

**Purchase of core food groups among
food-insecure families: secondary analysis
of the Spend Study**

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Abstract

Environmental, behavioural, and personal factors all influence food choices. A lack of income is one major reason for the purchase of foods that do not conform to dietary guideline recommendations; however limited research has been conducted investigating the efficacy of providing additional money to low income groups to see the impact this has on food purchasing.

This thesis has two parts: a descriptive study using baseline data from the Spend Study and an intervention study. The aims of the descriptive study were firstly to examine differences in food purchases (in relation to gram amounts and brand types) for low-income households with children by income (very low income (< \$30,000) compared to low income (\$30,000 to \$45,000)), food security status (low food security compared to moderate food security), and level of education (no secondary school qualification compared to secondary school or post-secondary school qualification(s)). A further aim was to examine whether expenditure on fruit and vegetables was adequate to meet “5+ a day” recommendations. The aims of the second part of this thesis (the intervention study) were to investigate whether the grams of food purchased per week changed with provision of supermarket vouchers and also to investigate the participant perceived impact of the additional money on food purchases.

The Spend Study was a parallel randomised controlled trial, involving food shopping receipt collection over an eight week period (a four week baseline phase followed by a four week intervention phase), conducted in Dunedin, New Zealand. Low-income, food-insecure households with at least one child less than 18 years of age were recruited. Participants were randomised to either an intervention group which received vouchers (n=82) or a control group which did not receive any vouchers until the end of the study (n=71).

Analyses of the baseline data (n=165) showed those with a higher income purchased significantly more grams of fruit per week, and those with a higher food security status purchased significantly more grams of vegetables per week. Higher educational attainment was associated with increased purchase of fruit and vegetables. Households needed to spend an additional \$2.76 per day on fruit and vegetables to meet “5+ a day”

recommendations. Provision of additional money did not have an effect on gram amounts or type of fruit and vegetables purchased (fresh compared to canned, dried, or frozen), but participants did note additional money relieved stress or enabled a wider variety of foods to be purchased. Results showed food purchase decisions are altered by household demographics such as income, education, and food security status.

Preface

The Spend Study was a randomised, controlled trial conducted by Dr Claire Smith between 2009 and 2010. Dr Smith's thesis (2011) and one research paper has been published from this (Smith, Parnell, Brown, & Gray, 2012b) and a further paper is under submission (Smith, Parnell, Brown, & Gray, 2012a). Dr Smith was also the author's supervisor for this research, assisting in formulating research questions, and helping with interpretation of the results.

The aims of the Spend Study were to examine the effect of provision of additional money on total food expenditure as well as on specific food groups, including fruit, vegetables, milk, dairy products, wholegrain bread, and lean meat and poultry amongst low-income, food-insecure families living in Dunedin. Due to time constraints only food expenditure was examined, however the quantity and quality of food purchased was also of interest. Therefore, this has formed the basis of this thesis. In total, eight weeks of food shopping receipts were collected. Part A (the descriptive study) of this thesis has used the first four weeks of food shopping receipts. For Part B (the intervention analysis) the full eight weeks of food shopping receipts were used.

The candidate was responsible for the following work as part of this thesis:

- Imputing gram amounts from receipts into the database (1 month);
- Imputing brand type information from receipts into the database (1 month);
- Formulating coding protocol for brand types and categorising foods into these (1 month);
- Collecting and imputing missing gram or brand type information from supermarkets, the Concise New Zealand Food Composition Tables, FOODFiles database, or manufacturer and online supermarket websites (2 weeks);
- Imputing any remaining missing gram amount information by calculating the average price per gram/mL for the food group from the database, and using the price for the unknown food item to calculate an estimated weight (1 week);
- Compiling data relating to income, education, and food security status of participants (1 week);
- Compiling feedback from the End of Study Questionnaire (1 week);

- Data cleaning, data storage, and preparation of data for statistical analysis (1 week).

The methods for the Spend Study have been described thoroughly elsewhere (Smith, 2011) however for the completeness of this thesis the candidate has also outlined methods with specific focus on the new analyses which this thesis includes. The present study is referred to as Spend2 in the Methods section, to differentiate between it and the original Spend Study.

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List of Abbreviations

NZANS 2008/09	New Zealand Adult Nutrition Survey 2008/09
CNS02	2002 National Children's Nutrition Survey
CSFP	Commodity Supplemental Food Program
FFES	Family Food Environment Survey
GST	Goods and Services Tax
HEI	Healthy Eating Index
HSC	Health Sponsorship Council
NHANES	United States National Health and Nutrition Examination Survey
NNS97	1997 New Zealand National Nutrition Survey
NZHEC	New Zealand Household Expenditure Survey
SHOP	Supermarket Healthy Options Project
SNAP	Supplemental Nutrition Assistance Program
SoFIE	Survey of Families, Income, and Employment
USDA	United States Department of Agriculture
VAT	Value Added Taxes
WHO	World Health Organization
WIC	Women, Infants and Children (part of the SNAP program).

Introduction

Access to adequate food, clothing and shelter are basic requirements to ensure well-being (Ministry of Social Development, 2008). In developed countries such as New Zealand, the variety of food that is available is extensive. However, there are still individuals and households living within New Zealand that report that they do not experience food security. Food security is defined as “access by all people at all times to enough food for an active, healthy life and includes at a minimum: a) the ready availability of nutritionally adequate and safe foods, and b) the assured ability to acquire acceptable foods in socially acceptable ways” (Anderson, 1990).

Food insecurity (the converse of food security) can have a negative impact on a person’s ability to obtain a nutritionally adequate diet, which can affect their physical and mental health and quality of life (Che & Chen, 1997). Food insecurity has been identified as an issue in several developed countries such as the United States of America (USA) (Holben, 2010), Canada (Kirkpatrick & Tarasuk, 2003), Australia (Booth & Smith, 2001), and New Zealand (University of Otago & Ministry of Health, 2011). Results from the New Zealand Adult Nutrition Survey 2008/09 (NZANS 2008/09) showed 7.3% of households were identified as having low food security (University of Otago & Ministry of Health, 2011) compared to 4.3% in the 1997 National Nutrition Survey (Parnell, 2005; Parnell, Reid, Wilson, McKenzie, & Russell, 2001). In addition to this, the 2002 National Children’s Nutrition Survey (CNS02) found 11.9% of households experienced low food security (Ministry of Health, 2003c). Results from The Survey of Families, Income, and Employment (SoFIE) estimated that over the 2004 to 2005 time period, approximately 15% of participants reported food insecurity (Carter, Lanumata, Kruse, & Gorton, 2010). Food security was measured in SoFIE with a shortened version of the food security index used in national nutrition surveys. After multivariate analysis, income was the strongest predictor of food insecurity. Results from these large national studies suggest that targeted policies aimed at groups with low socioeconomic status need to be considered to help to alleviate this problem.

Household income has a significant impact on household food security (Carter et al., 2010; Rose, 1999). Several studies have shown a relationship between food security

status and income, specifically that households with a lower income have poorer food security (Carter et al., 2010; Che & Chen, 1997). Independent of other demographic factors, income has been shown to have an influence on food purchasing decisions, specifically the likelihood of following a dietary pattern consistent with food and nutrition guidelines (Turrell, Hewitt, Patterson, Oldenburg, & Gould, 2002). Food prices increased by 1% between January 2011 and January 2012, a trend that has been observed over the past several years (Statistics New Zealand, 2011a, 2012). Low-income households are particularly vulnerable to the impact of rising food prices (von Braun, 2008).

Educational attainment also has an impact on diet quality (Robinson et al., 2004). Level of education is associated with income, but affects food choice through a different mechanism. Income impacts on the amount of money a person has to spend on food, whereas level of education may affect which food choices are made with the money that is available (Turrell, Hewitt, Patterson, & Oldenburg, 2003).

As food security, income, and education are all strongly related to food choice and therefore overall diet quality, the first aim of this thesis was to explore the impact of these on the purchase of core food groups in low-income, food-insecure households residing in Dunedin.

Research shows people in New Zealand are aware of healthy eating campaigns such as “5+ a day” (Ashfield-Watt, 2006). Therefore the consumption of a diet not compliant with national guidelines is not simply due to ignorance, but a combination of factors including an inability to purchase desired foods due to a limited income. Research conducted in a group of 108 families in Otara and Maurewa (in Auckland, New Zealand) supports this hypothesis (Turner, Connolly, & Devlin, 1992). Having insufficient food was reported by over half (53%) of households, with all households reporting a lack of money as the primary cause. Thirty three percent of participants who had insufficient food thought their diet was “usually unhealthy”, whereas only 14% of people who reported having enough food thought their diet was “usually unhealthy” (Turner et al., 1992). Adequate consumption of fruit and vegetables is integral to good health and important for protection against chronic diseases such as cancer and cardiovascular disease (Joshiyura et al., 1999; Joshiyura et al., 2001; Steinmetz &

Potter, 1996). Those with a low income are more likely to report difficulty in purchasing more fruit/vegetables within their current budget compared to those with a high income (Smith, Parnell, & Brown, 2009). The second aim of this thesis was to examine the current expenditure on fruit and vegetables per week by low-income, food-insecure households with children living in Dunedin, and assess whether or not this was adequate to meet “5+ a day” recommendations.

In the study mentioned above by Turner et al. (1992), seventy percent of participants thought having more money would enable them to improve the amount and quality of foods they consumed. As income is noted to be one of the largest factors which impacts on food security status, easing the burden of providing adequate and appropriate food should be considered. There is little published literature examining the impact that provision of additional money has on food purchasing, and the majority of studies available are not conducted in real-life settings, but are hypothetical scenarios (Epstein, Dearing, Paluch, Roemmich, & Cho, 2007; Inglis, Ball, & Crawford, 2008). The United States Department of Agriculture (USDA) has documented the impact of the Supplemental Nutrition Assistance Program (SNAP) on food security (Nord, 2011). This is one of the only programmes which demonstrates the effect of providing additional money to low-income families to spend on food in a real-life setting.

The Supermarket Healthy Options Project (SHOP), conducted by Ni Mhurchu and colleagues (2007), was the first randomised controlled trial to investigate the impact of *price reductions* on healthy foods in a New Zealand population. This was followed by the Spend Study, which was the first randomised controlled trial conducted in New Zealand to investigate the impact of provision of *additional money* on food purchases (Smith, 2011). Results have recently been published from the Spend Study which reported the effect on expenditure for total food and selected food groups; however no analyses were conducted to examine changes in gram amounts purchased with the additional money. Therefore, this thesis aims to extend on the findings of the Spend Study, by examining the effect of providing additional money (in the form of supermarket vouchers) on the gram amounts of fruit, vegetables, bread, and dairy products, and type of fruit and vegetables (fresh compared to canned, dried, or frozen) purchased by low-income, food-insecure households with children living in Dunedin.

The collection and analysis of food shopping receipts in the Spend Study allowed for an objective investigation into food purchasing choices. However, it is also important to assess whether or not participants perceived their food purchasing patterns had altered as a result of the provision of additional money. Feedback from participants also gave an indication of the adequacy of money provided. Therefore, the fourth aim of this thesis was to examine the perception of the effect of provision of additional money (in the form of supermarket grocery vouchers) on food purchasing by low-income, food insecure households with children living in Dunedin.

1. Literature Review

1.1. Introduction

Having enough food to eat is a basic requirement for life; however food security extends beyond this and incorporates factors such as accessibility, quality, availability, and acceptability of food (Parnell et al., 2001). Food security is defined as “access by all people at all times to enough food for an active, healthy life and includes at a minimum: a) the ready availability of nutritionally adequate and safe foods, and b) the assured ability to acquire acceptable foods in socially acceptable ways” (Anderson, 1990). Conversely, food insecurity is defined as existing “whenever the availability of nutritionally adequate, safe foods or the ability to acquire personally acceptable foods in socially acceptable ways is limited or uncertain” (Anderson, 1990). Other common terminology relating to food security, but with different definitions includes ‘community food security’, ‘food insufficiency’, ‘hunger’, and ‘nutrition security’ (Holben, 2010).

The prevalence of food insecurity is increasing in New Zealand, with three percent more households classified as having low food security in the NZ ANS2008/09 compared to the NNS97 (Russell et al., 1999; University of Otago & Ministry of Health, 2011). Several studies have shown a relationship between food security status and income, specifically that households with a lower income have poorer food security (Carter et al., 2010; Che & Chen, 1997). When measuring food security, a number of questions are asked in the context of a lack of money (e.g. “Food runs out in my/our household due to lack of money”). Therefore, it is not surprising that those on a lower income are more likely to be food insecure. However, not all low-income families are food insecure and food insecurity is not exclusive to low-income groups (Carter et al., 2010; Che & Chen, 1997), demonstrating that a number of different factors are involved in the development of food insecurity.

The purpose of this literature review is to:

- Discuss the impact of income, education, food security status, and price of food on low-income families’ food choices;
- Outline the strategies identified in the literature that low-income families employ to stretch food dollars;

- Review whether there is evidence that ‘healthy’ food is more expensive than ‘less healthy’ food;
- Review papers which explore the impact that altering the economic environment has on food purchasing;
- Examine the choice of generic compared to branded food products;
- Explore the use of a receipt-collecting methodology to describe food purchasing.

Databases including Medline via Ovid, CINAHL, Web of Knowledge, and Emerald were searched between March and May 2012 using the following search terms: income, low-income, food purchase, socioeconomic factors, social support, food, food preferences, food supply, price, receipt, generics, brands. In addition, reference lists from key published articles were reviewed for relevant articles. Several New Zealand based studies were also included. Articles published earlier than 1990 and in a language other than English were excluded. Literature searches using Emerald were limited to research papers only. When selecting literature on brand choice, articles were limited to those that discussed one of the following food groups: fruit, vegetables, bread, milk, or dairy products.

1.2. Factors impacting on low-income families food choices

In order to create appropriate public health policies, it is critical to understand factors that influence food choice. Several studies have described the determinants of food choice (Booth et al., 2001; Walker & Kawachi, 2012). Barriers to healthy eating identified in research by Walker and Kawachi (2012) amongst low-income participants included health consciousness; personal decisions; time factors; special occasions; crime and safety; budget considerations; shopping concerns; and corner convenience. The framework developed by Booth et al. (2001) (Figure 1) shows the many factors that influence a person’s food choices.

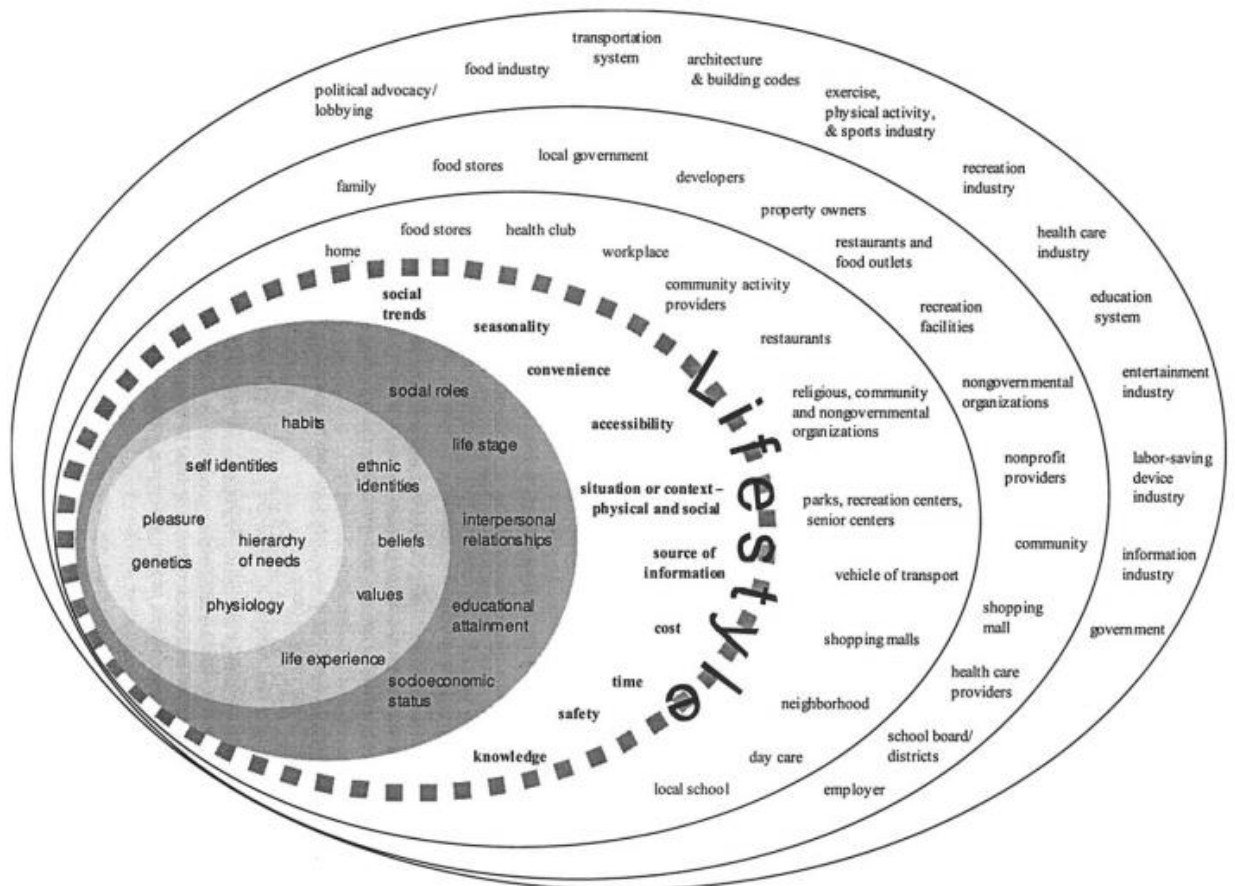


Figure 1: Framework for determinants of physical activity and eating behaviour

Public health interventions aiming to change food habits may have thus far been ineffective due to the complexity of food choice decisions and a limited understanding of how these choices are made (Jacquier, Bonthoux, Baci, & Ruffieux, 2012). As behaviour relating to food choice is complex and influenced by many factors, this literature review focuses on factors relating to food security, income, education, and price.

1.2.1. Food Security

The relationship between food security status and dietary intake and nutrient status has been extensively described elsewhere (Holben, 2010; Parnell, 2005; Stevenson, 2011). To illustrate the relationship, one recent Australian (Innes-Hughes & Cosgrove, 2010) and American study (Dixon, Winkleby, & Radimer, 2001) are discussed below, as well as findings from a New Zealand study (Parnell, Wilson, Mann, & Gray, 2005b). Dixon found food insufficiency was associated with poorer diet quality. The definition of food insufficiency is slightly different to food insecurity. Food insufficiency is defined as “an inadequate amount of food intake due to a lack of resources” whereas food

insecurity is defined as “limited or uncertain availability of nutritionally adequate and safe foods or limited or uncertain ability to acquire acceptable foods in socially acceptable ways” (Holben, 2010).

In the Australian study, participants who were food insecure were significantly more likely to consume less than two servings of fruit per day and less than three servings of vegetables per day (Innes-Hughes & Cosgrove, 2010). They were also more likely to consume less healthy foods such as takeaways and soft drink. A major limitation of this study was their method of measuring food security. Only one question was asked in relation to food security – “In the last 12 months, were there any times you ran out of food and couldn’t afford to buy more?”. This question only assesses the person’s financial access to food, but there are many more factors that impact on food insecurity.

The American study found adults between the ages of 20-59 who came from food insufficient families consumed less milk/milk products, fruit/fruit juices, vegetables, salty snacks, and desserts/sweets than their food sufficient counterparts (Dixon et al., 2001). The question they used to identify food insufficiency had been previously pilot-tested and was a reliable measure of food insufficiency. This study also used a very large, nationally representative sample (n=10,165), and adjusted for several confounders (such as age, gender, ethnicity, and area of residence) to accurately assess the impact food insufficiency had on dietary intake. Their results are therefore likely to reflect the true impact of food insufficiency in the American population.

Participants with the lowest level of food security in the NNS97 had higher intakes of all types of fat, and the lowest intakes of glucose, fructose, and vitamin C (Parnell et al., 2005b). Households with the lowest level of food security in the CNS02 had a significantly lower intake of total sugars, lactose, vitamin A, β -carotene, vitamin B12, and calcium (Parnell et al., 2005b). Nutrients such as glucose, fructose, lactose, and β -carotene are commonly found in perishable foods such as fruit, vegetables, and dairy products, so low levels of these in the diet indicate a low intake of these food groups. Eight indicator statements were used in the NNS97 and CNS02 to measure food security, and both of these studies used a nationally representative sample of New Zealand adults or children.

From these studies, it is clear that food security has consequences in respect to food and nutrient intake and, and is therefore highly likely to be related to food purchase.

1.2.2. Income

Socioeconomic status can be measured by income, education, occupation, area based index of deprivation (e.g. New Zealand Index of Deprivation), or a combination of these. Income has been identified as having a significant impact on food security status (Rose, 1999). In New Zealand between June 2010 and June 2011, median hourly earnings increased by only 1.9%, the smallest annual percentage increase since June 2000 (Statistics New Zealand, 2011c). Over the same time period, food prices increased by 7.5% and GST rose from 12.5% to 15% (Statistics New Zealand, 2011b). When families have other household expenses to pay such as rent or power, food is often viewed as a modifiable expense (Dobson, Beardsworth, Keil, & Walker, 1995; Smith, 2011). Several studies explored the relationship between food choice (particularly the choice of healthy food) and income level.

All of the studies reviewed below have large sample sizes, in particular the study by Kirkpatrick and colleagues (2012) which used data from the United States National Health and Nutrition Examination Survey (NHANES) (n=16,338). This survey was also nationally representative of the American population.

Studies from Australia and the United States showed a lower household income resulted in food purchases less consistent with dietary guideline recommendations (Giskes, Van Lenthe, Brug, Mackenbach, & Turrell, 2007; Inglis et al., 2008; Kirkpatrick et al., 2012; Turrell, 1996; Turrell et al., 2002; Turrell & Kavanagh, 2006). Therefore, it is clear that there is a strong relationship between the healthiness of food purchased and income. In two Australian studies, participants were asked about specific grocery purchases (including “tinned” fruit), however fresh fruit and vegetables were not included in the analyses (Turrell, 1996; Turrell & Kavanagh, 2006). Fresh fruit and vegetables can be viewed as more costly, perishable, and possibly less satiating (Drewnowski, 2004; Drewnowski, Darmon, & Briend, 2004; Drewnowski & Specter, 2004), so it is likely the relationship found would be strengthened by the inclusion of fresh varieties (i.e. those with a lower income would be even less likely to meet recommended dietary guidelines).

1.2.3. Education

Education is often used as an indicator of socioeconomic status. The impact of education on food choice must be considered separately from income, as income affects food choice through a different social process (Turrell et al., 2003). Income impacts on the amount of money a person has to spend on food, whereas education may affect which food choices are made with the money that is available (Turrell et al., 2003). Worsley et al. (2004) hypothesise three key reasons why education may influence food choice.

1. Education may change the way food and health information is accessed.
2. Those with a higher level of education may act on nutrition advice more quickly than those with a lower level of education.
3. Higher educational attainment could enable a person to ascertain a higher position in society. For example, someone with a PhD would have a higher earning potential than someone with no qualifications. This higher income may then give them the power to make different lifestyle choices.

Studies from the United Kingdom (UK), Denmark, Republic of Ireland, and Australia showed lower educational attainment was associated with lower diet quality (Barker et al., 2009; Groth, Fagt, & Brøndsted, 2001; Harrington et al., 2011; Hart, Tinker, Bowen, Longton, & Beresford, 2006; Robinson et al., 2004; Shelton, 2005; Turrell et al., 2002). Six of these studies used random sampling to recruit participants that were representative of the population of interest (Groth et al., 2001; Harrington et al., 2011; Hart et al., 2006; Robinson et al., 2004; Shelton, 2005; Turrell et al., 2002). They all had large sample sizes, ranging from 852 to 7432 participants.

Barker and colleagues (2009) conducted a cross-sectional survey with 372 women in Southampton, UK. Results showed that women with a lower level of education had a diet less consistent with national recommendations than those with a higher level of education. Those with a higher level of education also felt they had more control over their lives than women with a lower level of education. Limitations of this study included the use of a shortened food frequency questionnaire and a shortened measure of perceived control. The extensive, validated versions would have been more accurate. A convenience sample was used; therefore results are not representative of all child-

bearing women in Southampton. However, results were consistent with studies mentioned above.

Hart et al. (2006) investigated factors influencing fat intake amongst 2507 participants randomly selected from religious organisations in Seattle, USA. Participants with a graduate/professional school degree had a lower intake of fat (fat summary score = 2.40) compared to participants who reported their highest level of qualification as high school or less (fat summary score = 2.51) ($p < 0.002$). This study had a large sample size, however the sample was taken from one region and all participants were religious, which could influence food choices. Participants were recruited from a wide variety of Christian denominations including Catholic, Orthodox, Presbyterian, and Lutheran. Many Christians abstain from consuming meat (or other luxury food items) during Lent, which would influence their food purchases over this time period. The sample chosen was also highly educated, with over half of participants having at least a four year college degree.

Swiss researchers (Dickson-Spillmann & Siegrist, 2011) found those with higher educational attainment had a better knowledge of how to follow a healthy diet compared to those with lower educational attainment. They had a large sample size of 1043 participants, however not all participants interpreted the questions relating to nutrition knowledge in the same way (as some questions were open to subjective interpretation), which impacted on the validity of the questionnaire. Despite this limitation, a relationship between level of education and nutrition knowledge and therefore diet quality was found in this study.

Research conducted in Australia by Worsley and colleagues (2004) found those with a higher level of education consumed a wider variety of foods from the majority of the following food groups: fruit, vegetables, meat, fish, dairy, cereal, spreads, snacks, and sweets. Analyses were conducted separately for males and females and were stratified by age. This study involved 5,240 participants and the large random sample was representative of the Australian population.

Aside from their limitations, all of these studies showed a higher level of educational attainment resulted in healthier food choices, increased knowledge about consuming a healthy diet, and better overall diet quality.

1.2.4. Price

Relative to other factors important at the point of food purchase, price has been shown to have the greatest influence on food purchasing decisions (Dachner, Ricciuto, Kirkpatrick, & Tarasuk, 2010; Steenhuis, Waterlander, & de Mul, 2011). A recent study by the Health Sponsorship Council (HSC) in New Zealand (n=1740) showed the price of a food item was reported to be the most significant factor in food purchasing decisions (Murray, 2012). When asked which factors influenced their shopping decisions, 75% of respondents listed price as an important factor. The impact of price (in addition to perceptions of price) on the food purchasing behaviour of families with a range of income levels has been examined in several studies.

Daaman and Smith (2009) conducted a qualitative study amongst low-income women (n=92) in Minnesota, and found several factors influenced food choice, but the price of food was reported to have the largest impact. Other qualitative and quantitative research found similar results (Dachner et al., 2010; Turrell & Kavanagh, 2006; Wiig & Smith, 2008). As shown in the research by Dachner et al. (2010), the cost of a food item becomes a more important consideration with worsening food security status. Although people on a low income may be aware of the nutritional quality of foods and the impact on their health, for many these factors are secondary to price.

Although studies in Australia (Turrell, 1996) as well as New Zealand (Ni Mhurchu & Ogra, 2007) have shown the price of 'healthy' compared to 'less healthy' foods are similar (discussed in Section 1.3.), if healthy foods are perceived as more expensive, they are less likely to be purchased. Price perception refers to a participant's view of the cost of various food items, irrespective of objective pricing data. Perception of price was discussed in two studies (Giskes et al., 2007; Turrell & Kavanagh, 2006). Both of these studies found the perception of price had an impact on food purchases. These studies were both based in the Brisbane population and had relatively large sample sizes (n=812-1003).

The impact of changing the price of foods or altering the economic environment on food purchasing decisions is discussed further in Section 1.6.

1.3. Is there a difference in the price of ‘healthy’ and ‘less healthy’ foods?

Perceived price has a major influence on the purchase of ‘healthy’ foods by New Zealanders. In 2008, 30 to 34% of New Zealanders cited price as the major barrier associated with eating more fruits and vegetables (Sullivan, Oakden, Young, Lau, & Lawson, 2004). Two New Zealand and three Australian studies have examined the difference in price between a ‘healthy’ and ‘less healthy’ diet (Giskes et al., 2007; Ni Mhurchu & Ogra, 2007; Rydén & Hagfors, 2011; Turrell, 1996; Wang et al., 2010). In studies by Turrell et al. (1996), Giskes et al. (2007) and Wang et al. (2010) foods meeting dietary guidelines were classified as ‘recommended’/‘healthy’ food choices (e.g. wholemeal bread), and the standard choice was referred to as the ‘regular’/‘less healthy’ choice (e.g. white bread). Ni Mhurchu and Ogra (2007) categorised food items into food categories, and five ‘healthier’ options and five ‘regular’/‘less healthy’ options were chosen for each food category. Food categories were based on those used in the NNS97, and included meat and poultry, bread, breakfast cereal, butter and margarine, cheese, canned fish, canned fruit, milk, and soft drinks.

Three out of the five studies found no significant difference between the price of ‘recommended’ or ‘healthier’ food choices compared to ‘regular’ or ‘less healthy’ food choices (Giskes et al., 2007; Ni Mhurchu & Ogra, 2007; Turrell, 1996). These studies were conducted in New Zealand or Australian populations, and collected a large amount of data (n=403-882) from electronic sales figures (Ni Mhurchu & Ogra, 2007), information from shoppers (Giskes et al., 2007; Turrell, 1996), or actual prices from supermarkets (Giskes et al., 2007).

Upon examination of 1230 food outlets across the Waikato/Lakes area in New Zealand, Wang et al. (2010) observed that a ‘healthy’ basket would cost a family 29% (or \$39.88) more per week than a ‘regular’ basket (after removing sugar from the analysis and controlling for socio-economic factors). A major strength of this study was its collection of food prices across a large variety of food outlets.

Rydén and Hagfors (2011) investigated the cost of healthy eating for children in Sweden (n=2494). Dietary data was obtained from the 2003 Swedish national food survey (called 'Riksmarten – children') and the 2005 Healthy Eating Index (HEI) was used to assess the healthiness of participants' diets, where a higher HEI score indicated a healthier diet. Results showed after adjustment for energy (kJ), a healthier diet cost more (mean difference between HEI <50 and HEI >70 = (NZ) \$0.21/1000kJ). Children who were assessed as consuming a more expensive diet had a higher HEI score than those with a less expensive diet. For some food groups such as grains and fat, the healthier option was equivalent in price to the less healthy option; however this was not the case for other food groups such as meat and dairy. Children in Sweden are given free school lunches and children in day care receive all meals for free. Therefore, results are not comparable to children living in New Zealand.

Overall, results on the difference in price between a 'healthy' and 'less healthy' diet are mixed. The price of 'healthy' compared to 'less healthy' foods may be specific to a country or even to a city. Definitions of what constitutes 'healthy' or 'less healthy' foods also differ between studies, making comparisons difficult. More large scale studies are required, particularly in the New Zealand population, to assess the price difference between 'healthy' and 'less healthy' foods. Certainly perception of price exists, and this in itself can act as a barrier.

1.4. Food purchasing strategies of low-income families

People with low food security or a low household income use coping strategies to stretch food dollars, such as purchasing and eating less varied diets; shopping in discount stores; and purchasing low-priced food items (Holben, 2010; Leibtag & Kaufman, 2003). After exhausting all other options, people may participate in federal food and nutrition assistance programs (where available) or obtain emergency food from community food banks/pantries, emergency kitchens, and shelters (Holben, 2010). Four studies examined the different strategies low-income families employ when making food purchasing decisions.

Dachner et al. (2010) conducted a cross-sectional survey amongst low-income families (n=485) living in Toronto, Canada. The purchase of cheaper 'generic' brands was a common strategy used to stretch money. Generic brands are defined as those with

plainer packaging and no 'recognised' brand name (Prendergast & Marr, 1997). Some participants stated that they bought generic brands in order to save money; however others stated they preferred to buy branded products because they knew their families would eat them. This shows preference can still be important even on a tight budget.

Inglis et al. (2008) used an open-ended question to ask women about strategies they used to manage food expenditure when faced with the challenge of having to reduce their food budget by 25%. Low-income women were better at deciding which foods to remove and describing methods used to reduce food expenditure on a tight budget compared to high-income women. In addition, the methods used to reduce food expenditure by low-income women differed from methods used by high-income women. For example, low-income women reported using generic brands or buying foods close to or past their use-by date. High-income women stated they utilised specials, but would not buy products past their use-by date. This demonstrates that those living on a limited budget develop techniques for saving money, sometimes taking risks on quality, but also shows that income level has an impact on strategies used when trying to save money.

Research by Wiig and Smith (2008) on low-income women in Minnesota (n=92) found that women considered food items they already had in the house as well as items they could get from other assistance programmes when making food purchasing decisions. This demonstrates the complexity of decision making. These findings suggest that in general, low-income women are resourceful when it comes to providing food for their families, and consider the pool of resources available to them.

Although low-income families utilise a range of coping strategies, if there is simply not enough money to buy food, these strategies are ineffective (Hoisington, Shultz, & Butkus, 2002). There are several common misconceptions about the reasons why some families are unable to provide nutritious food for their families. These include poor budgeting, lack of planning, unwise purchasing habits, ignorance about healthy food, inadequate cooking skills, and failure to seek help from a food bank (New Zealand Network Against Food Poverty, 1999). However, international research has shown the major reason behind a diet that does not meet nutrition guidelines is inadequate income (Crotty, Utishauser, & Cahill, 1992; Cullum, 1997; Leather, 1995). In addition, over 30% of participants in the NZANS 2008/09 reported the variety of food they are able to

purchase is sometimes or often limited by a lack of money (University of Otago & Ministry of Health, 2011). Lower socioeconomic groups were identified as a key priority group in the New Zealand Healthy Eating, Healthy Action Strategic Framework (Ministry of Health, 2003b). Increasing skills such as budgeting and cooking may partially help some families, but it is not enough to negate the issue.

Overall, these studies show low-income households already utilise many strategies, however if there is simply not enough money to buy food, they can only go so far. Further research is required, particularly in the New Zealand setting, to examine methods to reduce the economic burden in order to help alleviate food insecurity. Population-based initiatives are required in order to ensure all New Zealanders have enough food to eat that is acceptable and appropriate, as solutions targeted at individuals may not make a large difference on their own (New Zealand Network Against Food Poverty, 1999).

1.5. Choice of generic versus branded products

As noted above, choice of generic/non-branded foods is a common strategy used to stretch food dollars. This section will focus on consumer perceptions of generic food products. Generic brands are defined as those with plainer packaging and no 'recognised' brand name (Prendergast & Marr, 1997). Other commonly used terminology includes 'budget brands', 'non-branded', 'own-brand', 'private label', and 'store brand'. These terms are used interchangeably in the following discussion, depending on the literature. In New Zealand, 'Homebrand', 'Pams', 'Budget', 'Select', 'Countdown Everyday' and 'Signature Range' are examples of generic brands. Branded food items (such as 'Watties') will be referred to as 'national brands' in the following discussion. Generally, store brands are only available at certain supermarket chains, whereas national brands are available at a variety of locations through branded food manufacturers and distributors (Volpe, 2011). Generic food items are usually cheaper than their branded equivalents as less money is spent on food labelling and advertising, however they can be perceived as being of lower quality (Prendergast & Marr, 1997). Studies have been conducted in New Zealand, Mexico and America exploring consumer perceptions of food products with a generic brand name.

Research by Prendergast and Marr (1997) and Yelkur (2000) found a significant relationship between income and purchase of generic products, with low-income households more likely to purchase generic products than high-income households. This could be because of the lower price of generic food products. Low-income groups allocate a larger proportion of their household budget to food (Caraher & Cowburn, 2005; Jacquier et al., 2012), so could potentially purchase generic brands to save money.

Research from mail-based surveys conducted in New Zealand and the United States of America showed consumers generally viewed the quality, taste, and performance of generic brands to be equal to national brands (Prendergast & Marr, 1997; Sethuraman & Cole, 1999). A questionnaire administered across three large grocery chains in Mexico found perceptions of the quality and performance of generic brands were strongly linked to income (Yelkur, 2000). Higher income groups felt the quality and performance of generic products was lower than those of branded products, due to the lower cost associated with generic products.

Both the New Zealand and Mexican studies investigated several food categories including canned foods (e.g. soup, jam, meat), frozen foods (e.g. pastries, fish, vegetables), and dried foods (e.g. cereal, biscuits, rice) (Prendergast & Marr, 1997; Yelkur, 2000). The American study examined more limited food groups and did not assess consumer perceptions of any canned foods (Sethuraman & Cole, 1999). Canned, dried, and frozen foods are all alternatives to fresh varieties, as these can be viewed as less affordable or desirable, so it is important to assess consumers brand preferences for these. As only one study was conducted in a New Zealand population, the other studies may not be applicable in a New Zealand environment.

1.6. Altered economic environment on food purchasing

There are two main approaches that could be used to alleviate the economic burden families' face as they attempt to provide adequate, appropriate food for their household. The first is to reduce the cost of food by altering tax levels or providing discounts. The second method is to increase the money available to households through food vouchers, assistance programmes (e.g. SNAP), increasing wage levels, or providing subsidies for other household expenses such as power and rent (Smith, 2011).

1.6.1. Taxation and price reductions

Taxing foods based on their nutritional value is one approach that has been recommended by international bodies such as the World Health Organisation (1988, 2003). The purpose of this is to discourage consumption of non-nutritional foods, but it adds to the cost of these foods. An increase in the cost of one or two food items does not necessarily ensure a higher overall diet quality, as cross price elasticity can occur (Epstein et al., 2012). Cross-price elasticity refers to the substitution of higher cost foods with other cheaper alternatives (which are no better nutritionally) such as the substitution of sugar-sweetened soft drink with other sugar-sweetened beverages (Epstein et al., 2012).

Westernised countries including Australia, Canada, France, and the UK have implemented strategies such as applying different levels of Goods and Services Taxes (GST) or Value Added Taxes (VAT) to foods. Both of these approaches are based on reducing the price of selected foods. These approaches would benefit all households, and do not necessarily target low-income families (Bowers et al., 2009). Reduction in the price of healthier foods may not necessarily correlate to an increase in their purchase, as money saved may be used to buy less healthy foods (Epstein et al., 2012).

It has also been noted that taxing non-nutritional food (e.g. foods high in fat or sugar) has a greater impact on those on a low income compared to those on a high income, as they are required to allocate a higher proportion of their total household income to food (Caraher & Cowburn, 2005; Jacquier et al., 2012). Taxation could reduce the purchasing power of low-income groups, as well as increase health and social inequalities (Jacquier et al., 2012). Several problems arise when using a tax-based approach to influence food choice. These include the classification of 'healthy' versus 'non-healthy' foods, as well as whether the taxing is used to generate income or influence behaviour (Caraher & Cowburn, 2005). The primary reason for adding a tax to foods may not be to improve the nutritional status of the population, but instead to generate revenue for the country.

Several studies have examined the relationship between price reductions on healthy foods and food purchase decisions. Waterlander et al. (2012) conducted a randomised

controlled trial in the Netherlands, investigating the effect of a 25% discount on fruit and vegetables on food purchasing behaviour, using a web-based supermarket simulation. Participants (n=115) were randomly assigned to the intervention group (25% discount on fruit and vegetables) or the control group (regular prices), and given a fixed budget to complete food shopping for their household for a typical week. After adjusting for confounders, the intervention group purchased approximately 25% more fruit and vegetables than the control group ($p=0.03$). The supermarket simulation was well designed, as it was modelled on the image of an actual supermarket, using photographs of real food items. However, it did not provide the complete array of products found at an actual supermarket. People may react differently when spending their own money. SHOP (Ni Mhurchu & Ogra, 2007) was a 2x2 factorial randomised controlled trial conducted in eight New Zealand supermarkets. Over one thousand shoppers were randomly assigned to one of four interventions: i) a 12.5% price discount on healthier foods; ii) tailored nutrition education; iii) discounts plus education; or iv) no intervention. Six months after randomisation, participants who received price discounts purchased 11% more healthy foods compared to those not randomised to receive discounts ($p<0.001$). This effect was sustained at 12 months post-randomisation, with those receiving discounts purchasing 5% more healthy foods ($p=0.045$). However, no changes were found in the amount of non-discounted, less healthy foods purchased. The real-life setting of this study adds strength, as results reflected true shopping habits. However, data was only collected for purchases from the one supermarket chain. Most participants purchased food from a number of different retail outlets, which means only approximately half of all household food purchases were captured (Ni Mhurchu, Blakely, Jiang, Eyles, & Rodgers, 2010).

French et al., in a series of four studies, investigated the impact of price reductions on the purchase of healthier food items (such as lower fat snacks and fruit and vegetables) from cafeterias and vending machines (French, Hannan, et al., 2010; French, Jeffery, Story, Hannan, & Snyder, 1997; French et al., 2001; French, Story, et al., 1997). All four of these studies, showed when prices are lowered on 'healthier' food and beverage options, the purchase of these items increased. Use of cafeterias and vending machines are real-life settings, which means results can be generalised to a wider population group. However, none of these studies investigated individual purchases from the cafeteria/vending machine and were based on sales data. Therefore, it cannot be

determined whether discounts resulted in increased purchases of healthy foods by the existing client pool or just altered the client pool using the cafeteria/vending machine.

Results from these studies are encouraging, as they demonstrate that discounting healthier food can result in an increase in purchase. However, funding would need to be obtained in order to provide price discounts on healthier foods on a long term basis. Price discounts also do not specifically target those on a low-income. As low-income groups are more likely to be food insecure (Carter et al., 2010), strategies that target them may be more applicable.

1.6.2. Provision of additional money

There is little published literature investigating the impact of provision of additional money on food purchases, and the majority of studies available are experimental. Studies by Epstein et al. (2007) and Inglis et al. (2008) examined the effect of provision of additional money in hypothetical situations.

Epstein et al. (2007) simulated a grocery store environment, and participants were given either \$15 or \$30 per family member and ask to select grocery items for the week. As the amount of money available to spend increased, the number of food items purchased increased. Participants were asked to use all money provided at once and were using money provided by the researcher, which could have impacted on shopping habits. As the researcher was present when decisions were made, participants may have made more socially desirable food choices. Shopping habits were only examined in one simulated grocery store, but it has been documented in other studies that low-income families often shop at a number of different stores to utilise discounts (Clifton, 2004; Dobson et al., 1995; Wiig & Smith, 2008). Therefore, they may have been able to purchase more items with their monetary allocation if allowed to shop around.

Research by Inglis et al. (2008) involved completion (by 74 women) of an itemised shopping list reflecting household supermarket purchases for a typical week. After food was selected, women were asked to select 10 items they would buy if they had 25% more of their food budget to spend. Low-income women chose a greater proportion of foods from the healthy food group (42%) compared to high-income women (33%) when given more money to spend. Prices for foods were taken from an online shopping

catalogue at one point in time. Therefore seasonal, weekly, and monthly variations in price were not taken into account. A change in price would impact on the shopping habits of low-income women, as they may shop around, buy seasonal items in bulk or purchase less of a food with an increase in price. When the amount of money available to high-income and low-income women for food was equalised, this did not appear to eliminate income differences in healthiness of the women's food choices. However, the change in baseline amount of additional money provided to low- and high-income women was not the same, meaning the comparison of food purchases when looking at modified budgets was not an ideal equalisation condition. Aside from these limitations, this study showed shopping patterns are complex, and that provision of additional money may result in some healthier food choices but does not completely eliminate unhealthy choices. Inglis et al. (2008) suggest a pathway for future research could include using shopping receipts to document actual amounts of money spent on food by low-income families. The feasibility of this is discussed later in the literature review.

Anderson et al. (2001) evaluated the Michigan Farmers' Market Nutrition Program to determine whether it resulted in an increase in fruit and vegetable consumption in low-income women. Participants were recruited from the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) and the Commodity Supplemental Food Program (CSFP). They were then assigned to one of four interventions: i) education about fruit and vegetables (health benefits, buying power, seasonality, storage, and preparation); ii) provision of coupons to spend at farmers' markets; iii) both education and coupons; or iv) no intervention. Fruit and vegetable intake was measured by a self-administered questionnaire. The largest effect was found when both coupons and education were provided. However, a major weakness of this study was its non-random assignment of participants to an intervention. The coupons only group was recruited solely from the CSFP. WIC participants were recruited from the ProjectFRESH program (an educational program providing participants with coupons to purchase fruit and vegetables at farmers' markets), which had a USDA-mandated education component; therefore these women could not be included in the coupons without education group. WIC participants may under-report dietary intake due to being part of ProjectFRESH. Therefore, caution needs to be taken when comparing the WIC group with the CSFP group.

The USDA funds several food assistance programs including the Food Stamps Program (now known as the Supplemental Nutrition Assistance Program or SNAP), the school meals programs, WIC and CSFP. SNAP benefits can be used to purchase general food items and seeds and plants to grow food, but cannot be used for alcohol, cigarettes/tobacco, non-food items, foods that will be eaten in the store, or hot foods. In order for stores to be eligible as part of SNAP, they must:

- Routinely offer at least three varieties of foods from each of the four food groups and offer perishable foods in at least two of the following categories: meat/fish/poultry, breads and cereals, fruits and vegetables, and dairy products;
- OR
- Make at least half of their sales (in dollars) from eligible SNAP foods (United States Department of Agriculture, 2012).

The USDA state “a dollar of food stamp benefit is estimated to increase food spending by 17 to 47 cents” (LeBlanc, Lin, & Smallwood, 2006). The Food Stamps Program has been shown to increase the food security status of low-income families and increase household food expenditure (LeBlanc et al., 2006), which shows there are tangible benefits to providing extra money to low-income families.

Additionally, Nord et al. (2011) found when the SNAP benefit levels were increased and eligibility criteria was widened in 2009, food expenditures increased and food insecurity decreased. Between 2008 and 2009, food expenditures by low-income families increased by 5% and food insecurity decreased by 2% (Nord & Prell, 2011). In the United States of America, food security is measured annually as a supplement to the Current Population Survey. Participants are asked about their food security status over a 12 month period as well as 30 days prior to the survey. Nord et al. (2011) also found the households that left the SNAP programme more than 30 days before the survey was administered were more likely to have very low food security compared to households that stayed on the SNAP programme. The conclusions drawn were that the SNAP programme improves food security status.

The majority of studies that have investigated the impact of providing additional money on food purchasing decisions have been conducted in the United States of America or Australia. The exception is the recent Spend Study (Smith, 2011), which is the only

New Zealand study to investigate the impact providing additional money for food has on purchasing decisions. In the Spend Study, 218 low-income households who reported food insecurity were randomised to an intervention group (that received supermarket vouchers) or a control group (that did not receive vouchers) for four weeks (Smith, 2011). Five dollars per week was allocated to each adult female (calculated based on results from the Family Food Environment Survey (Smith et al., 2009)), with amounts for other household members calculated relative to this. Provision of additional money increased spending on food by \$15.20 in the intervention group compared to the control group ($P=0.03$), but no difference was found in the purchase of fruits and vegetables, meat and poultry or dairy products between the two groups. The analysis only examined the differences in dollars spent on different food groups and did not examine any changes in gram amounts or brand types of food purchased, which is a limitation. As discussed earlier in the literature review, low-income households may purchase more low-priced food items or purchase more products with 'generic' brand names. Additional research is required in the New Zealand population to assess the impact of provision of additional money on food purchasing behaviour.

1.7. Use of receipt-collecting methodology

Evidence shows collection of receipts is a potentially feasible method of investigating food purchases of households (Cullen et al., 2007; French, Wall, & Mitchell, 2010; French, Wall, Mitchell, Shimotsu, & Welsh, 2009; Martin, Howell, Duan, & Walters, 2006; Rankin et al., 1998; Ransley et al., 2003). Using receipts to provide information on food consumption patterns has several advantages over methods such as food records or 24-hour recalls. It is quick, easy, and inexpensive, has a low respondent burden, and does not rely as much on memory or literacy (Martin et al., 2006). Receipt collection is also a method of obtaining information at the household level.

Martin et al. (2006) found collection of supermarket receipts was a feasible method as a proxy to dietary assessment. Analysis of foods purchased on grocery receipts showed the same association with participant self-reported body size as a food frequency questionnaire relating to fast-food consumption (i.e. higher purchase/consumption of fast foods resulted in higher self-reported body size). However, receipts were only collected from one supermarket at one point in time and data was obtained from a very

small convenience sample of volunteers (n=48). This means results are highly unlikely to reflect usual shopping practices, so findings should be interpreted with caution.

Ransley et al. (2003) found a strong correlation between food purchased and household intake for total energy and fat ($r=0.77$). Food purchases were measured using grocery receipts, a shopping diary (when a receipt was not obtained) and four-day food diaries completed by each member of the household. Results indicate grocery receipts could be used as an indicator of dietary intake. However, this study also only looked at supermarket purchases.

Studies by Cullen et al. (2007) and Rankin et al. (1998) explored the relationship between food purchasing and household characteristics. They showed it is possible to use supermarket receipts to examine food purchasing decisions of households. However, like the other two studies previously mentioned, they also only collected data on supermarket purchases. As food is increasingly being bought ready-made (Stewart, Blisard, Bhuyan, & Nayga Jr, 2004), purchases from all sources would provide a complete picture of food purchasing behaviour.

French et al. (2010; 2009) collected food receipts for four weeks as well as receipt annotation sheets which provided specific information on food purchased and sources of food purchases. However, not all foods listed on receipts were entered into the database. Only expenditures related to food categories of interest (fruit, vegetables, pre-packaged snacks and sweets, pre-packaged entrees, and beverages) were calculated. Actual receipts were also only used for editing purposes, as the receipt annotation sheets were the primary source for data collection. Strengths of this study were its inclusion of purchases from a wide range of sources (not just supermarkets) as well as the large level of detail that was collected on the food items purchased. This was the only study to document food purchases from all sources. It is interesting to note that even though a large amount of information was required from participants, 61% reported the time required for receipt collection and annotation was not a problem.

Overall, research shows collection of receipts can be a useful method to obtain information on the food purchasing patterns of households, and correlate well with

other methods of dietary assessment such as food records and food frequency questionnaires.

1.8. Summary

Food choice is influenced by a number of factors including individual factors such as income and education and environmental factors such as price. There is a large body of evidence showing the complexity of decision making in relation to food choice. All studies examined showed price reductions were effective in increasing purchase of healthier foods, and although most of the research was experimental, in general research conducted on the impact of provision of additional money of purchases showed an increase in spending on food.

The effect of provision of additional money has only been examined in a New Zealand setting in relation to the difference in dollars spent on different food groups. It is possible low-income families purchase a lower quantity of key food groups or purchase more foods with 'generic' brand names. The baseline data from the Spend Study allows for further exploration of differences in food purchasing by income, education, and food security. Spend2 also offers a unique opportunity to investigate the impact of provision of additional money on quantity and quality of foods purchased by low-income New Zealand households (in regards to gram amounts and types of brands purchased). As most of the current research is experimental, the Spend Study adds to previous research by examining the effect of provision of additional money in a real-life setting. Low-income households are more likely to be food insecure (Carter et al., 2010), so the Spend Study also provides the opportunity to investigate food purchases of low-income, food-insecure households specifically.

2. Objective Statement

Behaviour relating to food choice is complex, and influenced by many different factors (Booth et al., 2001). The literature review revealed that several studies have investigated factors impacting on food purchasing decisions. These studies compared high-income groups with low-income groups or food-secure households with food-insecure households, and the majority of studies were conducted in countries other than New Zealand (Dixon et al., 2001; Giskes et al., 2007; Inglis et al., 2008; Innes-Hughes & Cosgrove, 2010; Turrell, 1996; Turrell & Kavanagh, 2006). The Spend Study was unique as it captured food purchasing information from low-income, food-insecure households. As outlined earlier, only expenditure (\$) was documented, so the objectives of the current study were to explore gram amounts and brand types purchased. Although all participants were considered to have a low income, household income ranged from less than (NZ) \$20,000 to (NZ) \$45,000. Likewise, all participants identified as being food insecure, but this classification included those of low food security and those of moderate food security.

The following research questions were developed:

1. How do food purchases by low-income households with children living in Dunedin (in relation to gram amount and type of brand purchased) differ according to income, education and food security status?

1a) The difference in gram amounts purchased for fruit, vegetables, white bread, wholegrain bread, milk, and dairy products between:

- *Less than (NZ)\$30 000 per year and (NZ)\$30 000 - \$45 000 per year income groups;*
- *Low and moderately food secure groups;*
- *Households in which the main food preparer has no secondary school qualification, a secondary school qualification, or post-secondary school qualification(s).*

1b) The difference in brand types purchased for packaged fruit and vegetables, white bread, wholegrain bread, milk, and dairy products between:

- *Less than (NZ)\$30 000 per year and (NZ)\$30 000 - \$45 000 per year income groups;*

- *Low and moderately food secure groups;*
 - *Households in which the main food preparer has no secondary school qualification, a secondary school qualification, or post-secondary school qualification(s).*
2. Is the current expenditure on fruit and vegetables by low-income, food-insecure households with children living in Dunedin adequate to meet “5+ a day” recommendations?

There is limited evidence on the efficacy of providing additional money to households to investigate its impact on food purchasing behaviour. Most of the evidence available to date is from experimental studies or grey literature, and very little literature is available from the New Zealand environment. One of the recent policy recommendations made to improve the food security status of New Zealanders involved increasing the money available to households through a food voucher or Smart Card system (Bowers et al., 2009). However, in order to ensure systems like this will help alleviate food security and improve diet quality, studies need to be completed to test their efficacy and appropriateness. The recently published results from the Spend Study (discussed in the literature review) showed small, non-significant increases in expenditure on meat and poultry, fruit and vegetables, and dairy products with the provision of extra money (Smith, 2011). However, analyses were not conducted to examine differences in the type of brands or gram amounts purchased with additional money.

Therefore, additional research questions are as follows:

3. How does the provision of additional money (in the form of supermarket grocery vouchers) impact on gram amounts of fruit, vegetables, bread, milk and dairy products purchased by low-income, food-insecure households with children living in Dunedin?
4. How does the provision of additional money (in the form of supermarket grocery vouchers) impact on the type of fruit and vegetables (fresh compared to canned, frozen, or dried) purchased by low-income, food-insecure households with children living in Dunedin?

5. How do low-income, food-insecure households with children living in Dunedin perceive the effect of provision of additional money (in the form of supermarket grocery vouchers) on their food purchasing?

3. Methods

3.1. Study Design

The 'Spend Study' was a parallel randomised controlled trial, conducted in Dunedin, New Zealand between June 2009 and May 2010. Figure 2 shows participant flow. The methodology of the Spend Study has been described extensively elsewhere (Smith, 2011). Participants were recruited and began the study in groups of ten. If inclusion criteria was met (as outlined below), households were randomly assigned to one of two groups: an intervention group that received supermarket vouchers for their supermarket of preference for four weeks, and a control group that did not receive any supermarket vouchers until the end of the study.

In total, eight weeks of food shopping receipts were collected. Part A (the descriptive study) used the first four weeks of food shopping receipts which were collected during the baseline phase of the study. For Part B (the intervention study) the full eight weeks of food shopping receipts were used. There was a one week break between the baseline and intervention phase of the study. Prior to commencing the study, ethical approval was granted by the University of Otago Human Ethics Committee. In addition, all participants provided written and informed consent.

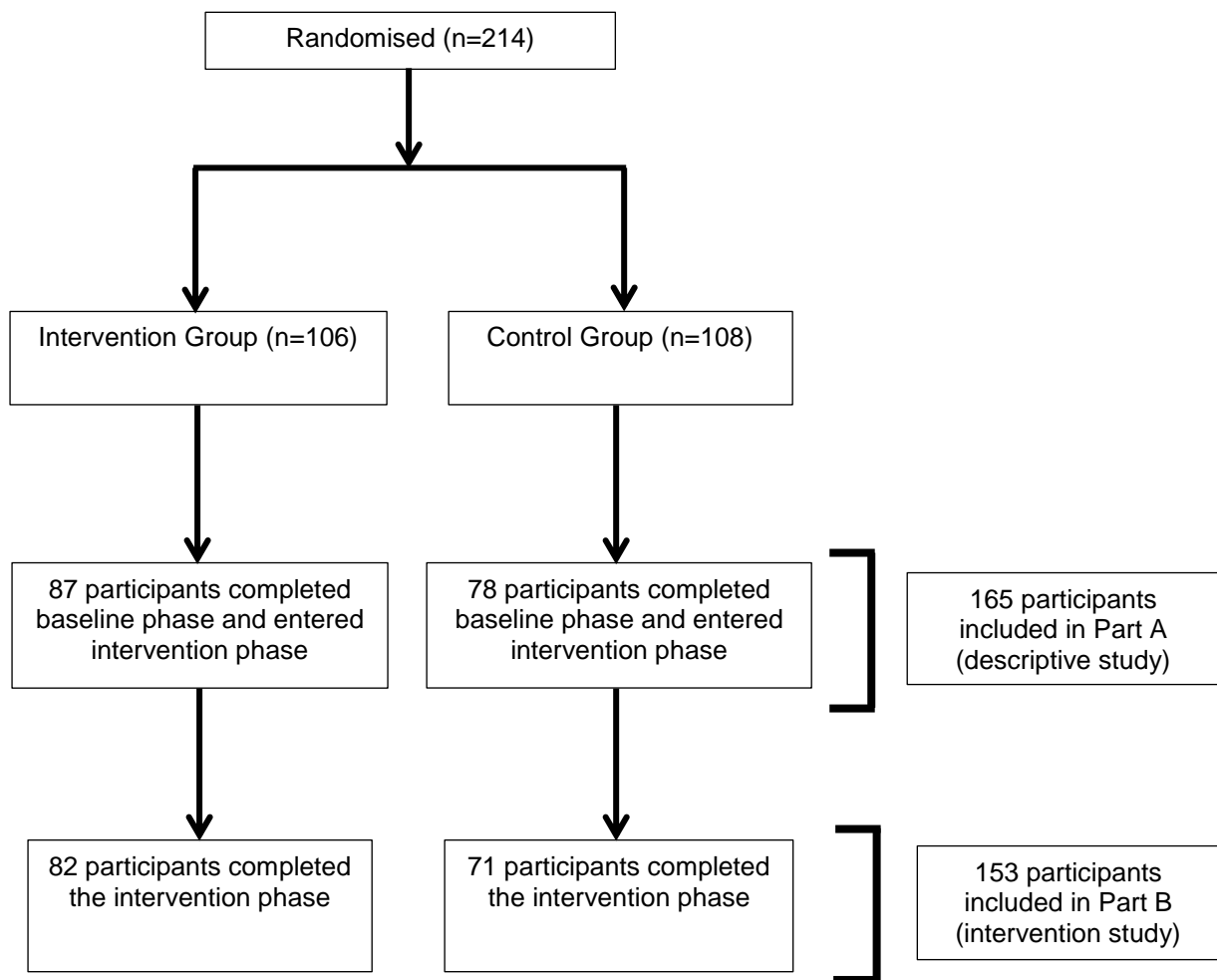


Figure 2: Participant Flow

3.2. Household recruitment and screening interview

Some participants were recruited from the Family Food Environment Study (FFES), conducted in 2007/08. The FFES was a cross-sectional survey (n=136) conducted in Dunedin and Wellington (Smith et al., 2009). Households were also recruited through advertisements in a Dunedin community newspaper as well as from flyers distributed at supermarkets and posters displayed in schools. Participants completed a screening interview to determine eligibility.

3.2.1. Eligibility

In order to be eligible to participate in the Spend Study, the following baseline inclusion criteria needed to be met (Smith, 2011):

- At least one child under the age of 18 living at home.
- Gross annual household income of less than (NZ) \$45,000.
- Not leaving Dunedin for more than one week over the eight week study period.
- No expected change in household composition over the study period.
- No expected change in household income over the study period.
- Purchase at least two thirds of food from a supermarket.

In addition to the above, only households reporting food insecurity were eligible to participate. Food security status over the past year was measured using eight validated statements developed specifically for use in national nutrition surveys (Ministry of Health, 2003c; Russell et al., 1999; University of Otago & Ministry of Health, 2011). The eight statements were:

1. I/we can afford to eat properly (always/sometimes/never).
2. Food runs out in my/our household due to lack of money (often/sometimes/never).
3. I/we eat less because of lack of money (often/sometimes/never).
4. The variety of food I am/we are able to eat is limited by a lack of money (often/sometimes/never).
5. I/we rely on others to provide food and/or money for food for my/our household when I/we don't have enough money (often/sometimes/never).
6. I/we make use of special food grants or food banks when I/we do not have enough money for food (often/sometimes/never).

7. I feel stressed because of not having enough money for food (often/sometimes/never).
8. I feel stressed because I can't provide the food I want for social occasions (often/sometimes/never).

Households who reported 'often' or 'sometimes' for statements 5 and 6, in addition to affirmative answers to three other statements were classified as having low food security. Households who positively identified with two or more statements (excluding those already classified as having low food security) were classified as moderately food secure.

If households met all of these inclusion criteria, they were then asked to provide further demographic information.

3.3. Demographics

The primary food preparer from each household that met inclusion criteria was interviewed via telephone to collect further demographic information. This included age, gender, ethnic group, household income over the previous year, home ownership, occupation of all adult household members, and any Government benefits received. Screening and demographic information was collected by the primary researcher and two trained research assistants. FilemakerPro7 software was used to enter responses to screening and demographic questions.

3.3.1. Income

Data was collected on annual household income before tax, and participants were classified into one of two categories: i) very low income (< \$30,000 per year) or ii) low income (\$30,000 to \$45,000 per year).

3.3.2. Education

The primary food preparer was asked to describe their highest school qualification and any post school qualifications for each household member older than 15 years. The main food preparer was then classified into one of three groups based on their highest educational qualification: no secondary school qualification; secondary school qualification; or post-school qualification(s).

3.4. Data collection

The main food preparer collected receipts for all foods and beverages purchased over an eight week period. After the screening interview, participants were sent an information sheet about the study as well as consent forms for each household member over 12 years of age. They were also sent two pre-stamped envelopes and four food recording sheets (one for each week) which were marked with the dates for receipt collection (Smith, 2011).

Receipts were collected from a variety of sources including supermarkets, dairies/corner shops, petrol stations, farmers markets and vegetable stalls, bakeries, butchers, fish mongers, take-away shops, and restaurants. Food recording sheets were completed when a receipt was not obtained, or for foods obtained that were not purchased. The primary food preparer was asked to write the date the food was purchased, the retail outlet, and a list of foods purchased and their associated prices (Smith, 2011).

Email, text or telephone reminders were used to contact the primary food preparer fortnightly to remind them to collect and return receipts. One pre-stamped envelope along with two food recording sheets was to be returned fortnightly. If receipts or food recording sheets were not returned, attempts were made to contact the household at least three times. If a household withdrew from the study, if possible they were contacted to ascertain the reasons for withdrawal (Smith, 2011).

3.5. Receipt coding and data entry protocol

Upon return of receipts, the dates of all receipts were checked by researchers to ensure they were within the specified collection period. For each household, receipts were numbered and labelled with a household identification number. Food items were entered into a database with the corresponding household identification number, receipt number, date of purchase, retail outlet, quantity purchased (g or mL) and brand name of food purchased (where applicable). The New Zealand Household Expenditure Classification (NZHEC) codes (used in the Household Economic Survey 2006/07) were used to code each food item. For the purpose of this analysis, these codes were

collapsed into the following major food groups: fruit, vegetables, white bread, wholegrain bread, milk, and dairy products.

3.5.1. Price

The purchase price was entered for each food item (and included discounts and GST). For food items with missing prices, the database was searched for the same item, purchased at the same store, and this was used. If no identical item was purchased, an estimated price was calculated by averaging all prices within the appropriate food code (Smith, 2011).

Price per 100g was calculated for fruit, vegetables, milk, bread, and dairy products. Price per 100g was also calculated for store, national, and premium brands within each of these food groups.

3.5.2. Quantity

The gram or mL amount of each food item purchased was entered into the database for the following food groups: fruit, vegetables, white bread, wholegrain bread, milk, and dairy products. Quantities were recorded as purchased and no adjustments were made to calculate the edible portion. In most cases, quantity was available on the receipt, but for a small number of food purchases the gram or mL information was missing or unclear. There were several reasons for this including: purchase of food items from a small shop, damaged receipt, limited product description on the receipt, or purchase of a food item that is commonly measured in an 'each' amount (e.g. broccoli). The following steps were taken when gram or mL information was missing or unclear:

1. The database was searched, and if an identical item was purchased at the same store for the same price on another occasion this quantity was used. Manufacturer and online supermarket websites were also used to find gram or mL information.
2. If the brand name and product description was identified from the receipt, the item was sighted at the supermarket and the gram/mL amount was obtained from packaging.
3. Some food items (e.g. broccoli, cauliflower, cucumber, bakery items) are most commonly purchased as an 'each' amount. For these items, an average weight (in grams) was obtained from the Concise New Zealand Food Composition

Tables or FOODFiles database if available. If the Concise New Zealand Food Composition Tables or FOODFiles database did not yield appropriate quantity information, an average weight was obtained for the food item by weighing 10 individual items (or as many as were available) and averaging the result. This was necessary for watermelon, pineapple, and corn.

4. For food items with an unknown gram/mL amount but a known price, the average price per gram/mL of similar food items was used to impute missing data.

For milk and other foods for which the information present on the receipts was in mLs, a density factor was used to convert measurements to grams. Density factors were obtained from the New Zealand Food Composition Database.

3.5.3. Brand type

The brand name for each food item was entered into the database for frozen, canned, and dried fruit and vegetables, bread, milk, and dairy products. The brand name was not recorded for fresh fruit or vegetables as they are often not “branded” or the branding is not identifiable on the receipt. If the brand name was unclear on the receipt, retail outlets were visited to seek clarification about information presented on the receipt and obtain the brand name for the item if possible. If the brand name for a food item was still unclear, ‘unknown’ was recorded.

Fruits and vegetables (canned, frozen, and dried), bread and milk products were classified into one of three categories based on their brand name: i) store; ii) national; or iii) unknown. Budget, Countdown Everyday, Homebrand, Pams, Select, and Signature Range were classified as store brands, and all other brands were classified as national (Appendix A). Dairy products (including yoghurt, cheese, cream, custard, mousse, dairy food and ice-cream) were classified into one of four categories based on their brand name: i) store; ii) national; iii) premium; or iv) unknown. A premium category was added for dairy products due to the large range of prices within the ‘national’ category. Price per 100g was averaged for each dairy product from the database. Yoghurt/dairy food with a price greater than \$0.60 per 100g; cheese with a price greater than \$2.00 per 100g; cream/sour cream/mousse/custard/reduced cream with a price greater than \$0.80 per 100g; and ice-cream with a price greater than \$0.70

per 100g were categorised as premium brands. Table A4 shows a full list of dairy products and their brand category.

3.6. Cost to meet “5+ a day”

Current New Zealand nutrition guidelines recommend consumption of at least two servings of fruit and at least three servings of vegetables per day for children, young people, and adults (Ministry of Health, 2003a, 2012). As an average portion of fruit or vegetables weighs approximately 80g, the World Health Organisation (1990) recommends consuming 400g of fruit and vegetables per day. Serving sizes are standardised in New Zealand nutrition guidelines, regardless of age or nutrient requirements, and the recommended number of servings for children, young people, and adults is the same (Ministry of Health, 2003c). Therefore, the cost to meet “5+ a day” was calculated in this study based on a daily fruit and vegetable intake of 400g per person per day (160g of fruit and 240g of vegetables). The average serving size of dried fruit is 30g (World Health Organization, 1990), however only 12% of fruit purchased in this study was non-fresh fruit (including canned, dried, and frozen). Therefore, a 400g recommendation per person per day may be a slight overestimate for people who consume one of their servings of fruit as dried fruit. Both fresh and non-fresh varieties were included in the analyses; however potatoes and kumara were excluded. Potatoes and kumara are often classified as ‘starchy carbohydrates’, and have also been excluded in other studies examining fruit and vegetable intake (Giskes, Turrell, Patterson, & Newman, 2002; Roos, Johansson, Kasmel, Klumbiene, & Prattala, 2001). As discussed in Section 4.2.1. of the Results, the median household size in the Spend Study was 4 people (2 adults and 2 children). The cost to meet “5+ a day” per household was calculated based on a four person household. The average price per gram for fruit and vegetables was calculated, and multiplied by 160 for fruit and 240 for vegetables.

3.7. Statistical Analysis for Descriptive Study

Stata 12 (Stata Corp, College Station, Tex, USA) was used for all statistical tests.

All households with complete shopping receipt data were included in the analysis of the descriptive study. The distributions for gram amounts purchased per week of fruit (fresh and non-fresh), vegetables (fresh and non-fresh), white bread, milk, and dairy products were not normal. Therefore, these variables were transformed by taking the

square root. Independent t-tests were conducted to examine differences in grams purchased by income and food security status. Linear regression was conducted to examine differences in grams purchased by level of education. For all analyses, p-values less than 0.05 were considered statistically significant, with p-values greater than 0.05 and less than 0.1 described as a tendency.

The distribution for the gram amount purchased per week of wholegrain bread was also not normal. Many households did not report any purchase of this food group, therefore medians and interquartile ranges were reported. The Wilcoxon Rank Sum Test was used to examine differences in grams of wholegrain bread purchased by food security status and income level. The Kruskal-Wallis test was used to examine differences in grams of wholegrain bread purchased by level of education.

The mean proportion of store brands purchased for consumers of each food group was calculated and compared. Linear regression was used to compare the proportion of store brands purchased by education, and independent t-tests were used to compare the proportion of store brands purchased by income and food security status. This process was repeated for national and premium (dairy) brands.

3.8. Intervention

The intervention involved allocation of supermarket vouchers, for the supermarket the primary food preparer stated was most often visited. Vouchers were posted weekly, and households were instructed to spend the vouchers received in the subsequent two weeks, apart from the final voucher which they were told to spend in the following week. The dollar value of each supermarket voucher was based on the number of members in the household and the age and gender of each household member (Smith, 2011).

Research from the FFES found low and medium income food-insecure households spent 9% less on food per week than food-secure households (Smith et al., 2009). This was estimated to be equivalent to (NZ) \$5 per week for an adult female, so the voucher amount was therefore set at (NZ) \$5 per week for adult female participants (Smith, 2011). However, not all participants in the study were adult females, so the Estimated Family Food Costs Survey was used to calculate the monetary value of vouchers

allocated to other members of the household (University of Otago, 2008). This was important as nutritional needs vary by age and gender. The Estimated Family Food Costs Survey is an annual survey which calculates the cost to purchase a basic, moderate, or liberal healthy diet for men, women, adolescents, and children (University of Otago, 2008). However, as the Spend Study was based in Dunedin, only the data on the cost of a basic diet from Dunedin was used.

Table 1 shows how values for each individual household member were derived.

Table 1: Spend Study voucher dollar allocation per person per week¹

	Basic Food Costs (NZ\$) 2008²	Cost ratio to an adult female	Spend Study (\$NZ) allocation/week
Adult Female (>18 years)	51	1.0	5.00
Adult Male (>18 years)	54	1.06 (54/51)	5.30 (5 x 1.06)
Boy (>10 years)	69	1.35 (69/51)	6.75 (5 x 1.35)
Girl (>10 years)	57	1.06 (57/51)	5.30 (5 x 1.06)
Boys and Girls (>5 years and ≤10 years)	45	0.83 (45/51)	4.15 (5 x 0.83)
Boys and Girls (>4 years and ≤5 years)	30	0.59 (30/51)	2.50 (5 x 0.59)
Boys and Girls (>1 year and ≤4 years)	28	0.55 (28/51)	2.75 (5 x 0.55)
Boys and Girls (≤1 year)	25	0.49 (25/51)	2.45 (5 x 0.49)

¹ (Smith, 2011)

² (University of Otago, 2008)

The value of the voucher allocated to each household was calculated by summing the total amount for each household member for the week. The weekly voucher value was rounded to the nearest five cents. Participants that shopped at PAK'nSAVE or New World supermarkets were provided with a prepaid voucher card with their weekly allocation loaded on. Countdown only issued vouchers in five dollar amounts, so households that identified Countdown as their supermarket of preference received their allocated amount rounded to the nearest five dollars (Smith, 2011). When receipts were returned to researchers in the post, they were checked to determine whether or not vouchers were being spent during the intervention phase (Smith, 2011).

3.8.1. Outcomes

The primary outcome for the Spend Study was the difference in phase two expenditure on fruit and vegetables between the intervention and control group (Smith, 2011). The outcomes investigated for Spend2 were:

1. The difference between the intervention and control group for the grams of fruit, vegetables, bread, milk, and dairy products purchased during the intervention phase.
2. The difference between the intervention and control group for the grams of fresh fruit and vegetables compared to canned, dried, or frozen fruit and vegetables purchased in the intervention phase.
3. The difference in participants' perception of purchasing patterns within the intervention group.

Methods used to obtain gram amount information for foods purchased by each household are described in Section 3.5.2.

3.8.2. End of Study Questionnaire

Upon completion of the study, an End of Study questionnaire was sent to all participants in the intervention group (n=82) (Appendix B). Participants were asked eight true/false questions relating to the quantity (grams/mLs) and quality (brand type) purchased of different food and non-food categories; amount of money spent on food; use of vouchers for special occasions/treats or to buy food or non-food items in bulk; timing of voucher use; and variety of foods purchased. There was also a space allocated at the end for participants to record any comments regarding the study. Household identification numbers were entered into a database alongside results from the questionnaire.

3.8.3. Sample size

Sample size for was calculated based on the primary outcome for the Spend Study, with change in the mean expenditure on fruit and vegetables as the primary endpoint (Smith, 2011). Sample size was calculated based on a minimum difference of (NZ) \$2 (SD = 4.7) between the intervention and control group for expenditure on fruit and vegetables (Smith, 2011). It was planned to recruit 237 households to allow for a 30% drop-out from withdrawals and non-return of food shopping receipts (Smith, 2011).

3.8.4. Randomisation

Once participants had agreed to take part in the Spend Study and had begun the baseline phase of data collection, they were randomly assigned to either the intervention or control group.

Randomisation was completed by the primary researcher of the Spend Study. This was conducted using computer-generated randomisation and unequal block sizes which were generated randomly (Smith, 2011).

3.8.5. Blinding

Participants were unaware when they were to receive vouchers. A detailed explanation of the participant blinding process is described elsewhere (Smith, 2011).

3.9. Statistical Analysis for Intervention Study

The distributions for gram amounts purchased per week during the intervention phase for fruit, vegetables, white bread, milk, and dairy products were not normal. Therefore, these variables were transformed by taking the square root. Linear regression was used to compare the intervention and control group for the grams of fruit, vegetables, white bread, and dairy products purchased with baseline purchase (grams) as a covariate. For all analyses, p-values less than 0.05 were considered statistically significant, with p-values greater than 0.05 and less than 0.1 described as a tendency.

The distribution for the gram amount purchased per week of wholegrain bread was also not normal. Many households did not report any purchase of this food group, therefore medians and interquartile ranges were reported. The Wilcoxon Rank Sum Test was used to examine differences in grams of wholegrain bread purchased by food security status and income level. The Kruskal-Wallis test was used to examine differences in grams of wholegrain bread purchased by level of education.

Linear regression was used to compare the gram amounts of fresh fruit and vegetables purchased compared to canned, dried, and frozen fruit and vegetables.

Microsoft Excel 2010 was used for the descriptive analyses of participants' perceptions of the effect of vouchers on quantity (grams/mLs) and quality (brand type) purchased, as well as on their general shopping habits and use of vouchers.

4. Results

The results section is presented in two parts. Part A presents results from the descriptive study and provides comparisons of gram amounts and types of brands purchased by income, education, and food security status. Part B presents results showing the effect of the intervention (provision of additional money on gram amounts purchased).

Table 2: Price per 100g for selected food groups

Food Group	Store			National		Premium	
	Price (\$) per 100g ¹	Price (\$) per 100g ¹	Number purchased	Price (\$) per 100g ¹	Number purchased	Price (\$) per 100g ¹	Number purchased
Fruit ²	0.32	0.46	451	0.53	812		
Vegetables ³	0.39	0.31	654	0.38	768		
White bread	0.40	0.35	593	0.35	1733		
Wholegrain bread	0.35	0.29	444	0.37	788		
Milk	0.17	0.16	2088	0.21	1147		
Dairy Products	0.57	0.56	404	0.55	1835	1.27	587

¹ Calculated by averaging the purchase price of foods from each food group over the eight week duration of the study.

² Includes packaged fruit only.

³ Includes packaged vegetables only, excluding potatoes and kumara.

4.1. Food Expenditure

Milk was the lowest in price, at \$0.16 and \$0.21 per 100g for store brands and national brands respectively (Table 2). For packaged fruit and vegetables, wholegrain bread, and milk, national brands were more expensive per 100g than store brands. Premium brand dairy products were the most expensive, at \$1.27 per 100g. Store brand wholegrain bread was less expensive than store brand white bread; however the opposite was found for national brand bread.

Table 3: Characteristics of Spend Study main food preparer and their household (n=165)

Characteristic	Number	(%)
Sex of main food preparer		
Male	9	(5)
Female	156	(96)
Age of main food preparer		
<40 years	87	(54)
40-49 years	61	(38)
50+ years	13	(8)
Ethnic group		
New Zealand European	142	(86)
Māori	10	(6)
Pacific	2	(1)
Asian	3	(2)
Other	8	(5)
Education level		
No secondary school qualification	30	(18)
Secondary school qualification	43	(26)
Post-secondary school qualification(s)	92	(56)
Benefit as primary income	82	(50)
Single parent household	78	(47)
Number of adults in house ¹	2	(1-2)
Number of children in house ¹	2	(1-3)
Home ownership		
Rent home	86	(55)
Own home	70	(45)
Income group		
Less than (NZ) \$30,000	92	(56)
(NZ) \$30,000-\$45,000	73	(44)
Food security status		
Low food security	41	(25)
Moderate food security	124	(75)

¹ Median and 25-75th percentile reported.

4.2. Part A – Descriptive Study Results

4.2.1. Participant Characteristics

Of the 236 people who were assessed for eligibility, 214 were randomised to the voucher group or control group. A total of 165 households had complete baseline data and were included in the analyses (Figure 2). Table 3 describes the baseline characteristics of the main food preparer and their household. The majority of main food preparers were female, less than 40 years of age, and of New Zealand European ethnicity. Over half had an annual household income of less than (NZ) \$30,000 and one quarter reported low food security. The majority of main food preparers had some form of qualification, with only 18% reporting having no secondary school qualification.

Table 4: Quantity purchased (g) and money spent (\$) per household per week on selected food groups (n=165)

Food Group	Quantity (g) per week		Percentiles					Expenditure (\$)	
	Mean	(95% CI)	10 th	25 th	50 th	75 th	90 th	Mean	(95% CI)
Fruit ¹	3342	(2927, 3756)	929	1595	2621	4469	6142	11.47	(9.98, 12.96)
Fresh	2928	(2560, 3297)	693	1405	2460	3943	5439	9.41	(8.14, 10.69)
Canned, dried, frozen	413	(336, 490)	0	42	250	584	1036	2.06	(1.66, 2.45)
Vegetables ²	2691	(2383, 2999)	608	1192	2240	3472	5643	8.89	(7.75, 10.04)
Fresh	2025	(1768, 2282)	315	872	1527	2704	4378	7.50	(6.52, 8.48)
Canned, dried, frozen	666	(569, 763)	0	200	568	940	1500	1.39	(1.12, 1.66)
White bread	1433	(1251, 1616)	250	625	1163	1962	2870	5.74	(5.05, 6.42)
Wholegrain bread	644	(497, 791)	0	0	350	875	1609	2.22	(1.67, 2.77)
Milk	5380	(4854, 5907)	1803	3090	4545	7210	9850	8.89	(8.06, 9.71)
Dairy Products	1706	(1536, 1876)	625	981	1475	2163	3164	8.33	(7.51, 9.15)

¹ Includes fresh, frozen, canned, and dried fruit.

² Includes fresh, frozen, canned, and dried vegetables, excluding potatoes and kumara.

4.2.2. Gram amounts purchased

4.2.2.1. Total quantity and expenditure

Table 4 shows during the baseline phase, households spent the most money (of the food groups examined) per week on fruit. Compared to the other food groups examined, milk was purchased in the largest quantity (grams) per week. Households purchased more than twice the amount of white bread compared to wholegrain bread per week, and the least amount of money was spent per week on the wholegrain bread food group. Milk showed the largest difference across percentiles for quantity purchased by household, with a difference of 8047g between the 10th and 90th percentiles. Twelve percent of fruit and 25% of vegetables purchased were canned, dried, or frozen.

Table 5: Gram amount purchased per week by income for selected food groups

Food Group	Very low income		Low income		p-value ²
	Mean (g) ¹	(95% CI)	Mean (g) ¹	(95% CI)	
Fruit ³	2570	(2129, 3053)	3336	(2832, 3882)	0.033
Fresh	2241	(1859, 2659)	2917	(2456, 3418)	0.033
Frozen, dried, canned	229	(155, 318)	296	(208, 398)	0.294
Vegetables ⁴	2118	(1759, 2511)	2645	(2254, 3066)	0.065
Fresh	1575	(1286, 1893)	1827	(1475, 2216)	0.293
Frozen, dried, canned	396	(288, 520)	611	(477, 761)	0.022
White bread	1175	(970, 1399)	1212	(962, 1492)	0.824
Milk	4682	(4028, 5385)	5031	(4303, 5817)	0.496
Dairy Products	1476	(1259, 1710)	1600	(1381, 1834)	0.450
Wholegrain bread ⁵	350	(0, 700)	350	(0, 1050)	0.433

¹ Geometric means are presented, calculated by back-transforming the arithmetic mean by taking the square root.

² Means compared (except for wholegrain bread) using t-tests, p<0.05 indicates statistical significance.

³ Includes fresh, frozen, canned, and dried fruit.

⁴ Includes fresh, frozen, canned, and dried vegetables, excluding potatoes and kumara.

⁵ Median and 25th-75th percentile reported. Wilcoxon Rank Sum Test was used for comparison, p<0.05 indicates statistical significance.

Table 6: Gram amount purchased per week by food security status for selected food groups

Food Group	Low food security		Moderate food security		p-value ²
	Mean (g) ¹	(95% CI)	Mean (g) ¹	(95% CI)	
Fruit ³	2386	(1736, 3138)	3077	(2832, 3882)	0.082
Fresh	2094	(1537, 2736)	2682	(2333, 3056)	0.094
Frozen, dried, canned	185	(84, 324)	284	(217, 360)	0.148
Vegetables ⁴	1778	(1268, 2374)	2548	(2254, 3066)	0.013
Fresh	1283	(858, 1795)	1828	(1572, 2103)	0.037
Frozen, dried, canned	290	(155, 467)	561	(458, 673)	0.006
White bread	1191	(922, 1495)	1191	(962, 1492)	1.000
Milk	4100	(3098, 5242)	5091	(4303, 5817)	0.083
Dairy Products	1355	(1002, 1762)	1590	(1381, 1834)	0.203
Wholegrain bread ⁵	188	(0, 550)	390	(0, 1050)	0.052

¹ Geometric means are presented, calculated by back-transforming the arithmetic mean by taking the square root.

² Means compared (except for wholegrain bread) using t-tests, p<0.05 indicates statistical significance.

³ Includes fresh, frozen, canned, and dried fruit.

⁴ Includes fresh, frozen, canned, and dried vegetables, excluding potatoes and kumara.

⁵ Median and 25-75th percentiles reported. Wilcoxon Rank Sum Test was used for comparison, p<0.05 indicates statistical significance.

4.2.2.2. Income

Households with a low income purchased significantly more grams of fruit per week, compared to households with a very low income (Table 5, $p=0.033$), with a significantly higher proportion purchasing fresh fruit (Table 5, $p=0.033$). There was also a tendency for very low income households to purchase fewer grams of vegetables per week ($p=0.065$). When vegetables were separated into fresh and non-fresh, a significant relationship was found, with very low income households purchasing less canned, dried, or frozen vegetables ($p=0.022$). No significant differences were found for any of the other food groups when households were compared by income level.

4.2.2.3. Food Security

Table 6 shows low food security status was significantly associated with purchase of fewer grams of vegetables per week ($p=0.013$). Households with low food security status purchased significantly less fresh and non-fresh vegetables compared to households with moderate food security ($p=0.037$ and $p=0.006$ respectively). Households with moderate food security had a tendency to purchase more grams of wholegrain bread than those with low food security ($p=0.052$); however the result was not statistically significant.

Table 7: Gram amount purchased per week by education level for selected food groups

Food Group	No secondary school qualification		Secondary school qualification			Post-secondary school qualification(s)		
	Mean (g) ¹	(95% CI)	Mean (g) ¹	(95% CI)	p-value ²	Mean (g) ¹	(95% CI)	p-value ²
Fruit ³	2210	(1559, 2973)	2923	(2283, 3642)	0.160	3129	(2667, 3627)	0.045
Fresh	1932	(1356, 2609)	2581	(2012, 3222)	0.150	2716	(2309, 3157)	0.053
Canned, dried, frozen	190	(87, 334)	244	(141, 375)	0.542	288	(208, 382)	0.229
Vegetables ⁴	1771	(1257, 2374)	2378	(1868, 2949)	0.132	2531	(2164, 2927)	0.036
Fresh	1155	(752, 1644)	1837	(1397, 2336)	0.043	1804	(1501, 2137)	0.029
Canned, dried, frozen	389	(222, 603)	440	(287, 626)	0.694	541	(421, 677)	0.213
White bread	1313	(939, 1751)	1253	(943, 1606)	0.820	1125	(921, 1350)	0.413
Milk	4730	(3641, 5960)	4654	(3743, 5664)	0.922	4955	(4301, 5656)	0.744
Dairy Products	1331	(1005, 1701)	1572	(1272, 1904)	0.319	1578	(1369, 1802)	0.248
Wholegrain bread ⁵	180	(0, 874)	275	(0, 700)	N/A	390	(144, 1050)	0.128

¹ Geometric means are presented, calculated by back-transforming the arithmetic mean by taking the square root.

² Groups compared using linear regression (except wholegrain bread), p<0.05 indicates statistical significance compared to no secondary school qualification.

³ Includes fresh, frozen, canned, and dried fruit.

⁴ Includes fresh, frozen, canned, and dried vegetables, excluding potatoes and kumara.

⁵ Median and 25-75th percentile reported. Kruskal-Wallis test was used for comparison, p<0.05 indicates statistical significance compared to no secondary school qualification.

4.2.2.4. Education

The mean gram amount of fruit and vegetables purchased was higher in households where the main food preparer had post-secondary school qualification(s), compared to households where the main food preparer had no secondary school qualification (Table 7, $p=0.045$ and $p=0.036$ respectively). In households where the main food preparer had post-secondary school qualification(s), there was a tendency for increased purchase of fresh fruit compared to households where the main food preparer had no secondary school qualification ($p=0.053$). Those with some level of qualifications purchased significantly more fresh vegetables than those with no secondary qualification ($p=0.043$ for secondary school qualification, $p=0.029$ for post-secondary school qualification(s)). No significant associations were found between level of educational attainment and gram amounts purchased of white bread, milk, dairy products, or wholegrain bread.

4.2.3. Expenditure required to meet "5+ a day"

Table 8: Expenditure required to meet "5+ a day"

Food Group	Purchase price (\$) per 100g ¹	Mean gram (g) amount purchased by households per day	Cost to purchase current daily intake	Cost to meet "5 a day" per household ²
Fruit	0.32	477	\$1.53	\$2.05
Vegetables	0.39	384	\$1.50	\$3.74

¹ Calculated by averaging the purchase price of all fruit/vegetables bought over the eight week duration of the study.

² "5 a day" calculated based on a 160g serving of fruit and a 240g serving of vegetables (or five 80g servings) per person. A "household" equates to four people.

Table 8 shows the amount of money spent on fruit and vegetables per day. Households would need to spend an additional \$0.52 on fruit and \$2.24 on vegetables per day in order to purchase two servings of fruit and three servings of vegetables for each household member.

4.2.4. Types of brands purchased

National brands were purchased more frequently than store brands for fruit, vegetables, white bread, wholegrain bread, and dairy products (Table 9). Milk was the exception, with store brands purchased 63% of the time. Premium dairy products were purchased more frequently than store brand dairy products, but less often than national brand dairy products.

Table 9: Percent of store, national, and premium brands purchased for each food group

Food Group	Number of Households ¹	Store (%)		National (%)		Premium (%)		Unknown (%)	
		Mean	(95% CI)	Mean	(95% CI)	Mean	(95% CI)	Mean	(95% CI)
Fruit ²	125	36.3	(30.1, 42.6)	59.1	(52.7, 65.6)			4.6	(1.4, 7.7)
Vegetables ³	137	46.6	(40.3, 52.8)	51.5	(45.3, 57.6)			1.9	(0.3, 3.6)
White bread	158	18.3	(14.2, 22.5)	53.6	(48.4, 58.8)			28.1	(23.7, 32.5)
Wholegrain bread	112	34.7	(27.0, 42.4)	61.5	(53.6, 69.4)			3.8	(1.2, 6.4)
Milk	164	63.2	(57.7, 68.8)	29.4	(24.2, 34.5)			7.4	(4.7, 10.1)
Dairy Products	162	14.6	(12.1, 17.2)	61.0	(57.4, 64.6)	18.6	(15.5, 21.7)	5.8	(4.1, 7.4)

¹ Households that did not purchase any of the food group were excluded from the analysis.

² Includes packaged fruit only.

³ Includes packaged vegetables only, excluding potatoes and kumara.

Table 10: Percent of store brands purchased by income level for selected food groups

Food Groups (Store Brand)	Number of Households ¹	Very low income		Low income		p-value ²
		Mean (%)	(95% CI)	Mean (%)	(95% CI)	
Fruit ³	125	36.2	(27.6, 44.7)	36.5	(27.2, 45.6)	0.966
Vegetables ⁴	137	44.6	(36.2, 52.9)	48.9	(39.4, 58.4)	0.496
White bread	158	18.3	(12.2, 24.3)	18.4	(12.9, 23.9)	0.967
Wholegrain bread	112	40.2	(29.4, 51.0)	27.8	(17.1, 38.6)	0.116
Milk	164	66.2	(58.9, 73.5)	59.5	(50.9, 68.0)	0.233
Dairy Products	162	15.6	(12.1, 19.1)	13.5	(9.7, 17.2)	0.416

¹ Households that did not purchase any of the food group were excluded

² P-values were calculated using t-tests, p<0.05 indicates statistical significance.

³ Includes packaged fruit only.

⁴ Includes packaged vegetables only, excluding potatoes and kumara.

Table 11: Percent of store brands purchased by food security status for selected food groups

Food Groups (Store Brand)	Number of Households ¹	Low food security		Moderate food security		p-value ²
		Mean (%)	(95% CI)	Mean (%)	(95% CI)	
Fruit ³	125	41.8	(29.0, 54.6)	34.3	(27.1, 41.4)	0.289
Vegetables ⁴	137	52.7	(39.6, 65.8)	44.3	(37.3, 51.4)	0.239
White bread	158	15.6	(8.5, 22.8)	19.2	(14.2, 24.1)	0.469
Wholegrain bread	112	36.9	(21.1, 52.7)	33.9	(25.0, 42.9)	0.741
Milk	164	67.5	(56.6, 78.4)	61.8	(55.4, 68.2)	0.378
Dairy Products	162	15.8	(10.4, 21.3)	14.2	(11.3, 17.2)	0.602

¹ Households that did not purchase any of the food group were excluded.

² P-values were calculated using t-tests, p<0.05 indicates statistical significance.

³ Includes packaged fruit only.

⁴ Includes packaged vegetables only, excluding potatoes and kumara.

4.2.4.1. Income

No significant associations were observed between the type of brand purchased and income level for any of the food groups examined (Table 10).

4.2.4.2. Food Security

A lower food security status did not significantly impact on the type of brand purchased for any of the food groups examined, but in general households with low food security purchased a higher percentage of store brand food products for most food groups (Table 11).

Table 12: Percent of store brands purchased by level of education for selected food groups

Food Group (Store brands)	Number of Households ¹	No secondary school qualification		Secondary school qualification			Post-secondary school qualification(s)		
		Mean	(95% CI)	Mean	(95% CI)	p-value ²	Mean	(95% CI)	p-value ²
Fruit ³	125	42.9	(28.5, 57.3)	32.6	(21.5, 43.7)	0.293	35.8	(27.0, 44.5)	0.403
Vegetables ⁴	137	46.3	(32.2, 60.4)	46.2	(34.0, 58.3)	0.990	46.9	(38.3, 55.5)	0.946
White bread	158	22.4	(12.9, 31.8)	10.2	(4.4, 16.0)	0.057	20.7	(14.7, 26.7)	0.759
Wholegrain bread	112	36.3	(21.2, 51.3)	23.5	(9.7, 37.3)	0.285	39.1	(28.0, 50.3)	0.784
Milk	164	66.4	(54.2, 78.6)	59.1	(47.5, 70.5)	0.388	64.2	(56.8, 71.6)	0.768
Dairy Products	162	16.3	(9.3, 23.3)	12.4	(8.1, 16.7)	0.332	15.2	(11.7, 18.7)	0.752

¹ Households that did not purchase any of the food group were excluded.

² Linear regression was used to compare the proportion of store brands purchased by education, p<0.05 indicates statistical significance compared to no secondary school qualification.

³ Includes packaged fruit only.

⁴ Includes packaged vegetables only, excluding potatoes and kumara.

4.2.4.3. Education

Level of educational attainment did not result in any difference in type of brand purchased for fruit, vegetables, wholegrain bread, milk, or dairy products (Table 12). However, those with secondary school qualifications purchased significantly more white bread with an unknown brand name compared to those with no secondary school qualification (Table C3 $p=0.03$). There was a tendency for households where the main food preparer had secondary school qualifications to purchase more store brand white bread or wholegrain bread with an unknown brand name than households where the main food preparer had no secondary school qualification (Table C3); however these results were not statistically significant.

Table 13: Characteristics of Spend Study main food preparer and their household at recruitment by group

Characteristic	Number (%)			
	Intervention group (n=82)		Control group (n=71)	
Sex of main food preparer				
Male	4	(5)	4	(6)
Female	78	(95)	67	(94)
Age of main food preparer ¹	40	(33-45)	38	(33-43)
Ethnic group				
New Zealand European	72	(88)	63	(89)
Māori	3	(4)	2	(3)
Pacific	1	(1)	1	(1)
Asian	1	(1)	2	(3)
Other	5	(6)	3	(4)
Education level				
No secondary school qualification	12	(15)	12	(17)
Secondary school qualification	22	(27)	20	(28)
Post-secondary school qualification(s)	48	(59)	39	(55)
Benefit as primary income	47	(57)	26	(37)
Single parent household	38	(46)	32	(45)
Number of adults in house ²	2	(1-4)	2	(1-4)
Number of children in house ²	2	(1-6)	2	(1-8)
Home ownership ³				
Rent home	40	(51)	36	(53)
Own home	38	(49)	32	(47)
Income group				
Less than (NZ) \$30,000	47	(57)	40	(56)
(NZ) \$30,000-\$45,000	35	(43)	31	(44)
Food security status				
Low food security	18	(22)	17	(24)
Moderate food security	64	(78)	54	(76)

¹ Median and 25th-75th percentile reported.

² Median and range (minimum-maximum) reported.

³ n=78 for the intervention group and n=68 for the control group for home ownership, as not all participants answered this question.

4.3. Part B – Intervention Results

4.3.1. Participant Characteristics

Sixty one households were excluded due to incomplete receipt data, inability to contact or withdrawal, so a total of 153 households completed the entire study and were included in the intervention analyses (Figure 2).

Table 13 describes the characteristics of the main food preparer and their household at recruitment by intervention group. The majority of main food preparers in both groups were female and of New Zealand European ethnicity. Characteristics between the intervention and control groups were similar, with over half having an annual household income less than (NZ) \$30,000 and almost one quarter reporting low food security. Over half (57%) of participants in the intervention group stated a Government benefit was their main source of income, compared to only 37% in the control group.

Table 14: Effect of vouchers versus no vouchers on weekly gram amounts purchased of selected food groups in the intervention phase

Food Group	Grams purchased per week								p-value ³
	Unadjusted Mean (95% CI)				Adjusted Mean (95% CI) ^{1,2}				
	Control Group (n=71)		Intervention Group (n=82)		Control Group (n=71)		Intervention Group (n=82)		
Fruit	3046	(2408, 3684)	3121	(2618, 3625)	2565	(2234, 2919)	2704	(2386, 3041)	0.567
Vegetable	2272	(1797, 2747)	2411	(2038, 2784)	2503	(2197, 2829)	2226	(1958, 2512)	0.198
White bread	1308	(1036, 1581)	1466	(1176, 1756)	1039	(868, 1224)	1247	(1072, 1435)	0.111
Wholegrain bread ⁴	525	(0, 1263)	368	(0, 850)					0.788
Milk	4983	(4277, 5688)	5037	(4328, 5747)	4518	(3957, 5115)	4437	(3919, 4987)	0.840
Dairy Products	1691	(1426, 1956)	1738	(1481, 1994)	1522	(1330, 1726)	1535	(1355, 1726)	0.922

¹ Data were log transformed and geometric means are reported.

² Adjusted for baseline purchase.

³ Control and intervention group compared using linear regression with adjustment for baseline purchase, p<0.05 indicates statistical significance.

⁴ Median and 25th-75th percentile reported. Wilcoxon Rank Sum Test used for comparison, p<0.05 indicates statistical significance.

4.3.2. Gram amounts purchased

There were no statistically significant differences in gram amounts purchased between the intervention and control groups during the intervention phase for any of the food groups examined (Table 14).

4.3.3. Type of fruit and vegetables purchased

Provision of additional money did not significantly alter the quantity (in grams) of fresh or canned, dried, or frozen fruit and vegetables purchased (Table 15 $p=0.907$ and $p=0.278$ respectively).

Table 15: Effect of vouchers versus no vouchers on weekly gram amounts of fruit and vegetables purchased during the intervention phase

Food Group	Control Group		Intervention Group		p-value ²
	Mean ¹	(95% CI)	Mean	(95% CI)	
Fresh fruit and vegetables	4502	(3715, 5289)	4438	(3710, 5166)	0.907
Canned, dried, and frozen fruit and vegetables	1027	(816, 1238)	867	(672, 1063)	0.278

¹ Adjusted for baseline purchase.

² $P<0.05$ indicates statistical significance.

4.3.4. Participants' perception of effect of vouchers

In total, 59% of the main food preparers in the intervention group returned the End of Study questionnaire.

Forty two percent of respondents stated they spent more on food when provided with vouchers (Figure 3). Participants reported using the vouchers to: i) buy food items in bulk (27%); ii) to increase the variety of food purchased (33%); iii) to buy food for special occasions (15%); or iv) to buy treats (31%). The majority of participants reported they made no change in the quantity (grams) or quality (brand type) of food or non-food items purchased when provided with supermarket vouchers (Figure 4 and Figure 5). Fruit, milk, and meat were the food groups for which participants most often reported a perceived increase in quantity purchased with provision of vouchers. Meat, fruit, vegetables, and snacks/biscuits/cakes were the food groups which showed the largest perceived change in brand type purchased with the provision of vouchers. No large differences were found for any of the other food or non-food groups for quantity or quality of items purchased when additional money was provided.

Twenty two respondents also included comments regarding the study (data not shown). There were several reoccurring comments made by participants including: i) vouchers enabled purchase of extras/treats/different foods; ii) voucher amount was too small to see a difference in purchasing patterns; iii) vouchers reduced stress relating to food purchasing; iv) receipt collection increased awareness of shopping patterns.

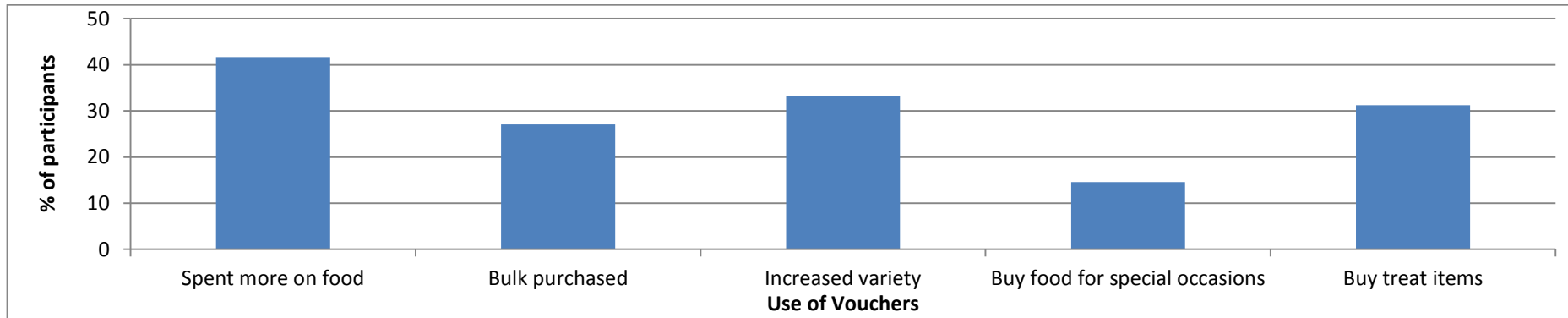


Figure 3: Participants' perception of their use of vouchers (n=48)

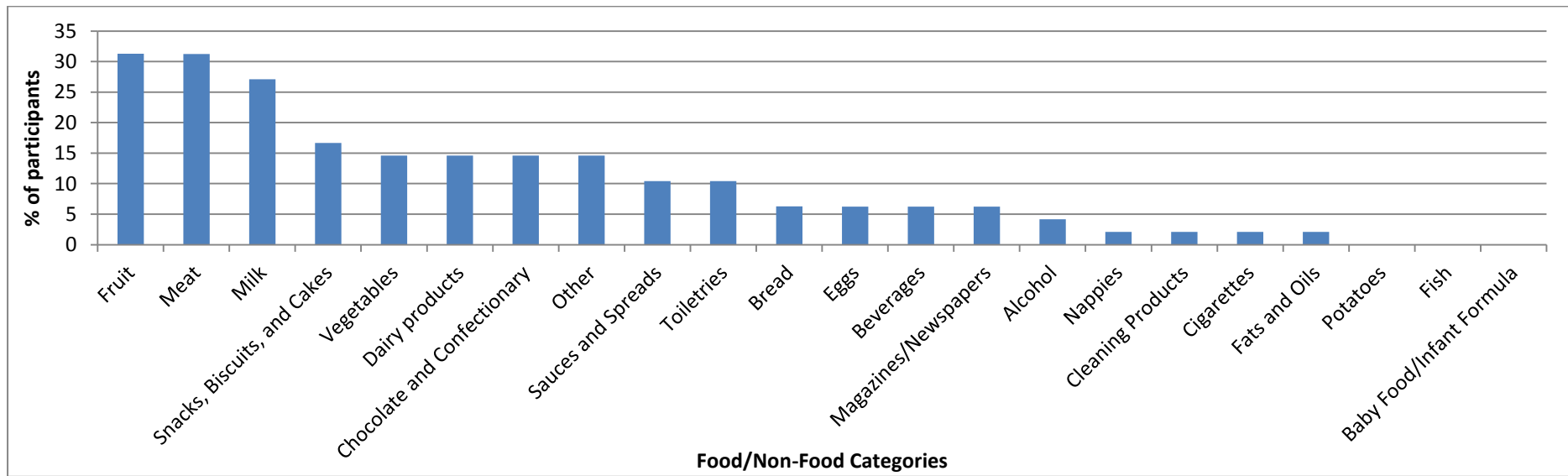


Figure 4: Percent of participants in the intervention group reporting a perceived increase in the quantity purchased of selected food and non-food items (n=48)

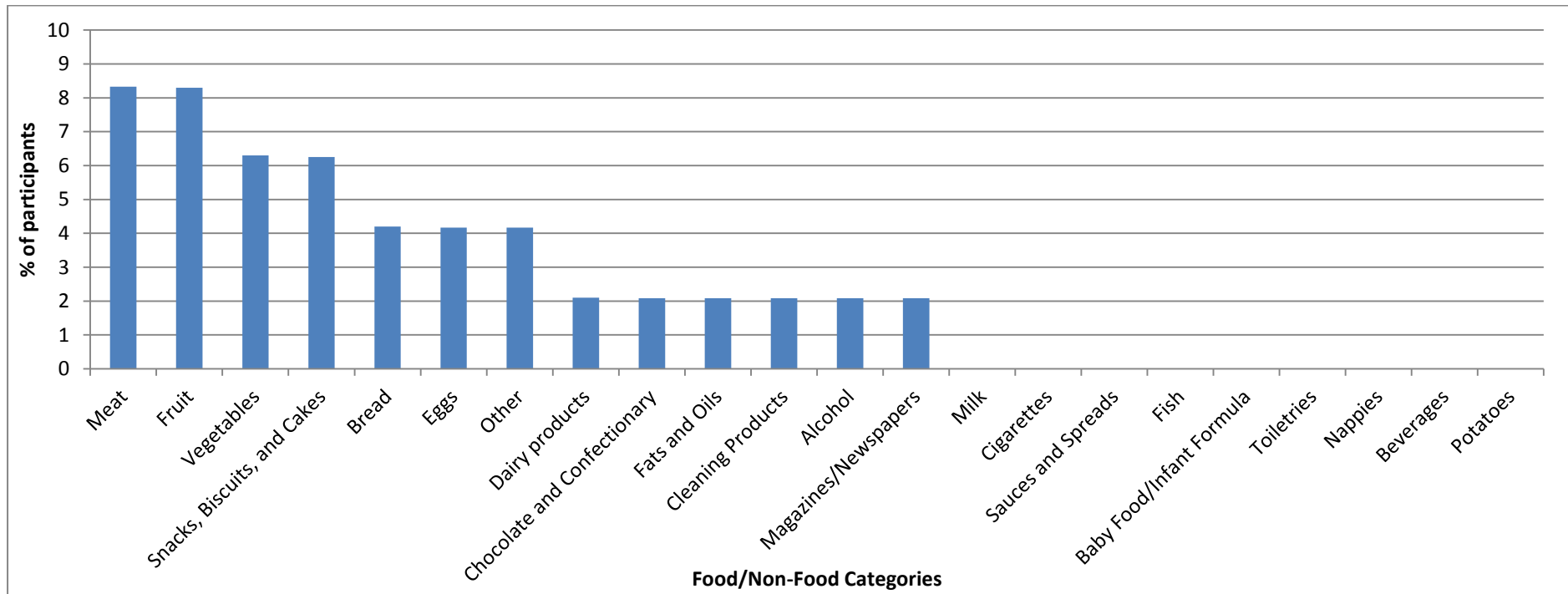


Figure 5: Percent of participants in the intervention group reporting a perceived change in the brand type (quality) purchased of selected food and non-food items (n=48)

5. Discussion

The Spend Study provided a rich data source to examine food purchasing practices of low-income, food-insecure households. For this thesis, further analyses of the Spend Study were conducted to examine firstly whether both quantity (grams) and quality (brand types) of food purchased differed by income, education, or food security status. Secondly, the effect of providing additional money on the gram amounts of fruit, vegetables, bread, milk, and dairy products, and type of fruit and vegetables purchased was examined. A discussion of the results is presented below.

5.1. Descriptive Study

5.1.1. Comparison of gram amounts purchased by income, education, and food security

More fruit was purchased in households with a higher level of income or education, and more vegetables were purchased in households with higher educational attainment or food security status. No differences were seen in the gram amounts purchased for bread, milk, or dairy products with stratification by income, education, or level of food security.

Households with a higher level of education purchased more fruit and vegetables. This finding is in agreement with Pollard et al. (2002), who reported that individuals with a higher education level have a higher consumption of fruit and vegetables compared to those with a lower education level. The results of the current study also showed that households with a higher income purchased more grams of fruit per week than households with a lower income, and households with higher food security purchased more grams of vegetables per week than households with lower food security, which is consistent with previous studies (Dixon et al., 2001; Parnell, Wilson, Mann, & Gray, 2005a; Tarasuk & Beaton, 1999) . However, it must be noted that these studies measure intake rather than food purchase.

The FFES (n=136), conducted New Zealand in 2007/08, also investigated fruit and vegetable purchases by income and food security status (Smith et al., 2009). Households with a lower income (< \$30,000) were less likely to purchase fresh vegetables compared to households with a medium or high income, but no significant

results were found for other types of fruit and vegetables (frozen or canned) when households were stratified by income or food security status. However, households with a lower income or lower food security status were more likely to report that purchasing more fruit or vegetables than they already do would be difficult on their budget (Smith et al., 2009). As this study included families across the socioeconomic status spectrum, with small numbers having low food security (n=13), firm conclusions could not be made. The Spend Study allowed examination of the same relationship in a larger group of food-insecure participants. Research from Smith et al. (2012a), alongside data from the current study (Spend2) clearly show that both expenditure and gram amounts purchased of fruit and vegetables are lower for those with low food security compared to those with moderate food security. As there was no difference in brand type purchased between low and moderately food secure groups in Spend2 (discussed in Section 5.1.2.), it is likely actual intakes are lower for those with low food security.

Both income and education were used as measures of socioeconomic status, because it is beneficial to investigate the effect of more than one socioeconomic indicator as they affect food choice through different social processes (Turrell et al., 2003). However, a limitation of this study was the lack of controlling for the effect of one indicator on the other (e.g. income was not controlled for in education analyses and vice versa). The differences shown between level of educational attainment and amount of fruit and vegetables purchased for example could be accounted for in part by other socioeconomic variables (Turrell et al., 2003). Therefore, these results may overestimate the true magnitude of effect.

The Spend Study data allowed the calculation of dollars spent per gram of fruit and vegetables. From this, we were able to estimate the dollars needed to meet fruit and vegetable guidelines. Households purchased an average of 119g of fruit and 96g of vegetables per person per day, which is below World Health Organization recommendations of 400g of fruit and vegetables daily (or five 80g servings) (World Health Organization, 1990). The current study showed \$1.45 needed to be spent per person per day (equivalent to \$40.53 per household per week) to meet “5+ a day” recommendations. This is consistent with other New Zealand research, which estimated the cost of five servings of fruit and vegetables was between \$1.13 (in summer) and \$2.12 (in winter) (Dresler-Hawke, 2007). Households in the current study spent \$21.21

on fruit and vegetables per week, which is inadequate to meet “5+ a day” recommendations. An additional \$19.32 would need to be spent per household per week to meet recommendations. Given overall food expenditure for households in the Spend Study was \$132.73 per week (Smith et al., 2012a), this is a significant amount.

Within the general adult New Zealand population, 66% reported consuming three or more servings of vegetables each day and 60% reported consuming two or more servings of fruit each day (University of Otago & Ministry of Health, 2011). In addition, those living in the most deprived areas were less likely to report consuming three or more servings of vegetables or two or more servings of fruit (University of Otago & Ministry of Health, 2011). Therefore, findings of the current study are of concern, as those in more disadvantaged circumstances may not be able to afford to meet national guidelines. Research shows the general population in New Zealand are aware of healthy eating campaigns such as “5+ a day” (Ashfield-Watt, 2006), so the consumption of a diet less in line with national guidelines is not simply due to ignorance. As not all food purchased is consumed, it is likely actual intake is lower than current recommendations, as the receipt data only showed the ‘as purchased’ portion rather than the ‘edible’ portion. Food may also be thrown away if not used, or gifted/shared with family and friends.

Twelve percent of fruit and 25% of vegetables purchased were canned, dried, or frozen. Internationally, purchase of convenience foods has increased, with research from the United States of America showing a doubling in sales of ready-prepared foods between 1982 and 1992 (Jekanowski, 1999). Reasons for changes in purchase patterns include altered in household dynamics (with more women in the workforce), smaller household size, amount of disposable income, and lack of time (Harris & Shiptsova, 2007). Fruit and vegetables are no exception to this, with European research showing a 13% increase in intake of frozen fruit and vegetables between 1991 and 1996 (Gracia & Albisu, 2001). Due to their longer shelf-life and reduced potential for wastage, canned, frozen, or dried fruit and vegetables may be preferable for those on a tight budget. As packaged and processed fruits and vegetables are often purchased and consumed, the nutritional value of these needs to be considered. This is discussed further below in Section 5.2.2.

5.1.2. Comparison of brand types purchased by income, education, and food security

Store brands are defined as those with plainer packaging and no ‘recognised’ brand name (Prendergast & Marr, 1997). Generally, store brands are only available at certain supermarket chains, whereas national brands are available at a variety of locations through branded food manufacturers and distributors (Volpe, 2011). In New Zealand, ‘Homebrand’, ‘Pams’, ‘Budget’, ‘Select’, ‘Countdown Everyday’ and ‘Signature Range’ are examples of store brands. Branded food items (such as ‘Watties’, ‘Vogels’, and ‘Anchor’) are referred to as ‘national brands’ in the following discussion. National brands were slightly more expensive (per 100g) than store brands for fruit, vegetables, wholegrain bread, and milk, and this finding is consistent with another New Zealand based study (Prendergast & Marr, 1997). Research by Prendergast and Marr (1997) (discussed in the literature review) showed that low-income households were more likely to purchase store/generic brands than higher-income households. Data collected by Statistics New Zealand also showed those on a limited income may purchase store brand food products, or change the brand they buy from week to week to utilise discounts, whereas those with more disposable income may have a higher level of brand loyalty (Statistics New Zealand, 2009). Our results do not reflect this; however there are several possible explanations for this.

All participants in the Spend Study had an annual household income of (NZ) \$45,000 or less and were all food insecure. Therefore, when households were stratified by income or food security status, differences between the two groups may have been too small to detect significant results. Future research should examine the difference in types of brands purchased amongst a wider population group.

Another explanation for the inconsistency found may be due to low-income shoppers purchasing national brands on special. A greater price difference may exist between store and national brands than shown in this study. However, our research demonstrates what happens in a real world setting, in the context of utilising discounts to stretch food dollars. As mentioned above, low-income shoppers may switch between brands weekly depending on discounts available, so show less brand loyalty (Statistics New Zealand, 2009).

Limited penetration of store brand food products for some food groups in New Zealand could also explain the lack of significant findings. Research conducted by Coriolis Research in 2003 showed only 8% of Progressive, 11% of Foodstuffs, and 15% of Woolworths supermarket sales were attributed to store brand products (Morris, 2002). Penetration of store brands in supermarkets in the United Kingdom and North America is much higher (Morris, 2002). For example, 52% of supermarket sales at Tesco in the United Kingdom around the same time period were store brands (Morris, 2002). Store brand penetration is slowly increasing in New Zealand (Morris, 2002), so it is possible that a difference may be detected in years to come. To our knowledge, there is no current published data on store brand penetration in New Zealand.

Sixty-three percent of milk purchased during the baseline phase was store brand, which was much higher percentage compared to the other food groups examined. Two explanations for this are: i) a higher penetration of store brand products in the milk category; and ii) reduced brand loyalty for milk. If participants perceived store brands to be equal to national brands in terms of quality, there would be no reason not to purchase store brands. Research also shows for foods such as milk, people have less brand loyalty and the cost (in terms of time, money, and effort) of swapping from one brand to another is low (Kwon, Lee, & Kwon, 2008).

Although national brand foods were purchased more often than store brand foods for the food groups examined (with the exception of milk), 4634 store brand foods were still purchased over the duration of the study. Therefore, store and national brand foods need to be considered equally in regards to nutrition labelling, fortification, and reformulation. Front-of-package labelling such as “% DI” (percentage of daily intake) is being voluntarily introduced by food manufacturers (Gorton, 2009). The purpose of this is to enable consumers to quickly estimate the contribution the food is making to their overall energy and nutrient intake. However, “% DI” values are rarely shown on store brand food products, as a key feature of these is their plainer packaging (Prendergast & Marr, 1997). Mandatory fortification of bread with iodine was introduced in New Zealand in 2009, which means the majority of commercially available bread is now fortified with iodine (including store and national brand breads) (Food Standards Australia New Zealand, 2012). However, fortification with folate is

still voluntary. This is problematic, as very few of the breads that are voluntarily fortified are store branded (Baking Industry Association of New Zealand, 2009).

Research conducted in 2004 showed foods with a lower cost or generic brand name often had higher sodium levels than their branded equivalents (Monro, Young, Wilson, & Chisholm, 2004). For this reason, the New Zealand Heart Foundation targeted the sodium level in bread as part of Project Target 450, as bread is the largest contributor to sodium intake in the New Zealand diet (Ministry of Health & University of Auckland, 2003). Breads with a low cost and high sales volume were targeted (which included both store and national brands), and several commercially available breads were reformulated as part of this (Heart Foundation, 2012). Some strategies are targeting both store and national brand foods, but other strategies such as voluntary folate fortification and front-of-package labelling may be missed by groups of the population who primarily purchase store brand foods. Given those with low socioeconomic status are typically at increased risk of chronic disease (Turrell & Mathers, 2001), and may be more likely to purchase store brand foods (Prendergast & Marr, 1997), it is important products they purchase are also targeted.

The high proportion of white bread with an brand type of ‘unknown’ purchased by participants is probably due to purchase of supermarket baked bread. Freshly baked bread from supermarkets was unable to be differentiated from bread where the brand type was unknown, so both were classified as ‘unknown’. Therefore, white bread had a substantially higher proportion of brands classified as ‘unknown’ compared to the other food groups. Households where the main food preparer had a secondary school qualification purchased significantly more white bread with an unknown brand type compared to households where the main food preparer had no secondary school qualification. Therefore, it is likely they were purchasing more supermarket baked bread.

5.1.3. Summary

This analysis has highlighted the importance of considering demographics such as household income, education, and food security status when investigating food choice. Although households are spending nearly one third of their food budget on fruit and vegetables, this is still inadequate to meet “5+ a day” recommendations. This study

confirms findings of other research showing fruit and vegetable intake is reduced in groups with low-socioeconomic status. The types of brands chosen by households were similar by income, education, or food security status. The limited penetration of store brands in New Zealand, equal perception of quality between store and national brands, use of discounts to purchase national brand products, and the homogeneity of the sample in respect to socioeconomic status could help to explain this.

5.2. Intervention Study

5.2.1. *Effect of provision of additional money on gram amounts purchased for selected food groups*

It was hypothesised that easing the economic burden facing families may allow them to choose ‘healthier’ food options. Recently published results from the Spend Study showed total expenditure on food was greater with the provision of additional money, but no changes were detected at the food group level (Smith, 2011). Therefore, one of the research questions in this study was to investigate the impact of the provision of additional money on gram amounts purchased of key food groups (fruit, vegetables, bread, milk, and dairy products). The current analyses found results consistent with the Spend Study, as gram amounts purchased for the food groups examined were not different between the control and intervention group. The majority of participants also did not perceive the additional money altered the quantity or quality of food they purchased. Possible explanations for these results are discussed below.

Two participants commented that the monetary value of the voucher they received was inadequate to alter their food purchasing behaviour. Recent qualitative New Zealand research by Ni Mhurchu and colleagues (2011) investigating consumer views on use of incentives to encourage healthy food purchases found some participants thought small incentives would encourage healthier food purchases, whereas other participants stated a minimum incentive of \$20 per week would be required. The average voucher amount provided in the Spend Study per household per week was \$17.15, which resulted in an increase in overall spending on food, but may have been too small to have a consistent effect on purchasing habits.

Only 59% of intervention group participants (n=46) returned the End of Study questionnaire, so non-response bias needs to be considered for this part of the analysis. People who respond to surveys may have different lifestyles or opinions to those who do not respond (Gibson, 2005). Therefore, it is possible the non-respondents had different perceptions of the impact of additional money on their food purchases. This could have been minimised by sending out reminders to participants, or by providing an additional monetary incentive for completing the questionnaire. The End of Study questionnaire was not pilot-tested or pre-tested. Several participants did not answer all the questions in the questionnaire, so there may have been some misunderstanding about what was required. In future studies, it would be advantageous to pilot and pre-test the questionnaire, as well as provide a reminder or incentive for participants to complete it, in order to obtain a complete picture of the perceptions of participants.

5.2.2. *Effect of provision of additional money on type of fruit and vegetables purchased*

It was of interest to assess whether participants were more likely to increase their purchase of fresh fruit and vegetables compared to canned, dried, or frozen varieties with the provision of additional money. Results showed extra money had no effect on the quantity of either fresh or non-fresh fruit and vegetables purchased and possible reasons are discussed below.

The descriptive study showed a higher income was associated with purchase of an increased quantity of fruit, which is consistent with research from the United States which showed ‘poor’ households (those households with an annual household income equal to 130% of the poverty line or less) purchased less fruit and vegetables, particularly fresh, compared to ‘non-poor’ households (Stewart, Blisard, & Jolliffe, 2003). Interestingly, this research also found small changes in income amongst ‘poor’ households did not result in changes in expenditure on fruit and vegetables; however the opposite was found for ‘non-poor’ households (Stewart et al., 2003). As all households in the Spend Study had a low income, provision of additional money may not have been beneficial unless it was significant enough to remove households from being classified as ‘poor’ or ‘very low-income’.

Perishability and potential for wastage are both barriers to the purchase of fresh fruit and vegetables (Pollard et al., 2002), and these would not be overcome with the provision of additional money. A recent study conducted in the United States showed when price, time to prepare, and wastage were considered, canned fruit and vegetables offered the best value in terms of cost-per-nutrients received within an edible portion (Kapica & Weiss, 2012). Frozen fruit and vegetables are nutritionally comparable to fresh varieties (Breene, 1994), however syrups or brines in canned foods, and the volume:sugar ratio of dried fruit needs to be taken into account when these items are chosen as alternatives to fresh fruit and vegetables.

5.2.3. Summary

The results of these analyses did not show that additional money altered the gram amounts purchased of key food groups or changed the type of fruit and vegetables purchased. The majority of participants also did not report changes in their purchasing patterns. Reasons for a lack of significant findings include inadequate provision of additional money, small response rate to the End of Study questionnaire, and increased perishability and potential for wastage with fresh fruit and vegetables. Future research should address the level of financial assistance required to alter food purchasing patterns, and provide incentives for participants to complete all parts of the study.

5.3. Strengths and Limitations

Strengths of the Spend Study include the real-life setting, capture of a low-income, food-insecure group, and collection of receipts from a variety of locations. Limitations include short study duration, small sample size, and recruitment of participants from Dunedin only. These have been discussed previously however for completeness will be outlined below. Strengths and limitations of the current extended analysis will also be discussed in detail.

New Zealanders purchase food from a variety of locations including supermarkets, green grocers, convenience stores, takeaway shops, and restaurants (Murray, 2012), so collection of receipts from each of these locations resulted in a more complete picture of food purchasing compared to other studies (Cullen et al., 2007; Rankin et al., 1998; Ransley et al., 2003). Recruitment and participation in the study spanned over a 12 month period, so seasonal variation was taken into account in regard to prices and food

items available. Participants also had free choice over what they spent the additional money they were allocated on. The Spend Study used random sampling to allocate participants to the intervention or control group, and had a high participant retention rate (71%). It is well documented that those on low-incomes are less likely to participate in studies (Turrell, 2000), so the high retention rate is encouraging.

Although participants clearly had a low income, they were also quite highly educated, with over half reporting post-secondary school qualifications (greater than three months full-time training). Only 39.9% of people aged over 15 in New Zealand have post-school qualifications (Statistics New Zealand, 2006b). Evidence shows those with a higher education level are more likely to make food choices in line with dietary guidelines (Groth et al., 2001; Robinson et al., 2004; Shelton, 2005), so Spend Study participants may have made 'healthier' food choices compared to other less educated low-income households.

The Spend Study only recruited participants who lived in Dunedin. People living in Dunedin mainly identify as New Zealand European (79%), with only 6.4% and 4.5% belonging to the Māori and Pacific Island ethnic groups respectively (Statistics New Zealand, 2006a), which is lower compared to New Zealand as a whole (Statistics New Zealand, 2006a). Therefore results from the Spend Study are not able to be generalised to the New Zealand population. Public health interventions need to be designed for specific ethnic groups as differences exist in their eating patterns (University of Otago & Ministry of Health, 2011), so targeted recruitment of people of Māori and Pacific Island ethnicity would enable a wider application of findings.

The intervention phase of the Spend Study ran for four weeks, which may have been too short for changes to be made in food purchasing patterns. Future randomised controlled trials conducted over a longer time-frame may show a difference in the quantity or quality of foods purchased. Previously published results from the Spend Study showed the number of receipts returned declined throughout the duration of the baseline and intervention phases (Smith, 2011). Therefore, the challenge of continued compliance (i.e. collecting receipts) with longer study duration needs to be considered.

Future research with a larger sample size and sample size calculations with gram amounts and type of brand purchased as the primary endpoints would provide a more conclusive result. The sample size for this study was calculated based on the primary endpoint for the Spend Study as it was initially designed, which was the change in mean expenditure on fruit and vegetables. This may be the reason why no significant associations were found in purchase of selected food groups with regard to gram amounts and brand types purchased in the current study.

Limitations pertinent to Spend2 include the investigation of a limited number of food categories, incomplete information available on receipts and food recording sheets, and method of brand classification. These limitations are discussed below.

Fruit, vegetables, bread, milk, and dairy products are key food groups required to make up a healthy diet (Ministry of Health, 2003a), and results from the Spend Study found small positive (but not statistically significant) differences in expenditure for fruit, vegetables, and dairy products with provision of supermarket vouchers (Smith, 2011). Time restraints prevented a wider investigation of all food categories and receipts did not provide enough information to include meat.

Although attempts were made to collect all receipts relating to food purchases, this was not always possible. Food recording sheets were used in this instance, however details given by participants on these sheets was often incomplete, which resulted in difficulty ascertaining exactly what was purchased. This was a particular problem for foods purchased at farmers' markets and fruit and vegetable shops/stalls. This could be overcome in future studies by improving the structure of the food recording sheet, and providing more explanation to participants about the importance of detailed data collection. Receipts from supermarkets provided the most complete information in respect to dollars spent, and gram amounts and brand types purchased. As the majority of food was purchased from supermarkets, it is likely results are reflective of typical food purchases. In some instances receipts did not contain quantity or brand type information, in particular for fruit and vegetables. In these cases, attempts were made to determine quantity or brand type information from other sources where possible, such as through manufacturer databases or site visits to supermarkets. A considerable burden

would have been placed on participants by asking them to weigh and record all food items for which the quantity was not present on the receipt.

Another limitation of the current study was the protocol used to categorise brands. Originally dairy products were given a brand type of 'store' or 'national' but due to the large price difference within the national brand category, it was feasible to add a third brand category. Dairy products were classified as 'national' or 'premium' based on price. However, it must be noted that no difference was found in the brand type purchased by income, education, or food security status when 'national' and 'premium' brands were considered separately or collapsed into one category.

6. Conclusion and Application to Practice

Food is an integral part of life, and impacts on nutritional status. Results from Spend2 showed education, income, and food security status are all associated with the quantity of fruit and/or vegetables purchased. Fruits and vegetables provide a number of key nutrients such as folate, vitamin A, vitamin C, potassium, fibre, vitamin K, vitamin E, and magnesium (Whitney & Rolfes, 2008). The evidence for a protective effect of fruit and vegetables on cancer and cardiovascular disease has also been well-established (Joshi et al., 1999; Joshi et al., 2001; Steinmetz & Potter, 1996). Those from more disadvantaged backgrounds may therefore be more at risk of being deficient in certain nutrients or developing chronic diseases associated with low fruit and vegetable intake.

The current study has demonstrated that demographic factors influence food purchases at the household level. It is often assumed that those with a lower income follow a diet less consistent with dietary guidelines due to poor budgeting, carelessness when shopping, ignorance about healthy food, inadequate cooking skills, or ability to grow their own fruit and vegetables (New Zealand Network Against Food Poverty, 1999). One of the key predictors of food insecurity is income (Rose, 1999), meaning that households may simply not be able to afford the foods they would like to stay healthy. When clinical dietitians are making recommendations to patients/clients, they need to be aware of the economic restraints that people face. An adequate assessment must be conducted in order to obtain a complete picture of demographic factors that may influence household food purchases. It should not be assumed that all people can afford to follow national guidelines, as an increase in expenditure on one food will impact on another. Therefore, innovative strategies need to be developed alongside the patient/client to enable them to improve their nutritional status within their budget. When recommending patients/clients eat more fruit and vegetables, preparation time, storage facilities, and cost all need to be taken into account. Dietitians need to consider the place of canned, frozen, or dried fruit and vegetables within the diet as alternatives to fresh, as these are being increasingly purchased and consumed.

Although this study did not detect any difference in quantity or quality of key food groups purchased with provision of additional money, several households commented

the extra money relived stress and enabled purchase of a wider variety of foods. It cannot be assumed that even though someone is getting assistance to purchase food (whether this be through a food bank or food grant) that they will purchase food more consistent with dietary guidelines. The assistance provided may be inadequate, or in a form that is unsuitable for the client. It is appropriate for dietitians to be familiar with benefit levels and current food spending within New Zealand. Dietitians need to tailor their practice to individual patients, and work alongside other agencies to ensure the patient receives the best treatment possible. Nutrition advice is often provided to an individual; however individuals are also part of wider families and communities. The role of dietitians should be to advocate for patients/clients, to ensure they have enough money to be food secure and provide a nutritious diet for themselves and their families.

This research has highlighted several important points, adding to the body of evidence showing the complexity of food purchase decisions. It is recommended future research is undertaken in across a wider population group, specifically targeting those of Māori and Pacific Island ethnicity. Longer study duration would also be beneficial. Further research is also needed to investigate the best method of delivering assistance as well as the level of assistance that is required to alleviate the economic burden that faces families when providing food for their household.

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Appendices

Appendix A Brand type classification

Appendix B End of Study Questionnaire

Appendix C Additional Tables

Appendix A Brand type classification

Table A1	Bread brand classification
Table A2	Fruit and vegetable brand classification
Table A3	Milk brand classification
Table A4	Dairy products brand classification

Table A1: Bread brand classification

Store	Budget Homebrand Pams Select Signature Range
National	Abe's Artisan Bakehouse Bazaar Burgen Couplands Dakshin De Brood Dovedale Freyas Giannis Gold Max Golden Joes Mamma Fiorellis Molenburg Mountain Bread Natures Fresh Norths Old El Paso Ploughmans Quality Bakers Rosedale Southern Plains Sunny Crust Tiptop Vogels

Table A2: Fruit and vegetable brand classification

Store	Budget Countdown Everyday Homebrand Pams Select Signature Range
National	18 below Alisons Angas Park Aristocrat Birdseye Camel Ceres Organics Cinderella Delish Delmaine Dole Emma Florida's Natural Fruzio Golden Circle Golden Sun Just Garlic La Italiana Leaderbrand Masterfoods McArthurs McCain Oak Oceanspray Savour SPC Sujon Summer Harvest Sun Valley Sunmaid Sunreal Sunsweet Surprise Talleys Tasti Trident True Foods Watties

Table A3: Milk brand classification

Store	Homebrand Pams Signature Range
National	a2 Anchor Carnation Cow and Gate Dairy Dale Dairy Fresh Get Natural Happy Valley Highlander Karikaas Klondyke Liddells Meadowfresh Naturalea Nestle Nippys Primo Rice Dream Sanitarium Soyfresh Swissmaid Tararua Vitasoy Wave Yakult Yeos

Table A4: Dairy products brand classification

<p>Store</p>	<p>Budget 500g cheese Budget 1kg cheese Homebrand 250g cheese Homebrand 500g cheese slices Homebrand 1kg cheese Pams 250g cheese Pams 500g cheese Pams 500g grated cheese Pams 750g cheese Signature Range 250g cheese slices Signature Range 500g cheese Signature Range 1kg cheese Homebrand 300mL cream Homebrand 500mL cream Homebrand reduced cream Pams 300mL cream Pams 500mL cream Pams 2L icecream Signature Range 2L icecream</p>
<p>National</p>	<p>Anchor 900g yoghurt (6 pack) Anchor 1200g yoghurt (12 pack) Dewinkel 1kg yoghurt Easiyo yoghurt mix (140-245g) Fresh and Fruity 300g yoghurt Fresh and Fruity 900g yoghurt (6 pack) Fresh and Fruity 1200g yoghurt (12 pack) Fresh and Fruity 1kg yoghurt Hansells 140g yoghurt mix Hansells 185g yoghurt mix Hansells 200g yoghurt mix Meadowfresh 750g yoghurt (6 pack) Meadowfresh 1kg yoghurt Naturalea 1L yoghurt Yogo 750g yoghurt (6 pack) Yoplait 750g yoghurt (6 pack) Yoplait 1kg yoghurt Alpine 500g cheese Alpine 750g cheese Alpine 1kg cheese Anchor 250g cheese Anchor 500g cheese Anchor 700g cheese Anchor 900g cheese Bouton D'or 200g feta Bouton D'or 200g ricotta Chesdale 250g cheese slices Country Goodness 250g cream cheese Country Goodness 500g cream cheese Country Goodness 250g cottage cheese</p>

Table A4: Dairy products brand classification

<p>National</p>	<p>Country Goodness 500g cottage cheese Dairymaid 800g cheese Karikaas 350g cheese Kraft 220g cream cheese Kraft 250g cream cheese Kraft 250g cheese singles Kraft 255g cheese spread Mainland 250g cheese slices Mainland 500g cheese Mainland 700g cheese Mainland 1kg cheese Milligans 1kg cheese Perfect Italiano 250g ricotta Rolling Meadow 1kg cheese Tararua 250g cream cheese Tararua 250g cottage cheese Tararua 500g cottage cheese Valumetric 500g cheese Valumetric 750g cheese Valumetric 1kg cheese Waimata 200g feta Anchor 300mL cream Anchor 500mL cream Country Goodness 500g sour cream Meadowfresh 300mL cream Meadowfresh 500mL cream Meadowfresh 600mL custard Meadowfresh 1L custard Swissmaid 600mL custard Swissmaid 1L custard Tararua 500g sour cream Al and Son 2L ice-cream Cadbury 2L ice-cream Deep South 2L ice-cream Kapiti 1L ice-cream Kiwi 2L ice-cream Mel-O-Rich 2L ice-cream Talleys 2L ice-cream Tiptop 1L ice-cream Tiptop 1.6L ice-cream Tiptop 2L ice-cream</p>
<p>Premium</p>	<p>Anchor 150g yoghurt Anchor 600g Symbio Biofarm 1L yoghurt Clearwaters 740g yoghurt Cyclops 473mL frozen yoghurt Cyclops 500g yoghurt Cyclops 1kg yoghurt Dewinkel 500g yoghurt Dewinkel 600g yoghurt</p>

Table A4: Dairy products brand classification

Premium	<p> Fresh and Fruity 500g greek yoghurt Fresh and Fruity 500g Splat Fresh and Fruity 500mL frozen yoghurt Fruche 300g yoghurt Kingland 250g soy yoghurt Kingland 500g soy yoghurt Meadowfresh 125g yoghurt Meadowfresh 400mL Activate Naturalea 600mL yoghurt Puhoi Valley 200g yoghurt Puhoi Valley 450g yoghurt Slimmers Choice 150g yoghurt Slimmers Choice 600g yoghurt Yoplait 150g greek yoghurt Yoplait 250g yoghurt Yoplait 500g Elivaé Yoplait 560g Go-Gurt Yoplait 600g Petit Miam Yoplait 400g Baby yoghurt Anchor 350g grated cheese Bel La Vache 140g cheese spread Bouton D'or 125g camembert Bouton D'or 125g brie Castello 100g cheese Ferndale 150g gouda Ferndale 200g parmesan Ferndale 200g gruyere Galaxy 100g cheese Galaxy 125g brie Galaxy 125g camembert Galaxy 200g parmesan Galaxy 200g feta Homebrand 35g cheese slice Kapiti 100g blue cheese Kraft 72g Dairybites Kraft 150g cream cheese Kraft 160g cream cheese Kraft 160g cheese wedges Lemnos 125g fruit cheese Longbush 200g feta Mable 200g cheese Mainland 70g blue cheese Mainland 100g parmesan Mainland 125g brie Mainland 125g camembert Mainland 200g special reserve cheese Mainland 375g cheese Ornelle 100g brie Ornelle 100g parmesan Ornelle 150g parmesan </p>
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Table A4: Dairy products brand classification

Premium	<p>Ornelle 200g feta Pams 200g feta Perfect Italiano 100g parmesan Perfect Italiano 125g parmesan Puhoi Valley 190g feta Signature Range 125g camembert Signature Range 125g blue cheese Talbot Forest 250g parmesan Te Mata 125g brie The Laughing Cow 140g cheese Waimata 110g camembert Waimata 125g brie Zany Zeus 168g haloumi cheese Anchor 250mL UHT cream Cinderella 284g reduced cream Country Goodness 250g sour cream Fresh and Fruity 150g mousse Nestle 250g reduced cream Pams 284g reduced cream Tararua 125g sour cream Tararua 250g sour cream Tatua 250g cream Cadbury 110mL Dream ice-cream Lite Licks 946mL ice-cream McDonalds soft serve ice-cream McDonalds ice-cream sundae NZ Natural 946mL ice-cream Streets 130mL Moritz Streets 288mL ice-cream Streets 300mL ice-cream Streets Cornetto Streets Magnum Streets 480mL Magnum pack Streets 488mL Cornetto pack Streets 732mL ice-cream Tiptop Big Bikkie Tiptop Choc Bar Tiptop Memphis Meltdown Tiptop Trumpet Tiptop Rocky Road Tiptop Jelly Tip Tiptop Goody Gum Drops Tiptop Pick 'n Mix 6 pack Tiptop Trumpet 4 pack Tiptop Eskimo Pie 6 pack Tiptop 900mL ice-cream slices Tiptop 2L ice-cream cake</p>
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Appendix B End of Study Questionnaire

End of Study Questionnaire

Please complete this questionnaire and send it back to us in the postage paid envelope provided.

1. While receiving the supermarket vouchers did you increase the quantity or change the quality of any of the following food or non-food items?

Please tick if you increased the quantity and/or quality for each item on the list below

	Increased the quantity	Changed the quality (brand)
a. Fruit		
b. Vegetables		
c. Potatoes		
d. Bread		
e. Milk		
f. Dairy		
g. Snacks, Cakes & Biscuits		
h. Eggs		
i. Beverages (excluding alcohol)		
j. Meat (includes red meat and poultry)		
k. Chocolate and confectionary		
l. Fats and Oils		
m. Sauces and Spreads		
n. Fish		
o. Baby food/infant formula		
p. Toiletries – shampoo, conditioner, toothpaste etc		
q. Nappies		
r. Cleaning products		
s. Alcohol		
t. Cigarettes		
u. Magazines/newspapers		
v. Other (specify)		

Please tick if the following statements are true or false for your household

	True	False
2. While receiving the vouchers I/we spent the same amount on food as normal		
3. While receiving the vouchers I/we spent more on food than normal		
4. I/we used the vouchers to buy food for special occasions/events		
5. I/we used the vouchers to buy treats		
6. I/we used the vouchers to buy food or non-food items in bulk		
7. I/we spent the vouchers as part of the weekly supermarket shop		
8. I/we increased the variety of food that I/we purchased		

9. If you spent the same amount on food as normal what did you use the extra money on (you may tick more than one):

- Not applicable
- Rent/mortgage
- Power
- Telephone
- Debt
- Gambling
- Entertainment
- Other _____

10. Do you take your children with you for your main shop?

- Every time
- Most times
- Sometimes
- Never/Rarely

11. Please write any comments you have regarding the study here:

Appendix C Additional Tables

Table C1 Percent of brands purchased by income level

Table C2 Percent of brands purchased by food security status

Table C3 Percent of brands purchased by level of education

Table C1: Percent of store, national, premium, and unknown brands purchased by income level for selected food groups

Food Group	Number of Households ¹	Very low income		Low income		p-value ²
		Mean	(95% CI)	Mean	(95% CI)	
Fruit ³	125					
Store		36.2	(27.6, 44.7)	36.5	(27.2, 45.6)	0.966
National		59.5	(50.6, 68.4)	58.7	(49.3, 68.1)	0.905
Unknown ⁴		4.3	(0.3, 8.4)	4.8	(-0.2, 9.9)	0.874
Vegetables ⁵	137					
Store		44.6	(36.2, 52.9)	48.9	(39.4, 58.4)	0.496
National		54.9	(46.5, 63.2)	47.5	(38.5, 56.5)	0.239
Unknown ⁴		0.54	(-0.1, 1.2)	3.6	(0.1, 7.0)	0.070
White bread	158					
Store		18.3	(12.2, 24.3)	18.4	(12.9, 23.9)	0.967
National		52.7	(45.1, 60.3)	54.6	(47.7, 61.6)	0.714
Unknown ⁴		29.0	(22.5, 35.5)	26.9	(21.0, 32.8)	0.642
Wholegrain bread	112					
Store		40.2	(29.4, 51.0)	27.8	(17.1, 38.6)	0.116
National		56.3	(45.4, 67.1)	68.0	(56.7, 79.4)	0.142
Unknown ⁴		3.5	(-0.1, 7.2)	4.1	(0.4, 7.8)	0.834
Milk	164					
Store		66.2	(58.9, 73.5)	59.5	(50.9, 68.0)	0.233
National		26.7	(20.1, 33.3)	32.7	(24.6, 40.8)	0.254
Unknown ⁴		7.1	(3.3, 10.8)	7.8	(4.0, 11.7)	0.780
Dairy Products	162					
Store		15.6	(12.1, 19.1)	13.5	(9.7, 17.2)	0.416
National		62.6	(58.0, 67.3)	59.0	(53.4, 64.6)	0.317
Premium		16.4	(12.8, 20.1)	21.3	(16.0, 26.5)	0.130
Unknown ⁴		5.3	(3.1, 7.5)	6.3	(3.8, 8.8)	0.549

¹ Participants that did not purchase any of the food group were excluded.

² p-values were calculated using independent t-tests. P<0.05 indicates statistical significance.

³ Includes frozen, canned, and dried fruit.

⁴ The unknown brand category was required to represent all foods purchased for which the brand type could not be ascertained.

⁵ Includes frozen, canned, and dried vegetables, excluding potatoes and kumara.

Table C2: Percent of store, national, premium, and unknown brands purchased by food security status for selected food groups

Food Group	Number of Households ¹	Low food security		Moderate food security		p-value ²
		Mean	(95% CI)	Mean	(95% CI)	
Fruit ³	125					
Store		41.8	(29.0, 54.6)	34.3	(27.1, 41.4)	0.289
National		54.3	(41.3, 67.2)	61.0	(53.5, 68.4)	0.364
Unknown ⁴		3.9	(-1.5, 9.3)	4.8	(0.9, 8.7)	0.810
Vegetables ⁵	137					
Store		52.7	(39.6, 65.8)	44.3	(37.3, 51.4)	0.239
National		47.1	(34.0, 60.1)	53.1	(46.2, 60.0)	0.388
Unknown ⁴		0.2	(-0.2, 0.6)	2.6	(0.3, 4.8)	0.209
White bread	158					
Store		15.6	(8.5, 22.8)	19.2	(14.2, 24.1)	0.469
National		53.5	(42.1, 64.9)	53.6	(47.8, 59.4)	0.991
Unknown ⁴		30.8	(21.4, 40.2)	27.2	(0.3, 4.8)	0.494
Wholegrain bread	112					
Store		36.9	(21.1, 52.7)	33.9	(25.0, 42.9)	0.741
National		60.7	(45.1, 76.3)	61.8	(52.6, 71.0)	0.905
Unknown ⁴		2.4	(-0.3, 5.0)	4.3	(0.9, 7.7)	0.538
Milk	164					
Store		67.5	(56.6, 78.4)	61.8	(55.4, 68.2)	0.378
National		26.8	(17.1, 36.5)	30.2	(24.2, 36.2)	0.571
Unknown ⁴		5.7	(0.6, 10.7)	8.0	(4.8, 11.2)	0.469
Dairy Products	162					
Store		15.8	(10.4, 21.3)	14.2	(11.3, 17.2)	0.602
National		61.8	(55.5, 68.0)	60.7	(56.4, 65.1)	0.806
Premium		15.6	(11.2, 19.9)	19.6	(15.7, 23.6)	0.262
Unknown ⁴		6.9	(3.3, 10.4)	5.4	(3.5, 7.2)	0.440

¹ Participants that did not purchase any of the food group were excluded.

² p-values were calculated using independent t-tests. P<0.05 indicates statistical significance.

³ Includes frozen, canned, and dried fruit.

⁴ The unknown brand category was required to represent all foods purchased for which the brand type could not be ascertained.

⁵ Includes frozen, canned, and dried vegetables, excluding potatoes and kumara.

Table C3: Percent of store, national, premium, and unknown brands purchased by level of education for selected food groups

Food Groups	Number of Households ¹	No secondary school qualification		Secondary school qualifications			Post-secondary school		
		Mean	(95% CI) ²	Mean	(95% CI) ²	p-value	Mean	(95% CI) ²	p-value
Fruit ³	125								
Store		42.9	(28.5, 57.3)	32.6	(21.5, 43.7)	0.293	35.8	(27.0, 44.5)	0.403
National		55.0	(40.3, 69.7)	59.1	(47.0, 71.1)	0.689	60.5	(51.5, 69.5)	0.534
Unknown ⁴		2.1	(-1.0, 5.1)	8.3	(-0.2, 16.8)	0.207	3.7	(-0.3, 7.8)	0.701
Vegetables ⁵	137								
Store		46.3	(32.2, 60.4)	46.2	(34.0, 58.3)	0.990	46.9	(38.3, 55.5)	0.946
National		52.6	(39.0, 66.2)	51.1	(39.3, 62.8)	0.872	51.3	(42.8, 59.9)	0.884
Unknown ⁴		1.1	(-1.1, 3.2)	2.8	(0.5, 5.0)	0.516	1.8	(-0.9, 4.4)	0.772
White bread	158								
Store		22.4	(12.9, 31.8)	10.2	(4.4, 16.0)	0.057	20.7	(14.7, 26.7)	0.759
National		53.2	(41.5, 64.8)	50.7	(39.5, 61.8)	0.761	55.0	(48.2, 61.8)	0.794
Unknown ⁴		24.5	(14.9, 34.1)	39.1	(28.2, 50.0)	0.032	24.3	(19.2, 29.4)	0.980
Wholegrain bread	112								
Store		36.3	(54.2, 78.6)	23.5	(9.7, 37.3)	0.285	39.1	(28.0, 50.3)	0.784
National		62.1	(46.8, 77.5)	67.7	(52.4, 83.1)	0.649	58.5	(47.3, 69.8)	0.737
Unknown ⁴		1.6	(-1.6, 4.7)	8.8	(0.7, 16.8)	0.075	2.3	(0.4, 5.1)	0.830
Milk	164								
Store		66.4	(54.2, 78.6)	59.1	(47.5, 70.5)	0.388	64.2	(56.8, 71.6)	0.768
National		28.5	(17.2, 39.7)	30.9	(20.6, 41.2)	0.760	28.9	(21.9, 35.9)	0.952
Unknown ⁴		5.1	(10.1, 9.2)	10.1	(3.2, 16.9)	0.237	6.9	(3.5, 10.3)	0.625
Dairy Products	182								
Store		16.3	(9.3, 23.3)	12.4	(8.1, 16.7)	0.332	15.2	(11.7, 18.7)	0.752
National		59.3	(51.6, 67.1)	60.9	(54.8, 67.0)	0.778	61.6	(56.3, 66.8)	0.644
Premium		17.5	(11.5, 23.6)	21.5	(15.6, 27.4)	0.411	17.6	(13.2, 22.1)	0.981
Unknown ⁴		6.9	(2.2, 11.6)	5.2	(2.5, 8.0)	0.513	5.6	(3.4, 7.8)	0.576

¹ Participants that did not purchase any of the food group were excluded.

² Linear regression was used to compare the percent of store, national, premium, and unknown brands purchased by education. $p < 0.05$ indicates statistical significance.

³ Includes frozen, canned, and dried fruit.

⁴ The unknown brand category was required to represent all foods for which the brand type could not be ascertained.

⁵ Includes frozen, canned, and dried vegetables, excluding potatoes and kumara.