An evaluation of 'Feed the Need' and other food assistance programmes on dietary intake and classroom success in a low decile school in South Auckland, New Zealand.

A thesis presented in partial fulfilment of the requirements for the degree of

Masters of Science

in

Nutrition and Dietetics

at Massey University, Albany

New Zealand

Samantha Marie Ansell

2016

Abstract

Background: Feed the Need (FTN) is a charitable organisation that provides lunches to low decile schools during winter. Limited literature investigates the effects of such programmes on dietary intake and classroom success in New Zealand children.

Aim: To assist Manurewa South School in demonstrating the effects of FTN on dietary intake at school, and classroom success in year five and six students.

Methods: Self-administered food records were completed by 82 year five and six students from Manurewa South School during one week of FTN (i.e. 'FTN week') and again two months after FTN's conclusion (i.e. 'control week'). Mean intake of energy and all macronutrients were estimated in both weeks, and compared to school-day requirements (40% of the Nutrient Reference Values). Meals offered to students by FTN were also analysed against school-day requirements. Key food sources were identified and intake was compared between the FTN and control weeks. Furthermore, attendance and classroom behaviour were analysed using the 'Positive Behaviour 4 Learning' screening initiative. Finally, focus groups were undertaken with three staff and six student representatives to understand perceptions of food assistance programmes available.

***Results*:** During the FTN week students consumed more energy, protein, carbohydrate, fat, saturated fat and dietary fibre ($p<0.05$). School-day dietary fibre requirements were not met during the control week but were achieved during FTN by girls (9.13±7.39g/day). During both weeks consumption of carbohydrate, protein and saturated fat exceeded school-day recommendations. FTN meals exceeded school-day recommendations for carbohydrate, protein and saturated fat. Sources of food included the dairy, home, school, FTN and 'other'. No difference in energy intake sourced from the home or dairy was observed between the weeks ($p>0.05$). Attendance rates and behaviour did not differ between the two weeks ($p>0.05$). Focus groups demonstrated concerns over the tenure and cultural appropriateness of FTN.

Conclusions: FTN increased energy, macronutrient, and dietary fibre intakes in students. Nutritional adequacy of FTN meals should be moderated, in particular the saturated fat content. Guidelines should be established to ensure nutritionally adequate meals are served by programmes like FTN.

Attendance and behaviour remained unaffected in this study. Longitudinal studies are required to determine the effects of FTN on attendance rates in school.

Key Words: Feed the Need, food assistance programmes, food insecurity, nutrition, public health, South Auckland, New Zealand

Acknowledgments

First and foremost, I would like to acknowledge my wonderful family for the support and guidance they have provided me throughout this journey. To Mum, Dad, Kerry and Rae, thank you for believing in me and for giving me the confidence to know that I am unstoppable and unbreakable when I put my mind to something.

A special mention goes to Elise, Kerry and Dad for tirelessly reviewing my work. I appreciate the time and energy you have sacrificed for me.

To Todd, thank you for being there whenever times were tough and for dealing with my weekly mood swings, and breakdowns. I am confident that I would not have made it through these past two years without your support, so thank you.

To my brother Chris and my beautiful friends, I am sorry I have been MIA for the past two years. Thank you for your understanding.

To my classmates, in particular Lisa and Vicki. We did it! I don't know how I possibly would have managed this without you both. Your friendship has helped to keep me slightly sane throughout this process.

A special mention goes to Lisa for helping me with my statistical analyses. In times of frustration and confusion, you were my rock.

To my research partner and friend Nitasha, I am so lucky to have had your support throughout this process. Your knowledge and positive attitude has been amazing.

To the staff and students from Manurewa South School, your hospitality and co-operation with data collection is duly acknowledged.

Lastly, to my supervisors Dr Carol Wham and Professor Bernhard Breier, thank you for sharing your knowledge and experience with me. This process has helped me to grow academically and also personally. Your passion for nutrition and public health is to be commended.

For Nana Doreen & Poppa. I'm sorry you never got to read my work; I know you both would have been incredibly proud. Thank you for your inspiration, and introducing me to the wonderful world of food.

Contents

List of Tables

List of Figures

List of Appendices

Abbreviations

AI	Adequate Intake
AMDR	Acceptable Macronutrient Distribution Range
BMI	Body Mass Index
CNS	Children's Nutrition Survey
EAR	Estimated Average Requirement
ECLS-K	Early Childhood Longitudinal Study – Kindergarten
EER	Estimated Energy Requirement
FAP	Food Assistance Programme
FG	Focus Group
FR	Food Record
FSM	Free School Meal
FTN	Feed the Need
KS1	Key Stage 1
KS2	Key Stage 2
NAGS	National Administration Guidelines
NRV	Nutrient Reference Value
NSC of Dietary Behaviours	The National Survey of Children and Young People's Physical Activity and Dietary Behaviours in New Zealand
NSLP	National School Lunch Programme
NZEO	New Zealand European and Other
PB4L	Positive Behaviour 4 Learning
SBP	School Breakfast Programme
SES	Socioeconomic Status
SSB	Sugar Sweetened Beverage
UK	United Kingdom
USA	United States of America
WHO	World Health Organisation

"Overcoming poverty is not a gesture of charity. It is the protection of a fundamental human right, the right to dignity and a decent life" (Mandela, 2005, para. 12)

Chapter 1: Introduction

Childhood is a time of rapid growth and development which can only be sustained through an adequate diet (Ministry of Health, 2012a). In New Zealand, many children go without this basic necessity. Not only does this result in immediate negative consequences, but later-life health and social outcomes can also be affected (Boyer, Nelson, & Holub, 2015; Ferraro, Schafer, & Wilkinson, 2015; Reilly & Kelly, 2011).

It is widely evidenced that the level of food insecurity a child experiences is strongly linked to diet quality, where socioeconomic status acts as an important determinant of health and nutrition (Statistics New Zealand and Ministry of Pacific Island Affairs, 2011; Tanumihardjo et al., 2007). This is believed to result from the increasing price of nutritious and healthy food products, such as fresh fruit and vegetables, which are often unaffordable and unavailable to low income families (Hopgood et al., 2010). A result of this is an increased consumption of refined, high fat foods in low income families and children (Maddison, 2010; Parnell, Scragg, Wilson, Schaaf, & Fitzgerald, 2003; Tanumihardjo et al., 2007). Consequentially, the risk for developing overweight and obesity in income deprived populations is increased, where the risk of obesity is 2.5 times higher in low income, compared to high income families within New Zealand (Pearson, Bentham, Day, & Kingham, 2014; Sharpe & Bradbury, 2015).

Multiple public health initiatives have been developed throughout New Zealand with the aim of supporting healthy food choices for children and families living in lower socioeconomic communities. The school setting is commonly used for the development of nutrition interventions in children due to evidence proving its efficacy in behaviour, knowledge and attitude change (Anderson, 2009). Such successful results could be explained by the following characteristics of this setting:

1. The tendency to capture an audience at an impressionable age (Katz, O'connell, Njike, Yeh, & Nawaz, 2008). Children entering adolescence are an extremely vulnerable, yet malleable target population. Though these young people are often susceptible to the obesogenic environments commonly seen in schools (Carter & Swinburn, 2004), they also

have the ability to learn life-long healthy habits through nutrition programmes established in this setting (Katz et al., 2008).

2. Schools are an environment where multiple demographics come together in the same setting. Nutrition interventions based at school are able to influence multiple races, ethnic groups, and income levels all in the one environment (Story, 1999). Hence, nutrition interventions in the school setting have the ability to reach those who are most vulnerable, whilst providing an opportunity for all children, regardless of ethnicity and socioeconomic status, to benefit.
3. Children consume 30-40% of total energy intake during the school day (Regan, Parnell, Gray, & Wilson, 2008; Yoong et al., 2015). Due to this significant proportion of total daily intake consumed on school grounds, the school setting acts as a powerful platform for nutrition interventions. With the promotion of healthy eating at school, overall total diet quality can be influenced and significant improvements in daily nutrient intakes can also be achieved.

In New Zealand a decile system has been generated in order to prioritise funding for those schools in greatest need. A school is given a decile rating based on the extent to which it draws its students from low socioeconomic communities. Decile one schools for example, are the 10% of schools with the highest proportion of students from low socioeconomic communities, compared to decile 10 schools which have the least (Ministry of Education, 2016). This provides a basis for funding where schools with the lowest decile rating receive the most government support (Ministry of Education, 2016). Such a school setting is crucial for the development of nutrition programmes, as targeted nutrition interventions to those who are most disadvantaged is cornerstone to reducing health inequities within the New Zealand context (Children's Commissioner, 2013).

With the growing relevance of food insecurity in developed countries like New Zealand, an increase in the presence of food assistance programmes in the school setting has been observed. In New Zealand there is no nationwide government-funded school lunch programme established, but multiple segmented food assistance programmes are in operation. These include such programmes as KidsCan, Fruit in Schools, KickStart, Fonterra Milk for Schools, Garden to Table, Health Promoting Schools, and other privately run programmes such as Feed the Need (FTN), and

the Eat My Lunch initiative (Children's Commissioner, 2013). The majority of these programmes are based around free food provision to those schools in most need, classified as those schools rated as decile one or decile two.

FTN is one of the many charitable organisations established in New Zealand with the aim of providing free food to food insecure children. It was developed in 2012 by Kerry Owen, and provides warm and nutritious meals to decile one and two primary schools around South Auckland during the winter months. Each winter the programme provides 68,000 hot lunches to 2,800 children in six primary schools around the Manurewa and Takanini region. The aim is to expand this project to the entire Auckland region by 2020, and then beyond to the rest of New Zealand (Feed the Need, 2014).

Many food assistance programmes in New Zealand schools only supplement food intake and do not provide a nutritionally complete meal. For example, the Fruit in Schools and Milk in Schools initiatives supplement singular food groups (i.e. fruit and vegetables/milk and alternatives). FTN is one of the only programmes available that provides a nutritionally complete meal to school children. Therefore, it is the platform on which the current thesis scope was developed.

FTN focuses on the winter months as this is the period when many children become ill and are absent from school (Feed the Need, 2014; Ministry of Education, 2015). Furthermore, FTN targets primary schools as young children are highly dependent on adequate nutrition for normal growth and development (Feed the Need, 2014; Ministry of Health, 2012a). To date, limited studies have investigated the effects of FTN on dietary intake and absenteeism in children. Furthermore, other effects on classroom success such as classroom behaviour have not been investigated. Therefore, it is important to explore whether FTN is achieving its primary goals of improving dietary intake in children and reducing absenteeism in low decile schools in order to ensure its efficacy.

1.1 Justification for Research & Scope

To date, limited published literature is available demonstrating the effects of food assistance programmes on food insecure children in high income countries like New Zealand (Mhurchu et al., 2010). These effects are multimodal, encompassing both a direct nutritional impact as well as higher level consequences such as the effects on a student's ability to thrive in the classroom (Mhurchu et al., 2010; Sharkey, Dean, & Nalty, 2013; Widenhorn-Müller, Hille, Klenk, & Weiland,

2008). The current study will add to the small body of literature currently available whilst also specifically investigating the effects of FTN on dietary intake and classroom success in school children.

1.2 Aim, Objectives & Hypothesis

Aim: To assist Manurewa South School in demonstrating the effects of Feed the Need on dietary intake at school, and classroom success in year five and six students.

Sub-Aim: To gain an understanding of staff and student perceptions of current food assistance programmes established at Manurewa South School.

Objectives:

1) Explore the dietary intake of year five and six students and the effect of Feed the Need on dietary intake, through an examination of energy, all macronutrients, total sugar, saturated fat and dietary fibre contributions to school-day estimated nutrient requirements.

2) Explore ethnic differences in dietary intake with and without the presence of Feed the Need.

3) Identify sources of food for students at Manurewa South School and determine any effects of Feed the Need on where students get their food from.

4) Investigate associations between Feed the Need and classroom success markers: Positive Behaviour 4 Learning (PB4L) scores and classroom attendance rates.

5) Investigate the attitudes and perceptions of school food programmes through focus groups with both students and staff.

1.3 Structure of Thesis

Chapter two is a literature review exploring food, nutrition and health in New Zealand children. An in-depth review of current evidence regarding the relationship between nutrition and classroom success is presented, as well as literature that focuses solely on the effects of food assistance programmes. Finally, a summary of current international food assistance programmes established in the school setting is also presented, and more specifically those available in New Zealand schools. Chapter three presents the methodology that was used in the study. Chapter four presents results and supporting statistical analyses, while chapter five provides an investigation and discussion of the main findings. Chapter six provides an overview of the main findings of the study and recommendations for FTN and future research. Chapter seven investigates the strengths and limitations to the current study, whilst chapter eight provides concluding remarks.

1.4 Contributions to the Study

Table 1.1: *Contributions to the study*

Researcher	**Contribution**
Samantha Ansell	Data collection, data entry, data spot check, statistical analysis
Nitasha Walia	Data collection, data entry, data spot check, statistical analysis
Tone Kolose (Principal) Elise (Teacher) Clyde (Teacher) Karen (Teacher)	Provided PB4L and Attendance data Assisted with data collection during class time Assisted with data collection during class time Assisted with data collection during class time
Arysbeth Pineda, Barni Ichpuniani, Emily Sycamore, Jeanette Farmilo and Lisa Henderson	Assisted with data collection in Week 1 (FTN week)
Alex Lawn, Amanda Whitford, Arysbeth Pineda, Ashleigh Jackson, Bani Ichpuniani and Lisa Henderson	Assisted with data collection in Week 2 (control week)

Chapter 2: Literature Review

2.1 Nutrition in Childhood

Childhood and adolescence is a time of rapid growth and development, where children undergo two major growth spurts by the age of 12-14 years old (Qi & Niu, 2015). During this time, children gain a large amount of weight, become taller, lay down bone mass, and develop sexual maturity (Mann & Truswell, 2012; Qi & Niu, 2015). Evidence suggests that growth and development in childhood can be a strong indicator of later-life health outcomes (Boyer et al., 2015; Ferraro et al., 2015; Reilly & Kelly, 2011). Therefore, it is important to ensure adequate macronutrient and micronutrient intakes in early-life in order to maintain quality of life in older age.

Childhood is also a time of cognitive development and maturation, where children develop attitudes and habits surrounding food and nutrition. This cognitive development is heavily influenced by the food environment, including factors such as parental and peer attitudes and food exposure (Scaglioni, Salvioni, & Galimberti, 2008). Evidence suggests that attitudes and habits developed in young people often persist into adulthood, consequentially affecting dietary habits and health outcomes in later-life (Lake, Mathers, Rugg-Gunn, & Adamson, 2006; Law, 2000). Therefore, it is important to sculpt healthy eating behaviours in childhood. This can be supported through adequate education and a facilitative food environment (Brug & Klepp, 2007).

2.2 Food Groups and Nutrient Reference Values (NRVs)

National food and nutrition guidelines have been developed in New Zealand in order to promote adequate health and nutrition of all New Zealanders. As with adult nutrition guidelines, the Ministry of Health has published recommendations regarding optimal food group intake in child populations aged 2-18 years. The food group recommendations include three serves of vegetables and two serves of fruit per day, at least five serves of breads and cereals per day, at least two to three serves of milk and milk products per day and finally, one to two serves of meat products per day, or at least two servings of alternatives if vegetarian (Ministry of Health, 2012a). It has been assumed that if the above recommended daily food group serves are achieved, then all essential macro and micro nutrients for adequate growth, development and weight maintenance will also be achieved (Foote, Murphy, Wilkens, Basiotis, & Carlson, 2004; Preedy, 2013).

Table 2.1 demonstrates the NRVs for the three macronutrients: protein, fat and carbohydrate, as well as recommendations for saturated fat and dietary fibre in children aged 9-13 years. As can be seen here, there is inconsistency in the recommendations available for each of these nutrients, related to the evidence available regarding optimal intakes (Ministry of Health, 2012a).

Table 2.1: *Australia, New Zealand Macronutrient NRVs*

Nutrient	AMDR (% energy)	EAR		AI	
		Boys	Girls	Boys	Girls
Protein	15-25%	31g/day (0.78g/kg)	24g/day (0.61g/kg)	-	-
Total Fat	20-35%	-	-	-	-
Saturated Fat	<10%	-	-	-	-
Carbohydrate	45-65%	-	-	-	-
Dietary Fibre	-	-	-	24g/day	20g/day

AI=Adequate Intake, EER=Estimated Energy Requirement, EAR=Estimated Average Requirement, AMDR=Acceptable Macronutrient Distribution Range

It is common practice to use the Estimated Average Requirement (EAR) to examine nutritional intakes at a population level (Institute of Medicine, 2000; Murphy & Poos, 2002). The EAR is defined as the estimated amount of a nutrient that is considered to meet the requirements of half of a population of healthy individuals, who are of a certain life-stage and gender (Ministry of Health, 2012a). As can be seen from **Table 2.1** there is insufficient evidence to provide an EAR for all nutrients, except protein. Other information available is the Acceptable Macronutrient Distribution Range (AMDR) and the Adequate Intake (AI). The AI is set when there is insufficient evidence for an EAR, as with dietary fibre, and indicates a low prevalence of inadequate intake when a population mean is at or above the established reference point (Institute of Medicine, 2000; Murphy & Poos, 2002).

Carbohydrate and total fat have limited evidence for an AI to be set. The National Health and Medical Research Council (2006) has demonstrated that there is insufficient evidence for the essentiality of total fats in the human diet, and hence national recommendations only provide AIs for linoleic, linolenic and total omega three fatty acids. Whereas, though an essential component to the human diet, there is limited data available for the type and amount of carbohydrate that should be consumed for most age groups, and hence an AI was unable to be set (National Health and Medical Research Council, 2006).

The AMDR is the range of intakes for each of the macronutrients that would allow for adequate intake of all other macronutrients whilst also ensuring good health (Ministry of Health, 2012a). Where no EAR or AI is available, this is the only other available New Zealand-based indication of optimal intake in populations. The Ministry of Health (2012a) has determined that the AMDR only applies to children aged 14 years and above. However, the range of intakes indicated by the AMDR should be considered appropriate for younger children, as long as they are growing normally (Ministry of Health, 2012a).

The Institute of Medicine (IoM) in the USA has also generated tables of recommendations for all macronutrients for different ages and genders. As with New Zealand specific data, no total fat or saturated fat recommendations are provided due to insufficient evidence. However, carbohydrate specific EARs are provided for both boys and girls aged 9-13 years at 100g/day (Institute of Medicine, 2005).

In the current study a combination of both New Zealand and American recommendations will be used to assess dietary intake in the sample population. Where New Zealand specific EARs or AIs are available these will take preference over international literature. However, the EAR for carbohydrate will be used as a reference point in conjunction with the New Zealand specific AMDR. Where no other national or international EARs or AIs are available, reference will only be made to the New Zealand specific AMDR. This is applicable for total fat and saturated fat intakes.

2.3 Dietary Behaviour of New Zealand Children

Over the past 20 years multiple national cross-sectional surveys have been undertaken in order to understand the eating patterns of New Zealand children. Some of the main studies from this period have included the 2002 National Children's Nutrition Survey (CNS) (Parnell et al., 2003), The 2007 New Zealand Children's Food and Drinks Survey (New Zealand Research Bureau, 2008), The National Survey of Children and Young People's Physical Activity and Dietary Behaviours in New Zealand (NSC of Dietary Behaviours) (Maddison, 2010) and The 2011/12 New Zealand Health Survey (Ministry of Health, 2012b). **Table 2.2** summarises the main findings from these surveys.

Determining trends in the dietary behaviours of children has proven difficult, as many of the nutrition surveys developed in New Zealand encompass different age ranges or different

methodologies of data collection. Consequentially, as can be seen in **Table 2.2** this results in inconsistent and sometimes conflicting data surrounding the eating patterns of children.

The discrepancies observed between the different dietary surveys presented in the current review are thought to be multifaceted. Firstly, it is thought that the various age ranges used between different surveys can significantly influence the conclusions made about dietary intake in children. It has been recognised that as children get older their autonomy over food choices increases (Whitney & Rolfes, 2002). Therefore, older children are often observed as having poorer eating habits than those who are younger, due to reduced parental guidance and increased peer and social influences (Ministry of Health, 2012a). Hence, nutrition surveys that encompass older children and young adults have found different eating patterns, than those surveys that only encompass younger age ranges.

The methodologies used in dietary data collection can also affect the conclusions made about the eating behaviours of New Zealand children, where the nutrition surveys presented above use a variety of methods of dietary assessment. For example, the CNS used a 24-hour dietary record method with both parents and children, to gain an accurate representation of usual dietary intake (Parnell et al., 2003). The NSC of Dietary Behaviours on the other hand used an age appropriate dietary questionnaire. This was adapted from the Adults Nutrition Survey developed by the Ministry of Health but was amended to improve simplicity and readability for younger populations (Maddison, 2010). The New Zealand Children's Food and Drink Survey used face-to-face interviews with parents to retrieve information on children's eating patterns (New Zealand Research Bureau, 2008). Finally, The New Zealand Health survey used a computerised questionnaire, where children were assisted by professionals within the health field (Ministry of Health, 2008). As dietary intake was not the core focus of this survey, the diet related questions had a very narrow scope looking only into fast food, fizzy drink and breakfast consumption.

It is well known that different dietary assessment methods have different limitations, with some being more appropriate for certain study aims, or population groups (Thompson & Subar, 2008). For example, Grandjean (2012) demonstrated that 24 hour food records are a good quantitative measure of dietary intake, whereas food frequency questionnaires are a good measure of usual dietary intake but are not quantitatively precise. Therefore, it is difficult to compare any trends produced from different surveys that have used different methods, as the dietary assessment method used may only capture certain aspects of intake or eating patterns.

Regardless of these limitations, some poignant themes have arisen from the current review regarding the dietary behaviours of New Zealand children. These include:

1. The proportion of children consuming the recommended serves of vegetables has reduced between the 2003 CNS and the 2010 NSC of Dietary Behaviours. This could be due to the significant increase in price of fresh fruit and vegetables.

2. The proportion of children consuming the recommended serves of fruit each day has increased between the 2003 CNS and the 2010 NSC of Dietary Behaviours. This could have resulted from increased consumption of sugar sweetened beverages (SSB), where fruit juice consumption has also increased.

3. Poor diet quality (high consumption of SSB and discretionary foods) is predominantly observed in Māori and Pacifika children and those coming from low income households.

4. Though the majority of New Zealand children are reported to be consuming diets that closely follow Ministry of Health (MOH) recommendations, this does not accurately reflect all children. Those from Māori and Pacifika populations, and those in low income New Zealand, are at greatest risk of dietary inadequacy.

5. Most New Zealand children consume a breakfast meal however, Māori and Pacific children are at greatest risk of skipping breakfast each day, as well as those from low income households.

6. Most New Zealand children consume lunch during the school day.

    i. The majority of children bring food from home for their lunch however Māori and Pacifika are less likely to bring food from home and more likely to purchase foods from the tuckshop.

7. New Zealand children consume high fat and high sugar snacks regularly.

    i. Māori children are more likely to consume potato crisps on a daily basis, as well as those from low income households.

    ii. Māori and Pacific children report the greatest consumption of discretionary baked items like cream filled biscuits.

8. SSB consumption is high in New Zealand children where over half of children consume fizzy drink at least once a week, and over 40% consume fruit juice at least once a week.

i. Pacifika and Māori children are mostly likely to have a regular consumption of fizzy drink, as well as low income households.

ii. Asian and NZEO children are more likely to consume fruit juices, as well as high income households.

Table 2.2: *Summary of evidence regarding the dietary behaviours of New Zealand children*

Survey	Age (years)	Key Findings
CNS (Parnell et al., 2003)	5-14	• Most children consumed morning tea and lunch at school. New Zealand European and Other (NZEO) children were most likely to consume a lunchtime meal and Māori and Pacifika children were least likely. • Approximately 43% of children consumed two serves of fruit/day. Pacifika children were most likely to meet recommendations (50%), followed by Māori and NZEO (40%). • 57% of New Zealand children consumed three serves of vegetables per day. • More deprived children, including Māori and Pacifika, were most likely to exceed recommended servings of meat/day. These foods were predominantly lower quality cuts. • The most deprived children, as well as with Maori and Pacifika, consumed the most discretionary carbohydrate products. • Fruit drink powder and concentrate were consumed on a weekly basis by 50% and 30% of children respectively. Overall Sugar Sweetened Beverage (SSB) consumption was the highest in the most deprived as well as Māori and Pacifika children.
New Zealand Children's Food and Drinks Survey (New Zealand Research Bureau, 2008)	5-16	• 93% of parents and caregivers reported that their children took food to school from home. Pacifika parents and caregivers were less likely to say that children brought food from home (85%) than other ethnicities (Māori 91%, NZEO 94%). • Least deprived children were most likely to report that food was taken to school from home (98%) compared to the most deprived (89%). • 69% of parents and caregivers said fizzy drinks were available in their household. Pacifika, and low income households, were more likely to have fizzy drinks available than Māori, Asian and NZEO households. • 85% of parents and caregivers said fruit juice was available in their household. Asian and NZEO households were more likely to have fruit juice available than Māori and Pacifika. • Parents/caregivers in least deprived areas were most likely to say fruit juice was available in their homes daily. • Almost all parents and caregivers said that fresh fruit and vegetables were available in their home, with 98% of these parents saying that their child ate fresh fruit daily, and 99% saying that their children at fresh vegetables daily. • Pacifika parents and caregivers were less likely than Māori and NZEO to say that fresh vegetables were

		available in the home. • The least deprived households were shown to have increased availability and consumption of fresh fruit. • Māori parents and caregivers were most likely to have potato crisps and snacks available in the home. • Potato crisps and snacks were more available in the most deprived household compared to the least deprived. Furthermore, the most deprived households were more likely to say that children consumed these snacks daily or more. • Sweets, lollies and chocolates were least available in the most deprived households.
NSC of Dietary Behaviours (Maddison, 2010)	5-24	• 78% of children consumed some sort of meal for breakfast, while over 4% never consumed a breakfast meal. • 87% of children sourced their lunchtime meal from home. This decreased with age. • 68.6% of children met recommendations for fruit intake each day and 39.7% for vegetables. The least deprived children were more likely to meet vegetable recommendations. Māori children were most likely to meet fruit recommendations whereas NZEO were most likely to meet vegetable recommendations (44.2%). • 31% of children ate potato crisps and snacks 1-2 times per week. • 36.3% of children ate take away foods 1-2 times/ week and 39.6% ate confectionary 1-2 times/week. • Over half of children consumed fizzy drinks at least once per week. Over 4.3% of children aged 10-14 years consumed fizzy drinks seven or more times per week, these trends increased with age. • Over 70% of children consumed fruit juice at least once/week and over 18% more than seven times/week.
The New Zealand Health Survey 2011/12 (Ministry of Health, 2012b)	0-14	• 87% of children consumed breakfast at home every day in the past week survey. • 81% of children aged 10-14 years ate breakfast at home every day compared to 94% of children aged 2-4 years. Māori and Pacifika children were less likely to eat breakfast than non-Māori, non-Pacifika children. • Children living in the most deprived areas were less likely to eat breakfast at home (83%) compared to children living in the least deprived areas (91%). • 20% of children consumed a fizzy drink three+ times/week. Highly deprived children, as well as Māori and Pacifika were more likely to have three+ fizzy drinks each week compared to the least deprived and non-Māori, non-Pacifika children. • 7% of children consumed fast food three+ times/week. Māori were twice as likely as non-Māori to consume three+ fast food meals/week, and Pacifika were three times as likely as non-Pacifika. • Children in the most deprived New Zealand areas were more likely to consume three+ fast food meals/week.

2.4 Environmental Influences on Food Intake

2.4.1 The Home Environment

Children are particularly vulnerable to household influences of dietary intake due to their lack of control over the food supply (Brug & Klepp, 2007; Patrick & Nicklas, 2005). Socioeconomic status (SES) and parental influences are considered key household factors that determine childhood eating patterns and overall health (Brug & Klepp, 2007).

Low income families often have nutrient poor, energy dense diets as quantity of food is frequently a priority over quality due to financial constraints (Tanumihardjo et al., 2007). An analysis of the 2003/04 Household Economic Survey (Statistics New Zealand, 2004) has demonstrated that low income families spend less money on food each week, however a greater proportion of their total income is consumed by the increasing price of food. Since this publication multiple other household economic surveys (HES) have been completed however, none of the latest releases have explored the proportion of total income which is spent on food. Nevertheless, the 2015 HES has demonstrated that over 20% of low income households (<$34,100/year) feel they have insufficient incomes to meet basic necessities (i.e. food and utilities), versus only 5-10% in moderate and high income families ($60,300-$130,990/year) (Statistics New Zealand, 2015). Furthermore, net disposable income after household expenses have been paid is comparatively smaller in low decile families (Perry, 2010).

It is understood that the patterns discussed above accumulate into a high pressure environment where anxiety can build as food insecurity increases. This is where a reliance on convenience and pre-packaged foods can originate. Such foods are often more affordable and less wasteful, but also nutritionally poor and energy dense.

Along with household income, discrepancies in the food environment associated with different income levels can also influence dietary intake (Story, Neumark-Sztainer, & French, 2002). In contrast to developing countries, where poverty is associated with starvation, developed countries like New Zealand encompass a paradox of energy dense and nutrient poor food consumption in lower socioeconomic areas (Tanumihardjo et al., 2007). It is understood that food retail outlets are socially patterned in New Zealand where deprived New Zealand children and adults alike are submerged into a highly obesogenic environment (Block, Scribner, & DeSalvo, 2004; Pearce, Blakely, Witten, & Bartie, 2007). This is similar to trends found internationally, where access to fast food outlets is greater in those areas with low income (Reidpath, Burns, Garrard, Mahoney, & Townsend, 2002). Research has shown that the lack of

availability of fresh and healthy foods compared with obesogenic foods in these environments, is a major contributor to inequities in health and diet between both those living in deprived communities and ethnic minorities associated with such areas (Morland, Wing, & Roux, 2002).

Finally, parent and caregiver influences over child eating habits should not be disregarded as a significant determinant of eating patterns in youth. This can encompass both a parent's influence as a role model in the household and through the transference of their values and attitudes surrounding healthy eating (Anzman, Rollins, & Birch, 2010; Ohly et al., 2013).

Hewitt and Stephens (2007) support the importance of parental influence on children's eating choices through their investigation of the role of the theory of planned behaviour in the eating habits of 10-13 year old New Zealand children (n=261). It was found that the influence of parental role modelling and values/attitudes (i.e. 'perceived subjective norms': a child's perception of whether their parents/caregivers would want them to consume a certain food item) was far more influential on child eating patterns than the direct control that a parent or caregiver can exert over the food supply.

2.4.2 The School Environment

The school environment is also extremely influential towards the dietary intake of children. It is estimated that children consume approximately 30-40% of their daily intake on school grounds (Regan et al., 2008; Yoong et al., 2015). Therefore, this provides an arena where societal influencers, such as peer food choices and the food environment, can have significant effects on the quality of a child's total food intake (Yoong et al., 2015).

In 2009 the National Administration Guidelines (NAGs) were amended where policy ensuring only healthy foods are offered in all schools around New Zealand was void. Because of this, no consistency exists between schools in New Zealand as to what food is available for children, and no policy is present ensuring the provision of only healthy foods in the school environment (New Zealand Parliament, 2009). Consequently, the majority of New Zealand schools are highly obesogenic, regardless of their decile rating, offering high fat foods such as pies, chips, and sausage rolls (Carter & Swinburn, 2004). This is significant, as approximately 56% of children and 62% of adolescents purchase goods from the school tuckshop (Adolescent Health Research Group, 2008).

Furthermore Watts, Lovato, Barr, Hanning, and Mâsse (2015) have demonstrated that along with the high availability of energy dense food products in the school environment, peer

attitudes and behaviours also play a major role in influencing children's dietary choices. It has been reported that energy dense treat foods that are present in the lunchboxes of peers often act as triggers for children to eat similar food items (Watts et al., 2015).

A study undertaken in Northern California investigated the way that peers directly influence each other's food choices. Students aged 9-11 years from a middle income, National School Lunch Programme (NSLP) eligible elementary school were recruited (n=76). It was demonstrated that over one third of students engaged in food exchange. This ranged from prosocial food exchange (sharing) to aggressive exchange (stealing). The majority of foods exchanged were high energy density and nutrient poor discretionary foods (Sutter, Nishina, Scherr, Zidenberg-Cherr, & Ontai, 2015).

Children often lack cognitive ability and maturity to independently make healthy food choices outside the home environment (Utter, Scragg, Percival, & Beaglehole, 2009). Therefore, those children who do not bring lunch to school are often more susceptible to poor food choices. Research shows that foods brought to school from home are often healthier and less energy dense than those purchased in the community or on school grounds (e.g. in school tuckshops) (Carter & Swinburn, 2004; Gillis & Bar-Or, 2003). This is believed to result from the lack of parental control, and mediation of goods purchased external to the home environment (Ministry of Health, 2012a).

Children living in the least deprived areas of New Zealand are more likely to bring food from home than those living in the most deprived areas (Parnell et al., 2003). This demonstrates how those children living in low income New Zealand are more susceptible to school environment influencers on dietary intake, external to the home environment. This includes the higher prevalence of take-away and convenience food outlets in low income areas of New Zealand, but also food availability on school grounds. All of these factors are out of the parent/caregivers' control, and are determined by wider factors in the New Zealand social system.

2.5 Nutrition Related Problems in Low Decile Children

A diet that does not follow national recommendations increases the risk of nutritional deficit and overweight/obesity (Ministry of Health, 2012a). According to the CNS (Parnell et al., 2003) nutrient intakes of New Zealand children are reported as mostly acceptable. However since the publication of this report, the obesogenic nature of communities worldwide has

exacerbated, with the promotion of sedentary behaviour and the consumption of energy dense discretionary foods (Osei-Assibey et al., 2012; World Health Organization, 2016).

Obesity and overweight have grown significantly in the last 20 years. According to World Health Organisation (WHO) standards, 32.3% of girls and 38.3% of boys in New Zealand are defined as either overweight or obese (Rajput, Tuohy, Mishra, Smith, & Taylor, 2015). Root causes for these high rates of obesity/overweight are largely argued, however poor nutrition and reduced physical activity are two major factors that have contributed to this epidemic (Hohepa, Schofield, & Kolt, 2004).

Increasing rates of obesity/overweight in children are concerning as childhood obesity strongly predicts weight and concurrent health conditions (such as ischaemic heart disease and colorectal cancer) in adulthood and later life (Hopgood et al., 2010; Ministry of Health, 2012b). Furthermore, it can also affect mental health as well (Puhl & Latner, 2007; Reilly et al., 2003). Studies have demonstrated that those children who are obese are more vulnerable to bullying in school, have a higher risk of self-esteem issues, anxiety, depression, and suicide (Farrant et al., 2013).

An extensive body of literature is available investigating the effects of the macronutrient composition of diets on excess body weight and adiposity in adults. For example, Merchant et al. (2009) demonstrate that in adult populations, a diet that is relatively high in carbohydrates, at approximately 47-64% of total energy consumed, is associated with a reduced risk of obesity and excess body fat percentages. Miller, Lindeman, Wallace, and Niederpruem (1990) support this, whilst also demonstrating that diets rich in total fat are also conducive of excess body weight and adiposity.

In child populations there is no evidence to suggest whether certain macronutrient ratios in the diet are protective against, or conducive towards increased body fat and overweight/obesity (Gow et al., 2014) and little is known whether current evidence in adult populations can be extrapolated in children. Nevertheless, it is understood that total energy in children's diets is a strong determinant of excess weight, regardless of macronutrient distributions in the diet (Gow et al., 2014; Stephens & Summar, 2008). Ning et al. (2014) have demonstrated in a study of 45 obese adolescents aged 11-18 years that a dose response relationship between weight loss and reduction in total energy intake can be observed. A decrease of 100 calories/day was shown to be significantly associated with reduction in bodyweight by 0.30kg, and reductions in Body Mass Index (BMI) by 0.09kg/m^2 ($p<0.01$).

Overall, the resulting consensus from current available evidence regarding dietary recommendations to reduce risk of overweight and obesity in child populations includes (Altman et al., 2015; Barlow, 2007; Peer & Ganie, 2016):

1. Moderating overall total daily energy intake.
2. Reducing the consumption of energy dense food items containing high amounts of added sugar and fat.
3. Reducing total sugar intake and avoidance of sugar sweetened beverages.

Obesity and overweight in New Zealand is skewed towards Māori and Pacifika ethnic groups, raising concerns for the equity of health in our nation. Māori children are approximately two times more likely than non-Māori to be overweight, where 17% of the child population are classified as overweight. Pacific Island children are also at a significantly higher risk of overweight, with 23% of children being classified as overweight and rates increasing annually (Ministry of Health, 2012b). Such trends are suspected to not only have a genetic origin but a social aetiology which has been reviewed above (Oliveros, Somers, Sochor, Goel, & Lopez-Jimenez, 2014; Tanumihardjo et al., 2007).

2.6 Classroom Success in Low Socioeconomic Status Children

In the current study, classroom success relates to a child's ability to thrive academically at school. Classroom success is pivotal in order to uplift individuals currently living in deprivation. Correa-Burrows, Burrows, Blanco, Reyes, and Gahagan (2016) demonstrate that academic attainment is closely linked to prospects of job, income and socioeconomic status attainment. Therefore, education is crucial in ensuring a promising future for the youth of New Zealand.

Classroom behaviour, attendance rates and nutrition/diet quality are all strong determinants of academic achievement and overall classroom success in children:

2.6.1 Classroom Behaviour and Classroom Success

There are multiple aspects of classroom behaviour which have been explored in the literature and investigated against academic achievement in children. It has been demonstrated that 'school readiness', defined by one's ability to self-regulate, to have social awareness, and limited issues with misconduct, are all independently and significantly related to classroom success irrespective of cognitive abilities (Webster-Stratton, Jamila Reid, & Stoolmiller, 2008). Such correlations are believed to exist as those with conduct problems are more likely to drop

out of the education system, have high absenteeism rates and hence, poorer academic success (Webster-Stratton et al., 2008).

Stephenson, Linfoot, and Martin (2000) have demonstrated in a qualitative study, that from a teacher's perspective, talking out of turn, disobedience and disrupting other students are seen as core behavioural problems in the classroom. These are considered major concerns as they act as barriers to learning, not only for the disruptive students, but for their peers as well. Furthermore, aggression was also seen as a main barrier to learning by teachers (Stephenson et al., 2000).

A school wide initiative aimed at promoting positive classroom behaviour in 28 schools in New Hampshire has demonstrated some positive results on classroom success. It was reported that the promotion of less deviant behaviour resulted in a reduction in office referrals and suspensions, whilst also recovering hours for learning and teaching. Further, with a reduction in misconduct, academic gains in both mathematics and reading were also observed in all schools undertaking the initiative (Muscott, Mann, & LeBrun, 2008).

2.6.2 Attendance Rates and Classroom Success

Evidence suggests that measuring school attendance rates could also prove as a useful indicator of classroom success (Demir & Karabeyoglu, 2016). A study conducted by Morrissey, Hutchison, and Winsler (2014) demonstrated that poor attendance rates was a strong predictor of poor grades, more so than tardiness. It is believed that this association between attendance and academic achievement could be explained by reduced exposure to teacher-led lessons and activities (Morrissey et al., 2014).

The relationship between excused and unexcused absence and academic achievement, was investigated in a quantitative modelling analysis of all second to fourth grade students in the Philadelphia School District (n=97,007). Students with a higher proportion of unexcused absences had greater academic risk, particularly in terms of mathematics skills developed. Whereas, those students with a higher proportion of excused absences had better maths and reading scores (Gottfried, 2009). These results possibly relate the fact that suspensions and disciplinary absence were not distinguished from unexplained absences in this study. However, this demonstrates that absence can be a marker of a variety of factors within a student's life that can lead to poor education attainment.

The New Zealand Ministry of Education strongly enforces school attendance for all school children. The Education Act 1989 requires parents to enrol their children in school and to ensure attendance whenever school is open, unless there is a good reason for non-attendance. Attendance in school is strongly encouraged in New Zealand as the Ministry recognises that everyday a child is not in school, they are not learning. This is understood to play a crucial role in academic achievement and drop-out rates (Ministry of Education, 2015).

2.6.3 Nutrition and Classroom Success

Adequate nutrition can also play a key role in influencing classroom success through multiple avenues such as: affecting brain maturation and development, influencing classroom behaviour, and also attendance rates (Belot & James, 2011; Feinstein et al., 2008). As can be seen from **Table 2.3** nutrition and dietary behaviours can significantly impact classroom success and academic achievement. Therefore, in low income areas where food insecurity is high, and diet quality is often poor, this could hence have detrimental effects on a child's ability to succeed academically.

Table 2.3*: Studies examining the relationship between nutrition and classroom success*

Author	Experimental Design	Study Methodology	Key Outcomes
Correa-Burrows et al. (2016)	Cohort Study. Data Collected from 2009- 12.	Diet quality of 395 Chilean students, aged 16.8±0.5 years was examined. Academic performance was measured using Grade Point Average (GPA) scores, and college admission tests in language and mathematics.	At age 16 an unhealthy diet was associated with reduced academic performance. Compared to healthy diets, those with unhealthy diets had significantly lower scores in language and mathematics and overall lower GPA scores.
Feinstein et al. (2008)	Cohort Study. Longitudinal data collected from expectant mothers in 1991 and 1992.	Key Stage 1 Results (KS1) for reading, writing and mathematics were used to measure school attainment in 6-7 year olds (n=13,988). Key Stage 2 Results (KS2) for English, mathematics, and science were used to measure school attainment in 10-11 year olds. Food frequency questionnaires were then provided to the mothers of these children regarding child's consumption of foods/beverages at 3, 4 and 7 years.	Higher 'junk' dietary patterns at all three ages was associated with lower KS1 and KS2 Results. A positive correlation was found between 'health conscious' dietary patterns and KS2 results. A negative association was found between eating school meals and school attainment, whereas the opposite was found for eating a home packed lunch.
MacLellan, Taylor, and Wood (2008)	Observational Study. Dietary data obtained from the 2003 Youth Behaviour Risk Survey.	325 Student were selected from four junior high schools around Canada. Dietary data, as well as demographic information and self-reported academic success scores were obtained from the Behaviour Risk Survey. Fruit & vegetable and milk scores were created and analysed against grade and sex.	Students with higher levels of academic performance were more likely to consume milk, fruit and vegetables, than those students with lower academic performance. It was demonstrated that fruit and vegetable consumption was significantly associated with a higher level of academic performance.
Øverby, Lüdemann, and Høigaard (2013)	Cross Sectional Study.	Ninth and tenth grade students (n=475) were given a validated food frequency questionnaire on selected healthy and unhealthy food items, meal frequency, and a self-reported learning difficulties questionnaire in reading, writing, and mathematics.	Consuming a regular breakfast was associated with reduced difficulty in reading, writing and mathematics. Increased intake of discretionary food items was associated greater self-reported difficulty in mathematics. Consuming a regular breakfast, lunch and dinner was associated with reduced difficulties in mathematics.
Theodore et al. (2009)	Observational Study.	The association between dietary patterns and intelligence was measured in 591 children of New Zealand European decent. The	A 'healthy diet' was shown to affect cognitive skills in 3.5-7 year olds where children who met requirements for fish products, breads, and cereals, had better IQ scoring. Those

		association between diet and intelligence was measured at 3.5 and 7 years.	children who ate breads and cereals had an average intelligence scoring of 3.96 points higher than children not consuming breads and cereals. At 7 years, children who ate fish products once a week had significantly higher intelligence scoring than those who did not eat fish weekly, with on average 3.64 points higher in IQ testing.
Nyaradi et al. (2013)	Prospective Cohort Study. Initial data was collected from primary caregivers between 1991 and 1995.	Mothers from the Western Australian Pregnancy Cohort were recruited. Diets of their children (n=2868) in early life were measured against cognition at 10 years. A 24 hour diet record was conducted when the children were between the ages 1-3 years. At the 10 year follow up children completed two cognitive tests including a measure of verbal ability and non-verbal reasoning.	Diet score was significantly associated with verbal and non-verbal ability, after adjusting for covariates (e.g. higher maternal age, maternal education, etc.). At 1 year of age positive associations were found between verbal ability and increased fruit intake and negative associations were found with higher intakes of SSB. At 2-3 years of age increased dairy consumption was positively associated with verbal cognitive outcomes. A higher intake of SSB consumption was negatively associated with non-verbal scores, whereas dairy at age 2 was associated with higher scores.
Alaimo, Olson, and Frongillo (2001)	Epidemiological Study. Data from the Third National Health and Nutrition Examination Survey (1988-1994) was investigated.	Data from children of the age of 6-11 years (n=3286) and 12-16 years (n=2063) was collected regarding food security. Regression analysis was then used to determine the relationship between cognitive, academic (intelligence testing) and psychosocial (levels of absenteeism, psych input, behavioural problems, number of friends, ability to get along with peers) measures and food insecurity.	In younger children, cognitive and academic test scores were lower (between 1.3 and 2.5 times lower) in food insecure families. Food insufficient children and teenagers were also more likely to require repeating a grade, and were at higher risk of missing a school day. Finally, food insufficient children and teenagers were more likely to have psychosocial difficulties.
Sigfúsdóttir, Kristjánsson, and Allegrante (2007)	Observational Study.	14 and 15 year old Icelandic students were recruited (n=5810). Students were analysed for selected health behaviours (e.g. fruit/vegetable consumption and physical activity) and academic achievement.	BMI had a significant effect on self-reported grades and emotional wellbeing (self-esteem and depressive symptoms) ($p<0.01$). When controlling for gender, parent education, family structure, and absenteeism, BMI is a significant predictor of academic achievement. Eating 'bad foods' ($\beta = -0.05$) and fruit and vegetables ($\beta = 0.09$) were also significant predictors of academic achievement.

2.7 Benefits of Food Assistance Programmes in Schools

Food assistance programmes have the ability to positively influence multiple aspects of wellbeing in children. Not only has literature reported improvements in dietary intake and nutrition with the provision of food assistance in schools but consequentially, such programmes may also have the ability to improve markers of classroom success in children such as attendance rates and classroom behaviour (Mhurchu et al., 2010; Sharkey, Dean, & Nalty, 2013; Widenhorn-Müller, Hille, Klenk, & Weiland, 2008). **Tables 2.4** and **Table 2.5** below demonstrate current literature available regarding the possible effects of food assistance programmes on deprived children.

As can be seen from **Table 2.4** there is conflicting evidence regarding the effects of different food assistance programmes on the nutrient intake and dietary habits of children. This could be a result of the different regulations and requirements of different food assistance programmes seen internationally. Nevertheless, key themes are seen in relation to the effects of food assistance programmes on overall nutrition and dietary habits in children. These include:

i. An increased consumption of both fruit and vegetable in children.
ii. An overall reduction in the energy density of meals consumed, possibly as a consequence of reductions in total fat and sugar intake.
iii. A reduction in the consumption of some discretionary food items can be seen. For example the reduction of SSB and confectionary items.

Changes in eating habits observed with the introduction of food assistance programmes may stem from an increase in availability/accessibility of healthy foods. Historically, research has demonstrated that a child's environment is a strong predictor of eating behaviours, and hence food products available influence diet quality (Hearn et al., 1998). With the introduction of food assistance programmes into the school environment, this results in an increase in the availability and access that children have to healthy food products such as fresh fruit and vegetables. Because of this, children make healthier food choices and diet quality improves.

As can be seen from **Table 2.5** there is limited conclusive evidence in developed countries illustrating the effects of food assistance programmes on classroom success in children. Though some studies have demonstrated positive effects on behaviour and academic success,

there are also studies which demonstrate no significant effects or deleterious effects on classroom success.

With evidence to show a positive relationship between improved nutrition and classroom success, it is surprising that the evidence for a positive effect of food assistance programmes on classroom success is not so strong. This could relate to the different nutritional regulations between programmes and hence discrepancies in the quality of foods served. However the student to teacher ratio, the income levels of different schools, and the demographics of students could also influence results.

Table 2.4*: Studies examining the relationship between the provision of food assistance programmes, nutrition and dietary behaviours in children*

Author	Experimental Design	Study Methodology	Key Outcomes
Gordon, Crepinsek, and Condon (2007a)	Observational Study. The first report of three volumes which focuses on the analysis of school meal programmes in schools in the USA.	8 students (~8-16years) from 398 (n=2,314) schools (a mix of elementary, middle and high school) with food assistance were recruited. Dietary records with students and parents were conducted in face-to-face interviews.	Less than one in three schools meals met dietary requirements for total and saturated fat (<10% energy) and 60-100% of schools served lunches that exceeded school-day recommendations (one third of RDA's).
Gordon, Crepinsek, and Condon (2007b)	Observational Study. The second report of three volumes which focuses on the dietary intake of students.	24 hour diet records were collected from students (n=2,314) and their parents. 30% of students were asked to complete a secondary record the following week to understand usual dietary intake.	Calcium, potassium and dietary fibre were significantly increased in students participating in the lunch programme compared to matched participants. Participants consumed approximately 51% of the AI for fibre versus 45% in non-participants. Increased dietary fibre was attributed to higher fruit and vegetable intake.
Gleason and Suitor (2001)	Cross Sectional Study. Data collection from the 1994-1996 Continuing Survey of Food Intake by Individuals.	An analysis of mean nutrient intakes in 6-18 year old children (n=2,700). Data was stratified by student participation and non-participation in school meal programmes. Dietary data was collected from participants on two non-consecutive days by 24 hour diet records.	School breakfast programme (SBP) participation was associated with higher intakes of energy, calcium, phosphorous. National school lunch programme (NSLP) participation was associated with a greater proportion of calories in the form of total fat, saturated fat and protein. Students who participate in both programmes are more likely to consume milk products, fruit and vegetables and less fizzy drinks.
Ashfield-Watt, Stewart, and Scheffer (2009)	Randomised Controlled Trial (pilot). Data collected in 2004.	Ten pairs of decile one schools were recruited (n=2,032). Within each pair one school was randomly allocated to receive free fruit, and the other was the control. The 'Day in the Life Questionnaire' was used to determine the effect of the intervention on dietary habits. This was implemented one week prior, mid and post-intervention.	With programme initiation a 22% reduction was seen in the number of children consuming no fruit during the school day. Fruit intake increased on average by 0.39 pieces of fruit per child. These results were not sustained and at six weeks post intervention fruit intakes were significantly lower than during the programme. Furthermore, fruit consumption in the group receiving free fruit was lower post intervention, compared to the control groups.
Boyd, Dingle, Campbell,	Cross sectional study design. Data collected in 2006.	An evaluation of dietary changes in participants of Fruit in Schools. All year 4 children (n=591) completed a baseline	Prior to Fruit in Schools, 66% of children consumed some fruit and vegetables the day before. By the end of 2006 this proportion increased to 74%. Before the initiation of Fruit in Schools, on

King, and Corter (2007)		diet survey at the start of 2006 (prior to starting Fruit in Schools) and at the end of 2006.	average students reported consuming 2.24 pieces of fruit per day, this increased to 2.54 pieces.
Stevens and Nelson (2011)	Cross Sectional Study. Data collected from the The Low Income Diet and Nutrition Survey in 2003-2005.	The current study investigated the contributions that the Free School Meals programme (FSM) makes to nutritional intake in children around the United Kingdom (n=311). Data was collected on lunchtime dietary intake, from The Low Income Diet and Nutrition Survey.	FSM children met more NRVs than with packed lunches brought from low income households. In younger children (4-7 years) packed lunches were shown to contribute the least amount of folate and higher levels of sodium, energy, fat, saturated fat, and non-milk sugars compared to the FSM programme. In older children (8-11 years), packed lunches provided more sodium, calcium, fat and saturated fat, than the FSM programme. FSM participation increased fruit and vegetable consumption from 0.6 to 0.7 in older and 0.6 to 0.8 portions per day in younger children.
Bere, te Velde, Småstuen, Twisk, and Klepp (2015)	Longitudinal Study. Data was collected before the intervention (2001), immediately post (2002) and at a 3 and 7 year follow up (2005/09).	An evaluation of the Fruit and Vegetables Make the Marks programme. 38 schools were evaluated through a food frequency questionnaire at baseline (2001) and at follow up in 2002, 2005 and 2009 (n=320).	Fruit and vegetable consumption increased with the implementation of the programme, by 0.44 portions/day. This effect weakened over time. The consumption of unhealthy snacks reduced, with effects becoming stronger over time. Unhealthy snack consumption reduced by 1.23 consumptions/week, and upon 7 year follow up, reduced by a further 2.02 consumptions.
Howard and Prakash (2012)	Cross Sectional Study. Dietary data from the 1998 Early Childhood Longitudinal Study – Kindergarten (ECLS-K).	An analysis of the effects of food assistance programmes on dietary intake of children aged 10-13 years through secondary data analysis of ECLS-K (n=5,140).	Children who consume partially or fully subsidised lunchtime meals have increased consumption of fruit and vegetables. Children partaking in the programme consumed on average 10.8 more serves of fruit each week, 3.1 more serves of green salad, 5.6 more serves of carrots, and 5.2 more serves of other vegetables.
Briefel, Wilson, and Gleason (2009)	Cross-sectional Study. 24 hour dietary record data from the 2004/05 School Nutrition Dietary Assessment Study (School Nutrition DAS).	Dietary data was collected from 2,314 school children. Information was collected on diet quality, and where meals came from i.e. home, National Breakfast Programme (NBP) or National School Lunch Programme (NSLP).	NSLP participants consumed the least amount of energy from SSB, but more energy from energy dense, nutrient poor foods such as fries, and baked items. Overall NSLP participant's dietary intake at school was lower in energy than non-participants.
Ishdorj, Crepinsek, and Jensen (2013)	Cross-sectional Study. 24 hour diet record data from the 2004/05 School Nutrition DAS.	Dietary data was collected from 2,096 school children. Information was collected on diet quality, and where meals came from i.e. home or NSLP.	NSLP participants consumed more fruit and vegetables than non-participants by 0.214 and 0.250 cups respectively. However, participants simultaneously consumed less fruits and vegetables out of school. This reduced by 0.063 and 0.099 cups respectively.

Table 2.5*: Studies examining the relationship between the provision of food assistance programmes, classroom behaviour and school attendance rates in children*

Author	Experimental Design	Study Methodology	Key Outcomes
Moore et al. (2014)	Randomised Controlled Trial. Data was collected before the initiation of the Primary School Free Breakfast Initiative in 2005 and at a 12 month follow up.	This study aimed to determine the effects of a free school breakfast on cognitive functioning in year 5/6 children (n=4,500). Dietary data was collected using a modified version of the 'Day in the Life' questionnaire. Behavioural difficulties were measured through the Strengths and Difficulties Questionnaire and intelligence and memory were measured using a validated pen-and-paper test.	No significant relationship was seen between cognitive testing and behaviour (conduct, emotional, hyperactivity, and peer related problems). Post-intervention, a small but insignificant effect was seen in episodic memory between control and intervention schools.
Sweeney, Tucker, Reynosa, and Glaser (2006)	Longitudinal Observational Study.	A 9am 'nutrition break' was evaluated in order to determine effects of the programme on self-reported hunger symptoms such as tiredness, ability to focus, headaches, and stomach aches in students (n=590). Teachers (n=140) were also asked to evaluate the programme in terms of its ability to generate a more supportive learning environment.	Boys reported fewer headaches with the 'nutrition break'. Overall, rates of hunger symptoms including: stomach ache, lack of focus, tiredness, and midmorning hunger reduced. 74% of teachers reported an improved learning environment (e.g. less disruptive behaviour). 24% of teachers stated that students performed better and were more alert, attentive, energetic, motivated and refreshed. 35% of staff stated that nutrition break had negative effects, including hyperactivity. Teachers reported concerns for the sugar content of foods served.
Widenhorn-Müller et al. (2008)	Randomized Controlled Crossover Trial.	The aim was to determine the effect of a breakfast programme on cognition and mood in students. 104 students between 13 and 20 years were randomly allocated into two groups. One group received a free breakfast and the other did not. Seven days later the treatment order was reversed. Cognitive function was measured using standardised tests of attention, concentration, verbal and spatial memory. Mood was measured using a self-administered questionnaire.	Visuospatial memory was significantly improved in male students. Furthermore, feelings of positivity were also improved in males. Self-reported alertness improved significantly in the entire sample population. Breakfast provision did not significantly affect sustained attention in class.

Anzman-Frasca, Djang, Halmo, Dolan, and Economos (2015)	Quasi Experimental Study Design. Data collected from 2012- 2013.	This study aimed to determine the benefits of the Breakfast in Classrooms initiative, on school attendance and academic achievement (school district record test scores). 257 schools (n=605) implementing the Breakfast in Classroom initiative and 189 schools (n=467) that were not implementing the initiative were recruited.	It was demonstrated that Breakfast in Class was significantly linked to greater overall school attendance. No group differences in standardized test performance in math or reading were observed.
Belot and James (2011)	Longitudinal Study. Data from 2002 to 2007 was analysed.	The Feed Me Better food assistance campaign was evaluated in schools around Greenwich (n=580) on academic success (test scores) and attendance, in comparison to neighbouring control communities (n=640).	Authorised absenteeism (commonly due to illness) reduced by 14% with the campaign. Improvements were seen in percentile scores for maths, science and English (3%, 4.5%, and 6% respectively) between Greenwich and neighbouring areas.
McLaughlin et al. (2002)	Randomised Controlled Trial.	The aim of the current study was to determine the effects of a free School Breakfast Programme (SBP) on intake, cognitive and emotional functioning, academic achievement, attendance, tardiness, classroom behaviour and food insecurity. 18 schools were recruited (three schools per district; two intervention schools and one control) (n=4,300). Data was collected via school records and interviews with staff, parents and students.	Students in the treatment group were more likely to consume a nutritionally substantial breakfast than the control. Students in both the control and treatment groups had similar cognitive test scores. There were no significant differences in maths and reading test scores between students. School attendance, tardiness, social/emotional functioning, food insecurity, and health status were not different for treatment and control school students.
Ecker (2012)	Cross Sectional Study Design.	The current study aimed to evaluate the BackPack Food Programme's effect on combating student's hunger and on-task behaviour in the classroom. Hunger surveys and direct student observations were conducted.	No significant increase was found in on task behaviour between baseline and follow up measures. Furthermore, there was no significant decrease in experienced hunger between baseline and follow up measures.
Rodgers and Milewska (2007)	Cross Sectional Study Data collected from 2002 to 2004.	The current study examined the effect of the BackPack Food Programme on behaviour and academic performance. Surveys were distributed to school nurses, counsellors and principals, in order to evaluate the behaviour of students with the initiation of the BackPack Food programme.	Participating students were more trusting and had better relationships with the student body and teaching staff. Furthermore participating students were more interested in school, and had higher self-esteem. Other benefits such as security and lowered anxiety were also observed. A significant impact was seen in eighth grade mathematics and literacy.

2.8 International Food Assistance Programmes

The prevalence of food insecurity in developed, high income countries is becoming more apparent (Wynd, 2011). Therefore, with the perceived benefits of school food assistance programmes for vulnerable children, an increase in their presence is being observed globally.

2.8.1 America

The United States (US) alone has developed four major government led school programmes to facilitate food provision to income deprived children including: the National School Lunch and Breakfast Programmes, the Summer Food Service Programme and the Special Milk Programme. The National School Lunch Programme and School Breakfast Programme are two initiatives that have been developed in order to provide free or subsidised breakfast and lunches to American children. These schemes have seen the US Department of Agriculture providing cash to non-profit private and public schools in order for free or subsidised meals to be provided to children in need. Free meals are provided to those children who come from families with an income at or below 130% of the Federal Poverty Level. Subsidised meals are also provided to those children who reside in families with an income between 130% and 185% of the Federal Poverty Level (United States Department of Agriculture, 2013, 2014, n.d.).

2.8.2 The United Kingdom

In the United Kingdom (UK), numerous government led initiatives have also been trialled in order to further support the nutrition of younger generations. The Universal Infant Free Meals scheme was developed in order to ensure that all children in reception, year 1 and year 2 in any government funded academy, free school, pupil referral unit, etc. are provided with one free meal during each school day (United Kingdom Department for Education, 2014). In contrast, the Free School Meals (FSM) project provides meals to students based on level of deprivation. Current benefit entitlements, income level, age and enrolment in full time education, are all taken into consideration when individuals apply for free school meals, and is given based on level of vulnerability (The Scottish Government, 2016; United Kingdom Government, 2015).

2.8.3 Australia

In Australia, there is limited government support for food assistance programmes to children living in deprivation. However, there are multiple food assistance programmes available that

are directed by not-for-profit, and non-government led organisations, and sustained by charity and private business. Foodbank Australia is the largest food relief programme available nationwide, and provides multiple different food assistance programmes to schools across the different states. For example Foodbank in Western Australia, Australian Capital Territory (ACT) and Foodbank in Tasmania, provide free school breakfast programmes for multiple disadvantaged primary schools around their respective states (Foodbank Australia, 2015; Tasmanian Food Secuirty Council, 2012).

Furthermore, 'Eat Up' is a non-profit organisation that provides free lunch meals to underprivileged school children. The organisation aims to provide healthy school lunch meals to those who go without by utilising existing and established organisations in the community, to create a new service of ready-made and delivered lunch meals to low income schools (Galea, n.d.).

2.8.4 New Zealand Food Assistance Programmes

Currently in New Zealand there is no nationwide government-funded school lunch programme, but multiple segmented organisations in operation. These include programmes such as: KidsCan, Fruit in Schools, Red Cross and KickStart Breakfast in Schools, Fonterra Milk for Schools, Garden to Table, and other privately run programmes such as FTN and the Eat my Lunch initiative (Children's Commissioner, 2013; Mhurchu et al., 2010). The majority of these programmes are based around free food provision to those schools most in need, classified as those schools rated as decile one or decile two. For example, Fruit in School is a relatively newly founded government led organisation that provides fresh fruit and vegetables to selected decile one and two schools around New Zealand for a three year period. Fonterra Milk in Schools is a similar concept, where free milk and refrigerators are supplied to selected low decile schools in need. Furthermore, such initiatives as Feed the Need (FTN) and Eat my Lunch are not-for-profit organisations that provide free lunch meals to selected low decile schools around New Zealand.

2.9 FTN

FTN is a charitable organisation established in New Zealand with the aim of providing free food to food insecure children. It was developed in 2012 by Kerry Owen, and provides warm and nutritious meals to decile one and two primary schools around South Auckland during the winter months. Each winter the programme provides 68,000 hot lunches to 2,800 children in six primary schools around the Manurewa and Takanini region.

FTN is implemented during the winter months as this is the period when many children become ill and are absent from school (Feed the Need, 2014; Ministry of Education, 2015). Furthermore, decile one and two primary schools have been targeted as young children are highly dependent on adequate nutrition for normal growth and development (Feed the Need, 2014; Ministry of Health, 2012a). To date, limited studies have investigated the effects of FTN on dietary intake and absenteeism in children. Furthermore, effects on other markers of classroom success such as classroom behaviour have not been investigated. Therefore, it is important to explore whether FTN is achieving its primary goals of improving dietary intake in children and reducing absenteeism in low decile schools.

It is important to ensure that evaluations of New Zealand specific food assistance programmes are undertaken. Not only is this important from a funding view point, but it is crucial in order to ensure the nutritional quality of such initiatives. With limited studies pertaining to the effects of food assistance programmes in New Zealand, and conflicting results internationally, more research is needed to explore the merits of such programmes for low decile school children.

Chapter 3: Methodology

3.1 Study Design

The current study was a cross-sectional observational design, where information was collected on the dietary intake, attendance and behaviour of year five and six students at a low decile school in South Auckland.

The overall aim of the study was to assist Manurewa South School in demonstrating the effects of FTN on dietary intake at school, and classroom success in year five and six students.

3.2 Ethical Approval

Ethical approval was obtained from the Massey University Human Ethics Committee. The study was classified as low risk as the children's school day would not be altered to disrupt learning or cause harm. Furthermore, to protect the children's interest the participants in the study would remain anonymous throughout the study.

Parents were notified of the study and consent was gained through the schools own communication system (e-newsletter). The researchers were not involved in the process of gaining consent.

3.3 Setting

Manurewa South Primary School met the requirement of being a recipient of the FTN food assistance programme.

3.4 Participants

Convenience sampling was used to recruit 82 year five and six students aged 9-11 years, from Manurewa South School. Students were recruited from three classrooms (Room 13, 14 and 15) and all students from each class participated in the study.

3.5 Assessment of Dietary Intake

School-day dietary intake of students was measured using a self-administered estimated food record (see Appendix A for Diet Record Questionnaire). The food records were designed to retrieve information regarding quantity and brands of foods consumed, as well as where the foods were sourced (e.g. home, dairy, school, FTN, other). Students were also required to

make note of the fluids they consumed throughout the school day, considering both volume and types of fluid.

Quantities of foods and fluids consumed were measured using either the weight provided on the manufacturers packaging or by approximate gross amounts. Massey University volunteers (MSc Diet or Nutrition students) and the two student researchers of this project facilitated these estimations. All volunteers were experienced in administering and undertaking dietary assessments.

When estimating the weight of a variety 'snack packs' such as crisp, cracker and biscuit packets, food models were provided of a standard small (20g), medium (40g) and large sized (120g) packet of crisps. Students then recorded small, medium or large on their food record. When the student researchers completed data input and handling, the weight of these food models was used as a reference for the weight of small, medium or large snack packs reported on food records.

The food models, as well as a model snack pack from the dairy (containing a juice bottle, fruit string, a packet of cookies and crisps) were also used to assist children in identifying the names of particular foods and in determining where their food was coming from.

Along with dietary data, gender and ethnicity was recorded by the participant on each food record completed.

3.6 Assessment of Classroom Success

Classroom success in the current study was measured via two markers: classroom behaviour and absenteeism. Both markers were measured using the Positive Behaviour 4 Learning (PB4L) screening initiative, and were retrieved from school archives following dietary data collection.

PB4L Initiative

The PB4L initiative, implemented by the Ministry of Health, is a 5 year series of interventions that can be executed in an education setting in order to promote the development of a more supportive learning environment for children. Briefly, this initiative involves three strategies: the Incredible Years Parent Programme, the Incredible Years Teacher Programme, and School Wide Behaviour Support Strategies. These initiatives are supported by a robust body of international literature, and are

based on the Positive Behavioural Interventions and Supports (PBIS) framework developed at the University of Oregon in the 90's (Ministry of Education, n.d.). The School Wide Behaviour Support strategy provides tools and training for teachers in order to generate more supportive environments for positive learning behaviour. Furthermore, this strategy provides a framework for tracking student behaviour (Ministry of Education, n.d.). Key behavioural themes are identified by each school; for example some key themes identified at Manurewa South School include: inappropriate physical contact, inappropriate language, misuse of property, defiance, vandalism and disrespect towards peers. Teachers then report individual student incidences of misconduct through an electronic system which also records time, location, severity, date of the incidence, and student details such as gender and ethnicity, for auditing and management purposes. Along with these markers of behaviour, attendance is also closely monitored and measured as the total number and percentage of school half days attended each term and each year.

3.7 Data Collection

The timing of data collection and the number of days of dietary data required was carefully considered. A one week period was used to capture a snapshot of dietary intake during FTN and also after the programme's conclusion (the FTN and control weeks). This was the longest time period deemed appropriate for the current school setting in order to prevent significant class and learning disruption for the participants involved. Evidence suggests that with more completed days of reporting, the validity of children's food records increases (McPherson, Hoelscher, Alexander, Scanlon, & Serdula, 2000). Therefore, through co-operation and compromise with the school an absolute maximum data collection period was established (a total of two weeks).

Hence, dietary data collection occurred at the commencement of the FTN food assistance programme, from the 22nd to the 26th of June 2015, and two months later at the conclusion of the programme (31st of August to the 4th of September 2015) (see **Figure 2**). Public and school holidays were considered in the dates allotted for data collection. It was also important to ensure that the second data collection period remained within the winter months to prevent any confounding effects of seasonal food selection between the two weeks of data collection.

Dietary data collection occurred immediately following the two major meal breaks at school, morning tea and lunch. This was chosen instead of collecting data at one point in time at the

end of the day, as literature has demonstrated the longer children wait between consuming a food and reporting it, the greater the risk of error (Baxter, Hardin, Royer, Guinn, & Smith, 2008; Baxter et al., 2014; Sharman, Skouteris, Powell, & Watson, 2016). Therefore, though it was more labour intensive for staff and students involved, it meant a more accurate dataset was produced at the end of data collection. Data collection times were as follows:

Table 3.1: *Time allocations for data collection*

Room Number	Morning Tea Data Collection	Lunch Data Collection
13	11.00am – 11.15am	1.30pm – 1.45pm
15	11.15am – 11.30am	1.45pm – 2.00pm
14	11.30am – 11.45am	2.00pm – 2.15pm

Each student was supervised closely by a Massey University volunteer to ensure food records were completed with maximum accuracy. There were approximately six volunteers supervising each classroom during data collection. These volunteers supervised three to four students per classroom, depending on the class size.

Attendance and PB4L scores from 2015 were collected from Manurewa South School the year following dietary data collection (see **Figure 2**). This data was collected for the same classes (Room 13, 14 and 15) where dietary data was obtained. Attendance and PB4L scores were collected two months prior to FTN (3rd March – 2nd June), all months during FTN (3rd June – 3rd September), and two months after the conclusion of FTN (7th September – 4th November).

3.8 Data Handling

Following data collection, raw datasets were reviewed for quality and completeness. Firstly, food records were classified as either complete or incomplete. Complete food records were identified as those that captured both student's morning tea and lunchtime dietary intake; whereas incomplete records only captured a student's morning tea or lunch time dietary intake.

Incomplete data was excluded from analysis, as it was deemed a poor representation of daily food consumption. Some children may have eaten all of their food for morning tea and nothing for lunch, or vice versa, and this pattern of dietary intake would have been poorly represented in incomplete food records collected.

Plain water consumption was also excluded from the analysis, as it was difficult to measure and hydration was not a part of the scope of the current study. Manurewa South School has multiple water fountains established around the campus, and the majority of students use these fountains on a regular basis. This meant that it was very difficult to quantify the amount of plain water consumed during the school day, with the majority of children recording 'sips' of water from the fountain on their food records. Therefore, all plain water was excluded from the current analysis, and only sugar sweetened beverages (SSB) were analysed. SSB are one of the highest contributors to total energy and sugar intake in many westernised diets, particularly in child populations (Reedy & Krebs-Smith, 2010). Therefore, it was appropriate that SSB were included in the nutrient analysis.

Finally, unusual outliers within the data set were removed. Students were removed on a day-by-day basis that were purposefully fasting on days of data collection (n=2). As fasting in this instance was culturally driven, these students were an inaccurate representation of students who ate nothing during the school day due to food insecurity.

Behavioural data was received from Manurewa South School in the form of excel spreadsheets. This data was broken down into three time periods including: before, during and after FTN. The spreadsheets received contained copious amounts of information that was not relevant to the current study, and therefore data was initially cleaned so that only relevant information remained (number of reported behavioural incidences during each time period).

Similarly attendance rates were also received through an excel spreadsheet. This data was also broken down into the three time periods: before, during and after FTN. Outliers were removed from the data set (n=2) and data was then analysed. Attendance rates were reported as the percentage of half days attended, in line with national reports.

A total of 82 students were included in the statistical analyses of behavioural misconduct (PB4L scores) and 80 in the analyses of absenteeism. Two students were removed from the attendance analysis due to prolonged unexplained absenteeism that could have confounded results observed.

Once the raw data had been cleaned, each student in the study was given a unique identification number in order to ensure confidentiality and consistency throughout the study period. Food records were then collated and analysed.

3.9 Dietary Data Analysis

Nutrient intakes were estimated from dietary records through the FoodWorks© database (version 7, 2013, Xyris Software, Queensland, Australia) which provided a range of nutrient values for specific food products available in both Australia and New Zealand. The Abridged version of FoodWorks was selected, and the New Zealand Diet and Recipe Analysis (FOODfiles Abridged) was chosen. Brand names and quantities of foods consumed, as recorded by the children, were used in order to determine nutritional intake of participants. Any packaged product that was consumed, but was not available on the FoodWorks database, was approximated using the most similar product available. Furthermore, where approximate serving sizes were not recorded in food records an estimated value was reported. These assumptions and estimates were kept consistent throughout data entry (see Appendix B).

All FTN meals consumed during the data collection period were also analysed in FoodWorks, using recipes that were directly sourced from the FTN programme (provided by Massey University Dietetic Co-ordinator of FTN annual nutrition audits).

Dietary data in FoodWorks was spot checked against raw food records in order to ensure accuracy. The two lead researchers of the current study undertook the spot check. A portion (20%) of the total dataset was checked for accuracy, with a >97% accuracy threshold required for the data to be deemed acceptable.

Foods were coded into five key food sources (home, school, FTN, dairy and other) based on the origin reported on food records. It was assumed that foods identified as coming from the school came from food assistance programmes, other than FTN, that were present at Manurewa South School. Other food assistance programmes present at the school included: KidsCan, Fonterra Milk in Schools, Fruit in Schools and Breakfast Club. Any foods that were purchased from the tuckshop, school canteen, dairy or bakery fell under the 'dairy' category. Any food that was brought to school from the home was classified into the 'home' category, and all other food sources that did not fall into the above categories, or came from an unspecified food origin were placed in the 'other' category.

3.10 Statistical Analysis

Statistical analyses were conducted using SPSS© statistical software package (IBM Corporation, New York, USA) and were reported based on the normality assumption of outcomes. As no extreme values were found after descriptive analysis this assumption was supported by the

Central Limit Theorem. The Central Limit Theorem states that if a sample size is large enough (n>30) then all sample means are considered normally distributed, regardless of the original distribution of the data. Whereas, data sets with a small sample size (n≤30) are assumed to be not-normal. Hence, data sets were considered large enough, and were reported and compared using the mean ± standard deviation (SD).

Mean dietary intakes of energy, all macronutrients, saturated fat and dietary fibre were compared to 40% of the NRVs (estimated school-day NRVs). Energy requirements were determined using age specific Estimated Energy Requirements from the Australia, New Zealand NRV tables (National Health and Medical Research Council, 2006). An age range of 9-11 years was used to encompass the requirements for all children recruited in the current study and a physical activity level (PAL) of 1.4 was set. This PAL was set because:

1. As children get older their physical activity levels reduce (Ministry of Health, 2012a).
2. Lower demographic populations experience more barriers to regular exercise than higher income populations such as limited access to gyms and sports fields, unsafe environments, and reduced recreation facilities (Miller & Gramzow, 2016).

Nutritional analysis of individual FTN meals were also undertaken using school-day NRVs (40% of total daily requirements) (Institute of Medicine, 2005; National Health and Medical Research Council, 2006). As there are no New Zealand specific nutrition guidelines in place for food service in schools, school-day NRVs will be used as a proxy for the nutritional quality of FTN meals served.

It is recognised that the use of AMDRs as a reference point for measuring nutritional adequacy of foods and meals is not necessarily appropriate, as an AMDR provides a reference for appropriate macronutrient consumption in comparison to total *daily* energy intake. Hence, where possible FTN meals were compared to 40% EARs or AI reference ranges in order to demonstrate whether suboptimal nutrition was consumed in the context of the school day.

The only available guidelines for fat intake are the AMDRs, due to insufficient evidence. This range was used in the current analysis of FTN meals in order to determine whether meals served contained an appropriate fat content. The use of this AMDR reference for FTN meals in isolation is supported by international literature and school food regulatory guidelines published in America. The Institute of Medicine Nutrition Standards for Food in Schools demonstrate that foods served in schools should contain less than 35% of total energy as fat (the upper limit of the New Zealand AMDR) (Stallings & Yaktine, 2007). Furthermore,

Arambepola, Scarborough, Boxer, and Rayner (2009) demonstrate a high fat food to exceed 20g/100, which amounts to approximately >35% of total energy. Therefore, though the AMDR may not be appropriate for individual-level food analysis, evidence supports its use as a reference point in the context of the current study.

Key food sources at Manurewa South School were determined. Mean nutrient intakes of all students recruited, based on these food sources was then explored using SPSS. This was analysed on a week-by-week basis in order to determine whether FTN affected where food consumed was coming from, during the school day.

Finally, mean behaviour and attendance rates were determined using SPSS. This was also analysed on a week-by-week basis to determine whether FTN affected these markers of classroom success.

3.10.1 Significance Testing

Once the appropriate descriptive statistics were reported for the current dataset, significance testing was undertaken against different dataset associations.

Paired Sample T-Tests were used to measure any significant differences in nutrient intakes between the control and FTN weeks, by gender, by day, and by food source, at a significance level of $p < 0.05$.

A One-Way ANOVA and post-hoc Tukeys Tests were used to determine any significant differences ($p < 0.05$) in nutrient intakes between ethnic groups during FTN and control week.

A Kruskal Wallis T-Test and post-hoc Mann Whitney Tests with Bonferroni Correction were used to determine significant differences in energy intake from the different food sources. A corrected significance level was set at $P = <0.005$ during FTN week and $P = <0.008$ during control week, in order to reduce the risk of type 1 error.

Behavioural incidences and classroom attendance rates during the control and FTN week were compared using Paired Sample T-Tests at a significance level of $p < 0.05$.

3.11 Data Storage

All raw food records have been secured in a locked cupboard on site at Massey University. Access to this data is only granted for the student researchers and supervisors of the current

study. This data will remain in the archives for 10 years and will then be disposed of accordingly.

3.12 Focus Groups

Focus groups were conducted in November following the completion of dietary data collection (see **Figure 2**).

3.13 Participants

Two individual focus groups were conducted, one with the students and one with school staff. Two teachers and the school receptionist participated in the staff focus group session (n=3). The two teachers that were included in the current study were the teachers of Room 13 and 14. The receptionist was included as she was at the forefront of food provision to students at the school. Two student representatives from Rooms 13, 14 and 15 participated in the student focus group session (n=6). Three boys and three girls were represented in the student focus group. These students were randomly selected by the teachers of Room 13, 14 and 15 to ensure no bias in the results obtained.

3.14 Moderator Guide

The focus groups were used to demonstrate the perceived benefits of school food assistance programmes such as FTN, whilst also gathering information on where the staff and students believed improvements could be made to current programmes established. The following topics were covered in each of the interviews (see Appendix C for complete Moderator Guides):

Staff:

1. Perceived benefits for students
2. Likes and dislikes of food assistance programmes, and FTN specifically
3. Impact on parents
4. Impact on classroom success
5. Thoughts on sustainability

Students:

1. Likes and dislikes of food assistance programmes, and FTN specifically

2. Thoughts on waste and waste management
3. Perceived benefits for students

3.15 Procedure

Two separate one hour long interview sessions were conducted. Each interview started with an introduction to the session, and informed consent. Confidentiality was assured for both students and staff.

In the student focus groups, children were encouraged to note down or draw any ideas that were triggered by the questions asked. Both staff and student focus groups were provided with snacks and water to support a more comfortable and casual interview environment.

Both interviews were audio recorded to allow the student researchers to synthesise and thematically analyse the material from the interviews.

3.16 Analysis

Ideas and themes that were repeated throughout the two focus groups, or had general consensus from the student and staff participants, were reported in the final results.

3.17 Study Overview

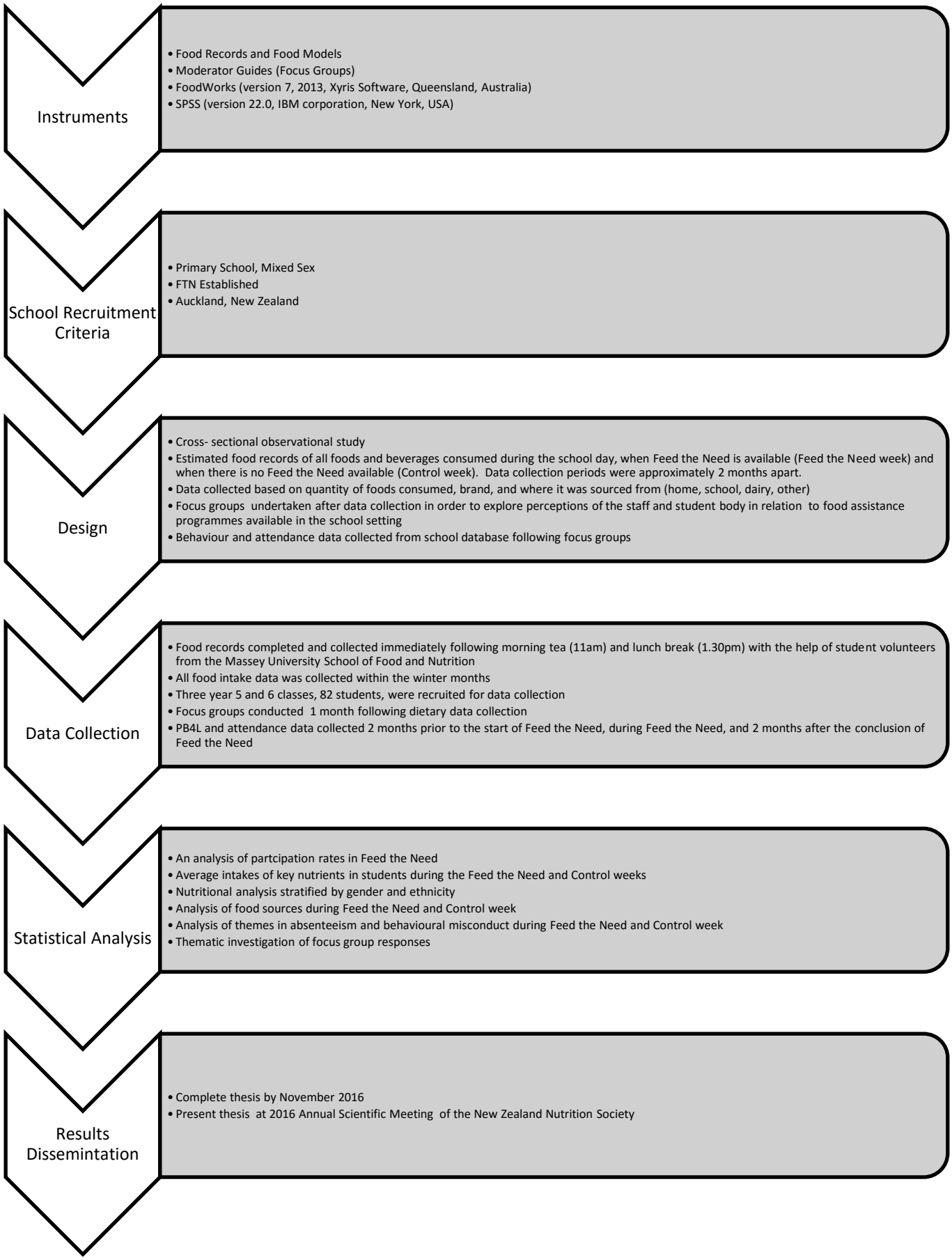

Figure 1: Study Overview

3.18 Data Collection Timeline

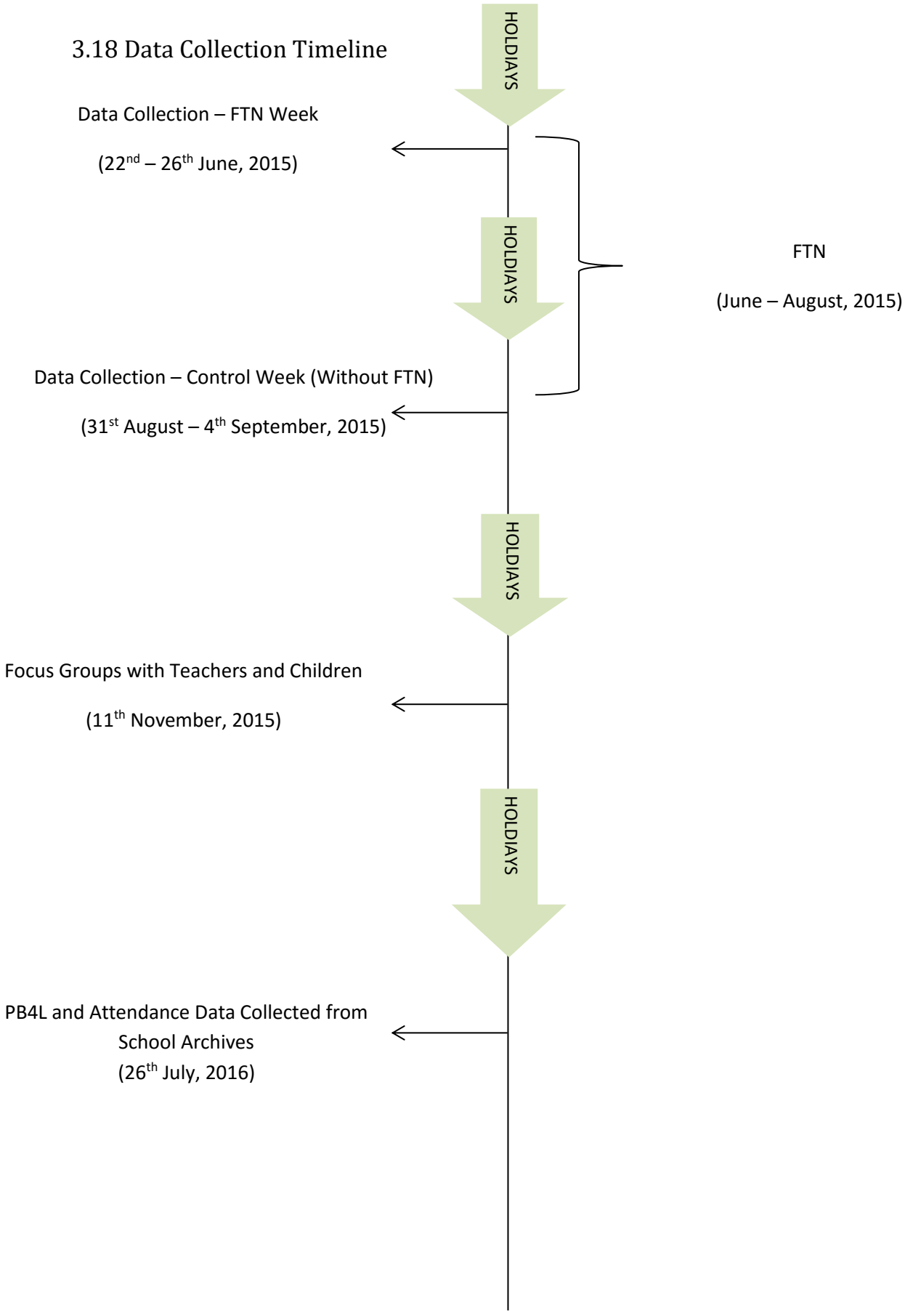

Figure 2: Timeline of data collection

Chapter 4: Results

4.1 Characteristics of Students

A total of 82 year five and six students from Manurewa South School participated in the current study. **Table 4.1** presents the student demographics. The mean age of the students was 9.70±0.68 years, with the majority identifying as Māori (43.9%), followed by Pacifika (36.6%) and New Zealand European and Other (NZEO) at 19.5%. 46.3% of participants were girls, and 53.7% were boys.

Table 4.1: *Demographic characteristics of students recruited from Manurewa South School*

Characteristics	Participants (n=82)
Age(years)*	9.70±0.68
Gender	
Boys	44 (53.7)
Girls	38 (46.3)
Ethnicity	
Māori	36 (43.9)
NZEO	16 (19.5)
Pacifika	30 (36.6)

All values presented as n(%) unless otherwise specified
*Values presented as mean±standard deviation

4.2 Completed Food Records (FRs)

Table 4.2 below presents the FRs collected from students during the FTN and control weeks. 256 complete FRs were collected during the FTN week, and 234 complete FRs were collected during the control week. While a further 171 incomplete FRs (missing their respective morning tea or lunch time FR) were collected during both the FTN and control weeks, these were not included in the subsequent analysis.

Table 4.2: *Complete and incomplete food records collected in the FTN and control week* ¥

	FTN (n=82)		Control (n=82)	
	Complete	Incomplete	Complete	Incomplete
Total	256	80	234	91

¥ *Incomplete food records were those where participants completed either a morning tea or lunch food record during the school day. Complete food records were those where participants completed both a morning tea and lunch food record.*

Table 4.2.1 presents the demographics of students who submitted fully completed FRs in the FTN and control weeks. Boys produced 49.6% of the complete food records in the FTN week and 53.4% during the control. Girls produced 50.4% of the complete food records in the FTN week and 46.6% during the control.

In the FTN week, 44.9% of the complete food records were produced by Māori students followed by 34.8% by Pacifika and 20.3% by NZEO students. In the control week 43.6% of the complete food records were produced by Māori students followed by 37.2% by Pacifika and 19.2% by NZEO students.

Table 4.2.1 *Complete food records collected in the FTN and control week, by gender and ethnicity ¥*

	FTN	**Control**
Gender		
Boys (n=44)	127(49.6)	125(53.4)
Girls (n=38)	129(50.4)	109(46.6)
Total	**256**	**234**
Ethnicity		
Māori (n=36)	115(44.9)	102(43.6)
NZEO (n=16)	52(20.3)	45(19.2)
Pacifika (n=30)	89(34.8)	87(37.2)
Total	**256**	**234**

All values presented as n(%)

¥ *Complete food records were those where participants completed both a morning tea and lunch food record during the school day.*

4.3 Frequency of FTN Meal Consumption

Table 4.3 presents the number of students who were captured consuming FTN meals during FTN week, as well as the total number of FTN meals consumed.

FTN meals were served on the Monday, Wednesday and Friday of FTN week. Of all food records completed on FTN days (159 food records), there were 97 reported incidences where at least one FTN meal was consumed by a student. This accounted for 61.0% of all food records completed on FTN days. Most incidences were recorded by Māori students (45.4%) followed by Pacifika (31.9%) and NZEO students (22.7%).

A total of 62 students (75.6%) consumed one or more FTN meals during FTN week. Of these students, 13 were NZEO (21.0%), 20 were Pacifika (32.2%) and 29 were Māori students (46.8%).

20.7% of Māori students who consumed FTN meals, consumed all three meals offered during the week, versus only 7.7% of NZEO and 5% of Pacifika students.

53.8% of NZEO students who consumed FTN meals, consumed two of the meals offered, versus 45% of Pacifika and 10.3% of Māori students.

69% of Māori students who consumed FTN meals, consumed one of the meals offered, versus 50% of Pacifika and 38.5% of NZEO students.

Table 4.3: *FTN meals consumed by students, defined by demographic characteristics*

	Students Consuming FTN Meals			**FTN Meals Consumed[1]**
	1 Meal Consumed	**2 Meals Consumed**	**3 Meals Consumed**	
Gender				
Boys(n=30)	17(56.7)	7(23.3)	6(20)	49 (50.5)
Girls(n=32)	18(56.3)	12(37.5)	2(6.2)	48 (49.5)
				97[2]
Ethnicity				
Māori (n=29)	20(69.0)	3(10.3)	6(20.7)	44 (45.4)
NZEO (n=13)	5(38.5)	7(53.8)	1(7.7)	22 (22.7)
Pacifika (n=20)	10(50.0)	9(45.0)	1(5.0)	31 (31.9)
				97[2]

All values presented as n(%)

[1] *FTN Meal = Incidence where **at least one** FTN food item is consumed.*

[2] *Total number of FTN meals consumed during FTN week*

4.4 Nutritional Analysis of FTN Meals

The meals served during FTN week included: Pumpkin & Bacon Soup (Monday), Cowboy Casserole (Wednesday), and Sloppy Joes (Friday) (See Appendix D for Ingredients Lists). **Table 4.4** below presents a nutritional breakdown of meals as compared to school-day estimated nutrient requirements (40% of total daily intake).

All meals exceeded estimated school-day protein and carbohydrate requirements for both boys and girls. Furthermore, all meals exceeded the recommended upper limit (<10%) for saturated fat.

4.4.1 Pumpkin & Bacon Soup

The Pumpkin & Bacon Soup did not meet the school-day adequate intake dietary fibre recommendations for either boys (9.6g/day) or girls (8g/day) at 5.9g/meal. Total fat content of the meal was within the recommended AMDR at 25% of kilojoules served. Finally, the energy content did not meet the lower range of EER for both boys and girls at 1961Kj/meal.

4.4.2 Cowboy Casserole

Cowboy Casserole met the school-day adequate intake dietary fibre recommendations for both boys and girls at 10.5g/meal. Total fat content of the meal exceeded the recommended AMDR at 55% of kilojoules served. Finally, the energy content exceeded the upper range of EER for both boys and girls at 3600Kj/meal.

4.4.3 Sloppy Joes

Sloppy Joes met the dietary fibre recommendations for girls only at 8.7g/meal. Total fat content of the meal exceeded the recommended AMDR at 45% of kilojoules served. Finally, the energy content fell within the EER range for both boys and girls at 2854Kj/meal.

Table 4.4: *Nutritional composition of FTN meals as compared to school-day NRVs[1, 2]*

Nutrient	Pumpkin & Bacon Soup[6] (~300g serve)	Cowboy Casserole[6] (~300g serve)	Sloppy Joes[6] (~300g serve)	NRVs[5] (40%)
Energy(Kj)	1961	3600	2854	**Girls: 2,560–2,800Kj/day(EER)[1]** **Boys: 2,720–3,080Kj/day(EER)[1]**
Carbohydrate(g)	64.6	58.7	54.9	**40g/day (EAR)[2]**
Protein (g)	19.7	34.3	35.3	**Girls: 9.6g/day (EAR)[1]** **Boys: 12.4g/day (EAR)[1]**
Total Fat (g) *(% energy)* Saturated Fat(g) (% energy)	13.2 *(25)* 7.3 *(14)*	52.6 *(55)* 25.5 *(27)*	34.0 *(45)* 16.9 *(22)*	- **20-35% energy (AMDR)[1,3,4]** - **<10% energy (AMDR)[1]**
Dietary Fibre (g)	5.9	10.5	8.7	**Girls: 8g/day(AI)[1]** **Boys: 9.6g/day(AI)[1]**

AI=Adequate Intake, EER=Estimated Energy Requirement, EAR=Estimated Average Requirement, AMDR=Acceptable Macronutrient Distribution Range

1. National Health and Medical Research Council. (2006). *Nutrient Reference Values for Australia and New Zealand Including Recommended Dietary Intakes.* Canberra: NHMRC. Where available, recommendations are based on boys and girls aged 9-13 years; EER = Requirements for 9-11 year old child, with PAL of 1.4 (Kuczmarski et al., 2000).
2. Institute of Medicine. (2005). *Dietary Reference Intakes For Energy, Carbohydrate, Fiber, Fat, Fatty Acids, Cholesterol, Protein And Amino Acids*. USA: National Academies Press. Recommendations are based on boys and girls aged 9-13 years.
3. Arambepola, C., Scarborough, P., Boxer, A., & Rayner, M. (2009). Defining 'low in fat' and 'high in fat' when applied to a food. *Public Health Nutrition*, *12*(03), 341-350.
4. Stallings, V. A., & Yaktine, A. L. (2007). *Nutrition Standards For Foods In Schools: Leading The Way Toward Healthier Youth*: USA: National Academies Press.
5. Values are 40% of total daily nutrient intake recommendations (Regan et al., 2008; Yoong et al., 2015).
6. All meals include one white dinner role and 10g of salted-butter in the above nutritional analysis.

4.5 Dietary Intake at School, in Students during the FTN and Control Weeks

The nutritional analysis in **Table 4.5** below presents the mean energy, macronutrient (including % of total energy), total sugar, saturated fat and dietary fibre intake of students during the school-day in the FTN and control weeks.

Mean intake of energy, all macronutrients, saturated fat and dietary fibre, were significantly higher in the FTN week compared to the control for both boys and girls ($p < 0.05$). Total sugars and protein (% energy) were also significantly higher in FTN week compared to the control week in boys only ($p < 0.05$).

Protein intake during the school day exceeded requirements (40% of total daily recommendations) for both boys and girls, in both the FTN and control weeks. Whereas, protein as a % of total energy did not meet the AMDR in boys and girls in both the FTN and control weeks.

Energy intake during the school day exceeded school-day requirements for both boys (3345±2162Kj/day) and girls (3367±1877Kj/day) during the FTN week only.

In the control week, neither boys nor girls met dietary fibre adequate intake requirements during the school day. During the FTN week, girls achieved these recommendations (8g/day) with a mean daily consumption of 9.1±7.4g/day. Boys fell shy of the recommendations (9.6g/day) by ~0.9g/day, with a mean daily consumption of 8.7±6.7g/day.

Both boys and girls, in the FTN and control week exceeded the AMDR for saturated fat (<10%). Carbohydrate and total fat however, fell within recommended ranges for both weeks.

Table 4.5: *Mean dietary intake of key nutrients in boys and girls during the school day, in the FTN and control weeks*

Girls(n=38)				
Nutrient	**FTN Week**	**Control Week**	**P-Value***	**NRVs[3] (40%)**
Energy (Kj)	3367±1877	2598±1626	***0.001***	**2,560–2,800Kj/day (EER)[1]**
Carbohydrate (g) (% energy) Total Sugars (g)	103.1±58.4 *(52±11)* 50.5±38.6	81.8±53.8 *(53±11)* 41.6±38.9	***0.007*** 0.502 0.105	**40g/day(EAR)[2]** **45-65%(AMDR)[1]** **-**
Protein (g) *(% energy)*	25.9±18.5 *(13±5)*	18.6±17.0 *(12±6)*	***0.004*** 0.282	**9.6g/day(EAR)[1]** **15-25%(AMDR)[1]**
Total Fat (g) *(% energy)* Saturated Fat(g) *(% energy)*	31.4±22.2 *(33±11)* 14.2±11.0 *(15±6)*	23.6±17.4 *(33±12)* 10.9±9.1 *(15±6)*	***0.005*** 0.861 ***0.019*** 0.804	**-** **20-35%(AMDR)[1]** **-** **<10%(AMDR)[1]**
Dietary Fibre (g)	9.1±7.4	6.6±3.5	***0.018***	**8g/day(AI)[1]**
Boys (n=44)				
Nutrient	**FTN Week**	**Control Week**	**P-Value***	**NRVs[3] (40%)**
Energy (Kj)	3345±2162	2269±1444	***<0.001***	**2,720–3,080Kj/day (EER)[1]**
Carbohydrate (g) *(% energy)* Total Sugars (g)	96.8±61.1 *(50±13)* 42.5±33.2	70.5±44.1 *(52±12)* 33.1±22.3	***<0.001*** 0.185 ***0.007***	**40g/day(EAR)[2]** **45-65%(AMDR)[1]** **-**
Protein (g) *(% energy)*	27.5±23.2 *(14±5)*	15.6±11.8 (12±6)	***<0.001*** ***0.006***	**12.4g/day(EAR)[1]** **15-25%(AMDR)[1]**
Total Fat (g) *(% energy)* Saturated Fat (g) *(% energy)*	32.1±28.5 *(34±13)* 14.3±12.2 *(15±7)*	21.5±17.4 *(33±12)* 10.2±9.3 *(15±7)*	***0.001*** 0.521 ***0.005*** 0.614	**-** **20-35%(AMDR)[1]** **-** **<10%(AMDR)[1]**
Dietary Fibre (g)	8.7±6.7	5.3±4.3	***<0.001***	**9.6g/day(AI)[1]**

AI=Adequate Intake, EER=Estimated Energy Requirement, EAR=Estimated Average Requirement, AMDR=Acceptable Macronutrient Distribution Range

Values presented as mean±standard deviation

** Significant results determined using Paired T-Tests; a p-value < 0.05 was considered a significant result.*

1. National Health and Medical Research Council. (2006). *Nutrient Reference Values for Australia and New Zealand Including Recommended Dietary Intakes.* Canberra: NHMRC. Where available, recommendations are based on boys and girls aged 9-13 years, EER = Requirements for 9-11 year old child, with PAL of 1.4 (Kuczmarski et al., 2000)

2. Institute of Medicine. (2005). Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein and amino acids. USA: National Academies Press. Recommendations are based on boys and girls aged 9-13 years.

3. Values are 40% of total daily nutrient intake recommendations (Regan et al., 2008; Yoong et al., 2015).

4.6 Day-By-Day Analysis of Dietary Intake in Students during the FTN and Control Weeks

The mean energy, macronutrient (including % of total energy), total sugar, saturated fat and dietary fibre intake of students was analysed in the FTN and control weeks, based on corresponding days of the week (see Appendix E and F for complete data analysis).

4.6.1 Monday

On the Monday of the FTN week, energy, carbohydrate, protein, protein (% energy) and dietary fibre intake were all significantly higher than the Monday in the control week ($p<0.05$). Whereas, total fat (% energy) intake was significantly lower from 32±11% to 26±9%. Pumpkin and Bacon Soup was served on the Monday of the FTN week.

4.6.2 Wednesday

On the Wednesday of the FTN week, energy, carbohydrate, protein, protein (% energy), total fat, total fat (% energy), saturated fat, saturated fat (% energy), and dietary fibre intake were all significantly higher ($p<0.05$) compared to the Wednesday in the control week. Carbohydrate (% energy) was significantly lower during FTN at 45±14% compared to 54±13% during the control. Cowboy Casserole was served on the Wednesday of the FTN week.

4.6.3 Friday

In the FTN week, energy, carbohydrate, total sugar, protein, total fat and saturated fat intake were all significantly higher compared to the Friday in the control week ($p<0.05$). Sloppy Joes were served on the Friday of FTN week.

4.6.4 Tuesday and Thursday

On the corresponding Tuesday and Thursday of the FTN and control weeks, key nutrient intakes did not significantly differ overall, except for total sugar intake between the Thursday of the control and FTN week. Total sugar was significantly higher at 52.7±36.2g during FTN compared to 38.6±27.7g during control week ($p=0.021$). No FTN meals were served on the Tuesday and Thursday of FTN week.

4.7 Dietary Intakes in Students during the FTN and Control Weeks by Ethnic Group

Key nutrient intakes during the FTN and control weeks were compared between the three ethnic groups identified at Manurewa South School (Pacifika, Māori and New Zealand European and Other (NZEO)). During the FTN week no significant differences were seen in all nutrient intakes between the ethnic groups ($p>0.05$) (see Appendix G for complete data analysis).

A significant difference was observed in the protein (% energy) intake between ethnic groups during the control week. As can be seen in **Figure 3**, NZEO students consumed significantly more protein (% energy) at 14±6%, compared to both Māori(11±5%) and Pacifika(11±6%) students($p <0.05$).

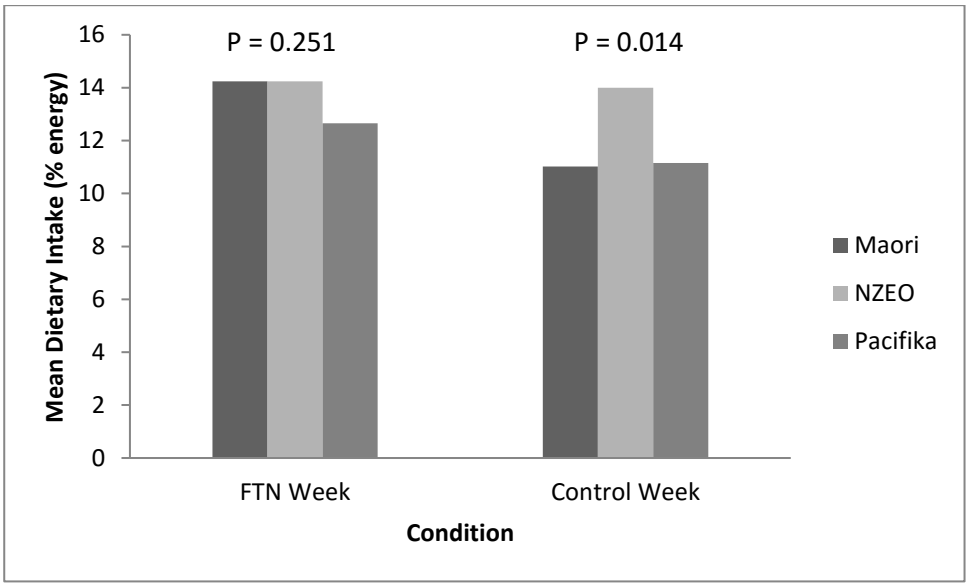

Figure 3: Protein (% energy) intake between ethnic groups during the FTN and control weeks

4.8 Key Food Sources at Manurewa South School

Students consumed foods during the school day from five key sources including the home, school (i.e. other food assistance programmes), FTN, dairy and 'other'.

A comparison of mean nutrient intakes between the FTN and control weeks, based on the key food sources, was completed (See Appendix H):

- There were minimal significant differences in nutrient intakes from foods sourced from the home, between the FTN and control weeks, except saturated fat intake which was significantly lower in the FTN week ($p=0.049$).
- No significant differences were seen in the energy or key nutrient intakes from foods sourced from the dairy between the FTN and control weeks ($p>0.05$).
- Energy, carbohydrate and total sugars were significantly higher from foods sourced from the school (other food assistance programmes) during the FTN week ($p<0.05$).
- There was a significantly higher total energy, carbohydrate, total sugar, fat, and saturated fat intake from foods sourced from 'other' sources in the FTN week ($p<0.05$).

A comparison of mean energy intakes between the different food sources during the FTN and control weeks was also undertaken (See Appendix I for the complete analysis). As presented in **Figure 4**, students consumed the most energy from foods that were sourced from the home in both the FTN and control weeks.

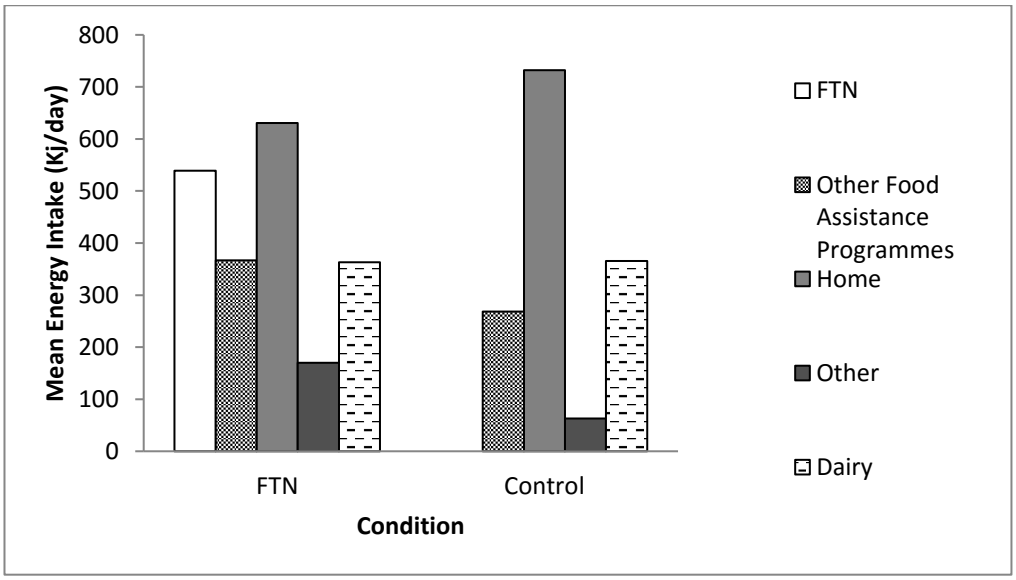

Figure 4: Mean energy intake in students, from the different food sources during the FTN and control weeks

An analysis was also undertaken on the number of students consuming at least one food item from the different food sources during the FTN and control weeks. **Figure 5** demonstrates that the majority of students consumed foods from the home and school (including FTN and other food assistance programmes), during both weeks. The number of students consuming foods from the 'other', school and dairy food sources was higher in the FTN week compared to the control week. During the FTN week, 60% of students consumed at least one food item from the dairy. During the control week 49% of students consumed at least one food item from the dairy.

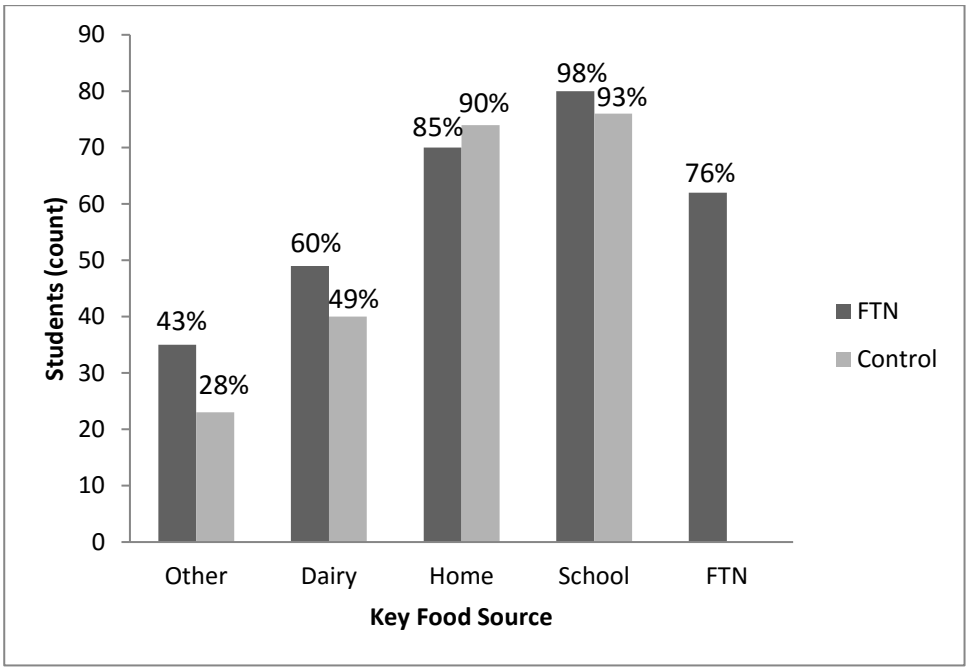

Figure 5: Students consuming at least one food item a from a key food source during the FTN and control weeks

Figure 6 demonstrates that an approximately equal proportion of students consumed at least one food from other food assistance programmes during the FTN (91.5% of students) and control weeks (92.7% of students). However, **Figure 7** shows that a larger quantity of food was consumed from other food assistance programmes during the FTN week (331 food items) compared to the control week (281 food items).

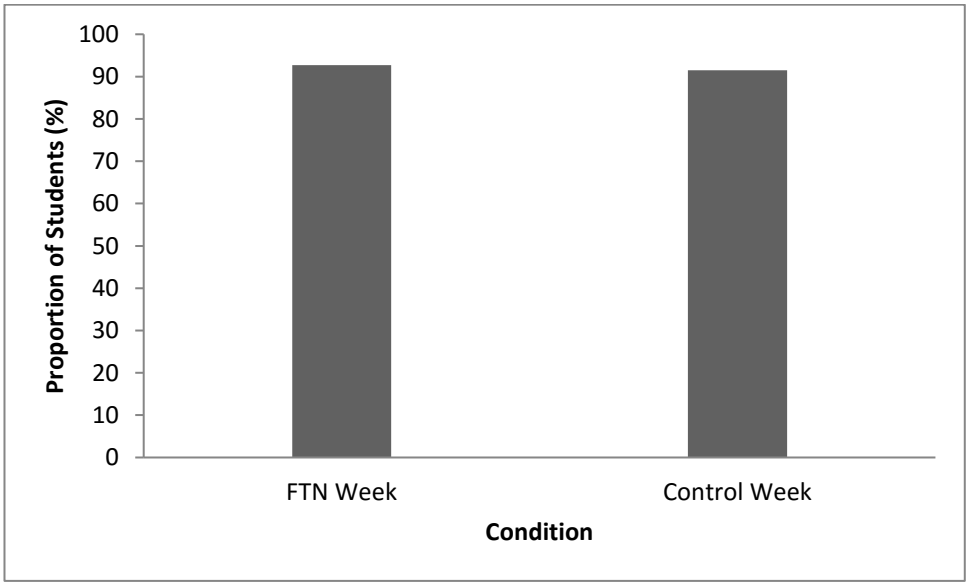

Figure 6: The proportion of students who consumed food from other food assistance programmes during the FTN and control weeks

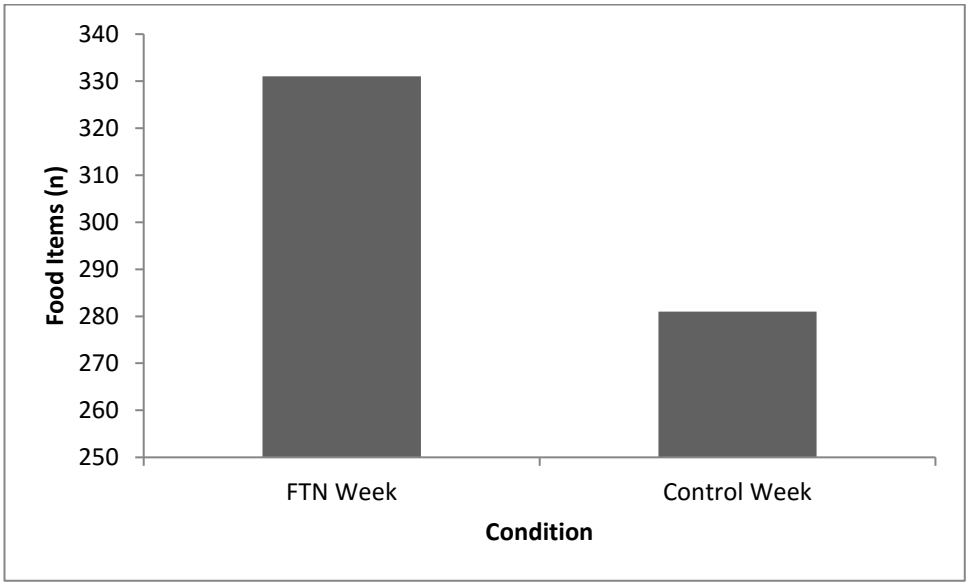

Figure 7: Total number of food items consumed from other food assistance programmes during the FTN and control weeks

Finally, common foods consumed from the key food sources were explored. A clear pattern was observed in the food being consumed from the dairy, whereas food consumed from the home and school (other food assistance programmes) appeared more sporadic. As presented in **Figure 8**, commonly consumed foods from the dairy included: potato crisps, baked goods (such as cakes, biscuits and muffins), sugar sweetened beverages (SSB), pies and snack bars. Potato crisps and baked items were the most commonly consumed types of foods from the dairy, followed by SSB.

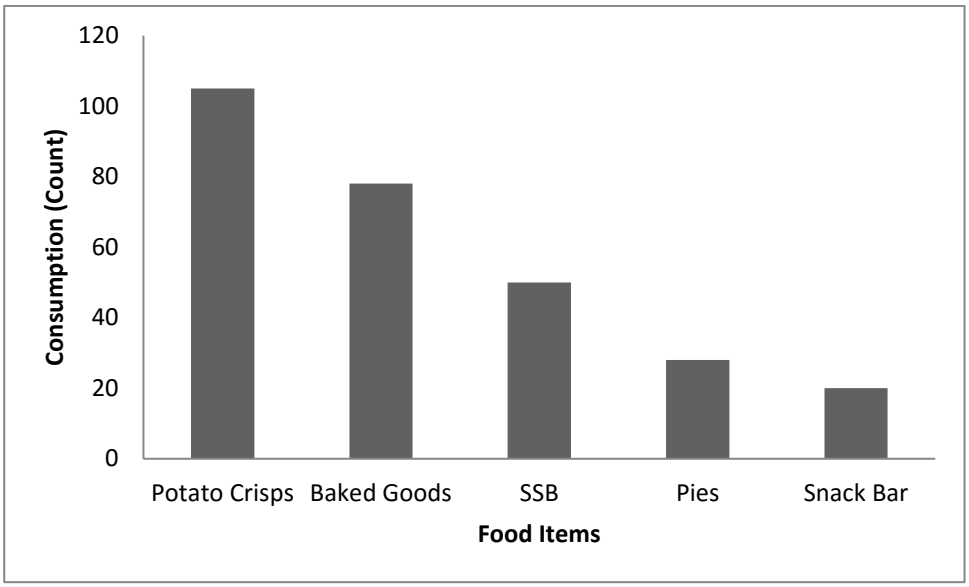

Figure 8: Commonly consumed foods from the dairy, throughout both the FTN and control weeks

4.9 Classroom Success

4.9.1 Behavioural Incidences during the School Day with and without FTN

Behavioural incidents were analysed during the entirety of FTN and 2 months before the commencement and 2 months after the conclusion of FTN.

On average a total of 11.50±6.66 behavioural incidences from all classrooms (Rooms 13, 14 and 15) were observed each month by teachers when FTN was present in school, whereas an average of 7.75±7.93 incidences each month were observed by teachers without FTN. There were no significant difference in the number of reported behavioural incidences with and without FTN (P>0.05).

	Without FTN	With FTN	P-Value*
Behavioural Incidences	7.75±7.93	11.50±6.66	0.359

Values presented as mean±standard deviation

**Significant results determined using a Paired T-Test; a p-value < 0.05 was considered significant*

Table 4.6: *Mean monthly behavioural incidences during the school day, with and without FTN*

4.9.2 School Day Attendance Rates with and without FTN

Figure 9 presents the average attendance rates (% half days attended) of students from Room 13, 14 and 15, with and without FTN (n=80). Average attendance rates were lower when FTN was present at school, where mean % of half days attended were reduced from 90.19±12.08% to 87.09±14.80%. No significant difference in attendance rates were observed between the two conditions ($p>0.05$).

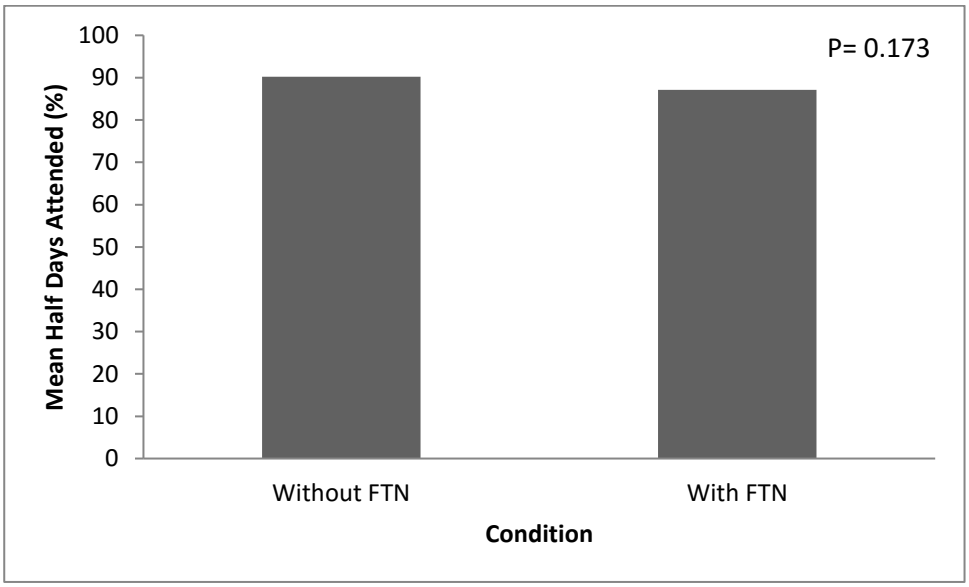

Figure 9: Student attendance rates (% of half days attended) with and without FTN

4.10 Focus Groups

4.10.1 Key Themes from Student Focus Group

After facilitating a focus group with six student representatives from Room 13, 14 and 15, four key themes regarding food assistance programmes currently established at Manurewa South School were observed (see Appendix C for moderator guide):

1. Gratitude and appreciation for food programmes provided.

Students in Focus Group 1 (FG1) demonstrated an appreciation for the various food programmes provided at their school. Furthermore, they understood that programmes placed in their school were selective and that a limited number of schools in South Auckland had the same opportunity as them.

"It makes me feel lucky …there is only a minimum of schools that get these things" (FG1, girl 1)

"It makes me feel appreciative to have all of these things because not a lot of schools get things; I'm glad that our school got chosen to have these things" (FG1, girl 2)

2. Positive contributions to student wellbeing.

2.1 Energy to play.

The students reported that the foods provided to their school gave them full tummies, but also expanded to say that the foods help to give them more nutrition to help them play, and keep active.

"it makes your brain wake up again…it gives you healthy bones…we need that for playing and swimming" (FG1, girl 2).

2.2 Better nutrition.

The students reported that the different food programmes available at their school, such as FTN, provided better quality and nutritious foods compared to what was originally available at their school (e.g. in the school canteens).

"…the brownie is full of sugar and makes you hyperactive…we use up the energy in like a minute, and then we get tired, and have a sore stomach" (FG1, girl2 and boy 1)

2.3 Food security.

Students demonstrated that the provision of a regular lunch meal from FTN helped to provide a sense of food security for those children who live in income deprivation.
"they are so joyful…after all those years of having a minimum of things, they get free things that will help them throughout life" (FG1, girl 1)

3. The importance of food culture.

Students demonstrated a food culture within the school environment which encompassed the growth of produce from the land, and the provision of culturally relevant food products (for example Kai Moana), but also responsible waste management and protection of the environment. The students commented that their school gardens were not being utilised to their full capacity, with fruits and vegetables going to waste. They demonstrated a sense of frustration towards this, wanting their gardens to be used to its full potential to help feed their school.
"I feel stink because I don't want to let food go to waste…some people in the world don't even get food, we need to be respectful for the food we have" (FG1, girl 3)

Students demonstrated neophobia towards uncommon and unfamiliar foods such as legumes. Aversions to certain meals that were provided by FTN was present, as they were not foods that the students normally consumed. For example one student commented on the Cowboy Casserole: *"I don't like it…it's not cooked how we like it to be cooked at home"* (FG1, girl 3).

4. Sustainability and tenure of food programmes.

The students did not have many negative comments regarding the quality food being provided through different programmes available. There was however, a concern/anxiety demonstrated amongst students regarding the intermittent nature of the programmes provided. The children demonstrated that they did not like FTN only coming in the winter months, and wanted food provision all year round.
"what I don't like about these programmes is that we don't get to have them every day" (FG1, girl 2)

4.10.2 Key Themes from Staff Focus Group

After facilitating a focus group with three staff representatives, four key themes regarding food assistance programmes currently established at Manurewa South School were observed (see Appendix C for moderator guide):

1. Gratitude and appreciation for food programmes provided.

Staff in Focus Group 2 (FG2) exhibited a sense of gratitude for the food programmes being offered to students at Manurewa South School. They felt it was a privilege that these foods were coming into the school, and that it benefited the children greatly.

"It's the best thing for our children" (FG2, staff 1)

"It's great to have the opportunity to have these offered to our school for our children. So we absolutely appreciate what's coming in…" (FG2, staff 1)

2. Positive contributions to student wellbeing.

2.1 Exposure to different foods.

The staff felt that the food programmes allowed greater exposure to a variety of different foods, that children in this demographic may not normally have the opportunity to try.

"…we get peanut butter and honey and the children absolutely love the honey. It's very expensive to buy in this market…." (FG2, staff 2) "…and some of them have never had that before so it's opening the children up to a different type of food." (FG2, staff 1)

"It's getting them to try things they haven't tried before like we had pineapple, we have the summer fruit…we used to have grapes…cherry tomatoes…" (FG2, staff 1, 2 and 3)

2.2 Improved social skills.

The staff also perceived that a more positive social environment was created in the classroom as a result of the presence of FTN specifically. It has allowed the development of table manners, and the concept of eating food at the table rather than whilst walking, playing or watching TV. Furthermore, it also helped children to demonstrate patience, and calmness while waiting at the table with their peers for the hot lunch meals to be delivered to the classroom.

"you also notice with our children too, that a lot of our children are walking around with food and it's like I think they do this at home; that they just have their meal and carry on around…and now they're sitting at the table." (FG2, Staff 1)

2.3 Perceived improved attendance rates.

Finally, the staff felt that attendance rates were improved with the presence of food assistance programmes.

"…some of our children stay away because they have no food, so we make it clear to the parents that that's not a reason for them to keep their children home, so it's encouraged less attendance issues with having that on board." (FG2, staff 2)

"… it's an attendance thing as well…it's something warm and filling and nutritious." (FG2, staff 1)

3. Parental support.

The staff felt that the food programmes provide a great deal of parental and family support. Staff report that during the winter months families can be under extreme financial pressure and the presence of these food assistance programmes removes a major component of that financial stress.

"…the winter months seem to be the neediest months for the families…the parents appreciate it, that there is something for their children…something hot in their tummy." (FG2, staff 1)

"fruit [is good too]…it's good cause they take it home and it goes towards the meal, towards the stew." (FG2, staff 1)

"…95% of the parents appreciate it." (FG2, staff 1)

4. Sustainability and tenure of food programmes.

The majority of discussions surrounding the food programmes available at Manurewa South School were positive however, the staff indicated their dislike for the limited timeframe of FTN. They also showed concern regarding future sustainability of food assistance programmes currently established at their school.

"…we gotta tick all the boxes otherwise [the food assistance programmes] may think the need is not there anymore" (FG2, staff 1)

"…we hope it doesn't stop." (FG 2, staff 1)

Chapter 5: Discussion

5.1 Overall Dietary Intake and the Effects of FTN

The school-day dietary intake of 82 year five and six students from Manurewa South School was explored in this study. Of the students recruited, most identified as Māori or Pacifika (80%). This is similar to other low decile schools around New Zealand where approximately 90% of all students attending decile one schools identify as Maori or Pacifika (Gordon, 2015; Ministry of Health, 2012b; Parnell et al., 2003).

Children are reported to consume approximately 30-40% of their total daily energy and nutrient intakes during the school day (Bell & Swinburn, 2004; Regan et al., 2008; Walton, Hannon, & Flynn, 2015). Findings from the current study have demonstrated that children consume more than 40% of the NRVs for carbohydrate, protein and saturated fat at school during both the FTN and control week.

Results from the CNS and the New Zealand Health Survey demonstrate that children living in deprivation tend to consume excess energy and macronutrients, particularly saturated fat and carbohydrate (Ministry of Health, 2012b; Parnell et al., 2003). The current study concurs with these findings due to the observed high consumption of carbohydrate, protein and saturated fat during the school day.

The obesogenic environment surrounding Manurewa South School is likely to have contributed to the high consumption of carbohydrate, protein and saturated fat. This is common in neighbourhoods of high income deprivation within New Zealand. In such environments healthy foods such as wholegrains and fruit and vegetables are often scarce, whilst discretionary foods and convenience stores are in abundance (Block et al., 2004; Pearce et al., 2007). A high density of dairies, bakeries and convenience stores were found within a 500m radius of Manurewa South School. Consequentially, this close proximity leads to an increased availability and consumption of discretionary foods (Block et al., 2004; Pearce et al., 2007).

The current study revealed foods commonly consumed from the dairy/shops included: potato crisps, baked goods, pies and sugar sweetened beverages (SSB). Clearly, this could contribute to the high carbohydrate, protein, fat and saturated fat intakes observed in the study population. Not only this, but no difference in energy intake from the dairy was seen between FTN and control week. These results suggest that students are consuming FTN meals, in addition to their standard diets which are often rich in discretionary food consumption. This could have contributed to the high carbohydrate, protein, and saturated fat intakes observed,

where both diets before and during FTN were persistently rich in discretionary foods. It is unsurprising that students did not reduce their discretionary food consumption during the FTN week, as simply providing a healthier food alternative is often not sufficient to create behaviour change in child populations (Blanchette & Brug, 2005).

The high intakes of carbohydrate, protein and saturated fat (>40% of daily intake) observed in this study may also be due to the presence of food assistance programmes throughout the school year. It has been reported that children who receive free school meals tend to consume a greater proportion of their daily food intake at school compared to non-participants (Nelson, Lowes, & Hwang, 2007). Therefore the proportion of daily food intake consumed at school may be higher in a low decile, compared to a higher decile school. In the current study food intake outside of school grounds was not analysed, therefore this limits the ability for conclusions to be made about the influence of in-school food assistance programmes on dietary intake in the home environment. Hence, this is an area where further investigations are required.

In this study dietary fibre intake was significantly higher during FTN week compared to the control week ($p<0.05$). This increase appears to be the result of food intake during school days when FTN was provided. Meals served during the FTN week included Pumpkin and Bacon Soup, Cowboy Casserole and Sloppy Joes. It is likely that the addition of beans and starchy vegetables to these meals has contributed to the observed improvements in dietary fibre consumption during the FTN week.

Many studies exploring the effects of food assistance programmes on dietary intake have noted an increase in dietary fibre consumption as a result of increased fruit and vegetable availability. Gordon et al. (2007a) found that dietary fibre was significantly increased in students aged between ~8-16 years, participating in a National School Lunch Programme (NSLP) in the USA, compared to matched participants. This increase in dietary fibre was mostly attributed to increased fruit and vegetable consumption in NSLP participants.

Dietary fibre is important with increased prevalence of refined, energy dense carbohydrate foods in many children's diets (Maddison, 2010; New Zealand Research Bureau, 2008; Parnell et al., 2003). In the National Children's Nutrition Survey (Parnell et al., 2003) the median intake of dietary fibre for children aged 7-10 years fell below daily recommendations. Furthermore, it is expected that low income children are at the greatest risk of inadequacy due to reduced affordability and accessibility of fresh fruit, vegetables and wholegrains (Maddison, 2010; Ministry of Health, 2012b; New Zealand Research Bureau, 2008; Parnell et al., 2003).

This supports findings in the current study where dietary fibre adequate intake requirements were not achieved in either boys or girls during the control week.

During the FTN week students also consumed significantly more protein than during the control week ($p<0.05$), where higher protein intakes were observed during school days when FTN was provided. In order to improve the nutritional composition of meals, FTN recipes had been fortified. It is possible that this food fortification has resulted in higher protein intakes observed in students during FTN week. For example, the Pumpkin and Bacon soup had added skim milk powder to increase the protein content of the meal served.

Studies rarely comment on changes in protein intake with the introduction of food programmes. One older American study has demonstrated an increase in protein intake with the introduction of the School Breakfast Programme and NSLP (Gleason & Suitor, 2001) however, recent evidence and literature demonstrating similar findings is rare. Evidence is probably limited due to the nutritional quality of many food assistance programmes available globally. Often these programmes only supplement intake through the supply of fruit and vegetables or snacks such as snack bars and because of this, protein content is often low.

Total fat and saturated fat intake were significantly higher during the FTN week. This is possibly related to the fat content of FTN meals served. The two meat based FTN dishes contained a high total fat (>40%) and saturated fat (>20%) content that exceeded recommendations. This may have resulted from the use of lower quality cuts of meat such a sausages and low grade mince. Furthermore, as butter was served with bread rolls this would have also contributed to saturated fat content of FTN meals.

A study in the UK has demonstrated reduced dietary fat and saturated fat intake in low income students aged 8-11 years when consuming free school meals (FSM) compared to packed lunches from home (Stevens & Nelson, 2011). In contrast to findings from the current study, this suggests that FSMs were lower in fat.

It is comparatively more difficult to investigate the intake of total and saturated fat from the current study in relation to findings from overseas studies, due to different regulatory requirements for foods served in schools. For example, the NSLP in the USA serves pizza, french fries and flavoured milks which provide a significant amount of saturated and total fat to the diets of students (Cole & Fox, 2008). Whereas, food assistance programmes in New Zealand often do not offer such discretionary food items.

Finally, energy intake was significantly higher during FTN week compared to the control, where estimated energy requirements were exceeded in both boys and girls. Again, higher energy intakes were found to be a result of FTN days specifically. Excessive energy intake, along with calorie dense foods, strongly determines risk for overweight in children (Gow et al., 2014; Stephens & Summar, 2008). Although it is important to ensure that meals provided to children in low decile schools are nutrient dense providing adequate protein for growth and development, total energy needs to be moderated, as overconsumption of kilojoules can be a problem in these population groups.

In the current study discrepancies in dietary intake between ethnic groups (Māori, Pacifika and NZEO) were observed. NZEO children were found to have the highest protein (% energy) intake at 14% compared to Māori and Pacifika students (~11%). However, protein (% energy) intake along with other nutrients did not differ between ethnic groups during FTN week.

Conflicting evidence is available regarding the differences in nutrient intakes between children of different ethnic groups living in New Zealand. Sluyter, Schaaf, Metcalf, and Scragg (2010) conducted a study on dietary intake at an Auckland high school and demonstrated that Māori and Pacifika children consumed significantly more protein, fat and carbohydrate per day compared to European students. However, when expressed as a percentage of total energy no significant differences were observed. In contrast, the National Children's Nutrition Survey demonstrated that NZEO children had the highest mean percent energy from protein compared with Māori and Pacifika children, whilst Māori children had the greatest mean protein intake/day compared to other ethnic groups (Parnell et al., 2003).

This evidence suggests that although Māori and Pacifika children may consume a larger volume of protein/day compared to NZEO children, when expressed as a proportion of total energy intake the differences are negligible. This may be due to the quality of protein sources consumed by Māori and Pacifika children as well as increased total daily energy consumption.

Findings from the current study should be interpreted with caution due to the low numbers of NZEO students. Only 16 students (19.5%) were of NZEO decent therefore it is unlikely that true differences in dietary intake will be presented. Furthermore, only low decile school children were recruited and hence differences in dietary intake between ethnic groups due to discrepancies in SES are not well reflected in the current study.

In this study macronutrient intakes from food coming from other food assistance programmes (excluding FTN) were significantly higher during FTN week compared to the control ($p<0.05$).

Therefore food intake from originally established food assistance programmes such as KidsCan and Milk in Schools was increased during the FTN week. There was an observed increase in milk, fruit and sandwich consumption where 16 more serves of milk, 22.5 more serves of fruit and over 30 more sandwiches were consumed from other food assistance programmes during FTN week compared to the control week. With no difference in the number of students consuming foods from other food assistance programmes, this suggests that certain children may be consuming more food from these programmes during FTN week.

An increased consumption of food from other programmes (excluding FTN) could be a consequence of increased household reliance on food assistance programmes during the FTN week. As overall mean energy intake from the home did not reduce during the FTN week this would indicate only a small number of households have increased reliance. However, more research is needed to understand this effect on household food environments, as this was not a part of the scope of the current study.

There was a lower intake of energy and macronutrients from foods reported as 'other' during the control week. As the control week proceeded the FTN week, this may have been a result of greater accuracy in student-reporting. It is important to consider that this could be confounding results observed.

5.2 Behaviour, Attendance and the Achievement Gap

No significant improvement in attendance rates was found during FTN. This is unsurprising as, compared to national benchmarks for attendance (90% of school half days), students in the current study attended school regularly (Ministry of Education, 2015). This does not follow observed trends where children from low decile schools often have poor attendance rates (Morrissey et al., 2014; Zhang, 2003).

High rates of absenteeism may not always be apparent in a well-supported low decile school. A variety of other meal programmes are available at Manurewa South School throughout the school year, independent of FTN. Therefore, children have nutritional support all year round regardless of deprivation levels, which may reduce levels of absenteeism.

Furthermore, it is important to consider that attendance rates during FTN were measured during the winter months, and the control comparison data was collected in Autumn and Spring. These Seasonal differences may have confounded the attendance rates observed in

this study as children are more vulnerable to illness during winter (Ministry of Education, 2015).

Finally, only two weeks were used to capture the difference in attendance rates between the FTN and control weeks. Though immediate effects of a food assistance programme on attendance rates (i.e. an incentive for children to come to school) may be observed, it is more likely that significant effects on attendance rates will be seen in a longer term study (i.e. improved attendance due to better health).

No significant differences were observed in the number of behavioural incidences when FTN was present. It could be speculated that behaviour might improve with greater nutritional adequacy of diets as a result of the relationship between diet and mental health/functioning in children (Kulkarni, Swinburn, & Utter, 2015). However, a child's behaviour in the classroom is influenced by many factors other than diet quality. Interpersonal relationships with staff, parents, peers, as well as other social circumstances that are occurring outside the school environment can all determine a child's behaviour in the classroom (Vitaro, Barker, Brendgen, & Tremblay, 2012). Furthermore, the small sample size of the current study could have influenced the ability to detect any differences in behavioural change over the two week period.

Some studies have demonstrated positive effects of food assistance programmes such as reduced hyperactive behaviour, better focus, and better student teacher relationships (Ecker, 2012; Rodgers & Milewska, 2007) while others have shown no affects (McLaughlin et al., 2002). These conflicting results could be due to a variety of personal and school-level environmental factors, such as the decile ratings and the teacher to student ratio.

5.3 Perceptions of School Food Assistance Programmes

From the focus groups undertaken with staff and students there was an overall sense of gratitude for the food assistance programmes provided at Manurewa South School. Students reported that "*It makes [them] feel lucky [as] there is only a minimum of schools that get all these things"* while teachers reported that *"It's the best thing, for [their] children"*. This feedback supports the positive perceptions and improved overall wellbeing experienced from the establishment of food assistance programmes (Sigfúsdóttir et al., 2007).

Furthermore, two key themes arose from focus groups with staff and students including cultural connection to food and the threatened sustainability of food assistance programmes.

Theme One: Cultural Connection to Food

Focus groups with student representatives demonstrated a clear cultural connection to food. Students emphasised a strong connection to the land, and how this was interconnected with food "*I feel stink because I don't want to let food go to waste… we need to be respectful for the food we have*". This response was expected as the majority of students were of Māori and Pacifika decent.

The Māori viewpoint on health, kai and the current food system can vary greatly from mainstream westernised opinions (Moeke-Pickering, 2015). To Māori, kai is more than just food but is a social commodity which is associated with mana and respect (Toi Tangata, n.d.). Furthermore, it is an extremely important component of spirituality and Manaakitanga (Moeke-Pickering, 2015; Parnell, Reid, Wilson, McKenzie, & Russell, 2001). Māori have communicated the major barriers to healthy kai include poverty, decreased access to traditional foods (with a forced dependency on cheap unhealthy foods), and a reduction in control of food distribution (Moeke-Pickering, 2015).

Children in the focus group commented that foods served through the FTN meal programme were *"not cooked how we like it to be cooked",* indicating some discourse between what is served during school hours, and the types of foods that are deemed socially acceptable. Furthermore, they also expressed a sense of neophobia towards certain food items that were served (e.g. legumes). This presents an issue with the current programme, as studies have demonstrated that children will only voluntarily consume foods if they like them (Lülfs-Baden & Spiller, 2009).

Perhaps this is why participation rates in the FTN programme were surprisingly low. Out of all diet records collected on FTN days, only 97 (61%) reported FTN meal consumption. This highlights the problem with a 'charitable model' or 'needs based approach' to poverty (Raine, McIntyre, & Dayle, 2003). Without challenging the importance of the current school food programmes in place, it is clear that food provision to those 'in need' has become a dominantly westernised strategy, lacking consideration as to the meaning of food to the many ethnicities currently experiencing poverty. Food is much more than an object that satisfies hunger to the indigenous culture of New Zealand. The process of providing food, particularly traditional kai, for one's children and whanau is core to Māori identity and seems to be lost from the current support programmes. It has been made clear from the literature, and also the Māori people,

that control and empowerment to provide healthful kai for one's self and whanau is important for uplifting individuals from poverty (Toi Tangata, n.d.; Voyle & Simmons, 1999). Future robust studies should consider the ability of food assistance programme to uplift the health of Māori populations, and to promote Māori ideologies of wellbeing. This area of research requires more thorough investigation.

Theme Two: Threatened Sustainability of Food Programmes

Both staff and students commented on the tenure of food assistance programmes established at Manurewa South School, where they expressed a concern regarding the sustainability of current food assistance programmes. Students reported that *"what [they] don't like about these programmes is that [they] don't get to have them every day"* whilst teachers commented that *"[they] gotta tick all the boxes otherwise [the food assistance programmes] may think the need is not there anymore".*

Limited studies are available that investigate the impact of intermittent school food assistance programmes on children involved. However, a small study conducted in New Zealand has demonstrated that a short term food assistance programme can be detrimental to eating behaviours once the programme has reached its conclusion (Ashfield-Watt et al., 2009).

This is an issue with current food assistance programmes aimed at providing foods to insecure communities and children. Programmes are often established without investigating the root source of food insecurity and poor eating behaviours, and therefore do not provide the appropriate tools for communities to obtain their own healthy and sustainable food supply. Nor do they look at a more transformative approach to solve the underlying social structure issues that result in vulnerability of certain populations to health and income inequities. Because of this, when such programmes are removed from schools the issues which originally resulted in food insecurity are still present. The current study has demonstrated the anxiety present regarding this issue, and the helplessness that comes with not knowing how long support will be provided.

Chapter 6: Main Findings and Recommendations

6.1 Main Findings

This study aimed to determine the effects of FTN on dietary intake at school, and classroom success in year five and six students at Manurewa South School. The first objective was to explore the dietary intake of students and the effects of FTN on dietary intake.

In the control week neither boys nor girls met dietary fibre AI requirements during the school day. However, during the FTN week dietary fibre was significantly higher, where girls achieved AI recommendations and boys fell shy by ~0.9g/day. This is likely due to the legumes and starchy vegetables served in FTN meals.

During the control week saturated fat dietary intake exceeded recommended ranges (<10% energy) in both boys and girls. During the FTN week, saturated fat intake was significantly higher and also exceeded recommendations. This increase is thought to result from FTN, where the two meat based dishes contained a high saturated fat content (>20%).

During the FTN week students consumed significantly more protein than in the control week. This is possibly a consequence of food fortification of FTN meals where, for example, the Pumpkin and Bacon soup had added skim milk powder to increase the protein content of the meal served.

Overall, during the FTN and control week mean intake of carbohydrate, protein and saturated fat exceeded estimated school day-requirements (40% of NRVs). It is thought that this excessive consumption relates to the obesogenic environment commonly associated with low income areas in New Zealand, where students had a rich intake of discretionary foods. Furthermore, the presence of year-long food assistance programmes is also thought to affect the proportion of daily food intake that students consume on school grounds.

The second objective was to explore ethnic differences in dietary intake with and without the presence of FTN. It was demonstrated that NZEO students consumed significantly more protein (% energy) than both Māori and Pacifika students. During FTN week these differences in protein (% energy) intake were reduced, and no differences in intake were observed. Although these results seem to positively reflect on FTN's ability to reduce ethnic differences in dietary intake, they cannot be substantiated due to an unrepresentative sample size of each ethnic group.

The third objective was to explore key food sources and the effects of FTN on where students get their food from. Key food source included: the dairy, school (other food assistance programmes), FTN and the home. FTN provided additive food and nutrition to the normal diets of students, rather than displacing foods from common sources such as the dairy.

The fourth objective was to investigate associations between FTN and markers of classroom success (attendance and behaviour). No significant differences were seen in attendance rates between the control and FTN week. It was demonstrated that on average students attended 90% of school half days without FTN and 87% when FTN was present. Such high rates of attendance may be a consequence of the year-long provision of a variety of food assistance programmes to this low decile school, hence providing nutritional support to all children and possibly reducing absenteeism levels.

Behavioural incidences during the school day were also shown to be unaffected by the presence of FTN. This is unsurprising as a child's behaviour in the classroom is influenced by many factors other than diet quality.

Finally, the fifth objective was to explore attitudes and perception of food assistance programmes established at Manurewa South School, including FTN. Gratitude and appreciation for programmes present at Manurewa South School was expressed in both staff and student focus groups conducted. Food assistance programmes were perceived to improve physical health through more adequate nutrition and to improve mental wellbeing by providing a sense of food security. They were also thought to increase exposure to different fruits and vegetables that may not be readily available in low income households. Both staff and students commented on the concern they have for the sustainability and tenure of food assistance programmes currently established. In particular students disliked the intermittent nature of FTN.

6.2 Recommendations for FTN and other food assistance programmes in New Zealand

The current study demonstrates equivocal findings regarding the benefits of in-school food assistance programmes such as FTN. Children from low decile schools often do not achieve daily nutrient recommendations, consuming excessive saturated fat and energy, and minimal dietary fibre. Therefore, further research is needed in order to truly understand any benefits

of in-school food assistance programmes on the dietary intake of children living in low income New Zealand.

Nutritional analysis of FTN meals demonstrate a need for official regulatory systems and auditing to ensure the nutritional adequacy of meals served. Furthermore, official nutrition guidelines for meals served in schools should be established, as has been undertaken in other countries like the US and the UK. With an increase in the number of charity driven food assistance programmes, it has become increasingly important to ensure that guidelines are established to ensure quality meal provision to all children.

It is well known that public health initiatives are often more successful when they include the population of interest in the planning and development stages (Potvin & Jones, 2011). Such principles should be considered when developing menus for FTN and other food assistance programmes, as the current study has demonstrated low participation rates in FTN. This is speculated to be due to the predominant westernised design of the current menu. Efforts should be made to involve students, whanau and communities in the planning, development and implementation of FTN meal service in order to increase acceptance.

6.3 Recommendations for Further Research

The current study has demonstrated multiple gaps in the understanding of food assistance programmes in New Zealand. Further research is needed such as:

- Longitudinal studies investigating the effects of food assistance programmes on health markers, illness and attendance rates.
- Studies comparing schools with FTN established to low decile schools with no food assistance, to understand the effects of such programmes on a true 'baseline' of dietary intake, where no external support is provided.
- Larger studies exploring the relationship between school decile ratings, and the proportion of daily food intake consumed on school grounds.
- More in depth studies looking at how food assistance programmes can affect food security and dietary behaviours in the home. Insight from the parents involved in such programmes would be invaluable.
- Long term investigations of the impact of intermittent food assistance programmes on the nutrition and mental health of children involved.

Chapter 7: Strengths and Limitations

7.1 Study Strengths

Nutrition Expert Volunteers

Nutrition experts (nutritionists and student dietitians) were used to assist students in completing estimated food records during data collection. Estimated food records are historically prone to error due to difficulties quantifying portion sizes (Forrestal, 2011; McPherson et al., 2000). However, as nutrition experts closely supervised participants and facilitated in quantifying portion sizes this error was minimised.

Data Collection Time Frame

Dietary data collection only occurred in the winter months. This was a significant strength to the current study as it ensured any seasonal variations in food availability did not confound the results obtained.

Focus Groups

Focus group findings added strength to the current study. In the current body of literature on social deprivation and the food system in New Zealand, there is limited qualitative information reporting the experiences of individuals (Fu, Exeter, & Anderson, 2015). Research that aims to understand the value of assistive public health initiatives from the perspective of those receiving the service is also inadequate. Therefore, the results presented are forefront in New Zealand research on food assistance programmes in New Zealand schools.

7.2 Study Limitations

Study Population

Convenience sampling was used to recruit 9-11 year old students from Manurewa South School. A consequence of this is that conclusions made regarding the effects of FTN on dietary intake are not generalisable to the wider New Zealand population. Furthermore, a poor representation of NZEO students was recruited in this study. Therefore, any inferences made with regards to ethnic inequities in nutrition and health cannot be stated with confidence.

Self-Administered Food Records

The use of a self-administered food record in a child population inevitably increased error during data collection. One key challenge experienced was illegibility of food records due to

student's hand writing. Though all efforts were made to ensure records were legible, strict data collection timings during school breaks meant that some records were not cross checked.

Study Time Period

Only one week of dietary data collection was undertaken with FTN, and one week without FTN. FTN provides a vast array of meals, of varying nutritional value throughout the winter months. Similarly, without FTN, day-to-day variation in dietary intake within and between students is also high. Because of this, a one week dietary record is unlikely to accurately reflect usual dietary intake. Furthermore, long term effects of FTN on dietary intake were not seen.

Observational Study Design

Although an observational study design was appropriate for the current study as it allowed for quick and inexpensive data collection, it also presented some limitations:

- No control school was recruited, and the control week of data collection included other school food assistance programmes. Therefore, the effects of FTN on dietary intake, as well as markers of classroom success were not measured against a strict baseline.
- School level confounders could not be controlled for. Massey University undertook nutrition education sessions at Manurewa South School with year five and six students during the focus group and dietary data collection period. This may confound the findings as nutrition education not only affects behaviour surrounding healthy food consumption, but it also affects knowledge and attitudes around nutrition and health (Evans et al., 2012).
- Nutrient intakes presented are mean nutrient intakes based on all the children rather than an individual level of analysis. Therefore, we cannot be sure that these overall mean intakes truly reflect the dietary intake of all students. This is particularly an issue in the current study with such extremes in dietary intake between study participants.

FTN Recipes

A nutritional analysis of FTN meals was based on recipes provided through the Massey University Dietetic Co-ordinator of the FTN annual nutrition audits. It was demonstrated from the 2015 Massey Dietetic Student audit of FTN, that recipes used by FTN were modified on the day of preparation and service (i.e. more water added to recipes, stock measured inaccurately, inconsistent serving sizes, etc.). Therefore, the accuracy of nutritional analysis is highly

dependent on recipes provided by the audit programme, and how closely the cooks followed recipes provided, on the day of service.

Macronutrient Nutrient Reference Values

It is widely evidenced throughout the Ministry of Health food and nutrition guidelines that NRV's are limited by the amount of evidence that is available to set reference ranges. Hence, a variety of different reference ranges including AMDRs, AIs and EARs were used in this study to determine diet quality. These values are predominantly based on New Zealand specific literature from the Nutrient Reference Values Australia New Zealand however some American based guidelines (e.g. EAR for carbohydrate) have been used due to limited available data in New Zealand. It is undesirable to have inconsistent reference values for each of the macronutrients analysed however we are limited to the current evidence available to set NRV's.

Furthermore, there are no school-day specific NRV's established and hence an arbitrary value of 40% of total daily intake has been estimated based on previous established literature.

Lack of Health Markers

Anthropometric markers were not measured in the current study due to limitations from the low risk ethics application undertaken. Although dietary intake of low decile school students was used to determine health and nutrition risk in particular New Zealand populations, a direct measure of physical adiposity such as waist circumference measures or BMI for age could have been useful.

Chapter 8: Conclusion

A well-designed food assistance programme for low decile schools has the potential to beneficially impact the dietary intake of children. FTN provided additive food and nutrition to the standard diets of students at Manurewa South School, where more energy and macronutrients were consumed by students during FTN week, including more dietary fibre. The energy density of FTN meals should be moderated, in particular the saturated fat content. At a minimum, official guidelines and more rigorous monitoring systems should be developed to assist charity driven independent food assistance programmes, such as FTN, in ensuring appropriate nutritional content of meals served.

Future research should investigate the impact of in-school food assistance programmes on the dietary behaviours of children in the home environment. Furthermore, a more rigorous investigation into the impact of such programmes on nutrient intakes during the entirety of the day is required.

Attendance and classroom behaviour remained unaffected in this short term study. Future longitudinal studies are required to determine the effects of FTN, and other food assistance programmes, on health and attendance rates in school.

References

Adolescent Health Research Group. (2008). Youth'07: The health and wellbeing of secondary school students in New Zealand. *Initial Findings. Auckland: The University of Auckland*.

Alaimo, K., Olson, C. M., & Frongillo, E. A. (2001). Food insufficiency and American school-aged children's cognitive, academic, and psychosocial development. *Pediatrics, 108*(1), 44-53.

Altman, M., Holland, J. C., Lundeen, D., Kolko, R. P., Stein, R. I., Saelens, B. E., . . . Epstein, L. H. (2015). Reduction in food away from home Is associated with improved child relative weight and body composition outcomes and this relation Is mediated by changes in diet quality. *Journal of the Academy of Nutrition and Dietetics, 115*(9), 1400-1407.

Anderson, J. (2009). Interventions on diet and physical activity: what works: World Health Organisation.

Anzman-Frasca, S., Djang, H. C., Halmo, M. M., Dolan, P. R., & Economos, C. D. (2015). Estimating impacts of a breakfast in the classroom program on school outcomes. *Journal of the American Medical Association Pediatrics, 169*(1), 71-77.

Anzman, S. L., Rollins, B. Y., & Birch, L. L. (2010). Parental influence on children's early eating environments and obesity risk: implications for prevention. *International Journal of Obesity, 34*(7), 1116-1124.

Arambepola, C., Scarborough, P., Boxer, A., & Rayner, M. (2009). Defining 'low in fat'and 'high in fat'when applied to a food. *Public Health Nutrition, 12*(03), 341-350.

Ashfield-Watt, P. A., Stewart, E. A., & Scheffer, J. A. (2009). A pilot study of the effect of providing daily free fruit to primary-school children in Auckland, New Zealand. *Public Health Nutrition, 12*(05), 693-701.

Barlow, S. (2007). Expert committee recommendations regarding the prevention, assessment, and treatment of child and adolescent overweight and obesity: Summary report. *Pediatrics, 120*(4).

Baxter, S., Hardin, J., Royer, J., Guinn, C., & Smith, A. (2008). Children's recalls from five dietary-reporting validation studies. Intrusions in correctly reported and misreported options in school breakfast reports. *Appetite, 51*(3), 489-500.

Baxter, S., Hitchcock, D., Guinn, C., Vaadi, K., Puryear, M., Royer, J., . . . Wilson, D. (2014). A validation study concerning the effects of interview content, retention interval, and grade on children's recall accuracy for dietary intake and/or physical activity. *Journal of the Academy of Nutrition and Dietetics, 114*(12), 1902-1914.

Bell, A., & Swinburn, B. (2004). What are the key food groups to target for preventing obesity and improving nutrition in schools? *European Journal of Clinical Nutrition, 58*(2), 258-263.

Belot, M., & James, J. (2011). Healthy school meals and educational outcomes. *Journal of Health Economics, 30*(3), 489-504.

Bere, E., te Velde, S. J., Småstuen, M. C., Twisk, J., & Klepp, K.-I. (2015). One year of free school fruit in Norway–7 years of follow-up. *International Journal of Behavioral Nutrition and Physical Activity, 12*(1), 1.

Blanchette, L., & Brug, J. (2005). Determinants of fruit and vegetable consumption among 6–12-year-old children and effective interventions to increase consumption. *Journal of Human Nutrition and Dietetics, 18*(6), 431-443.

Block, J. P., Scribner, R. A., & DeSalvo, K. B. (2004). Fast food, race/ethnicity, and income: a geographic analysis. *American Journal of Preventive Medicine, 27*(3), 211-217.

Boyd, S., Dingle, R., Campbell, R., King, J., & Corter, A. (2007). Taking a bite of the apple: The implementation of Fruit in Schools. *Wellington: New Zealand Council for Educational Research*.

Boyer, B. P., Nelson, J. A., & Holub, S. C. (2015). Childhood body mass Index trajectories predicting cardiovascular risk in adolescence. *Journal of Adolescent Health, 56*(6), 599-605.

Briefel, R. R., Wilson, A., & Gleason, P. M. (2009). Consumption of low-nutrient, energy-dense foods and beverages at school, home, and other locations among school lunch participants and nonparticipants. *Journal of the American Dietetic Association, 109*(2), S79-S90.

Brug, J., & Klepp, K. (2007). Children and adolescents. In M. Lawrence & T. Worsley (Eds.), *Public Health Nutrition: From Principles to Practice*. Australia and New Zealand: Allen and Unwin Pty Ltd.

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

Children's Commissioner. (2013). A framework for food in schools programmes in New Zealand. from http://www.occ.org.nz/assets/Uploads/Reports/Poverty/A-framework-for-food-in-schools.pdf

Cole, N., & Fox, M. (2008). Diet quality of American school-age children by school lunch participation status:

Data from the national health and nutrition examination survey, 1999-2004 United States Department of Agriculture.

Correa-Burrows, P., Burrows, R., Blanco, E., Reyes, M., & Gahagan, S. (2016). Nutritional quality of diet and academic performance in Chilean students. *Bulletin of the World Health Organization, 94*(3), 185-192.

Demir, K., & Karabeyoglu, Y. (2016). Factors Associated with Absenteeism in High Schools. *Eurasian Journal of Educational Research*(62).

Ecker, M. (2012). *The BackPack Food Program's effects on self-reported hunger and on-task behavior.* (Master of Arts), Minnesota State University, Mankato, America.

Evans, A., Ranjit, N., Rutledge, R., Medina, J., Jennings, R., Smiley, A., . . . Hoelscher, D. (2012). Exposure to multiple components of a garden-based intervention for middle school students increases fruit and vegetable consumption. *Health Promotion Practice, 13*(5), 608-616.

Farrant, B., Utter, J., Ameratunga, S., Clark, T., Fleming, T., & Denny, S. (2013). Prevalence of severe obesity among New Zealand adolescents and associations with health risk behaviors and emotional well-being. *The Journal of Pediatrics, 163*(1), 143-149.

Feed the Need. (2014). How it all started. from http://www.feedtheneed.co.nz/index.php/about-us/how-it-all-started/

Feinstein, L., Sabates, R., Sorhaindo, A., Rogers, I., Herrick, D., Northstone, K., & Emmett, P. (2008). Dietary patterns related to attainment in school: the importance of early eating patterns. *Journal of Epidemiology and Community Health, 62*(8), 734-739.

Ferraro, K. F., Schafer, M. H., & Wilkinson, L. R. (2015). Childhood Disadvantage and Health Problems in Middle and Later Life Early Imprints on Physical Health? *American Sociological Review*, 0003122415619617.

Foodbank Australia. (2015). How we work. from http://www.foodbank.org.au/about-us/how-we-work/

Foote, J. A., Murphy, S. P., Wilkens, L. R., Basiotis, P. P., & Carlson, A. (2004). Dietary variety increases the probability of nutrient adequacy among adults. *The Journal of Nutrition, 134*(7), 1779-1785.

Forrestal, S. G. (2011). Energy intake misreporting among children and adolescents: a literature review. *Maternal & Child Nutrition, 7*(2), 112-127.

Fu, M., Exeter, D. J., & Anderson, A. (2015). The politics of relative deprivation: A transdisciplinary social justice perspective. *Social Science & Medicine, 133*, 223-232.

Galea, L. (n.d.). Eat Up. from http://www.eatup.org.au/

Gillis, L. J., & Bar-Or, O. (2003). Food away from home, sugar-sweetened drink consumption and juvenile obesity. *Journal of the American College of Nutrition, 22*(6), 539-545.
Gleason, P., & Suitor, C. (2001). Children's diets in the mid-1990s: dietary intake and its relationship with school meal participation. USA: Mathematica Policy Research.
Gordon, A., Crepinsek, M. K., & Condon, E. (2007a). School Nutrition Dietary Assessment Study III, Volume I: School Food Service, School Food Environment, and Meals Offered and Served: Mathematica Policy Research.
Gordon, A., Crepinsek, M. K., & Condon, E. (2007b). School Nutrition Dietary Assessment Study III, Volume II: School Food Service, School Food Environment, and Meals Offered and Served: Mathematica Policy Research.
Gordon, L. (2015). 'Rich'and 'poor'schools revisited. *New Zealand Journal of Educational Studies, 50*(1), 7-21.
Gottfried, M. A. (2009). Excused versus unexcused: How student absences in elementary school affect academic achievement. *Educational Evaluation and Policy Analysis, 31*(4), 392-415.
Gow, M. L., Ho, M., Burrows, T. L., Baur, L. A., Stewart, L., Hutchesson, M. J., . . . Garnett, S. P. (2014). Impact of dietary macronutrient distribution on BMI and cardiometabolic outcomes in overweight and obese children and adolescents: a systematic review. *Nutrition Reviews, 72*(7), 453-470.
Grandjean, A. (2012). Dietary intake data collection: challenges and limitations. *Nutrition Reviews, 70*(suppl 2), S101-S104.
Hearn, M. D., Baranowski, T., Baranowski, J., Doyle, C., Smith, M., Lin, L. S., & Resnicow, K. (1998). Environmental influences on dietary behavior among children: availability and accessibility of fruits and vegetables enable consumption. *Journal of Health Education, 29*(1), 26-32.
Hewitt, A. M., & Stephens, C. (2007). Healthy eating among 10–13-year-old New Zealand children: Understanding choice using the Theory of Planned Behaviour and the role of parental influence. *Psychology, Health and Medicine, 12*(5), 526-535.
Hohepa, M., Schofield, G., & Kolt, G. (2004). Adolescent obesity and physical inactivity. *The New Zealand Medical Journal, 117*(1207).
Hopgood, T., Asher, I., Wall, C. R., Grant, C. C., Stewart, J., Muimuiheata, S., & Exeter, D. (2010). Crunching the numbers: The affordability of nutritious food for New Zealand children. *Nutrition & Dietetics, 67*(4), 251-257.
Howard, L. L., & Prakash, N. (2012). Do school lunch subsidies change the dietary patterns of children from low-income households? *Contemporary Economic Policy, 30*(3), 362-381.
Institute of Medicine. (2000). Dietary Reference Intakes: Applications in Dietary Assessment. Washington, DC: National Academy Press.
Institute of Medicine. (2005). *Dietary reference intakes for energy, carbohydrate, fiber, fat, fatty acids, cholesterol, protein and amino acids.* USA: National Academies Press.
Ishdorj, A., Crepinsek, M. K., & Jensen, H. H. (2013). Children's consumption of fruits and vegetables: Do school environment and policies affect choices at school and away from school? *Applied Economic Perspectives and Policy, 35*(2), 341-359.
Katz, D., O'connell, M., Njike, V., Yeh, M., & Nawaz, H. (2008). Strategies for the prevention and control of obesity in the school setting: systematic review and meta-analysis. *International Journal of Obesity, 32*(12), 1780-1789.
Kuczmarski, R. J., Ogden, C. L., Grummer-Strawn, L. M., Flegal, K. M., Guo, S. S., Wei, R., . . . Johnson, C. L. (2000). CDC growth charts: United States. *Advance Data*(314), 1-27.
Kulkarni, A., Swinburn, B., & Utter, J. (2015). Associations between diet quality and mental health in socially disadvantaged New Zealand adolescents. *European Journal of Clinical Nutrition, 69*(1), 79-83.

Lake, A. A., Mathers, J. C., Rugg-Gunn, A. J., & Adamson, A. J. (2006). Longitudinal change in food habits between adolescence (11–12 years) and adulthood (32–33 years): the ASH30 Study. *Journal of Public Health, 28*(1), 10-16.

Law, M. (2000). Dietary fat and adult diseases and the implications for childhood nutrition: an epidemiologic approach. *The American Journal of Clinical Nutrition, 72*(5), 1291s-1296s.

Lülfs-Baden, F., & Spiller, A. (2009). Students' perceptions of school meals: a challenge for schools, school-meal providers, and policymakers. *Journal of Foodservice, 20*(1), 31-46.

MacLellan, D., Taylor, J., & Wood, K. (2008). Food intake and academic performance among adolescents. *Canadian Journal of Dietetic Practice and Research, 69*(3), 141-144.

Maddison, R. (2010). *A national survey of children and young people's physical activity and dietary behaviours in New Zealand. [electronic resource] : 2008/09 key findings*: Auckland, N.Z. : Clinical Trials Research Unit, University of Auckland : Synovate, [2010].

Mandela, N. (2005). Mandela's Poverty Speech. from http://news.bbc.co.uk/2/hi/uk_news/politics/4232603.stm

Mann, J., & Truswell, S. (2012). *Essentials of human nutrition*: Oxford University Press.

Marett, A. (2014). Health Indicators of Child Poverty in New Zealand. Wellington, New Zealand: Parliamentary Library.

McLaughlin, J. E., Bernstein, L. S., Crepinsek, M. K., Daft, L. M., Murphy, J. M., Food Nutrition Service, A. V. A., & Office of Analysis Evaluation. (2002). Evaluation of the School Breakfast Program Pilot Project: Findings from the First Year of Implementation. Nutrition Assistance Program Report Series.

McPherson, R., Hoelscher, D., Alexander, M., Scanlon, K., & Serdula, M. (2000). Dietary assessment methods among school-aged children: validity and reliability. *Preventive Medicine, 31*(2), S11-S33.

Merchant, A. T., Vatanparast, H., Barlas, S., Dehghan, M., Shah, S. M. A., De Koning, L., & Steck, S. E. (2009). Carbohydrate intake and overweight and obesity among healthy adults. *Journal of the American Dietetic Association, 109*(7), 1165-1172.

Mhurchu, C. N., Turley, M., Gorton, D., Jiang, Y., Michie, J., Maddison, R., & Hattie, J. (2010). Effects of a free school breakfast programme on school attendance, achievement, psychosocial function, and nutrition: a stepped wedge cluster randomised trial. *BioMed Central Public Health, 10*(1), 738.

Miller, L. S., & Gramzow, R. H. (2016). A self-determination theory and motivational interviewing intervention to decrease racial/ethnic disparities in physical activity: rationale and design. *BioMed Cetral Public Health, 16*(1), 768.

Miller, W. C., Lindeman, A. K., Wallace, J., & Niederpruem, M. (1990). Diet composition, energy intake, and exercise in relation to body fat in men and women. *The American Journal Of Clinical Nutrition, 52*(3), 426-430.

Ministry of Education. (2015). Attendance in New Zealand Schools. Wellington, New Zealand: Ministry of Education.

Ministry of Education. (2016). School deciles. from http://www.education.govt.nz/school/running-a-school/resourcing/operational-funding/school-decile-ratings/

Ministry of Education. (n.d.). What is involved?. from http://pb4l.tki.org.nz/PB4L-School-Wide/What-is-involved

Ministry of Health. (2008). A Portrait of Health: Key Results of the 2006/07 New Zealand Health Survey. Wellington: Ministry of Health.

Ministry of Health. (2012a). Food and Nutrition Guidelines for Healthy Children and Young People (Aged 2 - 18 Years): A background paper. Wellington: Ministry of Health.

Ministry of Health. (2012b). The Health of New Zealand Children 2011/12: Key findings of the New Zealand Health Survey. Wellington: Minstry of Health.

Moeke-Pickering, T. (2015). Understanding Māori food security and food sovereignty issues in Whakatāne. *MAI Journal, 4*(1).

Moore, G. F., Murphy, S., Chaplin, K., Lyons, R. A., Atkinson, M., & Moore, L. (2014). Impacts of the Primary School Free Breakfast Initiative on socio-economic inequalities in breakfast consumption among 9–11-year-old schoolchildren in Wales. *Public Health Nutrition, 17*(06), 1280-1289.

Morland, K., Wing, S., & Roux, A. D. (2002). The contextual effect of the local food environment on residents' diets: the atherosclerosis risk in communities study. *American Journal of Public Health, 92*(11), 1761-1768.

Morrissey, T. W., Hutchison, L., & Winsler, A. (2014). Family income, school attendance, and academic achievement in elementary school. *Developmental Psychology, 50*(3), 741.

Murphy, & Poos. (2002). Dietary reference intakes: summary of applications in dietary assessment. *Public Health Nutrition, 5*(6a), 843-849.

Muscott, H. S., Mann, E. L., & LeBrun, M. R. (2008). Positive behavioral interventions and supports in new hampshire effects of large-scale implementation of schoolwide positive behavior support on student discipline and academic achievement. *Journal Of Positive Behavior Interventions, 10*(3), 190-205.

National Health and Medical Research Council. (2006). *Nutrient reference values for Australia and New Zealand: Including recommended dietary intakes*: Commonwealth of Australia.

New Zealand Parliament. (2009). Schools - Healthy Food National Administration Guidelines. from https://www.parliament.nz/en/document/49HansQ_20090217_00000012

New Zealand Parliament. (2014). Education (Breakfast and Lunch Programmes in Schools) Amendment Bill — First Reading. from https://www.parliament.nz/en/pb/hansard-debates/rhr/document/50HansD_20140528_00000044/education-breakfast-and-lunch-programmes-in-schools-amendment

New Zealand Research Bureau. (2008). 2007 New Zealand Children's Food and Drinks Survey. Auckland: National Research Bureau.

Ning, Y., Yang, S., Evans, R. K., Stern, M., Sun, S., Francis, G. L., & Wickham III, E. P. (2014). Changes in body anthropometry and composition in obese adolescents in a lifestyle intervention program. *European Journal Of Nutrition, 53*(4), 1093-1102.

Nyaradi, A., Li, J., Hickling, S., Whitehouse, A. J., Foster, J. K., & Oddy, W. H. (2013). Diet in the early years of life influences cognitive outcomes at 10 years: A prospective cohort study. *Acta Paediatrica, 102*(12), 1165-1173.

Ohly, H., Pealing, J., Hayter, A. K., Pettinger, C., Pikhart, H., Watt, R. G., & Rees, G. (2013). Parental food involvement predicts parent and child intakes of fruits and vegetables. *Appetite, 69*, 8-14.

Oliveros, E., Somers, V. K., Sochor, O., Goel, K., & Lopez-Jimenez, F. (2014). The concept of normal weight obesity. *Progress In Cardiovascular Diseases, 56*(4), 426-433.

Osei-Assibey, G., Dick, S., Macdiarmid, J., Semple, S., Reilly, J. J., Ellaway, A., . . . McNeill, G. (2012). The influence of the food environment on overweight and obesity in young children: a systematic review. *BMJ Open, 2*(6), 1-12.

Øverby, N. C., Lüdemann, E., & Høigaard, R. (2013). Self-reported learning difficulties and dietary intake in Norwegian adolescents. *Scandinavian Journal Of Public Health, 41*(7), 754-760.

Parliamentary Counsel Office. (2015). Education (Breakfast and Lunch Programmes in Schools) Amendment Bill. from http://www.legislation.govt.nz/bill/member/2012/0085/latest/whole.html

Parnell, Reid, J., Wilson, N. C., McKenzie, J., & Russell, D. G. (2001). Food security: is New Zealand a land of plenty? *The New Zealand Medical Journal, 114*(1128), 141-145.

Parnell, W., Scragg, R., Wilson, N., Schaaf, D., & Fitzgerald, E. (2003). NZ food NZ children. *Key Results of the 2002 National Children's Nutrition Survey*.

Patrick, H., & Nicklas, T. A. (2005). A review of family and social determinants of children's eating patterns and diet quality. *Journal of the American College of Nutrition, 24*(2), 83-92.

Pearce, J., Blakely, T., Witten, K., & Bartie, P. (2007). Neighborhood deprivation and access to fast-food retailing: a national study. *American Journal Of Preventive Medicine, 32*(5), 375-382.

Pearson, A. L., Bentham, G., Day, P., & Kingham, S. (2014). Associations between neighbourhood environmental characteristics and obesity and related behaviours among adult New Zealanders. *BioMed Central Public Health, 14*(1), 1.

Peer, N., & Ganie, Y. N. (2016). A weighty matter: Identification and management of overweight and obesity in adolescents overweight and obesity. *South African Medical Journal, 106*(7), 662-665.

Perry, B. (2010). Household incomes in New Zealand: trends in indicators of inequality and hardship 1982 to 2009. Wellington: Ministry of Social Development.

Potvin, L., & Jones, C. M. (2011). Twenty-five years after the Ottawa Charter: the critical role of health promotion for public health. *Canadian Journal of Public Health/Revue Canadienne de Sante'e Publique*, 244-248.

Preedy, V., Hunter, L., & Patel, V. (Ed.). (2013). *Diet quality: An evidence-based approach* (Vol. 2). New York, USA: Humana Press.

Puhl, R. M., & Latner, J. D. (2007). Stigma, obesity, and the health of the nation's children. *Psychological Bulletin, 133*(4), 557.

Qi, Y., & Niu, J. (2015). Does Childhood Nutrition Predict Health Outcomes during Adulthood? Evidence from a Population-Based Study in China. *Journal Of Biosocial Science, 47*(05), 650-666.

Raine, K., McIntyre, L., & Dayle, J. (2003). The failure of charitable school-and community-based nutrition programmes to feed hungry children. *Critical Public Health, 13*(2), 155-169.

Rajput, N., Tuohy, P., Mishra, S., Smith, A., & Taylor, B. (2015). Overweight and obesity in 4–5-year-old children in New Zealand: Results from the first 4 years (2009–2012) of the B4School Check programme. *Journal Of Paediatrics And Child Health, 51*(3), 334-343.

Reedy, J., & Krebs-Smith, S. M. (2010). Dietary sources of energy, solid fats, and added sugars among children and adolescents in the United States. *Journal of the American Dietetic Association, 110*(10), 1477-1484.

Regan, A., Parnell, W., Gray, A., & Wilson, N. (2008). New Zealand children's dietary intakes during school hours. *Nutrition & Dietetics, 65*(3), 205-210.

Reidpath, D. D., Burns, C., Garrard, J., Mahoney, M., & Townsend, M. (2002). An ecological study of the relationship between social and environmental determinants of obesity. *Health & Place, 8*(2), 141-145.

Reilly, J. J., & Kelly, J. (2011). Long-term impact of overweight and obesity in childhood and adolescence on morbidity and premature mortality in adulthood: systematic review. *International Journal of Obesity, 35*(7), 891-898.

Reilly, J. J., Methven, E., McDowell, Z. C., Hacking, B., Alexander, D., Stewart, L., & Kelnar, C. J. (2003). Health consequences of obesity. *Archives Of Disease In Childhood, 88*(9), 748-752.

Rodgers, Y. V., & Milewska, M. (2007). Food assistance through the school system: Evaluation of the Food for Kids backpack program. *Journal of Children and Poverty, 13*(1), 75-95.

Scaglioni, S., Salvioni, M., & Galimberti, C. (2008). Influence of parental attitudes in the development of children eating behaviour. *British Journal of Nutrition, 99*(S1), S22-S25.

Sharkey, J. R., Dean, W. R., & Nalty, C. C. (2013). Child hunger and the protective effects of supplemental nutrition assistance program (SNAP) and alternative food sources among Mexican-origin families in Texas border colonias. *BioMed Central Pediatrics, 13*(1), 1.

Sharman, S. J., Skouteris, H., Powell, M. B., & Watson, B. (2016). Factors related to the accuracy of self-reported dietary intake of children aged 6 to 12 years elicited with interviews: A systematic review. *Journal of the Academy of Nutrition and Dietetics, 116*(1), 76-114.

Sharpe, H., & Bradbury, S. (2015). Understanding excess body weight: New Zealand Health Survey. In Statistics New Zealand and Ministry of Pacific Island Affairs (Ed.). Wellington, New Zealand: Statistics New Zealand and Ministry of Pacific Island Affairs.

Sigfúsdóttir, I. D., Kristjánsson, A. L., & Allegrante, J. P. (2007). Health behaviour and academic achievement in Icelandic school children. *Health Education Research, 22*(1), 70-80.

Simpson, J., Duncanson, M., Oben, G., Wicken, A., & Pierson, M. (2015). Child Poverty Monitor 2015 Technical Report. Dunedin: New Zealand Child and Youth Epidemiology Service, University of Otago.

Sluyter, J. D., Schaaf, D., Metcalf, P. A., & Scragg, R. K. (2010). Dietary intakes of Pacific, Māori, Asian and European adolescents: The Auckland high school heart survey. *Australian and New Zealand Journal Of Public Health, 34*(1), 32-37.

Stallings, V. A., & Yaktine, A. L. (2007). *Nutrition standards for foods in schools: leading the way toward healthier youth*: USA: National Academies Press.

Statistics New Zealand. (2004). Household economic survey: Year ended 30 June 2004.

Statistics New Zealand. (2015). Household economic survey (income): Year ended June 2015.

Statistics New Zealand and Ministry of Pacific Island Affairs. (2011). *Health and Pacific peoples in New Zealand*. Wellington, New Zealand: Statistics New Zealand and Ministry of Pacific Island Affairs.

Stephens, K., & Summar, S. (2008). Dietary interventions for the treatment of obese children and adolescents. *Progress in Pediatric cardiology, 25*(2), 137-141.

Stephenson, J., Linfoot, K., & Martin, A. (2000). Behaviours of concern to teachers in the early years of school. *International Journal of Disability, Development and Education, 47*(3), 225-235.

Stevens, L., & Nelson, M. (2011). The contribution of school meals and packed lunch to food consumption and nutrient intakes in UK primary school children from a low income population. *Journal of Human Nutrition and Dietetics, 24*(3), 223-232.

Story, M. (1999). School-based approaches for preventing and treating obesity. *International Journal of Obesity, 23*, S43-S51.

Story, M., Neumark-Sztainer, D., & French, S. (2002). Individual and environmental influences on adolescent eating behaviors. *Journal of the American Dietetic Association, 102*(3), S40-S51.

Sutter, C., Nishina, A., Scherr, R. E., Zidenberg-Cherr, S., & Ontai, L. L. (2015). Sharing, trading, stealing exploring the role of peers in shaping foods available at lunchtime. *The Journal of Early Adolescence, 36*(4), 449-464.

Sweeney, N. M., Tucker, J., Reynosa, B., & Glaser, D. (2006). Reducing hunger-associated symptoms: The midmorning nutrition break. *The Journal of School Nursing, 22*(1), 32-39.

Tanumihardjo, S. A., Anderson, C., Kaufer-Horwitz, M., Bode, L., Emenaker, N. J., Haqq, A. M., . . . Stadler, D. D. (2007). Poverty, obesity, and malnutrition: an international perspective recognizing the paradox. *Journal of the American Dietetic Association, 107*(11), 1966-1972.

Tasmanian Food Secuirty Council. (2012). Food for all Tasmanians: A food security strategy. from http://www.dpac.tas.gov.au/__data/assets/pdf_file/0005/159476/Food_for_all_Tasmanians_-_A_food_Security_Strategy.PDF

The Scottish Government. (2016). Free school lunches. from http://www.gov.scot/Topics/Education/Schools/HLivi/schoolmeals/FreeSchoolMeals

Theodore, R. F., Thompson, J. M., Waldie, K. E., Wall, C., Becroft, D. M., Robinson, E., . . . Mitchell, E. A. (2009). Dietary patterns and intelligence in early and middle childhood. *Intelligence, 37*(5), 506-513.

Thompson, F. E., & Subar, A. F. (2008). Dietary assessment methodology. *Nutrition in the Prevention and Treatment of Disease, 2*, 3-39.

Toi Tangata. (n.d.). Kai Māori, Kai Ora Wai Māori, Ngai Māori from http://toitangata.co.nz/uploads/files/Kai_Maori_Wai_Maori_messages.pdf

United Kingdom Department for Education. (2014). Universal infant free school meals. from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/408015/Archived-Universal_infant_free_school_meals_departmental_advice_30092014.pdf

United Kingdom Government. (2015). Apply for free school meals. from https://www.gov.uk/apply-free-school-meals

United States Department of Agriculture. (2013). The School Breakfast Program. from http://www.fns.usda.gov/sites/default/files/sbp/SBPfactsheet.pdf

United States Department of Agriculture. (2014). Special Milk Program (SMP). from http://www.fns.usda.gov/smp/special-milk-program

United States Department of Agriculture. (n.d.). How to participate in Summer Meals. from http://www.fns.usda.gov/sites/default/files/sfsp/SFSP-Fact-Sheet.pdf

Utter, J., Scragg, R., Percival, T., & Beaglehole, R. (2009). School is back in New Zealand—and so is the junk food. *New Zealand Medical Journal, 122*(1290), 5-8.

Vitaro, F., Barker, E. D., Brendgen, M., & Tremblay, R. E. (2012). Pathways explaining the reduction of adult criminal behaviour by a randomized preventive intervention for disruptive kindergarten children. *Journal Of Child Psychology And Psychiatry, 53*(7), 748-756.

Voyle, J., & Simmons, D. (1999). Community development through partnership: promoting health in an urban indigenous community in New Zealand. *Social Science & Medicine, 49*(8), 1035-1050.

Walker, H. M., & Lamon, W. E. (1987). Social behavior standards and expectations of Australian and US teacher groups. *The Journal of Special Education, 21*(3), 56-82.

Walton, J., Hannon, E., & Flynn, A. (2015). Nutritional quality of the school-day diet in Irish children (5–12 years). *Journal of Human Nutrition and Dietetics, 28*(s1), 73-82.

Watts, A. W., Lovato, C. Y., Barr, S. I., Hanning, R. M., & Mâsse, L. C. (2015). A qualitative study exploring how school and community environments shape the food choices of adolescents with overweight/obesity. *Appetite, 95*, 360-367.

Webster-Stratton, C., Jamila Reid, M., & Stoolmiller, M. (2008). Preventing conduct problems and improving school readiness: evaluation of the incredible years teacher and child training programs in high-risk schools. *Journal Of Child Psychology And Psychiatry, 49*(5), 471-488.

Whitney, E., & Rolfes, S. (Eds.). (2002). *Life cycle nutrition: Infancy, childhood and adolescence* (Vol. 9). California, America: Wadsworth/Thomson Learning.

Widenhorn-Müller, K., Hille, K., Klenk, J., & Weiland, U. (2008). Influence of having breakfast on cognitive performance and mood in 13-to 20-year-old high school students: results of a crossover trial. *Pediatrics, 122*(2), 279-284.

World Health Organization. (2016). Global Strategy on Diet, Physical Activity and Health. What are the Causes? , from http://www.who.int/dietphysicalactivity/childhood_why/en/

Wynd, D. (2011). *Hunger for Learning: Nutritional Barriers to Children's Education:* Child Poverty Action Group.

Yoong, S. L., Nathan, N. K., Wyse, R. J., Preece, S. J., Williams, C. M., Sutherland, R. L., . . . Wolfenden, L. (2015). Assessment of the School Nutrition Environment: A Study in Australian Primary School Canteens. *American Journal Of Preventive Medicine, 49*(2), 215-222.

Zhang, M. (2003). Links between school absenteeism and child poverty. *Pastoral Care in Education, 21*(1), 10-17.

Appendices

Appendix A: Diet Record Questionnaire

Name:

Age:

Gender:

Year (circle): 5 or 6

Ethnicity (circle): New Zealand European / Maori / Pacific Island / Asian / Other:_____

Please fill out with as much detail as you can! Remember to include <u>anything</u> you drink throughout the day as well.

Time	**What did you eat?**	**Amount eaten** ***For example:*** ***1 small red apple*** ***2 slices of white bread*** ***1 trim milk box (250mL)*** ***1 subway with ham*** ***1 sandwich with 1 slice of ham and 1 slice of cheese***	**Brand** ***For example:*** ***Meadowlea Edam Cheese*** ***Tip Top Bread***	**Where did it come from?** **For example:** **-Home** **-Dairy** **-School** **(please specify e.g. Kidscan, Feed the Need etc.)-Other (please specify)**
Morning Tea	**Did you have breakfast at school?** **What did you have?**			

Time	What did you eat?	Amount eaten *For example:* *1 small red apple* *2 slices of white bread* *1 trim milk box (250mL)* *1 subway with ham* *1 sandwich with 1 slice of ham and 1 slice of cheese*	Brand *For example:* *Meadowlea Edam Cheese* *Tip Top Bread*	Where did it come from? For example: -Home -Dairy -School (please specify e.g. Kidscan, Feed the Need etc.) -Other (please specify)
Lunch				

Appendix B: Substitutions and Assumptions in FoodWorks Data Entry

Substitutions:

Food Item	Closest Match on FoodWorks	Quantity
Feed the Need Bread Rolls	Bread Rolls, white, pre-packaged	½ long roll = 1 bun
Wholemeal Buns	Bread Rolls, wholemeal, pre-packaged	½ long roll = 1 bun
Milk in Schools	Milk, Lite, 1.5% Fat	1 carton = 125mL
Potato Chips	Potato Crisps, flavoured	Snack pack = 20g Medium pack = 40g Large pack = 150g
Unspecified Bread	Bread, white, sliced, prepacked	
Burger Rings/Twisties, Poppa Jacks, Bongo	Corn snacks, cheese flavour	
Pottle of Yoghurt	Yoghurt, asst fruits&flavours, sweetened	
Muffin	Muffin, blueberry	
Oreo/cream filled biscuits	Biscuit, chocolate cream	
Chocolate wheelies		30g per snack pack
Oaty Slice snack bar Oat slice	Oatcake Biscuit	1 bar = 40g
"Salad"	Salad, veg, w/ salad cream dressing, canned	1 portion = 1 cup
Cracker packet	Rice cracker, plain, composite	1 small pack = 20g
Assorted iced biscuit snack pack	Hundreds and Thousands Iced Biscuits	1 small pack = 2 standard biscuits
Cookie Bear Cookies	Biscuit, basic, British recipe, baked	3 small biscuits = 1 standard biscuit
Homemade brownie	Standard Chocolate Cake	1 piece = 35g
Microwave convenience pizza	Pizza, Frozen, Individual Size, Hawaiian bkd	1 pizza
Doritos	Corn chips, cheese flavour	
Chicken flavoured rice crackers	BBQ Flavoured Rice Crackers	
Other chocolate baked goods	Standard chocolate cake w/ buttercream icing	1 slice = 20g
Chocolate fudge bar	Chocolate fudge biscuits	1 bar = 2 biscuits
"Chilli Peas"	Chickpeas, dried	Snack pack = 20g
Instant Noodles Unspecified	Soup, chicken-noodle, instant dry mix, Cup-a-Soup Lots-a-Noodles, Continental	1 cup = 1 pack
Raspberry fruit drink Strawberry juice	Grape Juice	125mL
Lolly string Fruit strings	Fruit jellies	
Peanut bar Peanut chocolate coated bar	Chocolate Bar w/ Peanuts	
Mango juice Orange juice Cordial (mango & orange) Just Juice	Juice, orange & mango, Just Juice	
Coconut chocolate cookies Vanilla cookie Chocolate peanut biscuits	Biscuit, cookie, chocolate chip	
Fruit sticks	Cereal soft bar, fruit filled	
Chocolate yoghurt	Yoghurt, assorted fruits & flavours, sweetened	
Brownie	Cookie, peanut brownie	
Luncheon	Sausage, chicken luncheon	0.25cup, shaved

MilkyBar – coco and vanilla	Chocolate, Nestle milky bar	
Round pizza from bakery	Pizza, barbeque chicken, large, baked, thick crust	1 slice
Fruit lollies	Hard candy, Chupa chups, assorted flavours	
Gummy watch	Fruit Jelly	
Fruit nuggets		20 nuggets = 1 pack of 17g
Barbeque Pizza - McCain	Pizza, barbeque chicken, large, baked, thick crust	1 slice
Sour cream & chives flavoured chips	Potato crisps, flavoured	
Ginger teddies	Biscuit, basic, NZ recipe	20g
Butter on Feed the Need bread rolls	Margarine, reduced fat	10g
Strawberry wafer biscuits	Biscuit, wafer, raspberry, cream filled	
Sour cream & chives crackers	Cracker, assorted flavours	
Biscuit – chocolate eclairs Chocolate biscuit	Biscuit, chocolate coated	
Cream doughnut Sugar doughnut	Doughnut, ring	
Vanilla muffin	Muffin, assorted flavours, toasted	
Fruit bar	Fruit Bar, strawberry	
Fruit O's	Fruitful Breakfast, Hubbards	1 serve = 1 cup
Subway bread	Bread Roll, white, pre-packaged	6 inch = 2 long rolls
M'n'M cookie	Cookies, Cookie Time, original	
Shaved roast beef	Beef, topside roast, lean, roasted	
Panda Chips	Potato Crisps, flavoured	Snack Pack = 20g
Strawberry yoghurt stick	Muesli bar, yoghurt coated, assorted	1 bar
Pizza bread loaf	Pizza, frozen, individual size, hawaiian baked	1 bread = 1 pizza
Nutrigrain muesli bar	Milo Snack Bar	1 bar = 55g
Caramel slice	Cake, gateaux	1 slice = 35g
Chocolate fudge bar	Chocolate Bar, milk	
Strawberry flakes	Fruit Jelly	3 flakes = 1 packet
Fruit o's	Fruit Jelly	
Tim Tam	Biscuit, chocolate coated	
Nut bar	Fruit & Nut Bar	
Fruit bun	Spiced Bun	
Steak and cheese pie Chicken pie	Pie, mince & cheese	Standard size = 170g
Yoghurt stick	Yoghurt, assorted fruits & flavours, sweetened	1 stick = 70g
Kiwifruit jam	Jam, berry fruit	
Sweet chilli crackers	Cracker, rice, BBQ flavours, baked	1 row = 10 crackers
Kit Kat chocolate	Chocolate Bar, milk	4 sticks = 1 large bar
Sour cream and chives chips	Potato Crisps, flavoured	
Apple juice	Juice, crisp apple, Fresh Up	
Ginger slice	Ginger cake	1 slice = 35g cake
Tomato and garlic flavoured pasta	Pasta, plain, boiled Sauce, pasta, chunky-vege, tomato based	1 small bowl = 1 cup cooked pasta and 0.25 cup sauce
Waffles	Pancake, plain	

Assumptions:

- **"bottle of juice"** assumed to be 350mL
- **"cheese sandwich"** is assumed to contain 30g of cheese
- **"large cookie"** = "Cookies, Cookie Time, original"
- "**sandwich**" is assumed to be two slices of bread unless otherwise specified
- **"some of FTN"** assumed to be a ½ serve
- **"strawberry biscuits"** are assumed to be **Shrewsberries**
- **"jelly cake"** is assumed to represent something similar to a trifle dessert
- **"normal"** pack of crisps is assumed to be a "medium size"
- **"nothing"** written on food record = No food consumed
- **Big Ben Pie** flavour unspecified = "**mince and cheese"** is assumed. Standard size is 170g
- **biscuit** = "biscuit, basic, NZ recipe"
- **Biscuit, Hundred & Thousands** quantity unspecified = 1 biscuit
- **Buja Mix** serve = 30g
- **Butter PCU** = butter salted, 10g
- **cake** unspecified = standard chocolate cake will be used at 60g per slice
- **carrot** = 0.25 cup in 1 sandwich
- **cheese chips unspecified** are assumed to be corn snacks
- **cheese slice** = 15g, where flavour/ brand unspecified = **"Cheese, Cheddar, tasty"**
- **chicken salad sandwich** or wrap assumed to contain ½ cup chicken breast and ½ vegetable salad
- **chocolate chip cookies/Biscuits, snack pack** = 2 regular chocolate chip cookies
- **chocolate pudding** = 113g
- **chocolate unspecified =** "Chocolate bar, milk"
- **Coke, medium** assumed to be 500ml
- **Cookies, unspecified** = "Biscuit, cookie, chocolate chip"
- **crackers,** flavour unspecified = **"Cracker,assorted flavours**", serve = 20g
- **cucumber slices** in a sandwich when unspecified assumed to be 5 slices
- **dried seaweed** 1 packet = 5g
- **egg** = 1 whole boiled in 1 sandwich
- **fizzy drink unspecified** is presumed to be a standard 330mL can of Coca Cola
- **french toast** = Bread, white, sliced, prepacked + 25g Egg, whole, scrambled /2 slices
- **fruit nuggets, sticks** and **jellies** are all recorded under **"fruit jellies"**. Each snack pack weighs approximately 17g
- **Fruitful Breakfast, Hubbards** standard serve size assumed to be 30g
- **hot drinks** unspecified = 10g + hot water and 50mL of milk
- **iced biscuits** = Hundred & Thousands iced biscuits
- **Jam** flavour unspecified **"Jam, berry fruit"** is used
- **juice box, small** = 125mL
- **juice flavour** if unspecified assumed to be Juice, grape 125ml carton
- **lettuce** = 0.25 cup in 1 sandwich or wrap
- l**ollies** unspecified are assumed to be a pack of fruit jellies

- **macaroni cheese** small serve = 150g
- **muffin** – where flavour is not specified **"Muffin, blueberry**" is used
- **peaches, canned** medium size is assumed to be 400g **"peaches, canned in juice"** is used
- **pizza flavour unspecified** = "Pizza, BBQ chicken, large, baked,thick crust"
- **Pringles** serve = small pack of 36g
- **raisins** = 30g box
- **Samosa** quantity unspecified = 50g. "Samosa, veg filled, deep fried, retai"
- sandwich **spreads & Dressings** = 1T
- **sausages** unspecified then **"Sausages, prepacked, dry fried, assorted meats & flavour"**, 2 sausages = 1 serve
- **shredded chicken** = "chicken, breast, deli-cooked, supermarket". Where quantity in sandwich unspecified, 0.5 cup/sandwich
- **snack bar** unspecified = 1 standard muesli is used
- **split stick** x 1 = ½ of an LCM bar
- **tomato** = 0.25 medium tomato in 1 sandwich or wrap
- **tuna** = Tuna,in spring water,canned,drained. 0.25 cup per slice of bread
- **Up&Go** x 1 assumed to be 350mL, large = 600mL
- **Weetbix** x 2 assumed with 0.25 cup milk
- where **potato chip flavour/brand** is unspecified, Potato Crisps, Flavoured are used
- **Yoghurt pottle** x 1 is assumed to weigh 125g
- **yoghurt tube** = 70g

Appendix C: Moderator Guides for Focus Groups

Moderator Guide – Student Focus Group

The aim of this session is to undertake a focus group with six student representatives, two from each of the three classrooms, to understand the students' perceived benefits of foods coming into the classroom

Overview

- 45 minutes will be used for informal discussion around foods provided at school: Milk, Fruit, Muesli Bars and Fruit Yogurt Pottles, Breakfast Club, and Subway lunches
  Children are invited to write these foods on different coloured paper with the aim of tightly focusing the discussion
  Children will be invited to express their ideas on paper if they wish, with the aim of understanding the students thoughts, feelings and beliefs regarding food provision and school programs
- It will be emphasised that this is an informal chat to gather perceptions; there are no right or wrong answers
- The session will be recorded as not to miss any 'important bits'. Confidentiality will be ensured – no names will be used in reporting

Guidelines

INTRODUCTION
Outline of the programmes offered, ***refer to list of foods generated by children***

Are you familiar with all of these foods coming into the classroom? What do you think about these different foods and programs?

QUESTIONS
1. What do you like about the foods coming into the classroom?

Probe - Thoughts, feelings, physical

2. What don't you like about the foods coming into the classroom?

3. Of the different foods coming into the classroom, which are your favorites?

Probe - Details about the different programs

4. What do you like about the soups and hot winter meals coming in?
Are there any other things that you like about it?

Probe - How it makes you feel, how it makes you act

5. What about anything you dislike about them?

6. What kind of foods would you like to see coming into the classroom?

Probe - hot/cold/healthy/unhealthy

7. How do you feel about foods coming into the classroom being packaged?

Probe - plastic wrappings, chippy packets, lots of rubbish

8. How do you feel about foods coming into the classroom being leftover?
What about if they are going to waste?

9. What could be the advantages of children in other schools having food in the classroom?

10. How might food in the classroom help other students?

Probe - From getting up in the morning, all the way to the end of the school day, where might extra food help?

Moderator Guide – Staff Focus Group

The aim of this session is to undertake a focus group with two teachers and the school receptionist in order to understand the perceived benefits of the food programmes at school.

Overview

- The session will focus on the school food programs offered at the school, over a timeframe of 45 minutes.
- It will be emphasised that this is an informal chat to gather thoughts, feelings and beliefs in relation to the food programmes and their perceived benefits.
- The session will be recorded, with permission, to ensure accuracy of information collected.
- Confidentiality will be ensured.

Guidelines

INTRODUCTION

Outline of school food programmes:

1. Feed the Need - hot meals that come to school on Mondays, Wednesdays and Fridays only during term 3 of school.
2. Milk in schools – provide cartons of milk on Tuesday and Thursday
3. Fruit in schools – provide fruits for the children everyday
4. Kidscan - provide muesli bars, fruit pottles and 2 trays of bread loaves per week
5. Breakfast Club

QUESTIONS

1. Refer to the food programmes (1-5) highlighted above
   Do these programmes in your view provide any benefits?

   Probes - Thoughts, feelings, opinion

   Which of these programmes would you say provides the most benefit for the children?

   Probes – Health, behaviour, thoughts, feelings

2. How does Feed the Need complement the other programmes?

   Probes – how does it fit in?

3. What do you like about it?

4. What do you dislike about it?

5. How could FTN do better?

6. How might the parents perceive benefits?

   Probes – Health, behaviour, thoughts, feelings

7. Which programmes might the parents perceive to be providing the greatest benefits?

8. What changes, if any, have you noticed in the classroom as a result of the programmes?

   Probes: Behaviour, attendance

9. How do you perceive the sustainability of these programmes? Feed the Need?

   Probes – Financial, advantages versus disadvantages

10. How do you perceive the sustainability of Feed the Need in other schools?

    Probes – Financial, advantages versus disadvantages

Appendix D: FTN Ingredients Lists

Pumpkin & Bacon soup

Ingredients *Makes 60 Serves (300g per serve)*

Onion,flesh,raw 1.5 kg
Carrot,raw 1 kg
Potato,flesh,raw 2 kg
Squash,Butternut,flesh,raw 4 kg
Pork,bacon,lean & fat,raw 500 g
Stock,meat 200 g
Water,tap 10 L
Milk,cow,powder,instant,skim 1.5 kg

Cowboy Casserole

Ingredients *Makes 100 Serves (282g per serve)*

Sausage,beef,uncooked 16 kg
Onion,flesh,raw 2 kg
Potato,flesh,raw 3 kg
Baked beans,canned in tomato sauce 4 kg
Tomato puree 3 kg
Oil,canola 0.175 L

Sloppy Joes

Ingredients *Makes 100 Serves (270g per serve)*

Beef,mince 12 kg
Baked beans,canned in tomato sauce 9 kg
Onion,flesh,raw 6 kg
Sauce,Worcestershire 125g
Sauce,tomato 125g

Appendix E: *A comparison of mean dietary intake of key nutrients between the FTN and the control weeks on corresponding days when FTN was served (i.e. Monday, Wednesday and Friday)*

Nutrient	Monday (FTN Week)	Monday (Control Week)	P-Value*	Wednesday (FTN Week)	Wednesday (Control Week)	P-Value*	Friday (FTN Week)	Friday (Control Week)	P-Value *
Energy(Kj)	3429± 2079	2451± 1748	***0.034***	3622± 1858	2153± 1154	***<0.001***	3770± 2724	1915± 1152	***0.007***
Carbohydrate(g)	115.0±69.5	79.6±62.7	***0.024***	92.9±43.4	72.3±42.9	***0.022***	103.8±70.1	55.8±29.5	***0.005***
(% energy)	*(56±8)*	*(55±10)*	0.632	*(45±14)*	*(54±13)*	***0.005***	*(48*±15*)*	*(52±14)*	0.319
Total Sugars (g)	48.3±35.3	41.4±46.7	0.435	42.0±38.0	35.0±25.6	0.250	45.0±39.2	21.7±15.7	***0.011***
Protein (g)	29.0±18.0	15.4±12.1	***<0.001***	28.2±20.3	11.9±8.4	***<0.001***	34.4±28.5	14.0±11.0	***0.006***
(% energy)	*(15±4)*	*(10±6)*	***<0.001***	*(12±4)*	*(10±5)*	***0.002***	*(14*±6*)*	*(12±7)*	0.358
Total Fat (g)	24.8±19.6	22.0±17.1	0.527	*42.3*±28.4	17.4±10.8	***<0.001***	39.3±36.5	19.8±16.3	***0.036***
(% energy)	*(26±9)*	*(32±11)*	***0.034***	*(41±11)*	*(31±13)*	***<0.001***	*(37*±11*)*	*(34±13)*	0.434
Saturated Fat(g)	11.4±8.9	10.5±9.0	0.680	19.5±12.8	7.8±5.1	***<0.001***	17.6±17.6	8.4±7.6	***0.043***
(% energy)	*(12±5)*	*(15±7)*	0.071	*(19±6)*	*(14±6)*	***<0.001***	*(17*±6*)*	*(14*±8*)*	0.201
Dietary Fibre (g)	9.6±4.6	6.2±3.7	***0.003***	10.7±5.0	5.4±3.0	***<0.001***	8.2±7.3	5.0±3.4	0.129

Values presented as mean±standard deviation

** Significant results determined using Paired T-Tests; a p-value < 0.05 was considered a significant result.*

Appendix F: *A comparison of mean dietary intake of key nutrients between the FTN week and the control weeks on corresponding days when FTN was not served (i.e. Tuesday and Thursday)*

Nutrient	Tuesday (FTN Week)	Tuesday (Control Week)	P-Value*	Thursday (FTN Week)	Thursday (Control Week)	P-Value*
Energy(Kj)	2246±1275	2389±1292	0.618	3225±1996	2843±1974	0.301
Carbohydrate(g) (% energy) Total Sugars (g)	77.3±51.0 *(55±13)* 41.8±38.9	*72.4*±42.9 *(50±11)* 40.9±32.1	0.654 0.117 0.914	99.7±59.9 *(52±8)* 52.7±36.2	85.6±55.6 *(52±9)* 38.6±27.7	0.190 0.916 ***0.021***
Protein (g) *(% energy)*	13.6±11.1 *(11±5)*	17.3±11.0 *(13±5)*	0.131 0.104	21.2±14.2 *(12±5)*	22.8±21.3 *(14±6)*	0.657 0.185
Total Fat (g) *(% energy)* Saturated Fat(g) *(% energy)*	17.7±12.4 *(31±14)* 8.1±6.2 *(14±7)*	22.5±15.2 *(34±13)* 11.3±8.6 *(17±7)*	0.141 0.275 0.074 0.150	30.7±24.8 *(33±10)* 15.0±13.0 *(16±7)*	26.6±23.1 *(32±11)* 12.5±12.4 *(15±6)*	0.343 0.628 0.298 0.379
Dietary Fibre (g)	6.1±7.8	4.8±3.6	0.451	6.3±3.4	5.5±2.9	0.332

Values presented as mean±standard deviation

** Significant results determined using Paired T-Tests; a p-value < 0.05 was considered a significant result.*

Appendix G: *A comparison of mean dietary intake of key nutrients in students during the school day, in the FTN and the control weeks, between ethnic groups*

	FTN				Control			
Nutrient	**Māori(n=36)**	**NZEO(n=16)**	**Pacifika(n=30)**	**P-Value***	**Māori(n=36)**	**NZEO(n=16)**	**Pacifika(n=30)**	**P-Value***
Energy (Kj)	3312± 1937	3137± 1493	3455± 2337	0.660	2257± 1475	2366± 1202	2646± 1737	0.214
Carbohydrate (g)	97.0±51.1	97.0±51.1	102.6±68.2	0.804	72.3±44.9	71.6±39.2	81.8±57.4	0.341
(% energy)	*(52±13)*	*(52±13)*	*(51±12)*	0.702	*(53±12)*	*(51±11)*	*(52±11)*	0.430
Total Sugars (g)	45.8±36.4	45.8±36.4	48.3±37.4	0.906	35.8±27.0	32.0±24.72	41.1±38.1	0.258
Protein (g)	27.5±18.14	27.5±18.14	25.8±22.31	0.898	15.0±12.7	19.3±12.8	17.8±16.6	0.178
(% energy)	*(14±5)*	*(14±5)*	*(13±5)*	0.251	*(11±5)*	*(14±6)*	*(11±6)*	***0.014**[a,b]*
Total Fat (g)	27.3±17.3	27.3±17.3	33.3±28.3	0.395	20.2±17.5	21.3±14.4	25.0±18.2	0.151
(% energy)	*(32±12)*	*(32±12)*	*(34±12)*	0.379	*(31±12)*	*(32±12)*	*(34±11)*	0.309
Saturated Fat (g)	12.2±8.0	12.2±8.0	15.2±13.6	0.346	9.4±9.5	9.4±7.4	12.0±9.42	0.118
(% energy)	*(15±7)*	*(15±7)*	*(15±6)*	0.495	*(14±7)*	*(14±7)*	*(16±6)*	0.160
Dietary Fibre (g)	9.2±5.8	9.2±5.8	8.7±6.9	0.906	5.6±3.5	5.3±3.0	6.5±5.0	0.239

Values presented as mean±standard deviation

** Overall significant results determined using using a One-Way ANOVA; a p-value < 0.05 was considered a significant result*

**Post-hoc Tukeys Tests used to determine where significance lies with the denotations a and b; a= significant difference between NZEO and Māori, b= significant difference between NZEO and Pacifika.*

Appendix H: *A comparison of mean dietary intake[1] of key nutrients in all students, based on foods coming from the home, dairy, FTN, other food assistance programmes and 'other' sources, between the FTN and the control weeks*

Sources	Energy (Kj)	% Total Mean Intake	Carbohydrate(g)	Total Sugars(g)	Protein(g)	Total Fat(g)	Saturated Fat(g)	Dietary Fibre(g)
Home (n=82)								
FTN Week	630±1153	(30%)	20.6±36.0	9.4±19.5	4.0±8.2	5.5±13.3	2.3±5.7	1.2±2.6
Control Week	732±1221	(51%)	22.3±35.0	9.2±16.6	5.0±9.5	6.9±14.7	3.1±6.7	1.4±2.7
P-Value*	0.119		0.373	0.802	0.070	0.104	***0.049***	0.150
Dairy (n=82)								
FTN Week	363±941	(18%)	11.0±28.0	4.9±14.9	2.1±6.5	3.7±10.6	1.7±5.0	0.5±1.7
Control Week	365±1020	(26%)	11.0±33.0	5.1±19.4	2.1±7.0	3.8±10.7	1.8±5.4	0.3±1.1
P-Value*	0.967		0.988	0.805	0.934	0.898	0.593	0.053
Other FAPs (n=82)								
FTN Week	367±735	(18%)	13.1±27.0	8.7±18.8	2.7±5.3	2.4±6.4	1.1±3.2	1.1±2.9
Control Week	268±593	(19%)	8.9±19.7	5.9±12.2	2.2±4.4	2.0±5.9	0.9±2.8	0.9±2.0
P-Value*	***0.024***		***0.005***	***0.003***	0.103	0.356	0.393	0.222
FTN (n=82)								
FTN Week	539±1243	(26%)	11.4±27.0	3.0±7.8	6.3±15.1	6.1±16.5	2.8±7.7	1.7±3.9
Control Week	-	-	-	-	-	-	-	-
Other** (n=82)								
FTN Week	170±604	(8%)	5.4±19.2	3.0±12.4	0.8±3.1	1.7±6.6	0.9±3.5	0.2±0.7
Control Week	63±352	(4%)	2.1±12.0	1.0±6.3	0.4±3.1	0.5±2.9	0.3±1.6	0.1±0.7
P-Value*	***<0.001***		***<0.001***	***0.001***	0.062	***<0.001***	***<0.001***	0.106
TOTAL MEAN INTAKE								
FTN Week	2070±2891		61.6±85.8	29.1±44.3	15.9±23.9	19.3±30.7	8.8±14.1	4.7±7.4
Control Week	1429±2198		44.2±68.8	21.2±37.2	9.8±15.6	13.2±22.4	6.1±10.6	2.7±4.5
P-Value*	***<0.001***		***<0.001***	***<0.001***	***<0.001***	***<0.001***	***<0.001***	***<0.001***

Values presented as mean±standard deviation, FAPs = Food Assistance Programmes

1. Mean intakes are a based on average daily consumption in all students (n=82).

**Significant results determined using Paired T-Tests; a p-value < 0.05 was considered a significant result.*

** 'Other' food source category included those foods where origin was unspecified, as well as foods coming from peers and Subway through the Subway lunch order programme.

Appendix I: *A comparison of mean energy intakes between the home, dairy, FTN, other food assistance programmes, and 'other' sources amongst all students during the FTN and the control weeks*

	Home	Dairy	Other Food Assistance Programme	FTN	Other	P-Value*
FTN (n=82)	630± 1153	363± 941	367± 735	539± 1243	170± 604	***<0.001*** ***a,b,c,d,e,f,h,i***
Control (n=82)	732± 1222	365± 1020	268± 593	-	63± 352	***<0.001*** ***a,b,c,f,g,h***

Values presented as mean±standard deviation energy intake

** Overall significant results determined using a Kruskal-Wallis Test; a p-value < 0.05 was considered a significant result*

***Post-hoc Mann-Whitney Tests using a Bonferroni Correction were used to determine where significance lies with the denotations a, b, c, d, e, f, g, h i; a= significant difference between dairy and home, b= significant difference between dairy and other food assistance programmes, c= significant difference between dairy and other, d= significant difference between home and FTN, e= significant difference between other food assistance programmes and FTN, f= significant difference between home and other, g= significant difference between home and other food assistance programmes, h= significant difference between other and other food assistance programmes, and i= significant difference between other and FTN.*