked returned food frequency questionnaire for completeness, measured child’s weight and height and provided instructions on weighed diet record
  - Second visit: checked returned weighed diet record for completeness
- Entered weighed diet record, demographic information, and anthropometric measurements into the appropriate analysis programs
- Carried out statistical analyses
• Obtained and distributed grocery vouchers to participants where required
• Sent individual results to participants

Supervisor Dr Anne-Louise Heath and Co-supervisor Associate Professor Rachael Taylor developed the idea for the study, assisted in the ethical approval and design process, aided in data interpretation and revisions, and oversaw all aspects of the study design and thesis write up.
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- Dr Anne-Louise Heath and Associate Professor Rachael Taylor: My two pillars of strength, whose expertise, understanding, and patience, added considerably to my graduate experience. I appreciate the endless support and encouragement you offered, and the opportunity to work with you all. Without both of you, this process would not have been so enjoyable.

- My Participants: The many families involved in the study that make up this thesis. Thanks for volunteering a great deal of your time and thank you and your children for making the data collection so much fun, for which I am extremely grateful.

- Liz Fleming: For the tutorials and ongoing support with Kai-culator, and for all the instances in which your assistance helped me along the way.

- Anna Howe: For her expertise and feedback with statistical analyses.

- Mum and Dad: You are like a hot air balloon. You help me to rise as high as I want and give me a great view of the world. Thank you ma and pa for always believe in me.

- Friends: You are like my family away from home; with you all I have been able to maintain a sustainable level of work/life balance throughout my university life. I am lucky to have you all.
# Table of Contents

Abstract............................................................................................................................................... vii
Preface................................................................................................................................................ vii
Acknowledgements ........................................................................................................................... vii
Table of Contents ............................................................................................................................... vii
List of Tables ....................................................................................................................................... vii
List of Figures ...................................................................................................................................... vii
List of Abbreviations ......................................................................................................................... vii
1. Introduction ...................................................................................................................................... 1
2. Literature Review ............................................................................................................................ 3
   2.1 Literature review methods ........................................................................................................... 3
   2.2 Health benefits of fruit and vegetable intake............................................................................ 4
      2.2.1 Immediate health benefits to preschool children............................................................... 4
      2.2.2 Potential future health benefits ......................................................................................... 8
   2.3 Fruit and vegetable intake among preschool children .......................................................... 10
   2.4 Recommendations for fruit and vegetable intake in preschool children ............................. 21
3. Objective Statement ....................................................................................................................... 24
4. Subjects and Methods .................................................................................................................... 26
   4.1 Study design ............................................................................................................................. 26
   4.2 Recruitment and participants .................................................................................................. 26
   4.3 Data collection ........................................................................................................................ 29
      4.3.1 Demographic questionnaire ............................................................................................. 30
      4.3.2 Anthropometric data ........................................................................................................ 30
    
vii
4.3.3 Food frequency questionnaire .................................................................31
4.3.4 Weighed diet record ...........................................................................32
4.4 Data entry ...............................................................................................34
4.5 Statistical analysis ..................................................................................35

5. Results .....................................................................................................37
5.1 Participants and recruitment .................................................................37
5.2 Daily average fruit and vegetable intake .............................................40
5.3 Major food items contributing to total fruit and vegetable intake ........45
5.4 Correlation between fruit and vegetable consumptions and vitamin C and fibre intake ....47

6. Discussion ..............................................................................................49

7. Application to practice .......................................................................56

8. References .............................................................................................59

9. Appendices ............................................................................................66
List of Tables

Table 2.1  Search strategies and key terms used to identify studies for the review ..............4
Table 2.2  Fruit and vegetable intake among preschool and school-aged children in New Zealand .................................................................16
Table 2.3  Fruit and vegetable intake among preschool children in other countries ..........18
Table 4.1  Recruitment activities in Dunedin ..................................................................28
Table 5.1  Characteristics of the study participants (n=17) ..............................................39
Table 5.2  Children’s average daily intakes of fruit, vegetables, fruit juices, and potatoes (g/d) from the 3 day weighed diet record (n=17) ..............................................................42
Table 5.3  Percentage of children who met the recommended guidelines for fruit and vegetable intake (n=17) ..................................................................................43
Table 5.4  Frequency of fruit and vegetable intake in the past 4 weeks based on the FFQ (n=17) ..............................................................................................................................44
List of Figures

Figure 4.1  Questions in the EAT3 FFQ used to assess the frequency of fruit and vegetable intake of the child in the past 4 weeks .................................................................32

Figure 5.1  Percentage of children who met the recommended guidelines for fruit and vegetable intake (n=17) .........................................................................................44

Figure 5.2  Food items contributing to total fruit intake (including fruit juice) in children.....46

Figure 5.3  Food items contributing to total vegetable intake (including potato) in children..46

Figure 5.4  Correlation between fruit and vegetable consumption (number of servings/day) and fibre intake (g/d) among children .................................................................48

Figure 5.5  Correlation between fruit and vegetable consumption (number of servings/day) and vitamin C (mg/d) intake among children .........................................................48
**List of Abbreviations**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>BMI</td>
<td>Body mass index</td>
</tr>
<tr>
<td>CSFI89</td>
<td>Continuing Survey of Food Intake by Individuals 1989</td>
</tr>
<tr>
<td>CSFI94</td>
<td>Continuing Survey of Food Intake by Individuals 1994</td>
</tr>
<tr>
<td>ECE</td>
<td>Early Childhood Education</td>
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<tr>
<td>FFQ</td>
<td>Food frequency questionnaire</td>
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<tr>
<td>MOH</td>
<td>Ministry of Health</td>
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<tr>
<td>NFCS77</td>
<td>Nationwide Food Consumption Survey 1977</td>
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<tr>
<td>USDA</td>
<td>United States Department of Agriculture</td>
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<tr>
<td>WDR</td>
<td>Weighed diet records</td>
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<td>WHO</td>
<td>World Health Organisation</td>
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1. Introduction

Fruit and vegetables are recommended as key components of a healthy diet because they provide essential vitamins and minerals, dietary fibre, and antioxidants [1]. Previous studies have shown that fruit and vegetables decrease the risk of diet-related chronic diseases particularly cardiovascular diseases [2-5] and stroke [5], which are the leading causes of death in New Zealand [6]. Scientific evidence has also shown that fruit and vegetables have probable protective effects against cancers, mainly cancer of the digestive tract [5, 7]. In addition, fruit and vegetables play a role in weight management and obesity prevention [5], due to their low energy density and high fibre content and their ability to replace higher energy foods from the diet. According to the New Zealand Health Survey 2012/13, 33% of children aged 2 to 14 years are either overweight (body mass index $\geq 85^{th}$ and $< 95^{th}$ percentile) or obese (body mass index $\geq 95^{th}$ percentile), an increase from 18% in just over three decades [8]. The increased prevalence of overweight and obesity among children may contribute to the early onset of chronic diseases in adulthood, such as diabetes and cardiovascular disease [5]. Adequate fruit and vegetable intake is therefore important for health throughout life.

Although fruit and vegetable consumption is important during the whole life course, it is particularly important in early childhood, since optimal nutrition is important at this crucial period for the physical growth and mental development of a child [1]. Furthermore, epidemiological studies have shown that eating habits and food preferences that are established in childhood continue into adult life [9, 10].
The Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2 to 18 Years) is evidence-based and provides the information to educate and encourage children and young people as well as their families or whānau to follow healthy lifestyles [1]. It is recommended that preschool children aged between 3 and 5 years consume a minimum of two servings of vegetables and two servings of fruit daily [1]. National surveys carried out in 2002 and 2010 showed that only a minority of school children and young people aged 5 to 24 years met the recommended intake of fruit and vegetables [11, 12].

Since dietary habits start being formed in early childhood it is important to determine the degree to which children comply with the current fruit and vegetable recommendations. Unfortunately, the fruit and vegetable intake of children in New Zealand has not been extensively studied so little information is available. In addition, no studies in New Zealand have used diet records (the “gold standard” dietary assessment method) to assess fruit and vegetable intake in preschool children. Therefore, this study aimed to determine the fruit and vegetable intake of a sample of preschool children aged 3 years, living in Dunedin using a weighed diet record; and to compare their fruit and vegetable intake with the New Zealand Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2 to 18 Years).
2. Literature Review

2.1 Literature review methods

Relevant articles were identified by searching the following databases: Medline via Ovid (from 1996 to 4th November 2013), Google Scholar (up to 4th November 2013). Subject headings or text word searches were guided by the “PICO – Population, Intervention, Control, Outcome” principle, that aided the candidate in finding relevant evidence in the literature. Search strategies and key terms used are outlined in Table 2.1. Additional studies were found in the bibliographies and reference lists of the original research articles.

The Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2-18 years) [1] as well as Eating for Healthy Children aged 2 to 12 [13] were obtained from the New Zealand Ministry of Health website. Several reports such as “Diet, Nutrition and the Prevention of Chronic Diseases”, “Food, Nutrition and the Prevention of Cancer: A Global Perspective”, and “Obesity: Preventing and Managing the Global Epidemic Technical Report”, were identified in a search of the World Health Organisation (WHO) website (http://www.who.int/en/).
Table 2.1 Search strategies and key terms used to identify studies for the review

<table>
<thead>
<tr>
<th>Search terms used to identify studies on the fruit and vegetable intakes among preschool children</th>
</tr>
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<tbody>
<tr>
<td>1. Child, Preschool</td>
</tr>
<tr>
<td>2. Diet/ or Diet Records/ or Diet Surveys/</td>
</tr>
<tr>
<td>3. Nutrition Surveys/</td>
</tr>
<tr>
<td>4. Vegetable.mp. or Vegetables/</td>
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<td>5. Fruit.mp. or Fruit/</td>
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<td>6. New Zealand.mp. or New Zealand/</td>
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<tr>
<td>7. (2) OR (3)</td>
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<td>8. (4) OR (5)</td>
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<td>9. (1) AND (6) AND (7) AND (8) (^1)</td>
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b) Search terms used to identify studies on the benefits of fruit and vegetables

<table>
<thead>
<tr>
<th>Search terms used to identify studies on the benefits of fruit and vegetables</th>
</tr>
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<tbody>
<tr>
<td>11. Food Habits/ or Diet/</td>
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<tr>
<td>12. Obesity.mp. or Obesity/</td>
</tr>
<tr>
<td>13. (11) OR (12)</td>
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<tr>
<td>14. (8) AND (10) (^1)</td>
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<tr>
<td>15. (8) AND (13) (^1)</td>
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1. Bold indicates searches for which papers were looked at.

2.2 Health benefits of fruit and vegetable intake

Diets high in fruit and vegetables are widely promoted for their health benefits because they contain vitamins, minerals, and phytochemicals. Additionally, fruit and vegetables are also a source of dietary fibre. Fruit and vegetables do not only have immediate impacts on children’s health but also have a role in health promotion and disease prevention in later life.

2.2.1 Immediate health benefits to preschool children

Fruit and vegetables promote healthy growth and development in children [1]. “Starchy” root vegetables are also an important source of carbohydrate in the New Zealand diet [1].
Increasing fruit and vegetable consumption may be an effective strategy for weight management given their low energy density and high content of fibre which may increase satiety [14]. Adequate consumption of fruit and vegetables among preschool children may help displace the intake of energy-dense, nutrient-poor foods, which is known to contribute to the development of overweight and obesity [14-16]. A study analysing the diets of participants aged ≥20 years from the 1989-1991 Continuing Survey of Food Intake of Individuals concluded that percentage of energy from fat was at or below the population average when the fruit intake recommendation was met [17].

An intervention study randomly assigned 27 children aged 6 to 11-years into two groups, an “Increase Fruit and Vegetable” group and a “Decrease Fat and Sugar” group. Children in the “Increase Fruit and Vegetable” group aimed to reach at least 2 servings of fruit and 3 servings of vegetable daily. After a year of follow up, a lower intake of high fat, high sugar, and low nutrient dense foods was observed in children who were assigned to the “Increase Fruit and Vegetable” group [15].

Increasing fruit and vegetable consumption seems to be an ideal preventative strategy for childhood overweight and obesity. However, data on the association between fruit and vegetable intake and anthropometric measures among preschool children are sparse and findings are inconsistent. A longitudinal study in low-income preschool children reported that each additional time fruit and vegetables were consumed per day, the risk of becoming overweight decreased [18]. Similarly, Faith et al reported that parental offering of whole fruit was associated with reduced adiposity gain of children between 1 and 5 years of age [19].
However, the association was only observed among those who were already at risk of becoming overweight or overweight and no association was seen for vegetable consumption [19]. Another cross-sectional study also found that overweight children aged 5 to 12 consumed less fruit and vegetables than children who were at healthy weight [15, 20]. However, causality cannot be inferred from this study because the data were collected at a single point in time, so the direction of the association cannot be determined. On the other hand, Newby et al found no significant association between fruit and vegetable intake and weight change among 1379 children who were 2 to 5 years of age [21].

The method of food preparation can affect the study findings. However, these data are not usually collected. Although fruit and vegetables in their natural state have a low energy density, the method of preparation influences their energy density [22]. Vegetables become more energy dense when fried, for example French fries and potato chips, when served with high energy sauces, for instance salad dressing and sour cream, or when prepared as mixed dishes such as casseroles and pies. Fried potatoes are one of the most popular vegetable choices among preschool children [10, 11]. It would be expected that failing to take into account food preparation would diminish an association between the consumption of vegetables and healthier weight [5].

Another variable that is likely to influence the results of the studies that were discussed previously, is the physical form in which the food is consumed. For example, fruit juice is low in fibre and thus is less satiating than whole fruit [23]. Dennison et al concluded that preschool children who consume more than 355ml of fruit juice daily were significantly more likely to
have a higher body mass index (BMI) percentile than children who consumed less than 355ml per day[24]. This study also reported that overweight preschool children consume more fruit juice than normal weight preschool children [24, 25]. However, Skinner et al found there was no significant association between fruit juice intake and childhood overweight in children 2 to 6 years of age [26, 27]. These results should be interpreted with caution, however, because it is possible that some of the beverages reported as “fruit juices” could be sugar sweetened drinks, or juices with a very low fruit juice content.

There is also growing evidence that fruit and vegetable consumption in children may protect against a range of childhood illnesses. The few studies that have focused on childhood respiratory health in relation to fruit and vegetable intake have been inconsistent. So far, no studies have been carried out in preschool children. A study of over 20,000 school aged children in six Central European countries found an association between respiratory symptoms and low intake of fruit and vegetables [28]. Other studies reported similar results, suggesting that consumption of fruit and vegetables has beneficial effects on asthma, rhinitis and wheeze among school aged children [29]. The protective effect of fruit and vegetables on respiratory health does not appear to be dose related. However, the majority of these studies were cross sectional and cannot therefore be used to assess of causal relationships, and can only be suggestive of an association between dietary intake and respiratory symptoms. Cook et al. found no statistically significant association between fresh fruit consumption and lung function in children [30] although this could be due to the small number of subjects with symptoms.
A single study has suggested that intakes of dark-green and deep-yellow vegetables are positively associated with bone mass accrual in children aged 3.8 to 7.8 years [31]. This might be because dark green leafy vegetables are good sources of calcium, which is an essential mineral for bone health.

Although evidence of a direct causal association between fruit and vegetable consumption, weight status and childhood illnesses among preschool children is lacking, adequate consumption of fruits and vegetables is still considered to be important for preschool children for normal growth and development.

### 2.2.2 Potential future health benefits

One study has suggested that children who are obese between the ages of 3 and 5 years are 4 times more likely to be obese as adults than children who are not obese [32]. The prevention of weight gain and maintenance of a healthy weight, which could potentially be mediated by higher intakes of fruit and vegetables, would therefore contribute to a reduction in other chronic diseases for which obesity is a major risk factor.

A study in Finland showed an association between childhood consumption of fruit and vegetables and quality of the diet later in life [33]. For example, participants who consumed more fruit and vegetables (75 g/1000 kJ) when they were between 3 to 18 years of age, were more likely to meet the recommendations for saturated fatty acid intake (not over 10% of total energy), fibre (at least 3g/1000 kJ) and salt (not over 500 mg/1000 kJ) in adulthood [33]. This finding indicated that fruit and vegetable intake in childhood is also a significant determinant of the cardiovascular quality of adults’ diets. Although few studies assess the long term
influence of childhood diet on adult cardiovascular health, study in the United Kingdom followed up the Boyd Orr cohort for 37 years and showed that children who were at the highest quartile of vegetable intake, with a daily mean intake of 116.1g, had a lower risk of stroke [34]. However, the protective effect of vegetables may result from confounders such as socioeconomic status because fruit and vegetables were both highly socially patterned in this cohort. Also, the subjects’ diet was poorly measured in childhood because these measures were derived from household diets rather than individual consumption. Furthermore, the cohort was recruited during and after the Second World War, so the range of childhood diets could be reduced. However, the strength of this cohort study is that recall bias is unlikely to have occurred as childhood dietary data was measured and recorded in advance of the occurrence of disease.

Besides the protective effect of childhood fruit and vegetable intake on cardiovascular risk in adulthood, a study which is also based on the Boyd Orr cohort discussed above [34], showed that higher fruit consumption in childhood is inversely associated with cancer incidence and mortality in adults [35]. People from the highest quartile of total fruit intake (88.4g per day) were at approximately 40% lower risk of developing cancer as compared with people from the lowest quartile (0.6g per day) [35]. However, there was no clear association between vegetable consumption and cancer incidence or mortality [35]. A few case control studies have found a small but not statistically significant relationship between fruit and vegetable consumption in childhood and adolescence and cancer risk in later life [36, 37]. The attenuation of risks could be due to recall errors. Use of information collected on exposures many years in the past will of course impair the quality of the data.
High consumption of fruit and vegetables in childhood may have a long term protective effect on health. However, it is uncertain if the beneficial effect on health during adulthood is solely related to the latent protective effect of fruit and vegetable consumption in childhood or due to healthy eating habits that have persisted into adulthood. This is because several studies have showed that food preferences and habits are formed in childhood and tend to be maintained into adulthood [9, 10].

In summary, the benefits of adequate childhood fruit and vegetable consumption seem to extend throughout the lifespan. Healthy habits developed during the preschool years may have a significant impact on future risk of nutrition-related chronic diseases. Therefore, children should be encouraged to consume adequate amounts of fruits and vegetables from a young age.

### 2.3 Fruit and vegetable intake among preschool children

The New Zealand Ministry of Health (MOH) recommends a minimum intake of two servings of vegetables and two servings of fruit daily for preschool children aged between 3 and 5 years [13]. To date, national estimates of the level of fruit and vegetable intake within this particular age group are scarce. Nevertheless, studies in samples that are not nationally representative have consistently reported that preschool children do not consume enough fruit and vegetables on a daily basis [38-41].

The New Zealand National Children’s Nutrition Survey was conducted and carried out with schoolchildren 5 to 14 years of age in 2003[11]. Forty-three per cent of these children ate fruit
at least twice a day while 57% ate vegetables three or more times a day [11]. Fruit and vegetable consumption was lower among Māori and Pacific Island children, and among children from socioeconomically deprived families [11]. This supports the suggestion made by Theodore et al. (2006) that social factors can influence fruit and vegetable intake levels [41]. A later national survey of children and young people’s physical activity and dietary behaviours in New Zealand carried out in 2008, found that 75% of children 5 and 9 years of age met the guideline for fruit intake but just 40% met the guideline for vegetable intake [12]. Only 30% of them met the guideline for both fruit and vegetable intake [12]. These national surveys are in school-aged children who are not necessarily eating the same diets as preschool children. For instance, several studies have found that older children are less likely to meet fruit and vegetable recommendations when compared to younger children [11, 12, 42]. In addition, recommendations differ for these different age groups. Preschool children are recommended to consume 2 servings of fruit and 2 servings of vegetable whereas the recommendation for school-aged children is 3 servings of vegetables and 2 servings of fruit [13]. Therefore, it is not appropriate to apply the findings in school-aged children to preschool children.

Although there are no national data on fruit and vegetable intake in preschool children, a few smaller studies have been carried out. These studies compared the dietary intake of preschoolers with the MOH recommended daily intakes. One study showed that about 70% and 50% of a sample of New Zealand European preschool children consumed the recommended servings of fruit and vegetables respectively [41]. However, it is not known if the results are generalizable to all New Zealand preschool children as there may be ethnic differences in the
proportion of children meeting the guidelines. For example, Soh et al (2000) reported that fewer than 40% of Chinese preschool children living in Dunedin, New Zealand, met the recommendations for fruit and vegetable intake [43]. Therefore, the proportion of preschool children in the general population eating sufficient fruit and vegetables is likely to be lower than has been reported to date when the range of ethnicities, socioeconomic status and parental education is taken into account [41].

In comparison to the New Zealand data, international studies reveal a lower level of fruit and vegetable intake among preschool children. The study by Huybrechts et al [38] showed less than half of preschool children in Flanders reached the minimum recommendation for fruit intake and fewer than 15% of them reached the minimum guidelines for daily vegetable intake. Similarly, studies have found that preschool children in New York only consumed 1.8 servings of fruit and less than 0.5 serving of vegetable per day [40], and those in Germany consumed an average of 170g of fruit and vegetables daily [39]. These showed that fruit and vegetable intakes among preschool children from other countries was very much lower than the New Zealand recommended guidelines as well as the WHO population goal [5, 13].

Overall, preschool and school-age children consume more fruit than vegetables [12, 39, 40, 44]. The types of fruit and vegetables consumed by New Zealand children appear to be similar to those in other countries. Generally, fruit that are commonly consumed are apples and pears, followed by oranges, mandarins and bananas [11, 44, 45]. The vegetable group most likely to be eaten was potato, particularly in fried form such as hot potato chips, French fries, wedges or hash browns [10, 11, 41, 45, 46]. Other vegetables that are commonly eaten are carrots,
broccoli, green peas, mixed vegetables, lettuce, cauliflower, cabbage, tomatoes, and corn [11, 44, 45]. Seasonal variation and ethnicity have been shown to affect the fruits and vegetables eaten by preschool children [43, 47].

Females generally consume more fruit and vegetables than males across the age groups [39, 41, 48]. This variation by sex, however, was not significant in either of New Zealand’s surveys of children [11, 12]. This might be because the data from the qualitative food frequency questionnaire (FFQ) and Dietary Habits Questionnaire that were used in these national surveys do not represent the true usual diet due to random and systematic errors. Certainly, weighed diet records are considered to provide more accurate dietary information than FFQs [49].

While levels of fruit and vegetable intake among preschool children appear to vary between different countries and studies, strict comparisons are difficult. This is because specific fruit and vegetables are sometimes excluded, and the rationale for such exclusions is not consistent between studies. For example, potatoes were not included in the vegetables food group in some studies [38, 50], instead they were categorised as belonging to the cereals and grains food group because of their high starch content [38]. Potatoes are not generally consumed in Asian countries, so exclusion of potatoes does not impact on assessments of vegetable intake in Asian countries. In contrast, data from studies which exclude potatoes are not applicable to New Zealand, because potatoes are one of the most commonly consumed vegetables among New Zealanders in general, as well as preschool children [11, 41, 46, 51]. Fruit classification is less debated, although there is no consensus about the inclusion of fruit juice. One hundred
per cent fruit juice can provide micronutrients that are present in the original fruit but without the fibre. However, fruit juice, especially with added sugar, can have a high energy content. Furthermore, participants might not be able to differentiate between 100% fruit juice and fruit flavoured drinks. This may explain why some studies exclude fruit juice from the fruit group [11, 12, 38, 41]. However, exclusion of fruit juice can underestimate children’s fruit consumption. In New Zealand, the MOH allows up to one serving of no-sugar-added fruit juice (250ml) to be counted as a serving of fruit [13]. Studies have showed that 100% fruit juice consumption was positively correlated with the likelihood of achieving recommended intakes of most nutrients as well as diet quality in preschool children [52, 53]. Although fruit juice can be categorised in the fruit food group, mean daily fruit juice consumption among preschool children was higher than the amount recommended in the United States [53, 54], and increased daily total energy intake [55]. The same applies to dried fruit, for which the inclusion or exclusion criteria differ in each study [11, 40]. Furthermore, fruit and vegetable intake from all sources is not always quantified, for example, some studies have not considered fruit and vegetables in mixed dishes during data analysis [38].

Another difficulty that arises in the comparison and interpretation of data from different countries is that the recommended guidelines and portion sizes that define a serve are highly variable. For instance, the Flemish food based dietary guidelines suggest 100-150g of vegetables and 125-250g of fruit daily, whereas the WHO population goal is 400g of fruit and vegetables combined [5, 38]. The United States Department of Agriculture (USDA) guidelines define one serving as one-half cup of cooked or raw vegetable, one-half cup of fruit, or 180ml of 100% fruit juice for children aged 4 years and older [56]. Moreover, in a number of studies
carried out in the United States, portion sizes for younger children are two-thirds the recommended portion size for adults to allow for their lower energy needs [10, 40]. In contrast, in New Zealand, recommended portion sizes are the same regardless of age group. Half a cup of cooked vegetables, half a cup of fruit, or 250ml of 100% juice are considered to be one serving for children from 2 to 12 years of age [1].

Accurate measurement of dietary intake is a major challenge for research focusing on fruit and vegetable consumption as well. Food records are often considered as the “gold standard” in dietary assessment providing an estimate of usual intake [49]. Assessing fruit and vegetable intake with an FFQ can lead to underestimation because some less commonly consumed food items were not listed in the FFQ [41], or overestimation because not all children are consuming whole servings of fruit or vegetables [41]. Studies have revealed that FFQs may overestimate fruit and vegetable intake when compared to food diaries [57].

Kranz et al. (2004) reported that the proportion of preschool children consuming the recommended servings of fruit and vegetable has significantly increased in the United States between 1977 and 1998 [58]. Hence, a new study is necessary in order to obtain a more recent picture of fruit and vegetable consumption among pre-schoolers in New Zealand, with careful decisions made about whether to include potatoes as vegetables, and fruit juice and dried fruit as fruit.

Table 2.2 and Table 2.3 summarised the fruit and vegetable intake among preschool and school-aged children in New Zealand and in other countries respectively.
Table 2.2: Fruit and vegetable intake among preschool and school-aged children in New Zealand

<table>
<thead>
<tr>
<th>Study</th>
<th>Subjects</th>
<th>Study methods</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Worsley, A et al. 1993 [48]</td>
<td>667 Dunedin, New Zealand adolescents, 15 years old</td>
<td>FFQ (validation not stated)</td>
<td>More girls consumed fruit and vegetables than boys</td>
</tr>
<tr>
<td>Soh, Ferguson et al. 2000 [43]</td>
<td>17 Dunedin, New Zealand Chinese children, 12 and 60 months old</td>
<td>3 day 24-hour recall collected on non-consecutive days over a two-week period</td>
<td>Less than 40% were meeting recommendation for fruit and vegetables</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Number of servings was compared with the New Zealand Food and Nutrition Guidelines</td>
</tr>
<tr>
<td>Ministry Of Health 2003 [11]</td>
<td>3275 New Zealand children, 5 to 14 years old</td>
<td>Validated qualitative FFQ</td>
<td>43% ate fruit at least twice a day</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>57% ate vegetables three or more times a day</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>No sex differences in fruit and vegetable consumption</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Older children ate fruit less frequently than younger children</td>
</tr>
<tr>
<td>Theodore, Thompson et al. 2006 [41]</td>
<td>550 New Zealand European children, 3.5 years old</td>
<td>Validated FFQ</td>
<td>73% were reported as eating the recommended servings of fruit/d</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Serving size examples used in the study were comparable to serving sizes defined in the New Zealand MOH guidelines.</td>
<td>46% were reported as eating the recommended servings of vegetables/d</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Females were more likely to consume vegetables</td>
</tr>
<tr>
<td>Study</td>
<td>Subjects</td>
<td>Study methods</td>
<td>Findings</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>--------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------</td>
</tr>
</tbody>
</table>
| Clinical Trial Research Unit 2010 [12] | 756 New Zealand children, 5 to 9 years old | Dietary Habits Questionnaire, questions on foods from fruit and vegetables group                   | • 74.9% met the guideline for fruit intake  
• 36.6% met the guideline for vegetable intake  
• 30% met the guideline for both fruit and vegetable intake |

Did not include fruit/vegetable juice or dried fruit  

Potatoes included in vegetable regardless of preparation and cooking methods
<table>
<thead>
<tr>
<th>Study</th>
<th>Subjects</th>
<th>Study methods</th>
<th>Findings</th>
</tr>
</thead>
</table>
| Dennison, Rockwell et al. 1998 [40]        | 223 children, from a rural community in upstate New York, 2 and 5 years old | 7-day estimated diet record                    | - Children consumed 1.8 total fruit servings/day (half of the servings as fruit juice)  
- 3% of the 2-year-old children and none of the 5-year-old children consumed 3 servings/day of vegetables  

Serving sizes for the 2-year-old children were reduced by one-third. |
| Ballew, Kuester et al. 2000 [52]           | 1800 United States children, 2 to 5 years                                | Single 24-hour-recall                           | - Half of the participants aged 2 to 5 years drank juice  
- The likelihood of achieving recommended intakes of most of the nutrients increased significantly with the consumption of 100% juice. |
| Alexy, Sichert-Hellert et al. 2001 [39]    | 344 German children, 4 to 6 years old                                   | 3-day-weighed diet record                      | - Boys and girls consumed 102.2g/day and 106g/day of fruit respectively  
- Boys and girls consumed 64.1g/day and 65.6g/day of vegetables respectively  
- Girls statistically significantly consumed more fruit and vegetables than boys |
Table 2.3: Fruit and vegetable intake among preschool children in other countries (continued)

<table>
<thead>
<tr>
<th>Study</th>
<th>Subjects</th>
<th>Study methods</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kranz, Siega-Riz et al. 2004 [58]</td>
<td>8626 United States children, 2 to 5 years old</td>
<td>The NFCS77 and CSFII89 collected 1 day interviewer-administered 24-hour recall and 2 additional days of self-administered 1-day estimated diet records. The CSFII94 survey data were collected through 2-day household interview.</td>
<td>Over a 21-year period from 1977 to 1998, consumption of fruit and vegetables increased</td>
</tr>
</tbody>
</table>
| Kranz, Mitchell et al 2005 [59] | 5437 United States children, 2 to 5 years old | 2 days of dietary intake data via interview                                                                                                                                                                 | Dietary fibre consumption among participants was lower than the Adequate Intake  
Fruit and vegetable intakes are significantly related to dietary fibre consumption levels. |
<table>
<thead>
<tr>
<th>Study</th>
<th>Subjects</th>
<th>Study methods</th>
<th>Findings</th>
</tr>
</thead>
</table>
| **Huybrechts, Matthys et al. 2008 [38]** | 2095 Flanders children, 2.5-6.5 years old | 3-day-estimated dietary record. Juices, vegetables soup, and potatoes are not categorised in fruit and vegetable food groups. Data are compared with the Flemish food based dietary guidelines: vegetables 100-150g/d, fruit 125-250g/d | - 34-45% reached the daily minimum recommendation for fruit intake  
- <5% of the youngest children and <20% of the oldest preschool children reached the minimum guideline for daily vegetable intake  
- 34-45% reached the daily minimum recommendation for fruit intake |
| **Fox, Condon et al. 2010 [45]** | 1461 United States older toddlers and young pre-schoolers, 2 and 3 years old | Single 24-hour recall Mixed dishes were not included in the food groups. | - 70% consumed vegetables as a distinct food item at least once a day. Fewer than 15% consumed dark-green and deep-yellow vegetables. French fries and other fried potatoes were the most commonly consumed vegetable  
- 87% consumed at least one distinct portion of fruit or 100% juice daily. Fresh fruit was the most common type of fruit consumed. |
2.4 Recommendations for fruit and vegetable intake in preschool children

The New Zealand Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2-18 years) aim to promote optimal growth and prevent childhood obesity as well as diet-related chronic diseases [13]. The guidelines encourage people to consume a variety of food from the fruit and vegetable food groups each day, including different colours and textures [13]. Recommended vegetables include all starchy and non-starchy vegetables such as potatoes, kumara, taro, broccoli, pumpkin, tomato, beetroot, and others. A wide range of fruit is suggested, for example kiwifruit, bananas, apples, and oranges. Juiced vegetables and juiced or dried fruit are described as containing fewer beneficial compounds than whole food and they are high in sugar. Therefore, the Food and Nutrition Guidelines state that if vegetable or fruit juice, or dried fruit, are consumed, they can only contribute up to one serving of the total recommended number of servings for fruits and vegetables [13].

In the 2002 New Zealand Children’s Nutrition Survey, all vegetables including fried potatoes such as hot potato chips, kumara chips, french fries, wedges or hash browns were categorised in the vegetable group [11]. Similarly, according to the New Zealand Food Composition Database, all vegetables are included in the vegetable group regardless of how they are prepared and cooked [60]. Fruit juice, however, was excluded from the fruit category in the Children’s Nutrition Survey [11].

The inclusion of “starchy” vegetables as vegetables is controversial, mainly because these plant foods contain variable amounts of starch [5]. Potatoes represent the largest percentage of vegetables consumed in New Zealand, but are often in fried form [1, 11]. This is a concern because fried potatoes are not as rich in phytochemicals as many other
vegetables, and they are energy-dense [61]. While potatoes are considered to be a vegetable in New Zealand’s guidelines, many dietary guidelines in other countries categorise potatoes in the cereal group [62, 63]. Also, WHO as well as Food and Agriculture Organisation (FAO) expert consultation report on diet, nutrition and prevention of chronic diseases, specifies that root vegetables, for example potatoes and kumara, should not be included in measurements of recommended intakes of fruit and vegetables [5]. The World Cancer Research Fund (WCRF) excludes potatoes from their list of recommendations for vegetable consumption as well [7].

A similar issue is the question of whether to include fruit juice in dietary guidelines. Fruit juice is included in the serving suggestions for the New Zealand guidelines. Nevertheless, fruit juice provides less satiety and may lead to high consumption of sugar [54]. High consumption of fruit juice may also be associated with higher BMI [24, 27]. Additionally, the consumption of fruit juice is related to an increased risk of dental caries [64]. There is also confusion by the public about cordial and fruit juice drinks, which they may not differentiate from pure fruit juice. This is a problem because they often contain added sugar.

In New Zealand, serving sizes of fruit and vegetables are standardised regardless of age group or nutrient requirement, but the number of servings varies. For example, preschool children are recommended to consume 2 servings of fruit and 2 servings of vegetables daily while the recommendation for young children and adults are 2 servings of fruit and 3 servings of fruit per day [13]. Internationally, many studies support the minimum goal of 5 servings of fruit and vegetable daily [7, 65, 66]. The American Institute for Cancer Research (AICR) sets 400 g or 5 servings of fruit and vegetable per day as a minimum
recommendation and estimates that more than 400g of fruit and vegetable consumption per day could prevent at least 20% of all cancer incidence [7]. According to the Food Guide Pyramid developed in 1992 by the USDA, fruit and vegetable recommended servings are based on energy requirements [56]. Recommendations for 1600kcal, 2200kcal, and 2800kcal are 5, 7, and 9 servings of fruit and vegetable per day, respectively [56]. The current nutrition guideline published by the USDA, MyPlate, also suggests that the amount of fruit and vegetable consumed should depend on age, sex, and level of physical activity and recommends one cup of fruit and one cup of vegetable daily for children 2-3 years old [67]. On the other hand, Gandini et al. [68] and European Prospective Investigation into Cancer and Nutrition (EPIC) studies [69] suggest a dose-response relationship, where higher intakes provide greater protective effects; and lower than recommended intake levels are associated with increased risk of disease. The exact quantity and variety of fruit and vegetables needed for maximum protection from diseases is not clear, however recommendations for New Zealand preschoolers have been clearly stated.
3. Objective Statement

Fruit and vegetables form an important part of a healthy diet because they are sources of a wide range of vitamins, minerals, antioxidants, and dietary fibre. An adequate nutrient intake is particularly important in children because childhood is a crucial time for both physical and mental growth and development. In addition, dietary habits that are formed in childhood are maintained into adulthood. Therefore, it is important to determine whether children’s fruit and vegetable intake is optimal. However, the only previous study reporting the fruit and vegetable intake of New Zealand preschool children used a food frequency questionnaire (FFQ) to assess children’s intake. The FFQ method has been shown to be less accurate than weighed diet records, meaning that the current reported intake of fruit and vegetable intake might be over- or under-estimated [41, 49]. To date, no studies in New Zealand have assessed the fruit and vegetable intake of preschool children using diet records.

The aim of this study was therefore to determine the fruit and vegetable intake of a sample of preschool children aged 3 years and living in Dunedin, using a weighed diet record; and to compare their fruit and vegetable intake with the Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2 to 18 Years).

The specific objectives were to:

1. Determine the fruit and vegetable intake of the study sample.
2. Estimate the percentage of the study sample meeting the Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2 to 18 Years) for fruit and vegetable intake.
3. Determine the food items which are contributing to fruit and vegetable intake for the study sample.

4. Determine the association between fruit and vegetable intake and vitamin C and fibre intake in the study sample.
4. Subjects and Methods

4.1 Study design

The overall aim of the EAT3 study was to validate a food frequency questionnaire (FFQ) for assessing food and nutrient intake in 3-year old children, used in the Prevention of Overweight in Infancy (POI) study. The POI study is a large randomized controlled trial investigating the efficacy of interventions to improve sleep, diet and activity from birth to 5 years of age [70]. In brief, in the present study, an FFQ was completed twice by parents approximately one month apart. A 3-day weighed diet record (WDR) was also obtained between FFQ administrations. Although a sample of 100 children is required for the validation study [71], the candidate collected data from 25 children. Other Master of Dietetics (MDiet) students will collect the remaining data for the EAT3 FFQ validation study over the course of the next 2 to 3 years. The main aim of this thesis was to determine the fruit and vegetable intake of a sample of preschool children aged 3 years and living in Dunedin, using a weighed diet record, and to compare their fruit and vegetable intake with the Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2 to 18 Years).

4.2 Recruitment and participants

The Human Ethics Committee of the University of Otago, Dunedin, New Zealand approved the study (Appendix A). Māori consultation was undertaken (Appendix B) during the design of this study, and written informed consent was obtained from all primary caregivers at the first appointment.

Recruitment into the study took place between July and August 2014, in Dunedin, following the study advertising protocol (Appendix C) and recruitment protocol.
(Appendix D). Primary caregivers of pre-schoolers aged 3 years were recruited through posters (Appendix E), flyers (Appendix F), emails, and on internet web pages as described in detail in Table 4.1. The candidate also recruited by word-of-mouth and encouraged participants to approach their friends to assess interest in participating.

Children were excluded from the study if they had a health condition which would affect feeding and/or growth.

At the second visit, all participants signed a travel reimbursement form (Appendix G) and received a grocery voucher of up to $25 ($5 for each visit and each completed day of WDR) as reimbursement for travel to attend appointments. A nutrient analysis of their child’s diet (Appendix H) and a healthy eating pamphlet produced by the Ministry of Health New Zealand [13] were provided at the end of the study.
Table 4.1: Recruitment activities in Dunedin

<table>
<thead>
<tr>
<th>Recruitment Period</th>
<th>July to August 2014</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Posters</strong></td>
<td>30 posters displayed in early childhood centres and kindergartens, 6 in School of Dentistry, 6 in Dunedin Hospital, 6 in Medical Practices, 5 in supermarkets’ staff room, 5 in dairies and takeaway shops, 4 in child clothing stores, 3 in playcentres, 2 in Dunedin City Library, 2 posters in Moana swimming pool, 1 in the Parents Centre Dunedin, 1 in The Hub, South Dunedin</td>
</tr>
<tr>
<td><strong>Flyers</strong></td>
<td>180 flyers distributed to parents at early childhood centres and kindergartens, the Parents Centre Dunedin, and participants who came for visits (to give to friends)</td>
</tr>
<tr>
<td><strong>Emails</strong></td>
<td>Two emails sent to all University of Otago staff and postgraduate students based at the Dunedin campus</td>
</tr>
<tr>
<td><strong>Internet webpages</strong></td>
<td>Conscious Parenting group Dunedin Facebook page, Dunedin Parents Centre Facebook page, Dunedin Kindergartens Facebook page, EDGAR Diabetes &amp; Obesity Research website</td>
</tr>
<tr>
<td><strong>In person</strong></td>
<td>Playgroup at Dunedin Parent Centre, playgroup at The Hub</td>
</tr>
</tbody>
</table>
4.3 Data Collection

Once primary caregivers had expressed an interest in the study through email, text, or telephone call, they received a phone call from the candidate to check their eligibility and answer any of their questions. If participants were eligible, their first study appointment was booked. The research candidate then sent an information pack including a letter confirming their appointment time (Appendix I), an information sheet (Appendix J), consent form (Appendix K), map to find the appointment room (Appendix L), demographic questionnaire (Appendix M), and EAT3 FFQ (Appendix N).

The study comprised two visits following the appropriate protocols (Appendix O and P). Both visits took place at the BLISS study office (5 Leithbank, Dunedin).

Parents were asked to read the information sheet, sign the consent form, and complete the demographic questionnaire and EAT3 FFQ before coming to the first appointment. At the first visit, the demographic questionnaire and FFQ were checked for completeness. Participants were given verbal and written instructions for completing the WDR and a set of electronic scales to use during the study. The child’s weight and height were also measured. Over the next 3 to 4 weeks, the diet record was completed on three randomly allocated days (including one weekend day). At the second visit, the completed WDR was returned and checked by the candidate for completeness. Primary caregivers then completed the EAT3 FFQ for a second time (these data will be used to assess repeatability in a subsequent study).
The candidate received training on the collection of height and weight measurements in children from an experienced paediatrician. Instructions on completing the diet record were given to parents according as described in the EAT3 food diary (Appendix Q).

4.3.1 Demographic questionnaire

The demographic questionnaire was based on the one used in the Eating Assessment in Toddlers aged 12 to 24 months (EAT) study [72, 73]. The questionnaire contained questions relating to the primary caregiver and their child, including primary caregiver’s and child’s date of birth, relationship to child in the study, number of children born to the caregiver, and the ethnicity of both the primary caregiver and the child.

4.3.2 Anthropometric data

At the first visit, the child’s weight and height were measured following an anthropometry protocol (Appendix R), using the same technique and the same equipment for each participant. A Body Composition Analyzer BC-418 (Tanita, Illinois, United States) was used to weigh children and a Leicester wall stadiometer (Tanita, Illinois, United States) was used to measure height. All equipment was calibrated at the beginning of each examining day. Children were asked to wear light clothing and to remove their shoes and hair ornaments for the measurements. If the child refused to remove all heavy clothing or was wearing a nappy (diaper), a note was made on the Anthropometry and Checklist Sheet (Appendix S) and the measured weights were adjusted accordingly (as stated in the anthropometry protocol (Appendix R)). During weight measurement, the child was requested to step on the weighing platform with bare feet, so that their heels touched the posterior electrodes and the fronts of the feet touched the anterior electrodes. If children were not willing to cooperate, the caregiver was asked to stand on the scales, the scales
tared, and then the child given to the caregiver to hold and the weight recorded. During the height measurement, the child was asked to stand on the centre of the base with their feet 2 to 3 cm apart and move back until their heels, buttocks, and upper part of their back touched the back of the stadiometer. The child’s head was positioned so that it was in the Frankfort Plane. The researcher moved the headboard onto the child’s head while holding the child’s head. Height and weight measurements were taken in duplicate to the nearest 0.1 cm (height) or 0.1 kg (weight). All measurements were conducted in the following sequence: height, weight, height, weight. A third measurement was taken if the duplicate measures are not within 0.1 kg for weight and 0.7 cm for height. The two closest measurements were used to create the average. All data was recorded on the Anthropometry and Checklist Sheet (Appendix S).

4.3.3 Food frequency questionnaire

The EAT3 FFQ was designed based on the validated FFQ developed for the Prevention of Overweight in Infancy (POI) study [70]. The questionnaire consisted of questions on 13 food groups (bread and crackers; breakfast cereals; rice and pasta; meat, chicken, fish, eggs, and beans; vegetables; fruit; milk and milk products; puddings; cakes, biscuits, and snacks; drinks; spreads; takeaways) using a total of 101 food and drink related questions. The FFQ assessed the frequency of intake across seven categories ranging from not eaten this month to 5 or more times a day. Serving sizes and leftovers were not assessed in the EAT3 FFQ because this FFQ is used to determine the frequency of consumption of the food items listed, but not the quantity.
This particular study only used the data collected from the two questions in the EAT3 FFQ which assess the frequency of fruit and vegetable intake of the child in the past 4 weeks (Figure 4.1).

**Figure 4.1: Questions in the EAT3 FFQ used to assess the frequency of fruit and vegetable intake of the child in the past 4 weeks**

<table>
<thead>
<tr>
<th>F. Vegetables</th>
</tr>
</thead>
<tbody>
<tr>
<td>29. How often has child’s name had vegetables in the past 4 weeks:</td>
</tr>
<tr>
<td>☐ Never</td>
</tr>
<tr>
<td>☐ 1-3 per month</td>
</tr>
<tr>
<td>___ times a week</td>
</tr>
<tr>
<td>___ times a day</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>G. Fruit</th>
</tr>
</thead>
<tbody>
<tr>
<td>42. How often has child’s name had fruit in the past 4 weeks:</td>
</tr>
<tr>
<td>☐ Never</td>
</tr>
<tr>
<td>☐ 1-3 per month</td>
</tr>
<tr>
<td>___ times a week</td>
</tr>
<tr>
<td>___ times a day</td>
</tr>
</tbody>
</table>

The FFQ was completed twice by the primary caregiver, prior to the first visit and during the second visit, approximately four weeks apart.

### 4.3.4 Weighed diet record

The candidate modified an existing WDR booklet used in a previous toddler study, so that it was suitable for 3 year olds [72, 73]. The WDR booklet was labelled the “EAT3 food diary” booklet (Appendix Q).

At the first visit, all participants received written and verbal instructions for completing a three-day WDR, and were provided with the “EAT3 food diary” booklet, a set of dietary
scales (Salter Electronic Model Selectronic 2200, Victoria, Australia) and two spare batteries. Scales were accurate to within ± one gram.

The child’s WDR was completed by their primary caregiver and the caregivers at the child’s childcare centre (if applicable) for 3 days over a 3 to 4 week period. The study aimed to achieve an even spread across all days of the week by allocating participants the days to do weighing and recording, including 2 week days and 1 weekend day. All participants received a reminder text the day before each of their specific diet recording days and a phone call after their first day to assess how the recording had gone and to answer any questions they may have had.

On each allocated day, participants were asked to weigh and record all foods and drinks consumed by their child. They were asked to record the time and location where the food was eaten and the name, brand, and cooking method used to prepare the food. The participant was then asked to weigh and record the weight of the empty plate or mug, and then weigh each food item, and record the weight, without taring the scales between foods. They were then asked to weigh all the leftovers and attempt to estimate the amount of each food making up the leftovers (e.g., half the potato, no peas, 1/8 of the fries). At a later date the candidate then calculated the ‘amount eaten’ by subtracting the leftovers from the amount offered.

The diet record contained a question asking the parent if the child was unwell on the day of recording, and if this influenced their child’s appetite by increasing or decreasing it.
Participants were supplied with a supplementary page containing photographs of commonly eaten ‘takeaway foods’ (e.g., McDonald’s fries, pizza) (Appendix T). Each photograph contained a food item with a corresponding weight, and participants were able to estimate the approximate weight of the food the child was offered. The supplementary page also had a ruler and set of circles for measuring any food items that could not be weighed.

The primary caregiver who attended the first visit was asked to instruct any other carers on how to record foods and drinks eaten by their child at times when they were not present. If the primary caregiver provided the food that was eaten while their child was with another carer, the primary caregiver was asked to weigh the food items beforehand, and request that all leftovers be returned so they could be weighed.

At the second appointment, when the diet record was returned, the candidate checked the diet record to identify any mistakes, missing foods, or illegible handwriting. These were then clarified with the primary caregiver.

4.4 Data entry

Data from the demographic questionnaire and anthropometric measurements were entered into an Excel spreadsheet (Microsoft Excel 2010; 14.0.6123.5001; Microsoft Corporation, Redmond, Washington, United States). The diet records were entered into Kai-culator (Version 1.10), a web-based dietary software program developed by the Department of Human Nutrition at the University of Otago. Kai-culator analyses diet records using the New Zealand Plant and Food Research FOODfiles 2010 version 02, which contains information on the composition of foods available and consumed in New Zealand.
Diet records were entered under the participant’s code. Foods and beverages were entered using 24 hour time to indicate eating occasion. The amount of food consumed was entered as weight (g, Kg) or volume (mL, L) as often as possible. Where this was not appropriate, household measures were used and translated to weight or volume by Kai-culator. In the diet records, participants provided all ingredients where possible for homemade recipes, and the proportion of the total recipe offered to the child. Raw ingredient weights were converted to cooked weights using conversion factors provided by Food Standards Australia New Zealand [74]. The percentage of each ingredient was calculated so they could be entered in Kai-culator based on the proportion of the total cooked recipe given to the child as recorded in the diet record. Therefore, fruit and vegetables in the mixed dishes were taken into account when we determined the fruit and vegetable intake of the children. Where the exact brand or flavour of a particular food item was not available, a food of the same type and with the most similar nutrient composition was used. All the diet records were checked for accuracy and consistency of data entry. If the dietary data was not sufficiently detailed, the candidate contacted participants to clarify specific details.

4.5 Statistical Analysis

All statistical analyses were conducted using Microsoft Excel 2010 (14.0.6123.5001; Microsoft Corporation, Redmond, Washington, United States), or SPSS version 20.0.0 (IBM Corporation, New York, United States of America). Continuous data were checked for normality using the Shapiro-Wilk test, and visually by producing histograms with a normal curve superimposed. If the variable was normally distributed, means and standard deviation were calculated. Otherwise, median, 25th percentile, and 75th percentile were presented. Numbers and percentages were calculated for categorical variables. Descriptive
statistics were calculated separately for participants who completed the study and for participants who did not.

The average daily intake of fruit, vegetables, fruit juices, and potatoes in children as a whole group, children who consumed potatoes, and children who did not consume potatoes were calculated separately. Comparisons of means of fruit, fruit juice, vegetables, and fruit and vegetables combined, between potato consumers and non-potato consumers, were calculated using an independent-samples t-test when variables were normally distributed. If variables were not normally distributed, the Mann-Whitney U-test was used. Both independent-samples t-test and Mann-Whitney U-test had a level of statistical significance set at a p-value of less than 0.05.

The strength of relationship between the fruit and vegetable intakes and fibre and vitamin C were assessed using the Pearson’s correlation coefficient. However, due to the small sample size, all statistics were undertaken with unadjusted variables.
5. Results

5.1 Participants and recruitment

In total, 20 parent-child pairs were recruited from Dunedin between July 2014 and August 2014. Of the 20 parents and children recruited into the study, 3 did not return any written dietary records (2 due to time constraints, 1 due to a family issue) and were excluded from the study, resulting in an 85% completion rate. There were no significant differences in the mean weight, height, and body mass index (BMI) of the children who finished the study compared to those who did not (data not shown).

Characteristics of the parents and children who participated in the study are summarized in Table 5.1. Only 1 parent-child pair who completed the study was a father-child pair (n=1, 5.9%) and the remaining participants were mothers and children. Parents had a mean age of 36.7 years (SD 7.7) and were predominantly New Zealand European (n=14, 82.4%) with 3 parents identifying as Asian (17.6%). On average, parents had 2 children (SD 0.0) including the study child. The mean age of the children at the date of their first appointment was 3.3 years (SD 0.2) and more than half (n = 10, 58.8%) were female. Sixteen of the children were New Zealand European and their mean BMI was 16.4 (SD 1.3). Three (17.6%) out of the 17 children were obese (>95th percentile), while the remaining had a BMI within the healthy range using the Centre of Disease Control and Prevention (CDC) BMI-for-age growth chart [75]. Parents described their study child as sick on a total of 12% (n=6) of the diet record days. On these sick days, 50% (n=3) of children were thought to have a decreased appetite and the rest had no change. Diet records on all sick days were included in our study as they only constituted a small
proportion of the total diet record days, and were considered to reflect the common occurrence of preschool children being unwell.
Table 5.1: Characteristics of the study participants (n=17)

<table>
<thead>
<tr>
<th></th>
<th>Mean (SD)</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Parent/Primary caregiver</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>36.7 (7.7)</td>
<td></td>
</tr>
<tr>
<td>Number of children (including study child)</td>
<td>2.0 (0.0)</td>
<td></td>
</tr>
<tr>
<td>Ethnicity (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NZEO</td>
<td>14 (82.4)</td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>3 (17.6)</td>
<td></td>
</tr>
<tr>
<td>Māori</td>
<td>0 (0.0)</td>
<td></td>
</tr>
<tr>
<td><strong>Child</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>7 (41.2)</td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>3.3 (0.2)</td>
<td></td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NZEO</td>
<td>16 (94.1)</td>
<td></td>
</tr>
<tr>
<td>Asian</td>
<td>3 (17.6)</td>
<td></td>
</tr>
<tr>
<td>Māori</td>
<td>1 (5.9)</td>
<td></td>
</tr>
<tr>
<td><strong>Anthropometric measurements</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>16.4 (2.1)</td>
<td></td>
</tr>
<tr>
<td>Height (cm)</td>
<td>99.9 (4.5)</td>
<td></td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>16.4 (1.3)</td>
<td></td>
</tr>
</tbody>
</table>
5.2 Daily average fruit and vegetable intake

Daily average intakes of fruit and vegetables were 132.2g (SD 72.4) and 39.0g (SD 26.7) respectively (Table 5.2), indicating that children consumed almost three times as much fruit in grams than vegetables. Because fruit juices are included in the fruit food group in the Ministry of Health (MOH) dietary guidelines [1], we included fruit juice in the fruit and vegetable combined data. However, intake of fruit juices was relatively low amongst these children with a median intake of 21.0 grams a day (IQR: 15.2, 71.9).

Vegetables were examined both including and excluding potatoes (Table 5.2). As a group, the 17 children consumed a small amount of potatoes each day [median = 13.3g (IQR: 7.7, 29.0)] daily, which increased to 18.9g (IQR 13.1, 38.8) when only those who actually ate potatoes were included (n = 12). Average daily vegetable intake was 32.3g lower (P=0.048) in non-potato consumers than in potato consumers (Table 5.2). Overall, non-potato consumers appeared to have a lower daily average intake of energy (data not shown), fruit, fruit juice, and fruit and vegetables combined, but these differences were not statistically significant (Table 5.2). Most children chose healthy options for potatoes. Of the 12 potato consumers, only 3 children ate potatoes in fried form (1 child consumed 10g of hash brown and 70g of hot chips, and 2 other children consumed 35g and 172g of wedges respectively at one time).

Table 5.3 presents the intake of fruit and vegetables in terms of the number of servings each day, showing that most of the children consumed 1 serving of fruit (n=9, 52.9%) and less than 1 serving of vegetables (n=13, 35.3%) per day. Eleven children (64.7%) had a total intake of 1-3 servings of fruit and vegetables per day while the remaining 6 children
(35.3%) consumed less than 1 serving daily. **Figure 5.1** illustrates that only 5.9% of the children reached the minimum dietary guidelines for daily fruit intake. No children met the vegetable guideline, and no children met both the fruit and the vegetable guidelines on the days of the survey.

**Table 5.4** shows the frequency of children consuming fruit and vegetables based on the data collected from food frequency questionnaire (FFQ). The majority of the children had fruit [n=12 (70.6%)] and vegetables [n=13 (76.5%)] 1 to 2 times a day. One parent (5.9%) reported that their study child only had vegetables 1 to 3 times per month.
Table 5.2: Children’s average daily intakes of fruit, vegetables, fruit juices, and potatoes (g/d) from the 3 day weighed diet record (n=17)

<table>
<thead>
<tr>
<th></th>
<th>Whole group (n=17)</th>
<th>Potato consumers (n=12)</th>
<th>Non-potato consumers (n=5)</th>
<th>P value&lt;sup&gt;5&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SD)&lt;sup&gt;1&lt;/sup&gt;</td>
<td>n&lt;sup&gt;2&lt;/sup&gt; (%)</td>
<td>Mean (SD)&lt;sup&gt;1&lt;/sup&gt;</td>
<td>n&lt;sup&gt;2&lt;/sup&gt; (%)</td>
</tr>
<tr>
<td>Fruit</td>
<td>132.2 (72.4)</td>
<td>17 (100)</td>
<td>149.3 (65.5)</td>
<td>12 (100.0)</td>
</tr>
<tr>
<td>Fruit juice</td>
<td>21.0 (15.2, 71.9)&lt;sup&gt;3&lt;/sup&gt;</td>
<td>9 (52.9)</td>
<td>30.5 (16.9, 79.6)&lt;sup&gt;3&lt;/sup&gt;</td>
<td>8 (66.7)</td>
</tr>
<tr>
<td>Vegetables</td>
<td>31.0 (25.2, 52.7)&lt;sup&gt;3&lt;/sup&gt;</td>
<td>17 (100)</td>
<td>41.0 (29.4, 62.7)&lt;sup&gt;3&lt;/sup&gt;</td>
<td>12 (100.0)</td>
</tr>
<tr>
<td>Potatoes</td>
<td>13.3 (7.7, 29.0)&lt;sup&gt;3&lt;/sup&gt;</td>
<td>12 (70.6)</td>
<td>18.9 (13.1, 38.8)&lt;sup&gt;3&lt;/sup&gt;</td>
<td>12 (100.0)</td>
</tr>
<tr>
<td>Fruit and vegetables combined&lt;sup&gt;4&lt;/sup&gt;</td>
<td>214.7 (107.7)</td>
<td>17 (100)</td>
<td>243.6 (104.6)</td>
<td>12 (100.0)</td>
</tr>
</tbody>
</table>

1. Mean (SD) unless stated otherwise
2. Number of children consuming each food in the respective groups
3. Median (25<sup>th</sup> percentile, 75<sup>th</sup> percentile) is presented because Shapiro-Wilk test for normality revealed data were not normally distributed
4. Fruit juice was included in the combined count because it contributes a maximum of one serving of the total recommended number of servings for fruit and vegetables food group according to MOH guidelines [1]
5. P value for t-test if the variable was normally distributed and P value for Mann-Whitney U test if the variable was not normally distributed, comparing between potato consumers and non-potato consumers
Table 5.3: Percentage of children who met the recommended guidelines for fruit and vegetable intake ¹ (n=17)

<table>
<thead>
<tr>
<th>Food groups</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Met fruit guideline ²</td>
<td></td>
</tr>
<tr>
<td>&gt;2 servings</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>2 servings</td>
<td>1 (5.9)</td>
</tr>
<tr>
<td>1 serving</td>
<td>9 (52.9)</td>
</tr>
<tr>
<td>&lt;1 serving</td>
<td>7 (41.2)</td>
</tr>
<tr>
<td>Met vegetable guideline ²</td>
<td></td>
</tr>
<tr>
<td>&gt;2 servings</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>2 servings</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>1 serving</td>
<td>4 (23.5)</td>
</tr>
<tr>
<td>&lt;1 serving</td>
<td>13 (35.3)</td>
</tr>
<tr>
<td>Met both the fruit and the vegetable guidelines ²</td>
<td></td>
</tr>
<tr>
<td>&gt;4 servings</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>4 servings</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>1-3 servings</td>
<td>11 (64.7)</td>
</tr>
<tr>
<td>&lt;1 serving</td>
<td>6 (35.3)</td>
</tr>
</tbody>
</table>

¹: Food and Nutrition Guidelines recommended by Ministry of Health, New Zealand [1]
²: Fruit juice was included in the combined count because it contributes a maximum of one serving of the total recommended number of servings for fruit and vegetables food group according to MOH guidelines [1]
Figure 5.1: Percentage of children who met the recommended guidelines for fruit and vegetables intake \(^1\) (n=17)

<table>
<thead>
<tr>
<th></th>
<th>Fruit guideline only</th>
<th>Fruit and vegetable guidelines</th>
<th>Vegetable guideline only</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5.9 %</td>
<td>0.0 %</td>
<td>0.0 %</td>
</tr>
</tbody>
</table>

\(^1\): Food and Nutrition Guidelines recommended by Ministry of Health, New Zealand [1]

Table 5.4: Frequency of fruit and vegetables intake in the past 4 weeks based on the FFQ (n=17)

<table>
<thead>
<tr>
<th>Frequency of intake</th>
<th>Fruit n (%)</th>
<th>Vegetable n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td>1-3 times per month</td>
<td>0 (0.0)</td>
<td>1 (5.9)</td>
</tr>
<tr>
<td>1-6 times a week</td>
<td>2 (11.8)</td>
<td>2 (11.8)</td>
</tr>
<tr>
<td>1-2 times a day</td>
<td>12 (70.6)</td>
<td>13 (76.5)</td>
</tr>
<tr>
<td>≥ 3 times a day</td>
<td>3 (17.6)</td>
<td>1 (5.9)</td>
</tr>
</tbody>
</table>
5.3 Major food items contributing to total fruit and vegetable intake

The major food items contributing to total fruit intake and total vegetable intake are shown in Figures 5.2 and 5.3 respectively. Banana, fruit juice, and apple represented nearly 75% of all fruit intake – on average banana comprised 24.4%, fruit juice 24.1% and apple 20.1% of the total amount consumed. Other less frequently consumed types of fruit were grapes, pear, orange, and kiwifruit. Overall, fresh fruit was the most common type of fruit, consumed by all children (n=17, 100%). Five children (29.4%) had dried fruit, mostly raisins, and only 1 child (5.8%) consumed canned fruit (data not shown).

Potato was the highest contributor to total vegetable intake (21.6%) among children followed by carrots (18.5%), and vegetables in mixed dishes (18.2%). Other sources of vegetable intakes in children were broccoli, potato in mixed dishes, corn, and salad vegetable mixture.
Figure 5.2: Food items contributing to total fruit intake (including fruit juice) in children

![Bar chart showing fruit intake]

- Banana: 24.4%
- Fruit juice: 24.1%
- Apple: 20.1%
- Grapes: 7.2%
- Pear: 4.7%
- Orange: 4.1%
- Kiwifruit: 3.3%

Figure 5.3: Food items contributing to total vegetable intake (including potato) in children

![Bar chart showing vegetable intake]

- Potato: 21.6%
- Carrots: 18.5%
- Vegetable in mixed dishes: 18.2%
- Broccoli: 8.8%
- Potato in mixed dishes: 8.0%
- Corn: 3.5%
- Salad vegetable mixture: 2.7%
5.4 Correlation between fruit and vegetable consumption and vitamin C and fibre intake

Figure 5.4 shows that dietary fibre intake was correlated significantly with servings of fruit and vegetables consumed by children per day ($r=0.634$, $p<0.006$). There was also a strong correlation between vitamin C intake and total fruit and vegetable intake (Figure 5.5; $r=0.818$, $p<0.001$).
Figure 5.4: Correlation between fruit and vegetable consumptions (number of servings/day) and fibre intake (g/d) among children

![Graph showing the correlation between fruit and vegetable consumptions and fibre intake among children.](image)

Figure 5.5: Correlation between fruit and vegetable consumptions (number of servings/day) and Vitamin C (mg/d) intake among children

![Graph showing the correlation between fruit and vegetable consumptions and Vitamin C intake among children.](image)
6. Discussion

The average daily fruit and vegetable intake of preschool children in this sample was considerably lower than the recommended intake in the New Zealand Ministry of Health (MOH) Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2-18 years) [1]. Only 1 child (6%) ate 2 servings of fruit per day and no children had 2 or more servings of vegetables daily. As a result, no children met the recommended guidelines for fruit and vegetables combined, although most children did eat fruit and vegetables once or twice each day. Of interest is the finding that non-potato consumers had a significantly lower vegetable intake and tended to consume less fruit and vegetables combined, as compared to potato consumers. This study also showed that children who consumed more fruit and vegetables had higher intakes of vitamin C and fibre. A relatively limited variety of fruit was observed in our study sample. Only three types of fruit – banana, fruit juice, and apple, accounted for 70% of the total fruit intake. Similarly, the diversity of vegetables was low among the children, with potatoes and carrots representing nearly half of the total vegetable intake.

In New Zealand, the recommended number of servings and portion sizes of fruit and vegetables are the same across children aged 2 to 18 regardless of their energy requirements [1]. However, the American Institute for Cancer Research and World Cancer Research Fund (AICR) defines one portion of fruit or vegetable as 80g and states that children’s portions and goals should be proportionately smaller than those for adults to allow for their lower energy needs [76]. In a number of studies carried out in the United States, portion sizes for children 2 to 3 years of age are two thirds the recommended portion sizes for adults [10, 40]. The
average daily vegetable intake in our study sample was 31g, and hence failed to achieve even these adjusted recommendations.

Overall, the results of our study were consistent with the results reported in previous studies on fruit and vegetable intake among children in New Zealand and in other international studies [11, 12, 38-41, 43], in that preschool children do not consume sufficient fruit and vegetables.

However, compared to the only study carried out in New Zealand which described the dietary intake of preschool children, the proportion of children consuming the recommended daily intake of fruit and vegetables was much lower in our study [41]. The same phenomenon was observed when comparison is made between our study and the National Survey of Children and Young People’s Physical Activity and Dietary Behaviours in New Zealand which was carried out with children and young people aged 5 to 24 years of age in 2008 to 2009 [12]. Three quarters of their study sample met the guideline for fruit intake and nearly half of them met the guideline for vegetable intake [12, 41]. In contrast, in our group of Dunedin preschool children, only 6% met the guideline for fruit while none of them met the guideline for vegetables. This could be due to the data on fruit and vegetable intake in both the study of New Zealand preschoolers and the National Survey of Children and Young People’s Physical Activity and Dietary Behaviours being collected by food frequency questionnaire (FFQ), a dietary assessment method that is more likely to overestimate fruit and vegetable intake [57]. In other international studies that used diet records to assess children’s dietary intake, the levels of fruit and vegetable consumption were closer to our findings. For example, a German
study showed that children 4 to 6 years old consumed 104g of fruit and 64g of vegetables daily, as compared to 132g and 39g of fruit and vegetables respectively in our study [39]. Similar results were found in a study undertaken in Flanders [38] where fewer than 5% of preschool children reached the minimum guideline for daily vegetable intake [38].

As mentioned previously, direct comparisons between studies are difficult due to differences in the dietary assessment methods used. Furthermore, not all studies have included fruit and vegetables in mixed dishes during data analysis. It is even harder to compare our study with studies done in other countries. This is because the food culture, definition of fruit and vegetables, and the recommended portion size that defines a serve vary across countries. For example, in Spain, dietary guidelines suggest the same number of servings of fruit and vegetables for children although the recommended portion sizes are smaller [50]. Furthermore, fruit juice and potatoes are excluded from the fruit and vegetable food groups in Spain [50].

It is alarming to observe the large percentage of children consuming diets that are lacking in fruit and vegetables, even after considering fruit and vegetables in mixed dishes such as stir-fried dishes and casseroles as was done in the current study. Barriers to achieving adequate fruit and vegetable intake could be explained by the socio-ecological model [77], which is an approach to health promotion that offers a broader perspective. The socio-ecological model provides better understanding of the multiple factors and barriers that impact a dietary behavior such as fruit and vegetable consumption. Intrapersonal factors such as children’s taste preferences have been consistently shown to be a main reason for not liking fruit and vegetables [78-80]. Some studies have showed that children generally prefer fruit to
vegetables because of their sweet flavour [79, 81, 82], which could explain the finding that fruit consumption was higher than vegetable consumption in our study sample. Several other interpersonal factors should also be considered as they relate to the food choices of young children. For instance, studies have shown that children learn to eat fruit and vegetables from family members, particularly their mother [81, 82], but that preschool-aged children consume a small amount of fruit and vegetables per day in childcare [83, 84]. The majority of the parents who completed the current study were employed mothers and their children went to childcare. This could contribute to the low fruit and vegetable intake in the present study. Paget et al. [83] and Ball et al. [84] used a researcher-based, observation system to collect data so their representation of dietary intake by children at the childcare centres would be relatively accurate.

The most common types of fruit and vegetables consumed by the children in our study appeared to be similar to those in other studies [11, 44, 45]. However, contrary to expectations, the current study did not find that potatoes in fried form are eaten frequently by children, which has been shown consistently in many other studies [11, 41, 45, 85]. Interestingly, we found that children who did not consume potatoes had a lower intake of vegetables, and of fruit and vegetables combined than children who did eat potatoes. No other studies appear to have reported a similar relationship previously. Perhaps the current group of non-potato consumers was not representative of the wider group, and thus skewed the data since potato is one of the most commonly eaten vegetables in New Zealand, including in preschool children [11, 41, 51]. Another possible explanation for this is that non-potato consumers have a lower mean energy intake, hence a lower overall dietary intake as compared to potato consumers.
However, the difference of energy intake between these two groups was not statistically significant.

Similar to the current findings, 100% fruit juice has been consistently shown to be one of the main fruit sources in children’s diet [40, 45, 52]. In New Zealand, the MOH states that if 100% fruit juice is consumed, up to one serving (250ml) can be counted as a serving of fruit [1]. Our analysis suggests that the preschool children are consuming, on average, appropriate amounts of 100% fruit juice. Previous studies showed that fruit juice contributed significantly to the intake of several important nutrients in preschool children, such as vitamin C, folate, magnesium and potassium [52] and that children’s overall diet quality was positively associated with 100% fruit juice consumption [26, 53]. Given the low level of fruit consumption, 100% fruit juice appears to be one way to increase fruit intake; however, the goal should be to encourage intake of all types of fruit.

Different types of fruit and vegetables have different combinations of nutrients and other potentially important components [16]. The current study found that total fruit and vegetable intake was correlated with vitamin C and fibre intake. This finding supports the 2002 New Zealand Children’s Nutrition Survey which showed that fruit and vegetables are the major sources of nutrients for children particularly dietary fibre, vitamin C, β-carotene, and vitamin E [11].

However, with the small sample size in the present study, caution must be applied, as the findings might not be generalisable to all preschool children in New Zealand. It is important to
bear in mind the possible bias that might be in the study. For instance, the parents recruited in our study were mostly university staff which might result in overrepresentation of well-educated subjects. Furthermore, the parents who agreed to participate in our study may have been more concerned with food and nutrition than those who did not participate, since they were volunteers for a nutrition study. We were also unable to control for confounders during data analysis due to the small sample size. Another limitation arising from our study is that the data were collected over a one-month period during the winter season hence they did not allow for seasonal variability in the intake of food. Studies have demonstrated that a lower availability of fruit and vegetables is apparent during the winter months [86, 87]. This could mean that data for fruit and vegetable intakes collected at other times of the year in this population could potentially be higher.

Strengths of this study include the use of a 3-day-weighed diet record to assess children’s dietary intake. The diet record is often considered to be the “gold standard” of dietary assessment [49]. In addition, diet records were completed by parents and caregivers on 2 weekdays and 1 weekend day so therefore should be more likely to reflect children’s usual intake. Diet records were also verified for accuracy and completeness at the second visit with the parents.

These results indicate the need for greater efforts targeting improvements in fruit and vegetable consumption among New Zealand pre-schoolers, both in quantity and variety, in order to produce a healthful diet and to prevent diet-related diseases in our future adult population. A larger study with a more nationally representative sample is suggested. It should
also be further investigated whether the current recommended portion sizes of fruit and vegetables for preschool children are practical and whether revisions and amendments are needed, given their lower energy needs. Lastly, barriers to increasing consumption of fruit and vegetables should be investigated, and strategies for appropriate programs and interventions should be developed.
7. Application to Practice

The New Zealand Dietetic Board states that “dietitians apply scientific knowledge about food and nutrition to individuals and groups in states of health and disease to promote optimal health outcomes within the social, economic, and cultural context of the New Zealand population” [88].

In our sample of Dunedin preschool children aged 3 years, the level of fruit and vegetable intake was low with 6% of the children meeting the recommended number of servings of fruit and no children met the guideline for vegetables per day. A larger and more nationally representative survey is needed to determine whether the fruit and vegetable intake of all New Zealand preschool children is this low. In the meantime, given the compiling evidence suggesting health benefits of increased fruit and vegetable intake [2-5], and that food habits and eating patterns developed in early childhood ‘track’ into later childhood and adulthood [9, 10], dietitians should continue to promote fruit and vegetable consumption in children.

Parents, and increasingly early childhood education (ECE) providers, play an important role, both as role models and gatekeepers of the foods available, in influencing what children eat. Therefore, dietitians need to work in partnership with families and ECE providers to ensure that fruit and vegetables are offered as part of the meals and snacks provided to children, and that a positive eating environment is achieved in order to foster healthy eating habits in children. There are several ways in which dietitians can contribute to this. For example, dietitians can provide hands-on nutrition workshops to educate parents on the importance of fruit and vegetables as well as cooking classes to demonstrate how to incorporate fruit and
vegetables into daily meals. Dietitians can also develop or provide consultation to the available ECE nutrition programs, for instance the “Fuelled4life” program by the New Zealand Ministry of Health and New Zealand Heart Foundation. In addition, dietitians should encourage families to become active in ECE nutrition programs, and help facilitate effective communication between families and programs.

In addition to promoting increased consumption of fruit and vegetables in terms of quantity, dietitians should also promote consuming a variety of fruit and vegetables, to ensure the best possible benefits. Studies have consistently found that potato was the most commonly eaten type of vegetables among New Zealanders, including in our study sample. Although potato is a good source of several nutrients such as potassium and dietary fibre, it does have a relatively high carbohydrate and energy content [1], and does not provide food components that some other vegetables provide. Therefore, dietitians should further emphasise the promotion of other “non-starchy” vegetables in order to increase the variety of vegetables consumed by preschool children.

If future nationally representative data find the same results as the present study that preschool children did not consume excessive amounts of 100% fruit juices (i.e. they consume less than 250mL per day), dietitians should consider recommending fruit juice intake among children as it can contribute to the daily fruit intake as well as nutrient intake. However, it is important for dietitians to educate parents and caregivers about the difference between fruit drinks and 100% fruit juices; and to avoid giving fruit juices as continuous snacks in a bottle or sippy cup because of the risk of dental caries. Dietitians should also ensure that children’s fruit juice

57
intake is within the recommendations, especially for overweight or obese children and for children who are at risk of overweight or obesity.

Finally, given that other international organisations and studies have suggested that the serving sizes of fruit and vegetables for preschool children should be proportionately smaller than those for adults to allow for their lower energy needs [10, 40, 76], dietitians should participate in research and review the scientific literature to examine whether the serving sizes of fruit and vegetables currently recommended by the Ministry of Health are practical and realistic for preschool children to achieve, and whether revisions are needed.
8. References


9. Appendices

A. Human ethics application: approval letter
B. Ngāi Tahu Research Consultation Committee letter
C. Advertising protocol
D. Recruitment protocol
E. Recruitment poster
F. Recruitment flyer
G. Travel reimbursement form
H. Participant results letter
I. Letter confirming appointment time
J. Participant information sheet
K. Consent form
L. Map to the appointment room
M. Demographic questionnaire
N. EAT3 food frequency questionnaire
O. First visit protocol
P. Second visit protocol
Q. EAT3 food diary booklet
R. Anthropometry protocol
S. Anthropometry and checklist sheet
T. EAT3 food diary supplementary page
Appendix A

Human ethics application: approval letter
Dr A-L Heath  
Department of Human Nutrition  
Division of Sciences  

23 June 2014

Dear Dr Heath,

I am writing to let you know that, at its recent meeting, the Ethics Committee considered your proposal entitled "EAT3: What are New Zealand 3 year olds eating?".

As a result of that consideration, the current status of your proposal is: Approved

For your future reference, the Ethics Committee’s reference code for this project is: H14/083.

The comments and views expressed by the Ethics Committee concerning your proposal are as follows:

While approving the application, the Committee would be grateful if you would respond to the following:

Although not a condition of approval, the Committee commented that it could prove problematic for parents to weigh all the food for their child for the duration of the study (4-5 weeks).

Please remove reference to reimbursement on the Consent Form (item 6). Please be aware that care needs to be taken with wording when preparing all contracts, advertising material and other documents where research participants will be reimbursed or provided with a gift for their participation. The University of Otago's Financial Services Division is currently reviewing what wording can be used by researchers, as words such as "remuneration" and any mention of time involved with the study implies that there is an employment relationship between the study participant and the University. This has tax and administrative implications for both the participant (PAYE will need to be deducted from their payment) and the University (the participant will need to fill in personnel forms and be loaded to payroll). Likewise the mention of "gifts" or "token of thanks" raises other tax implications which may burden the participant and/or the department. Researchers are encouraged to use wording such as "reimbursing the participant for expenses or the cost of participating." If you would like to discuss issues of tax liability, please contact the Financial Service Division's Treasury Accountant (ext 8185) or Senior Accounts Administrator (ext 8226).
Please provide the Committee with copies of the updated documents, if changes have been necessary.

The standard conditions of approval for all human research projects reviewed and approved by the Committee are the following:

Conduct the research project strictly in accordance with the research proposal submitted and granted ethics approval, including any amendments required to be made to the proposal by the Human Research Ethics Committee.

Inform the Human Research Ethics Committee immediately of anything which may warrant review of ethics approval of the research project, including: serious or unexpected adverse effects on participants; unforeseen events that might affect continued ethical acceptability of the project; and a written report about these matters must be submitted to the Academic Committees Office by no later than the next working day after recognition of an adverse occurrence/event. Please note that in cases of adverse events an incident report should also be made to the Health and Safety Office:

http://www.otago.ac.nz/healthandsafety/index.html

Advise the Committee in writing as soon as practicable if the research project is discontinued.

Make no change to the project as approved in its entirety by the Committee, including any wording in any document approved as part of the project, without prior written approval of the Committee for any change. If you are applying for an amendment to your approved research, please email your request to the Academic Committees Office:

gary.witte@otago.ac.nz

jo.farrondo.diaz@otago.ac.nz

Approval is for up to three years from the date of this letter. If this project has not been completed within three years from the date of this letter, re-approval or an extension of approval must be requested. If the nature, consent, location, procedures or personnel of your approved application change, please advise me in writing.

Yours sincerely,

[Signature]

Mr Gary Witte
Manager, Academic Committees
Tel: 479 8256
Email: gary.witte@otago.ac.nz

c.c. Professor S Samman       Department of Human Nutrition
Appendix B

Ngāi Tahu Research Consultation Committee letter
Tuesday, 17 June 2014.

Dr Anne-Louise Heath,
Department of Human Nutrition,
DUNEDIN.

Tēnā koe Dr Anne-Louise Heath,

EAT3 - What are New Zealand 3 year olds eating

The Ngāi Tahu Research Consultation Committee (The Committee) met on Tuesday, 17 June 2014 to discuss your research proposition.

By way of introduction, this response from The Committee is provided as part of the Memorandum of Understanding between Te Rūnanga o Ngāi Tahu and the University. In the statement of principles of the memorandum it states “Ngāi Tahu acknowledges that the consultation process outlined in this policy provides no power of veto by Ngāi Tahu to research undertaken at the University of Otago”. As such, this response is not “approval” or “mandate” for the research, rather it is a mandated response from a Ngāi Tahu appointed committee. This process is part of a number of requirements for researchers to undertake and does not cover other issues relating to ethics, including methodology they are separate requirements with other committees, for example the Human Ethics Committee, etc.

Within the context of the Policy for Research Consultation with Māori, the Committee base consultation on that defined by Justice McGechan:

"Consultation does not mean negotiation or agreement. It means: setting out a proposal not fully decided upon; adequately informing a party about relevant information upon which the proposal is based; listening to what the others have to say with an open mind (in that there is room to be persuaded against the proposal); undertaking that task in a genuine and not cosmetic manner. Reaching a decision that may or may not alter the original proposal."

The Committee considers the research to be of importance to Māori health.

As this study involves human participants, the Committee strongly encourage that ethnicity data be collected as part of the research project. That is the questions on self-identified ethnicity and descent, these questions are contained in the latest census.

The Committee suggests dissemination of the research findings to relevant National Māori Education organizations and Toitu te Iwi at Te Rūnanga o Ngāi Tahu regarding this study.

We wish you every success in your research and The Committee also requests a copy of the research findings.

This letter of suggestion, recommendation and advice is current for an 18 month period from Tuesday, 17 June 2014 to 9 December 2015.
Nāhaku noa, nā

Mark Brunton
Kaiwhakahaere Rangahau Māori
Research Manager Māori
Research Division
Te Whare Wānanga o Otago
Ph: +64 3 479 8738
Email: mark brunton@otago.ac.nz
Web: www.otago.ac.nz
Appendix C

Advertising protocol
EAT-3 Advertising protocol

Objectives:

1. To identify locations for recruitment advertising that parents of 36-47 month old children are likely to see
2. To gain permission to advertise in these locations
3. To distribute posters and emails
4. To arrange meetings in person with mothers and parenting groups and preschools

Step – Before

Equipment required:

- Posters
- Blue tack
- Drawing pins
- Cellotape
- Advertising Tracking sheet

Equipment required when meeting with parent groups and preschools:

- Appointment diary
- Posters
- Consent forms and information sheets
- Pens
- Sheet to record:
  - Name of parent and child
  - Contact details (phone number, cell phone number, address, email)
  - Time arranged for first visit
  - Best time to call to confirm visit
a) **Putting up posters in public spaces**

Permission is to be obtained, and posters are to be distributed to the following public spaces:

- Dunedin City Library
- Dunedin Hospital
- Local cafes and take-away stores
- Local supermarket
  - Centre City: New World, Countdown, Pac N’ Save
  - Gardens: New World
  - Roslyn: New World, Fresh Choice
  - St Clair: Four Square
  - Anderson Bay: Woolworths
- Dairy
- Moana pool
- Chipmunks ([http://www.chipmunks.co.nz/stores/dunedin/](http://www.chipmunks.co.nz/stores/dunedin/))
- Children clothing stores

**Ask permission to advertise:**

**In person:**

Hi, my name is Fam, I’m a Master’s student at the University of Otago. I’m studying the food intake of 3 years old 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 Fam. I am a student dietitian doing my master’s degree through the University of Otago. I am studying the food intake of 3 years old, and I need to require 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, mail, 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,

Fam, Student Dietitian, Department of Human Nutrition
famji744@student.otago.ac.nz
02 205 02269

Follow-up phone call:
If emails have not been replied to after 3-days, ring the respective settings to see if they got my email enquiry.

b) Approaching local parenting and mothers’ groups
   - The Hub (http://www.dmm.org.nz/Hub.htm)
   - The Parents Centre Dunedin (http://www.parentscentre.org.nz/dunedin/)
   - Plunket (https://www.plunket.org.nz/plunket-near-you/?region=Otago&district=&suburb=&service=Play+groups&start=0)

Phone call/ in person:
Hi, my name is Fam and I am doing my Master’s degree through the University of Otago. I am looking at the food intake of 3 years old. I need to recruit 30 parents of 3 years old to take part in the study.

I was wondering if it would be possible for me to meet with the parents in (your coffee group/parenting group/play group) to let them know about the research I am doing, and to see if anyone would be interested in taking part in the study? We will be giving parent a grocery voucher of up to 25 dollars as a thank-you for taking part.

(If yes, arrange a time and place to meet with group, and book into my diary. Also provide person with my phone number and email address in case times change.)

Thank you for your help.
By email:

To (name),

I am a student dietitian doing my master’s degree with the University of Otago. I am looking at the food intake among 3 years old. I need to recruit 30 parents of 3 years old to take part in the study.

I was wondering if it would be possible for me to meet with (your coffee group/parenting group) to let them know about the research I am doing, and to see if anyone would be interested in taking part in the study?

If so, is there a time and place that would suit the group for me to meet up with them?

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

Any help you are able to give me with this would be very much appreciated. Please do not hesitate to contact me with any questions.

Thank you for your time.

Kind regards,

Fam, Student Dietitian, Department of Human Nutrition

famji744@student.otago.ac.nz
02 205 02269

c) Approaching local preschools

List of local preschool:
http://www.minedu.govt.nz/Parents/AllAges/ECEListing.aspx?page=0

Phone call/ in person:

Hi, my name is Fam and I am doing my Master’s degree through the University of Otago. I am looking at the food intake of 3 years old. I need to recruit 30 parents of 3 years old to take part in the study.

I was wondering if you would be able to either: forward an email on my behalf, explaining the study in more detail to parents who are enrolled with your centre, or consider letting me to approach the parents in your centre, or even leave some pamphlets with you to distribute to parents, to see if they would be interested in participating in the study.
If this is not possible, I was wondering if you have a newsletter or notice board that I would be able to put an advertisement in to let parents enrolled with your centre know about the study?

Or do you have some any suggestions of how I can get in touch with the parents and let them know about the study?

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

Thank you for your help.

(Provide person with my phone number and email address in case any changes with the plan)

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

See recruitment protocol page 7.

**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 D
Recruitment protocol
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 and consent forms, letter, map, demographic questionnaire, and FFQ within one week of first contact
4. To make the first appointment

Steps – Before

Recruitment participants:
Parent-child pairs with child 36-47 months old (n = 25-30)

Equipment required:

- Tracking sheet
- Diary

Check student email account twice a day from Monday to Friday.

Steps – During

a) Email response:
- Respondents will email me at famj744@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 (PDF).
- 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 2 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, letter, map, demographic questionnaire, and FFQ 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 EAT-3 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 demographic questionnaire and food frequency questionnaire 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,

Fam, Student Dietitian, Department of Human Nutrition

famji744@student.otago.ac.nz

0220502269
If all participant positions have been occupied,

Dear (name),

Thank you for your interest in taking part in the EAT-3 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,

Fam, Student Dietitian, Department of Human Nutrition
famji744@student.otago.ac.nz
0220502269

**Follow up phone call:**

Hi I’m Fam calling from the EAT-3 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’m doing The EAT-3 Study as part of my master’s degree. I’m looking at the food intake of 3 years old.

Before our first meeting I will post you a questionnaire and ask you to fill out about what your child has eaten over the past month, and some brief questions about you and your child.

At our first meeting, I will collect those questionnaires. I also measure your child’s height and weight. This appointment will take about an hour at the most.

I also show you how to weigh and record what your child eats for three days over of the next month. Then we will arrange a second meeting to collect the food record, and ask you to fill in the questionnaire about what your child has eaten over the past month for a second time.

This second appointment should take about half an hour of your time.

We will be giving parent 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 if you are eligible to take part?

- What is your child’s name?
- When is [child’s name] birth date?
- Is [child’s name] 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 demographic questionnaire, FFQ, information sheet, and consent form will be posted to them shortly
- Ask them to fill out the questionnaires and bring them to the first appointment.

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

- Collect email, postal address, cell phone number
- Thank them for their interest

b) Phone response:

- Respondents will reach me at 0220502269 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 demographic questionnaire, FFQ, information and consent forms within one week of first contact
Hi (name), thank you for calling and showing an interest in our study.

My name is Fam. I’m doing The EAT-3 Study as part of my master’s degree. This study is looking at the food intake of 3 years old.

Before our first meeting I will post you a questionnaire about what your child has eaten over the past month, and some brief questions about you and your child.

At our first meeting, I will collect those questionnaires. I also measure your child’s height and weight. This appointment will take about an hour at the most.

I will also show you how to weigh and record what your child eats for three days over of the next month. Then we will arrange a second meeting to collect the food record, and ask you to fill in the questionnaire about what your child has eaten over the past month for a second time.

This second appointment should take about half an hour of your time.

We will be giving parent 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 if you are eligible to take part?

• What is your child’s name?
• When is [child’s name] birth date?
• Is [child’s name] affected by any health condition that would affect their 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 –

• Collect email, postal address, cell phone number
• Arrange time for first appointment
• Tell them that a copy of demographic questionnaire, FFQ, information sheet, and consent form will be posted to them shortly
- Ask them to fill up the questionnaires and bring them to the first appointment.
  
  If MAYBE – follow-up with a phone call within a week

- Collect email, postal address, cell phone number
- Thank them for their interest

**c) Recruit in person:**
- Local parenting and mothers’ groups will email me at famji744@student.otago.ac.nz or reach me at 0220502269 if I am allowed to meet with the parents to explain my study

---

**Meeting with parents:**

Hi everyone. My name is Fam and I’m currently doing the EAT-3 study as part of my master’s degree through the University of Otago. Thanks for your time to meet with me and allow me to explain about my study today.

The EAT-3 study is looking at the food intake among 3 years old. It is important to know what the children in this age group are eating, because we know that eating habits are formed in childhood and are maintained to adulthood. By the end of the study, we will provide you the results of the study. We will also be giving parent a grocery voucher of up to 25 dollars as a thank-you for taking part.

You are eligible to be in this study if you have a 3-year old 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 of the next month. I will also measure your child’s height and weight in our first appointment.

Do you have any questions for me at this time?

  - Answer questions accordingly

If you would like to take part in the study, please leave your contact details with me and I will give you the questionnaires and consent form. If you need more time to decide if you would like to participate, you may also email or call me with your decision. My email address is famji744@student.otago.ac.nz and cell phone number is 0220502269.

Thank you.
If parent is interested - can I ask you a few questions to check if you are eligible to take part?

- What is your child’s name?
- When is [child’s name] birth date?
- Is [child’s name] affected by any health condition that would affect feeding and/or 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 –

- Collect email, postal address, cell phone number
- Provide information sheet, consent form, FFQ, demographic questionnaire
- Arrange time for first appointment
- Ask them to fill up the questionnaires and bring them to the first appointment.

If MAYBE – provide information and consent forms and follow-up with a phone call

- Collect email, postal address, cell phone number
- Thank them for their interest

d) Recruit through University email

Dear all,

My name is Fam and I am a student dietitian from the Department of Human Nutrition at the university. I am currently doing the EAT-3 study as part of my master’s degree. The EAT-3 study is looking at the food intake among preschool children in Dunedin.

I am writing to invite you to participate in my research study. You are eligible to be in this study if you have a 3-year old 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 of the next month. I will also measure your child’s height and weight in our first appointment. Attached is an information sheet and consent form 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 contact me at famji744@student.otago.ac.nz or 0220502269.

Thank you very much.

Kind regards,

Fam, Student Dietitian, Department of Human Nutrition

famji744@student.otago.ac.nz

0220502269

---

**Steps – After**

**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 2 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 FFQ, demographic questionnaire, information and consent form sent
  - Date to follow up if maybe
  - Eligibility
  - Print sheet of sticker labels of all reminders/appointments to put in diary

- Post FFQ, demographic questionnaire, information and consent form not more than 2 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 (FFQ, demographic questionnaire, 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 E
Recruitment poster
EAT3 – What are New Zealand 3 year olds eating?

Even though the preschool years are so important to children’s long-term health and development, very little is known about what New Zealand preschoolers are eating. The aim of the EAT3 research study is to find out what New Zealand 3 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 3 year old child (36-47 months of age) 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 4 hours over a month.

If you are interested or would like further information please contact me:

Fam

famji744@student.otago.ac.nz or 02 205 02269

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

Reference: 14/083
Appendix F
Recruitment flyer
EAT3 – What are New Zealand 3 year olds eating?

Even though the preschool years are so important to children’s long-term health and development, very little is known about what New Zealand preschoolers are eating. The aim of the EAT3 study is to find out what New Zealand 3 year olds are eating, and at the same time to develop a new, and much quicker, way of measuring what they eat.

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Fam

famji744@student.otago.ac.nz

0220502269

This project has been reviewed and approved by the University of Otago Human Ethics Committee (Health). Reference: 14/083

EAT3 – What are New Zealand 3 year olds eating?

Even though the preschool years are so important to children’s long-term health and development, very little is known about what New Zealand preschoolers are eating. The aim of the EAT3 study is to find out what New Zealand 3 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 3 year old child (36-47 months of age) who would like to know more about what their child is eating.

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If you are interested or would like further information please contact me:

Fam

famji744@student.otago.ac.nz

0220502269

This project has been reviewed and approved by the University of Otago Human Ethics Committee (Health). Reference: 14/083
Appendix G

Travel Reimbursement Form
Travel Reimbursement Form

I have received a voucher to the value of $____ as a reimbursement of costs involved in travelling to this research project.

The University and I do not intend that my participation in this research project will form an employment relationship.

Name:

Date:

Signed:
Appendix H

Participant results letter
By email:

Dear Name,

Thank you very much for participating in the EAT3 Study; please find enclosed your child’s nutrient results. We apologise for the delay in getting these results back to you. The dietary recommendations are set for 1-3 year olds and so should be quite relevant to your child’s diet providing they have not had any major changes to their consumption of the food listed on page 3.

Adequate intake – above the RDI

The results of the analysis of your child’s food diary suggest that they are eating a well-balanced diet, with all of the nutrients we analysed fitting within the recommended ranges. This is an excellent outcome.

OR, Probably an adequate intake – between the RDI and EAR

The results of the analysis of your child’s food diary suggest that they are eating a well-balanced diet with most of the nutrients fitting within the recommended ranges. Your child’s [nutrient] intake was slightly low, but may not be a problem as these recommendations are set to cover everybody, and some people need less than others. If you are worried, try offering more foods rich in [nutrient] as described on the bottom of page 3.

OR, Low intake – below the EAR

The results of the analysis of your child’s food diary suggest that they are eating a diet that may be a bit low in [nutrient]. We would suggest you try and offer more foods rich in [nutrient], as described at the bottom of page 3.

We do appreciate you helping us with the study – our apologies for taking so long to get back to you.

Kind regards,

Fam, Student Dietitian, Department of Human Nutrition

jiayunfam@gmail.com
# Nutrient Analysis

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Estimated Average Requirement</th>
<th>Recommended Dietary Intake</th>
<th>Your child’s average daily intake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protein</td>
<td>12 grams</td>
<td>14 grams</td>
<td>grams</td>
</tr>
<tr>
<td>Calcium</td>
<td>360 mg</td>
<td>500 mg</td>
<td>mg</td>
</tr>
<tr>
<td>Iron</td>
<td>4 mg</td>
<td>9 mg</td>
<td>mg</td>
</tr>
<tr>
<td>Zinc</td>
<td>2.5 mg</td>
<td>3 mg</td>
<td>mg</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>25 mg</td>
<td>35 mg</td>
<td>mg</td>
</tr>
</tbody>
</table>

**What can this nutrient analysis tell me?**

This nutrient analysis shows your child’s average intake of nutrients over the 3 days you kept the food diary. From this you can see how likely it is that they are getting enough of each nutrient. Please note – if your child has a low intake of a nutrient this does not necessarily mean they are deficient in that nutrient. The only way to diagnose a nutrient deficiency is from tests such as blood tests.

**What is the “Recommended Dietary Intake?”**

The Recommended Dietary Intake (you may have seen it called “RDI” on food packets) is the daily intake of a nutrient that will meet the needs of almost every child aged 1-3 years. If your child has a nutrient intake that is the same as, or higher than the RDI it is very likely they are getting enough of that nutrient.

**What is the “Estimated Average Requirement?”**

The Estimated Average Requirement or EAR is the daily intake of a nutrient that will meet the needs of half of all 1-3 year old children. If your child has nutrient intakes that are the same as or above the EAR, there is still a good chance they are getting enough of the nutrients they need.

**What does it mean if my child has 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 they are getting enough of that nutrient. If you’re concerned you could try offering more foods that contain the nutrient or nutrients you’re worried about. See the next page for some ideas.
What does it mean if my child has a nutrient intake below the EAR?

If your child has a nutrient intake below the EAR, then it’s possible they may not be getting enough of that nutrient. See the bottom of this sheet for some ideas about what foods to offer to boost their intake of the nutrient or nutrients you’re concerned about.

How accurate is this nutrient analysis?

The accuracy of this nutrient analysis depends on how accurate and detailed the food diary was. There are also other factors that can 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 actually be higher than this analysis has shown.

There’s also a chance that the 3 days of recording weren’t representative of what your child usually eats – for example if on the 3 days you were recording your child didn’t eat any of a particular food that they usually eat then the analysis may not be an accurate reflection of their nutrient intake.

<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 calcium are:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cow’s milk, yoghurt, custard, cheese, calcium-fortified soymilk and calcium-fortified soy yoghurt</td>
</tr>
</tbody>
</table>

<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</td>
</tr>
<tr>
<td>Eating vitamin C containing foods (see list below) at the same time as iron-containing foods increases iron absorption</td>
</tr>
</tbody>
</table>

<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>Fruit such as oranges and mandarins, kiwifruit, berries, apples, bananas, pineapple and colourful vegetables such as tomatoes, capsicum (for example “red pepper”), broccoli, cauliflower, cabbage and kumara</td>
</tr>
</tbody>
</table>
Appendix I

Letter confirming appointment time
Dear (name),

Thank you for taking part in our EAT-3 Study. I am writing to inform you about our first appointment:

**Date:**

**Time:**

**Location:** 5 Leithbank Street, 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 some forms and questionnaires that we would like you to read and complete.

Before you come to our first appointment, we would like you to:

1. Read the **information sheet**
2. If you are happy to take part, sign the **consent form**
3. Complete **EAT-3 Questionnaire**
4. Complete **Food Frequency Questionnaire**

Please bring the documents with you when you come to your appointment.

I will give you a quick phone call on the day before our first appointment as a reminder. I can also answer any questions you might have about the questionnaires at that time.

Thank you very much for your time. I look forward to meeting you.

Kind regards,

Fam, Student Dietitian, Department of Human Nutrition

famji744@student.otago.ac.nz

02 205 02269
Appendix J

Participant information sheet
EAT3 – What are New Zealand 3 year olds eating?

*Principal Investigator: Dr Anne-Louise Heath*

*Email:* anne-louise.heath@otago.ac.nz  
*Phone:* 479-8379

**PARTICIPANT INFORMATION SHEET**

Thank you for your interest in the EAT3 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?**  
Even though the preschool years are so important to children’s health and development, very little is known about what New Zealand preschoolers are eating. Do they eat vegetables? If so, what kinds of vegetables do they like? Do they eat meat? If so, what kinds of meat do they like? Are they getting enough nutrients? The aim of this study is to find out what New Zealand 3 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 EAT3 study is being paid for by University funds.

**Who can participate?**  
We are seeking 100 parents of healthy 3-year olds (36-47 months of age).

**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 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 EAT3 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

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 8256 or email gary.witte@otago.ac.nz). Any issues you raise will be treated in confidence and investigated and you will be informed of the outcome.
Appendix K

Consent form
EAT3 – What are New Zealand 3 year olds eating?

Principal Investigator: Dr Anne-Louise Heath

Email: anne-louise.heath@otago.ac.nz

Phone: 479-8379

CONSENT FORM FOR PARTICIPANTS

Following signature and return to the research team this form will be stored in a secure place for ten years.

Name of participant:.................................................................

1. I have read the Information Sheet about this study and understand the aims of this research project.
2. I have had enough time to talk with people of my choice about taking part in the study.
3. All my questions about the project have been answered to my satisfaction, and I understand that I am free to ask for more information at any stage.
4. I know that taking part in the project is entirely voluntary, and that I am free to withdraw from the project at any time without disadvantage.
5. I know that as a participant I will complete three questionnaires and write down what my child eats and drinks for 5 days, and that my child’s height and weight will be measured.
6. I know that when the project is completed all personal identifying information will be removed from the paper records and electronic files which represent the data from the project, and that these will be placed in secure storage and kept for at least ten years.
7. I understand that the results of the project may be published and be available in the University of Otago Library, but I agree that any personal identifying information will
remain confidential between myself and the researchers during the study, and will not appear in any spoken or written report of the study.

Signature and name of participant: ________________________________ Date: ____________

Signature and name of witness: ________________________________ Date: ____________
Appendix L

Map to the appointment room
Please contact me if you have any questions:

Fam – 0220502269 / famji744@student.otago.ac.nz
Appendix M

Demographic questionnaire
EAT3 Demographic Questionnaire

1. What is today’s date? _________ day/month/year
2. How are you related to the child in this study? ________________
3. What is your date of birth? _________ day/month/year
4. How many children do you have? ________________
5. To which ethnic group(s) do you belong? Please tick all the boxes that apply
   - NZ European
   - Māori
   - Samoan
   - Tongan
   - Cook Island Māori
   - Niuean
   - Chinese
   - Indian
   - Other
   If other, please state: ________________
6. If Māori, please provide your tribal affiliations ________________
7. What is your child’s date of birth? ________________ day/month/year
8. What is your child’s sex?: Male / Female (please circle)
9. To which ethnic group(s) does your child belong?
   - NZ European
   - Māori
   - Samoan
   - Tongan
   - Cook Island Māori
   - Niuean
   - Chinese
   - Indian
   - Other
   If other, please state: ________________
10. If Māori, please provide the tribal affiliations for your child ________________

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

EAT3 Food frequency questionnaire
3 year Food Frequency Questionnaire

To be administered to the child’s main carer

EAT3 study number

Interview date

Instructions for interviewers:

- Ensure study number is recorded at the top of this page
- Fill in the date completed above
- Ask each question in turn as it is worded in the questionnaire
- Make sure that you go through the examples with the parent
- Use “Ready Reckoner 1” if parent says that the child has something regularly but only for part of the week, for example, “Beth has a banana twice a day during the week but not at all at the weekend”. This will give you the single frequency option to use.
- Use “Ready Reckoner 2” for those questions that include more than one food e.g., “pies and sausage rolls” if the parent says they eat pies at a different frequency than sausage rolls. This will give you the single frequency option to use.
- You should only enter one value for frequency (that is, how often a week OR a day, not both)
- And there must be a value for every food (i.e., use the not eaten column if appropriate)
These questions ask how often child's name has eaten certain foods or beverages over the past 4 weeks.

Please remember that this information is stored by ID number so no-one will be able to associate what you tell us with you or your child.

Child’s name may sometimes be fed by a relative, friend or someone else. If you know the type of food and approximate amount [she] has eaten at these times please include them.

We are not wanting to know how much of each food they ate, simply how often they ate each food.

For example, over the past 4 weeks, if your child:
- had a drink of milk every day for breakfast and lunch – that is two times a day
- had a mince pie once a week and a sausage roll once a week – that is two times a week (even if they are eaten at the same meal)
- didn’t eat any bananas

Then we would fill in the questionnaire like this:

<table>
<thead>
<tr>
<th></th>
<th>Not eaten this month</th>
<th>Less than once a week</th>
<th>Once a week</th>
<th>2 times a week</th>
<th>3 times a week</th>
<th>4 times a week</th>
<th>5 times a week</th>
<th>Every day</th>
<th>2 times a day</th>
<th>3 times a day</th>
<th>4 times a day</th>
<th>5 or more times a day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cows milk (blue, silver top) as a drink</td>
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<td></td>
</tr>
<tr>
<td>Meat pies and sausage rolls</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Banana</td>
<td>✓</td>
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</tbody>
</table>
Each food should only be reported once. For example, if your child has custard and canned fruit every night for pudding, then we will fill in the questionnaire like this:

<table>
<thead>
<tr>
<th></th>
<th>Not eaten this month</th>
<th>Less than once a week</th>
<th>Once a week</th>
<th>2 times a week</th>
<th>3 times a week</th>
<th>4 times a week</th>
<th>5 times a week</th>
<th>Every day</th>
<th>2 times a day</th>
<th>3 times a day</th>
<th>4 times a day</th>
<th>5 or more times a day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Custard and other milk puddings</td>
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<tr>
<td>Canned fruit</td>
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<td></td>
<td></td>
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<tr>
<td>Puddings not yet described</td>
<td>✔</td>
<td></td>
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</tr>
</tbody>
</table>

So the custard and fruit would not be included under any other pudding options such as "puddings not yet described" also shown above.

Each food in a mixed dish needs to be reported separately. This can be a bit complicated when you think of separate but similar dishes. For example, if child’s name eats pasta with a tomato-based sauce twice a week and a lasagne with a tomato and meat sauce once a week, then they are having:

- pasta twice a week from the pasta and tomato PLUS pasta once a week from thelasagne so pasta **three times a week** in total
- cooked tomato twice a week from the pasta and tomato PLUS cooked tomato once a week from the lasagne so cooked tomato **three times a week** in total
- whereas the mince is once a week only – as it is not in the pasta and tomato sauce

So the table would look like this:

<table>
<thead>
<tr>
<th></th>
<th>Not eaten this month</th>
<th>Less than once a week</th>
<th>Once a week</th>
<th>2 times a week</th>
<th>3 times a week</th>
<th>4 times a week</th>
<th>5 times a week</th>
<th>Every day</th>
<th>2 times a day</th>
<th>3 times a day</th>
<th>4 times a day</th>
<th>5 or more times a day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other pasta</td>
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<tr>
<td>Cooked tomato (eg. pasta sauce, canned tomato)</td>
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<tr>
<td>Mince and patties</td>
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</tr>
</tbody>
</table>
A. Baby or toddler food

1. Did child's name eat any baby food or toddler food from a jar, tin or packet in the past 4 weeks?
   (eg. "Little Kids" cheesy ravioli, "Peach, apricot and semolina")
   □ No [go to Question B.2]
   □ Yes

B. Bread and crackers

<table>
<thead>
<tr>
<th>Food</th>
<th>Not eaten this month</th>
<th>Less than once a week</th>
<th>Once a week</th>
<th>2 times a week</th>
<th>3 times a week</th>
<th>4 times a week</th>
<th>5 times a week</th>
<th>6 times a week</th>
<th>Every day</th>
<th>2 times a day</th>
<th>3 times a day</th>
<th>4 times a day</th>
<th>5 or more times a day</th>
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</thead>
<tbody>
<tr>
<td>2. White bread, buns (not iced), crumpets</td>
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<td>3. Wholemeal or wholegrain bread, buns</td>
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<td>4. Crackers (wheat, rice or corn-based)</td>
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<td>5. Rice cakes, rice wheels, crispbreads</td>
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</tbody>
</table>
C. Breakfast cereals

<table>
<thead>
<tr>
<th>Food</th>
<th>Not eaten this month</th>
<th>Less than once a week</th>
<th>Once a week</th>
<th>2 times a week</th>
<th>3 times a week</th>
<th>4 times a week</th>
<th>5 times a week</th>
<th>6 times a week</th>
<th>Every day</th>
<th>2 times a day</th>
<th>3 times a day</th>
<th>4 times a day</th>
<th>5 or more times a day</th>
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</thead>
<tbody>
<tr>
<td>6. Weet-bix, Fruity-bix or similar</td>
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<td>7. Porridge</td>
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<td>8. Cornflakes, rice bubbles</td>
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<td>9. Coco-pops, Honey Puffs or similar</td>
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<td>10. Nutrigrain, Milo cereal or similar</td>
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<tr>
<td>11. Muesli and &quot;light&quot; muesli (eg. &quot;Light and Tasty&quot;, &quot;Light and Right&quot;)</td>
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<td>12. Other breakfast cereals not listed</td>
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</tbody>
</table>

D. Rice and pasta

<table>
<thead>
<tr>
<th>Food</th>
<th>Not eaten this month</th>
<th>Less than once a week</th>
<th>Once a week</th>
<th>2 times a week</th>
<th>3 times a week</th>
<th>4 times a week</th>
<th>5 times a week</th>
<th>6 times a week</th>
<th>Every day</th>
<th>2 times a day</th>
<th>3 times a day</th>
<th>4 times a day</th>
<th>5 or more times a day</th>
</tr>
</thead>
<tbody>
<tr>
<td>13. Rice</td>
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<td>14. Instant noodles</td>
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<td>15. Canned spaghetti</td>
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<tr>
<td>16. Other pasta</td>
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</tbody>
</table>
### E. Meat, chicken, fish, eggs, beans

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Not eaten this month</th>
<th>Less than once a week</th>
<th>Once a week</th>
<th>2 times a week</th>
<th>3 times a week</th>
<th>4 times a week</th>
<th>5 times a week</th>
<th>Every day</th>
<th>2 times a day</th>
<th>3 times a day</th>
<th>4 times a day</th>
<th>5 or more times a day</th>
</tr>
</thead>
<tbody>
<tr>
<td>17.</td>
<td>Pizza</td>
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<tr>
<td>18.</td>
<td>Chicken nuggets or shapes, fish fingers or shapes, battered or crumbed fish</td>
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<tr>
<td>19.</td>
<td>Other chicken (eg. roast, stir-fry, BBQ)</td>
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<td>20.</td>
<td>Other fish (eg. canned, pan-fried)</td>
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<tr>
<td>21.</td>
<td>Sausages, sauselogs, hot dogs (including vegetarian)</td>
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<tr>
<td>22.</td>
<td>Ham, bacon, luncheon, salami</td>
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</tr>
<tr>
<td>23.</td>
<td>Meat pies and sausage rolls</td>
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<tr>
<td>24.</td>
<td>Mince &amp; patties (from beef or lamb)</td>
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<tr>
<td>25.</td>
<td>Pork and other meat</td>
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</tr>
<tr>
<td>26.</td>
<td>Eggs</td>
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<tr>
<td>27.</td>
<td>Canned beans (including baked beans)</td>
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<td>28.</td>
<td>Hummus (chickpea dip)</td>
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</table>
**F. Vegetables**

29. How often has child’s name had vegetables in the past 4 weeks:

- [ ] Never
- [ ] 1-3 per month
- [ ] ___ times a week
- [ ] ___ times a day

<table>
<thead>
<tr>
<th>Food</th>
<th>Not eaten this month</th>
<th>Less than once a week</th>
<th>Once a week</th>
<th>2 times a week</th>
<th>3 times a week</th>
<th>4 times a week</th>
<th>5 times a week</th>
<th>6 times a week</th>
<th>Every day</th>
<th>2 times a day</th>
<th>3 times a day</th>
<th>4 times a day</th>
<th>5 or more times a day</th>
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</thead>
<tbody>
<tr>
<td>30. Potato and kumara (boiled, baked, microwaved, mashed)</td>
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<td>31. Hot chips, potato shapes, roast potato or kumara</td>
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<td>32. Carrot</td>
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<td>33. Pumpkin</td>
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<td>34. Green peas</td>
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<td>35. Sweet corn</td>
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<td>36. Broccoli and cauliflower</td>
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<td>37. Green leafy vegetables (silver beet, cabbage or similar)</td>
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<td>38. Salad greens (lettuce, cucumber or similar)</td>
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<td>39. Raw tomato</td>
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<td>40. Cooked tomato (pasta sauce, canned tomato or similar)</td>
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<td>41. Other vegetables</td>
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</tbody>
</table>
### G. Fruit

42. How often has child’s name had fruit in the past 4 weeks:
- Never
- 1-3 per month
- ___ times a week
- ___ times a day

<table>
<thead>
<tr>
<th>Food</th>
<th>Not eaten this month</th>
<th>Less than once a week</th>
<th>Once a week</th>
<th>2 times a week</th>
<th>3 times a week</th>
<th>4 times a week</th>
<th>5 times a week</th>
<th>Every day</th>
<th>2 times a day</th>
<th>3 times a day</th>
<th>4 times a day</th>
<th>5 or more times a day</th>
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</thead>
<tbody>
<tr>
<td>43. Canned fruit</td>
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<td>44. Banana</td>
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<td>45. Apples</td>
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<td>46. Pears</td>
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<td>47. Oranges, mandarins or similar</td>
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<td>48. Kiwifruit</td>
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<td>49. Grapes</td>
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<td>50. Berries (fresh or frozen)</td>
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<td>51. Dried fruit</td>
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<td>52. Avocado</td>
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<td>53. Other fruit</td>
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</table>
## H. Milk and milk products

<table>
<thead>
<tr>
<th>Food</th>
<th>Not eaten this month</th>
<th>Less than once a week</th>
<th>Once a week</th>
<th>2 times a week</th>
<th>3 times a week</th>
<th>4 times a week</th>
<th>5 times a week</th>
<th>Every day</th>
<th>2 times a day</th>
<th>3 times a day</th>
<th>4 times a day</th>
<th>5 or more times a day</th>
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</thead>
<tbody>
<tr>
<td>54. Low-fat cows milk (green, lite blue, yellow-top) as a drink</td>
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<tr>
<td>55. Low-fat cows milk on cereal or other food (not custard or sauces)</td>
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<tr>
<td>56. Cows milk (blue, silver-top) as a drink</td>
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<tr>
<td>57. Cows milk on cereal or other food (not custard or sauces)</td>
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<td>58. Other milk (goat, soy, rice) as a drink</td>
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<tr>
<td>59. Other milk (goat, soy, rice) on cereal or other food</td>
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<td>60. Flavoured milk (including Milo, Quick, Drinking chocolate, Up-and-Go)</td>
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<td>61. Cheese (including in recipes)</td>
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<td>62. Yoghurt or dairy food</td>
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<td>63. White sauce or cheese sauce</td>
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<td>64. Butter</td>
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<td>65. Margarine</td>
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<td>66. Cream or sour cream</td>
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</tbody>
</table>
### I. Puddings

<table>
<thead>
<tr>
<th>Food</th>
<th>Not eaten this month</th>
<th>Less than once a week</th>
<th>Once a week</th>
<th>2 times a week</th>
<th>3 times a week</th>
<th>4 times a week</th>
<th>5 times a week</th>
<th>6 times a week</th>
<th>Every day</th>
<th>2 times a day</th>
<th>3 times a day</th>
<th>4 times a day</th>
<th>5 or more times a day</th>
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<tbody>
<tr>
<td>67. Ice cream</td>
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<tr>
<td>68. Custard and other milk puddings</td>
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<td>69. Puddings not yet described</td>
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### J. Cakes, biscuits and snacks

<table>
<thead>
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<th>Food</th>
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<th>Less than once a week</th>
<th>Once a week</th>
<th>2 times a week</th>
<th>3 times a week</th>
<th>4 times a week</th>
<th>5 times a week</th>
<th>6 times a week</th>
<th>Every day</th>
<th>2 times a day</th>
<th>3 times a day</th>
<th>4 times a day</th>
<th>5 or more times a day</th>
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</thead>
<tbody>
<tr>
<td>70. Biscuits - coated (with chocolate, icing, yoghurt)</td>
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<td>71. Biscuits - other</td>
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<td>72. Cakes and slices</td>
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<td>73. Muffins and scones</td>
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<td>74. Croissant, sweet buns, iced buns, pastries</td>
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<td>75. Fruit bread, currant buns</td>
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<td>76. Chocolate, lollies</td>
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<td>77. Crisps, corn chips, corn snacks (e.g. Cheezels)</td>
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<td>78. Muesli, nut, cereal or puffed rice bars</td>
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<td>79. Fruit leather, fruit strings, fruit rollups</td>
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</table>
### K. Drinks

<table>
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<tr>
<th>Food</th>
<th>Not eaten this month</th>
<th>Less than once a week</th>
<th>Once a week</th>
<th>2 times a week</th>
<th>3 times a week</th>
<th>4 times a week</th>
<th>5 times a week</th>
<th>Every day</th>
<th>2 times a day</th>
<th>3 times a day</th>
<th>4 times a day</th>
<th>5 or more times a day</th>
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<tbody>
<tr>
<td>80. Fruit juice (&quot;Fresh up&quot;, &quot;Just Juice&quot;, freshly squeezed)</td>
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<td>81. Fruit drinks, Ribena, cordial, sachets</td>
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<td>82. Regular fizzy drinks (lemonade, coke)</td>
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<td>83. Diet fizzy drinks (lemonade, coke)</td>
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</table>

84. How often does your child drink water?  
   - [ ] Never  
   - [ ] Occasionally  
   - [ ] Often  
   - [ ] Every day

### M. Spreads

<table>
<thead>
<tr>
<th>Food</th>
<th>Not eaten this month</th>
<th>Less than once a week</th>
<th>Once a week</th>
<th>2 times a week</th>
<th>3 times a week</th>
<th>4 times a week</th>
<th>5 times a week</th>
<th>Every day</th>
<th>2 times a day</th>
<th>3 times a day</th>
<th>4 times a day</th>
<th>5 or more times a day</th>
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<tbody>
<tr>
<td>85. Jam or honey</td>
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<td>86. Nutella</td>
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<td>87. Marmite or Vegemite</td>
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</tr>
</tbody>
</table>
## Takeaways

How often did your child have food from the following takeaway outlets over the past 4 weeks?

<table>
<thead>
<tr>
<th>Food</th>
<th>Not eaten this month</th>
<th>Less than once a week</th>
<th>Once a week</th>
<th>2 times a week</th>
<th>3 times a week</th>
<th>4 times a week</th>
<th>5 times a week</th>
<th>Every day</th>
<th>2 times a day</th>
<th>3 times a day</th>
<th>4 times a day</th>
<th>5 or more times a day</th>
</tr>
</thead>
<tbody>
<tr>
<td>88. Takeaways from a fish and chip shop</td>
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<tr>
<td>89. Burgers or other items from McDonalds or Burger King</td>
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<tr>
<td>90. KFC or other fried chicken</td>
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<tr>
<td>91. Subway</td>
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<tr>
<td>92. Kebabs or wraps</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>93. Sushi</td>
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<tr>
<td>94. Chinese or Thai or similar</td>
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</tbody>
</table>
## 0. Other foods and drinks

95. Is there anything else child’s name has had to eat or drink at least once a week in the past 4 weeks that we have not already included?

<table>
<thead>
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<th></th>
<th>2 times a day</th>
<th>3 times a day</th>
<th>4 times a day</th>
<th>5 or more times a day</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Food</strong></td>
<td>Not eaten this month</td>
<td>Less than once a week</td>
<td>Once a week</td>
<td>2 times a week</td>
<td>3 times a week</td>
<td>4 times a week</td>
<td>5 times a week</td>
<td>6 times a week</td>
<td>Every day</td>
<td>2 times a day</td>
<td>3 times a day</td>
<td>4 times a day</td>
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<tr>
<td>96.</td>
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</tbody>
</table>
**Other carers**

100. On average over the past 4 weeks, how many meals per week were given to your child by someone other than yourself?

   ____ Meals

   If more than 0 then:

101. How many of the meals given by others have you been able to include in the questionnaire?

   [ ] None
   [ ] Some
   [ ] Most
   [ ] All

---

**Thank you**

We really appreciate the time and effort you have put into completing this questionnaire.
Appendix O

First visit protocol
EAT-3 First Visit Protocol

Objectives:

1. To obtain consent to participate, and collect consent forms
2. To collect demographic questionnaire and FFQ from the participants
3. To measure height and weight of the participants’ child
4. To explain to participants how to complete the food diary
5. To leave food record, scales, and batteries with participants
6. To arrange a time to come back for second appointment

Steps – Before

Equipment required:

- Anthropometry protocol and equipment stated
- Calibrated scales
- Calibrated stadiometer
- Pens
- Ruler
- Stapler
- Diary for making second appointments
- Blank food record
- Plate and food items for demonstrations
- Dietary scales and batteries
- Books/colouring in/pens
- Toys (set up in play room)
- Information and consent forms (spare copy)
- Demographic questionnaire (spare copy)
- Food frequency questionnaire (spare copy)

Call participant the day before to remind them of time of appointment

Record ID number on diet record
Steps – During

1. **Introductions**
   - Introduce yourself
   - Thank participant for taking the time to meet today
   - Check if they have read and understood the information sheet (show them one). Ask if they have any questions about it.
   - If asked to explain the study, explain the aim of the study and what the research will be used for:
     
     "This study is being done to determine the nutrient and food intake of 3-year olds New Zealand children."
   - Ask if already signed/happy to sign consent form [do not proceed without signed consent forms. If do not want to sign, thank them and leave]
   - Briefly explain what will happen today:
     
     "I will collect the demographic questionnaires and FFQ from you. I will go through them with you to ensure that everything have been filled in correctly"
     
     "I will take your child’s weight and height measurements"
     
     "After this is completed, I will show you how to use this set of scales and food diary (show diary) to record what your child eats for three days this month"

2. **Weight and Height**
   - Refer to Anthropometry Protocol (Appendix H)

3. **Teach participant to use Food Diary and Scales**
   - Show participant 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 instructions in the food diary and demonstrate with the food items; sequential recording and leftovers
   - Ask participant to fill in the record for 3 days over the next month. These are the days written on the front of the diet record
   - Tell participant that I will be calling them on the first day of diet recording to check if they have any queries or face any difficulties.
   - Advise participant to contact me with any questions while filling in the record
• Advice participants not to change their children’s diet
  “Finally, I realize 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 do not change what your child would normally eat because of it, and please record everything your child eats on the days you are recording – even if they only have a bite or sip of a food or drink – please record it.”

4. Any questions?
• Answer accordingly

5. Wrap up
• “I would like to arrange a time in one month to meet up with you again, to collect the food diary, and to ask you to complete the FFQ for a second time. Do you know a day and time that would be suitable for you then, or would you like me to ring you closer to the time?”

  (If they know a time and day, write collection date on their food record for them, and record time, date, name and address in my appointment diary.

  If not, then record a reminder to contact them in diary and also on the participant tracking sheet)

6. Thank participant for their time today
• “Your participation is extremely helpful to this valuable research, and is very much appreciated.”

7. Show contact details to participant
• On the back of food record
• Email: famj744@student.otago.ac.nz
• Contact number: 0220502269

Steps – After

• Filing FFQ and demographic questionnaire into participant file
• Record reminder dates in diary according to diet record plan
• Record next appointment date and reminder
Appendix P

Second visit protocol
Second Visit Protocol

Objectives:

1. To ask participants to complete FFQ for second time
2. To collect food record and scales from participants
3. To check answers in food record

Steps – Before

Equipment required:

- Pens
- FFQ
- Participant file

Call participant the day before to remind time of appointment

Record ID number on FFQ

Steps – During

1. Introductions
   - Introduce yourself
   - Thank participant for taking the time to meet today
   - Briefly explain what will happen today:
     - “First I will ask you to fill out the FFQ again. This FFQ asks you about what foods you think your child has eaten over the past month.”
     - “After this is completed, I will go through the food diary with you to ensure that everything is OK and collect the scales from you.”

2. Ask participant to fill up Food Frequency Questionnaire
• Explain that there are no right or wrong answers
• Complete the FFQ according to the instructions on the FFQ

3. **Check Food Diary**
   • Ask to see the food diary and scales
   • Check to see all columns have been filled in correctly.
   • If anything is missing or difficult to understand ask for clarification

4. **Wrap up and thank participant for their time today**
   • “Your participation is extremely helpful to this valuable research, and is very much appreciated.”

5. **Provide reimbursement**
   • Participants will receive a grocery voucher of up to 25 dollars to reimburse them for their time.
   • When receiving their voucher, participants will be required to sign reimbursement form stating that they have collected their voucher.

---

### Steps – After

• Filing FFQ and Food diary into participant file
• Participants will be given the opportunity to have the results of the study emailed to them. If they select this option in their consent form, I will send the results at the completion of the study (December 2014/January 2015).
Appendix Q

EAT3 Food diary booklet
EAT3 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>Amount eaten</th>
</tr>
</thead>
</table>
| Please write down **where** your child ate each meal, snack or drink. | Please write down the **time** your child had something to eat or drink, including am or pm. | **Name**: Describe the food or drink.  
**Brand**: Name the brand.  
**Cooking method**: 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.  
If a recipe was used to make a dish please write "see recipe" and write out the recipe on the page labelled "Recipes". | 1) **Weigh an empty plate or mug** using the scales provided.  
2) Write down the weight.  
3) If you add several foods to the same plate you will need to write down the **weight of each food** as you add it. | 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 weight of each food as you add it. | 1) After your child has eaten their meal place the same plate or mug with all the leftovers on the scales and write down the total weight of the food or drink and the plate or mug.  
2) Estimate how much of each food was left over (for example, half the potato).  
"Leftovers" are **everything** that your child didn't eat so please try and scrape everything your child didn't eat back on to the plate and weigh. | Office use |
An example filled out by the parents of a 3 year old child

Day 1  Date: 9 March 2014  Day of week: Thursday  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>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 170g 179g</td>
<td>127g</td>
<td>Office use</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Please write down if you have toast or sandwich slice bread.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>At Café with Gran</td>
<td>10am</td>
<td>Fruit cake Bobby banana Water</td>
<td>4 match boxes medium 1 medium glass</td>
<td>45g 50g small</td>
<td>1/8 leftover 1/3 leftover</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>If you are having fruit and don’t have your scales you can write down whether it is a small, medium or large piece of fruit.</td>
<td></td>
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</tr>
<tr>
<td>McDonald’s</td>
<td>12pm</td>
<td>Cheeseburger Medium fries (from supplementary page) McDonald’s lemonade</td>
<td>125g</td>
<td>145g 195g</td>
<td>15g</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>See page 21 of this diary for takeaway foods size guide.</td>
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</tr>
<tr>
<td>Home</td>
<td>3pm</td>
<td>Tasti milky’s muffin bar - choc vanilla</td>
<td>20g</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Home</td>
<td>6pm</td>
<td>Home-made mince (see recipe) Potato, boiled Butter Peas, frozen, boiled Just Juice, Orange and mango fruit juice</td>
<td>175g</td>
<td>1/4 of recipe 414g 419g 459g 491g 210g</td>
<td>215g (half the potato, no peas)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Please weigh the total amount of food left over + weight of plate or mug.</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>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).</td>
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<td></td>
</tr>
</tbody>
</table>
Example

Recipes – Day 1

Please write down:

1. Name of the recipe(s) (i.e. 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>Amount eaten</th>
</tr>
</thead>
<tbody>
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</tr>
</tbody>
</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 leftover + plate or mug</th>
<th>Amount eaten</th>
</tr>
</thead>
</table>

Office use
<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>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>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>If unwell, did this influence your child’s appetite?</td>
<td>No</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>Yes – decreased appetite  Yes – increased appetite</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>
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</tr>
</tbody>
</table>
Day 2 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>Amount eaten</th>
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</table>

12
### Day 2 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>Amount eaten</th>
</tr>
</thead>
</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.).
   Yes ☐
   No ☐  (please go to page 15)

(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)
   Yes ☐
   No ☐

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).
Day 3  

<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>Amount eaten</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
</tbody>
</table>

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

Yes – decreased appetite  Yes – increased appetite

Is your child unwell?  YES / NO

Date:  Day of week:
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>Amount eaten</th>
</tr>
</thead>
<tbody>
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</tr>
</tbody>
</table>

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>Amount eaten</th>
</tr>
</thead>
<tbody>
<tr>
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</tr>
</tbody>
</table>

Office use
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).
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

Anthropometry protocol
EAT-3 Measurement Protocol

Objectives:

1. To take anthropometric measurements (weight and height) of children aged 36-47 months.

Steps – Before

Equipment required:

- EAT-3 First Visit Protocol
- Anthropometry and checklist sheet
- Leicester Height Measure
- Body Composition Analyzer (Tanita BC-418) and Instruction Manual
- Alcohol wipes
- Pens/pencils
- Calculator
- Length rod for calibration
- Weight for calibration

Researchers should ensure they are familiar with the protocols without the need for constant referral back to it. Ask for additional training if you do not feel adequately trained to undertake the measures.

Check booking of venue and that equipment is set up and available: wipe electrodes on BIA with alcohol wipes before use.

Stadiometer should be calibrated with a standard length rod scale should be calibrated with standard weight at the beginning of each examining day. If the readings deviate from the expected value, record the differences and adjust measurements accordingly. Likewise, inform the principal investigator (Anne-Louise Heath) or senior technician (Kieran Columb) to get a new set of equipment.
Steps – During

1. Welcome and introductions
   - Introduce yourself to parent and child
   - Tell child what you will be doing to them, before you do it. Remain calm and confident
   - Ask the child to remove their shoes and socks, any heavy jackets, jerseys, hair ornaments etc. They must be in light clothing. If they have jeans on or other heavy clothing, either offer them alternative clothing (if this is an option) or make a note on the anthropometry sheet of what they were wearing.

2. Anthropometric measurements
   
   General outline
   - It is important to follow the same technique and protocol for each successive measurement
   - Follow through the order of measurements on the Anthropometry and Checklist sheet.
   - Immediately record the measurement after it is read, use pencil and write directly on the Anthropometry and Checklist sheet.
   - Measurements are taken on a hard surface
   - If two measures of height and weight do not lie within the maximum allowable difference, take a third measurement. Do NOT take a third measurement if the first two are within the limits.
   - The measurer’s confidence is important for reassuring both the parent and child, and includes maintaining eye contact and talking to the child in calm, reassuring voice. It is the measurer’s responsibility to make the child feel comfortable about the measurements being taken.

   **Height measurement**

   **Equipment:** Leicester Height measure

   **Method:**

   1. Place the stadiometer on a flat, stable surface.
   2. Check the shoes, socks, and hair ornaments have been removed.
   3. Ask the child to stand on the centre of the base with their back to the stadiometer.
For example, say: “Please stand on the centre of the base with your back to the measuring machine.”

4. Ask them to stand with their feet 2-3 cm apart and move back until their heels touch the bottom of the stadiometer upright. Their buttocks and upper part of their back should also be touching the stadiometer upright. Their head does not have to touch the stadiometer.
   For example, say: “Put your feet together and move them back until your heels touch the back of the measuring machine. Stand up straight and look straight ahead.”

5. The child’s head should be in the **Frankfort Plane**. This is achieved when the lower edge of the child’s eye socket (the orbit) is horizontally aligned with the middle of the child’s ear canal (the tragus) (See Figure). The vertex is the highest point on the child’s head. If the child’s head is not aligned properly (and it probably will not be), ask the child to look up or down a little until it is in the Frankfort Plane.
   For example, say: “Please look up [or look down] a little bit.” (You can move their head gently if you think it is appropriate – tell them that you are going to do so.”

![Diagram of Frankfort Plane](image)

6. When you are happy that the respondent is in the correct position, ask them to take a deep breath and hold it.

7. Lower the blue headboard until it is in contact with the head. Compress the hair if needed. Make sure you don’t bend the headboard form the horizontal, nor move the respondent’s head.

8. Hold the headboard firmly at its final position and take the reading to the nearest 0.1cm. Make sure that you ALWAYS record the height to 1 decimal place – even it is 119cm make sure you record 119.0cm.

9. When you have completed the reading, ask the child to step away from the stadiometer.

10. Move straight to the data sheet and record your reading.
Weight measurement

**Equipment:** Body Composition Analyzer BC-418

**Method:**

1. Turn machine on, 0.0 will appear in the upper display.
2. Ensure that children are wearing only light clothing (essentially as little as possible, remove all clothes that they are happy to) and no shoes. If the child refuses to remove all heavy clothing, make a note on the Anthropometry and Checklist Sheet, and make adjustment on measured weight accordingly.
   - Diaper – 0.1kg
   - Jeans – 0.5kg
   - Hoodie/jacket/coat – 0.3kg
3. Ask the child to step on to the weighing platform with bare feet so that their heels touch the posterior electrodes and that the fronts of the feet touch the anterior electrodes. You may need to reposition the child’s feet a little.
4. When you have completed the reading, ask the child to step off the platform.
5. Move straight to the data sheet and record your reading to 1 decimal place.

**Is a third measurement required?**

A third measurement needs to be taken and recorded if the two previous measures differ by more than the following:

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

To check whether a third measurement is required, do the following:

- Do the two height measurements fall within 0.7cm of each other?
- Subtract to find out: height 2 – height 1 (it doesn’t matter if the answer is a negative – the amount is correct and the sign – positive or negative does not matter)
- If it is 0.7cm or lower – this is ok – don’t take a third measure
- If it is greater than 0.7cm, then take a third measure

Do the same procedure for weight – but use a difference of 0.5kg as your guide.
After measurements have been taken, child can put clothes back on, and offer child toys or colouring while explaining food diary to parent.

Measurement calculation

- All measurements should be averages of the duplicate measures obtained.
- Use Swedish rounding
  - If it is less than 0.5 (ie. 0.1-0.4) you round DOWN
  - If it is 0.5 or above (ie. 0.5-0.9) you round UP
- Was a third measurement required? If yes, then the average measure should be calculated from the two closest measures – see example below.
- Calculate average height and record it on the Anthropometry and Checklist sheet to the nearest 0.1 cm.
- For example:
  Height 1 = 115.9 cm
  Height 2 = 115.1 cm
  115.9 – 115.1 cm = 0.8 cm which is bigger than the allowable difference – therefore a third measure should have been taken
  Height 3 = 116.3 cm
  Therefore to calculate the average height, you would use Height 1 and Height 3 as these are the two closest measures
  Average height = [(Height 1) 115.9 cm + (Height 3) 116.3 cm] ÷ 2
  = 232.2 cm ÷ 2
  = 116.1 cm
- Calculate average weight and record it on the Anthropometry and Checklist sheet to the nearest 0.1 kg.
- BMI is calculated as weight in kilograms divided by height in metres squared (weight (kg)/height (m)²)
  - Use the average height and average weight
  - Calculate BMI and record on the Anthropometry and Checklist sheet to one decimal place.
Appendix S

Anthropometry and checklist sheet
# EAT-3 Anthropometry and Checklist Sheet (First Visit)

**Study code:**

**Date of measure:**

**Measurer:**

**Child’s date of birth:**

**Child’s sex (circle the one that applies):**  
- BOY  
- GIRL

<table>
<thead>
<tr>
<th>Child height 1</th>
<th>Child height 2</th>
<th>(Child height 3)</th>
<th>Average height (cm)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>_____________</td>
<td>_____________</td>
<td>_____________</td>
<td>_____________</td>
</tr>
</tbody>
</table>

**Comments:**  
__________

<table>
<thead>
<tr>
<th>Child weight 1</th>
<th>Child weight 2</th>
<th>(Child weight 3)</th>
<th>Average weight (kg)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>_____________</td>
<td>_____________</td>
<td>_____________</td>
<td>_____________</td>
</tr>
</tbody>
</table>

**Comments:**  
__________

**BMI (kg/m^2):**  
__________

*If a 3rd measure is entered, the mean is taken from the two closest measurements. If the distance between each of the “pairs” is identical then use the mean of all 3

**Checklist:**

- [ ] Consent form signed
- [ ] EAT-3 Questionnaire completed
- [ ] FFQ completed
- [ ] Food diary provided
- [ ] Scales provided: ________________
- [ ] Date and time arranged for second visit: ________________
EAT-3 Checklist Sheet (Second Visit)

Study code:

Date of second visit:

Child’s date of birth:

Child’s sex (circle the one that applies):  BOY  GIRL

☐ FFQ completed
☐ Food diary completed
☐ Scales returned: _____________
☐ Reimbursement form signed
☐ Grocery voucher provided: _____________

Does participant want to have the results back?  YES  NO

If yes, email address: ______________________

Comments:
Appendix T

EAT3 Food diary supplementary page
Supplementary Pages – Takeaway Foods Estimation Guide

Hawaiian Pizza

Fries

Battered Fish

Chips