Cooking intervention increases diet quality in adolescents: a randomised controlled trial

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Abstract

**Background:** There is limited evidence to support the direct impact of cooking interventions on diet quality, especially in adolescents. Diet quality can be measured using a Diet Quality Index (DQI). The New Zealand Diet Quality Index-Adolescents (NZDQI-A) is a validated tool used to assess adolescents’ adherence to the national eating guidelines.

**Objective:** To investigate the associations between a cooking intervention and 1) diet quality index; and 2) intake of fruit and vegetable food groups.

**Design:** This thesis reports on the interim analysis of the seven-week follow up of a cooking intervention. This study used a randomised controlled trial time series design. Eighty-four participants (aged 13-15 years old) were allocated to control or intervention groups by block-randomisation. After randomisation, those allocated to the intervention group participated in a one-week intensive cooking program. Questionnaires were completed by participants at baseline, end of intervention and seven-week follow-up. Anthropometry measurements were also taken at baseline and seven-week follow-up. The participants in the intervention then received six take-home food bags, once a week for six weeks. Those allocated to the control group were required to complete questionnaires and anthropometry at the same point as the intervention group. The New Zealand Adolescent Food Frequency Questionnaire (NZAFFQ) was used to calculate The New Zealand Diet Quality Index-Adolescents (NZDQI-A). Effects of intervention on DQI and fruit and vegetable subscales were estimated using linear regression adjusted for baseline.

**Results:** Interim analysis of the seven-week follow-up data in 84 participants (intervention = 66, control =18) showed the difference in the magnitude of change in
DQI scores between the two groups between baseline and follow up is 7.7 in favour of the intervention group. Sub scores of fruit and vegetables (FV) also significantly increased by 3 and 2.6 points respectively. Further breakdown of intervention FV scores showed improvement in adequacy category as 58.8% of the intervention participants moved up a category of fruit intake and 42.9% for vegetable adequacy made the same shift up a category. Group interview feedback reported general positive reflections on grocery shopping, making a meal for their family members, learning new skills, meeting new people and enjoyment of cooking and eating.

**Conclusion:** Participation in a cooking intervention increased total DQI and sub-scale fruit and vegetable groups. Cooking also increased adequacy of intake of both fruit and vegetables. Participants generally enjoyed and requested similar programs to be run in the future.
Preface

This candidate’s supervisor Dr Paula Skidmore conceived the concept of the research that was conducted for this thesis. She was also responsible for the process of Ethical approval, study design, study population and research protocols. Statistical analysis was conducted by Dr Jill Haszard. Dr Paula Skidmore and Caleb Robinson were responsible for randomisation of participants. Dr Katherine Black, Nick Scullion, Rosie Jackson and Olivia Toldi were responsible for the gathering of anthropometric data. Caleb Robinson and Rosie Finigan were the lead cooking instructors and program organisers. Rosie Jackson is a Master of Dietetics colleague who worked closely collecting data on self-efficacy and confidence, and whose data is reported in a separate thesis.

The aforementioned people were key members of the research team. This team and the candidate were responsible for the following:

- Collating questionnaires
- Recruiting participants
- Food preparation
- Food allocation and purchasing
- Food substitutes researched and priced
- Packing and distributing take home food bags
- Teaching and assisting in participant cooking
- Collecting informal feedback
- Administration of questionnaires
- Collection of anthropometric measurements
- Development of staples to be provided and take-home bag recipes.
- Scheduling participants for follow-up
- Data entry
- Social media updates and support

The candidate was heavily involved with three of the intervention weeks with Rosie Jackson and assisted with the preparation of the food for the duration of all of the cooking weeks. This included assisting with the recipe development, shopping trips with students, ingredients shopping, ordering and cooking. In addition, the candidate collected, entered and interpreted the questionnaire data.

The candidate was responsible for completing the following under supervision from Dr Paula Skidmore and Dr Katherine Black:

- Reviewed current literature on cooking interventions in adolescents
- Interpretation of results
- Writing of thesis
Acknowledgements

Thank you to my primary supervisor Dr Paula Skidmore for your support, advice and guidance throughout the duration of my thesis. Thank you to my secondary supervisor Dr Katherine Black for your advice and feedback and Dr Jill Haszard for conducting the statistical analysis for this thesis.

Thank you to the COOK Study team who made this project happen.

Special mention to Sprout founders Callum Hann and Themis Chryssidis for allowing us to utilise your wealth of knowledge and resources as well as taking the time to come to New Zealand to coach and implement the cooking program.

Many thanks to my fellow Masters of Dietetics students for keeping me sane, especially Rosie Jackson whom I have enjoyed working with throughout the program.

To my friends, family and partner Jonathon, your unwavering support and encouragement throughout my university years is what has allowed me to achieve this, thank you all so much for your sacrifices that have allowed me to pursue my passion in nutrition.
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<tr>
<td>BMI</td>
<td>Body Mass Index (weight (kg)/ Height (m)²)</td>
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<tr>
<td>COOK Study</td>
<td>Create Our Own Kai Study</td>
</tr>
<tr>
<td>DQI</td>
<td>Diet Quality Index</td>
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<tr>
<td>FFQ</td>
<td>Food Frequency Questionnaire</td>
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<tr>
<td>NZ</td>
<td>New Zealand</td>
</tr>
<tr>
<td>NZAFFQ</td>
<td>New Zealand Adolescent Food Frequency Questionnaire</td>
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<tr>
<td>NZDep2013</td>
<td>New Zealand Deprivation Index 2013</td>
</tr>
<tr>
<td>NZDQI-A</td>
<td>New Zealand Diet Quality Index for Adolescents</td>
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<tr>
<td>NZEO</td>
<td>New Zealand European and Other</td>
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<tr>
<td>SES</td>
<td>Socioeconomic status</td>
</tr>
<tr>
<td>THFB</td>
<td>Take home food bag</td>
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<tr>
<td>YPAQ</td>
<td>Youth Physical Activity Questionnaire</td>
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1 Introduction

The development of many non-communicable diseases including cardiovascular disease and some cancers are influenced by diet quality (1, 2), defined as adherence to national health guidelines. In New Zealand, the child obesity rates have remained stable at 11% since 2011/2012 (3). The dietary contribution to this statistic is frequent intake of energy dense food which increases total energy consumption and intake from fat, and is inversely associated with intake of fruit, vegetables and milk (4) which reduces the intake of the essential vitamins and minerals that these provide (5). Dietary choices are influenced by food availability, accessibility and diversity and one of the biggest challenges today’s society faces is people’s ability to make informed choices that best suit their dietary requirements and lifestyle. The increased availability of calorie dense, pre-made, packaged and convenience ‘fast’ foods has reduced the need for individuals to have the skills to prepare and cook a well-rounded, healthy meal with the ingredients required to provide essential vitamins and minerals. This is reflected in studies that show cooking skill level is a predictor of frequency of convenience food intake i.e. adults who have greater cooking skills are less likely to eat convenience/fast foods as frequently as those with a lower skill level (6, 7).

Having an active role in meal preparation is associated with greater intake of fruit, vegetables, fibre, folate and vitamin A, with lower intake of saturated fats, fried foods and carbonated beverages in young adults (8). However, cooking skills, which in the past were taught in classes like home economics, are no longer considered an integral part of the curriculum. This has decreased the opportunities for children and adolescents to acquire this essential life skill (9). These changes in society have also coincided with an increased popularity of television cooking shows like Master Chef and Master Chef Junior which demonstrates that there is still an abundance of interest in cooking. There are numerous
studies that have investigated cooking classes and the positive effect these have on the fruit and vegetable intake of participants across an array of age groups (10-12). Despite this, there is only limited published research on the effects of cooking classes amongst adolescents (13-18 years (13)) and specifically the impact on diet quality.

Adolescents are the ideal target audience for tackling obesogenic habits as they are on the cusp of gaining sole responsibility of their own dietary intakes. However, adolescents are a particularly challenging group in which to study diet quality due to the multiple influences on eating habits including body image, peers, snacking, eating both out and in the home, as well as the known underreporting of consumed food with overweight adolescents (14). Despite these challenges, one study reported that encouraging the cooking of family meals together improves adolescents’ feelings of wellbeing, increases participation in cooking and results in healthier eating (15).

Therefore, the primary aim of this research project is to determine the long-term effects of a cooking intervention on diet quality in adolescents, from a variety of socio-economically diverse schools across Dunedin, Otago, New Zealand. The cooking intervention, the Create Our Own Kai (COOK) Study is a one-week cooking intervention paired with six weeks of take home food bags (one per week) focusing on cooking skills, cooking confidence, well-being and diet quality incorporating fruit and vegetable intake. The data presented in this thesis is an interim analysis, seven weeks post cooking intervention, as the one-year follow-up is outside of the scope of this thesis.

While there are a multitude of cooking classes and interventions conducted worldwide, to the best of our knowledge this is the first randomised-control trial to combine; 1) an intensive hands-on cooking week, 2) cooking for the family, 3) take home ingredient and recipe bags with social media support and 4) one-year follow up. It is definitely a first for New Zealand.
2 Literature Review

2.1 Literature Search Strategy

Relevant literature was obtained searching the databases Medline via Ovid and CINAHIL during the period of September 2016 through to April 2017. The following keywords were used in varying combinations: adolescent(s), teenagers, youth, cooking, diet quality, nutrition and cooking education. Further literature was sourced from the reference lists of those articles already published. World Health Organisation and New Zealand government websites were accessed for demographic data.

2.2 Cooking, health and adolescents

Involvement in food preparation and cooking is one of the many factors that play a role in diet quality and consequently the health of adolescents. Having the skills and the knowledge to cook healthful foods at home reduces the need to frequently eat out and consume ready-made meals which are generally higher in saturated fat and cholesterol (16). Eating at home with the family has been demonstrated to be conducive to healthier eating habits including increased intake in fibre and fruit and vegetables, and decreased intake of fried foods (17). In New Zealand, adolescents (13-18 years old) (3) that reported the highest levels of cooking skills were almost twice as likely to meet the guidelines for recommended fruit and vegetable intake than those with the lowest level of cooking skills (18). These results are replicated in other studies which have also found an association between higher consumption of fruit and vegetables and participation in home cooking (19, 20).

Adolescents experience a challenging transition phase where high energy requirements are necessary for growth and this is paired with increased independence, eating out more
frequently, body image concerns, peer pressure and busy lifestyles (21). Due to these external and internal influences adolescents are continually not meeting dietary guideline requirements. Nearly 80% of obese adolescents will still be obese as adults (22); therefore, interventions with a focus on adolescent years is pertinent in determining the impact that cooking frequency and ability have on long term food intake and health outcomes.

2.3 Diet Quality and Measurement

Diet quality can be measured using an index which can estimate overall food consumption taking into account nutrients, food groups and how these interact (23, 24). A diet index is developed to reflect the level of adherence to an established dietary guideline that defines healthy eating within a specific population (25) (e.g. Ministry of Health Guidelines for Healthy Children and Young People, New Zealand (26)). A reliable method of calculating the adherence to these guidelines is through a diet quality index (DQI). While the calculation of a DQI is relatively quick, the methods to gather the required data varies in complexity, cost, time and participant burden. The most common and reliable methods used to obtain dietary information are of 24-hour recalls, food records (diary), or a validated food frequency questionnaire (FFQ) (27). Food records and twenty-four hour recalls both have their advantages and disadvantages as summarised by Magarey et al. (27)

Due to feasibility, participant burden and requirement of multiple records to gain an accurate view of usual intake, conducting 24-hour recalls and food diaries are not an ideal approach for a cohort that are generally time poor (21). On the other hand, FFQs are relatively affordable and do not require special administration training. They also have low participant burden and are able to achieve an overview of total diet or to focus on specific foods and nutrients, depending on the design and aim of the FFQ. FFQs can be especially favourable with large cohorts and can be used to calculate a DQI. Higher DQI scores indicate greater adherence to predefined eating guidelines and are associated with
desirable health outcomes including a reduced risk of all-cause mortality (24, 28). There are multiple DQIs used world-wide (25, 29). One type of DQI the Healthy Eating Index (HEI) used in America, gathers its data from 24-hr recall as well as two-day food records (30, 31). This is very time consuming and requires training of investigators to administer. DQIs used in Mediterranean (32), Canadian (33) and Australian (34) adult age cohorts use validated FFQs to obtain population data. In adolescents, the HEI which is used in American adult populations has been modified for use specifically in adolescent age groups by adopting the FFQ methodology (35). Wong et al. (36) showed that a high score (top one-third) in the New Zealand Diet Quality index for Adolescents (NZDQI-A) is associated with an overall better diet quality, higher intake of iron and lower intake of total fat. As eating guidelines are specific to a population, both by country and age, the DQI that is used must also incorporate these demographic characteristics. The NZDQI-A is a relatively new, reliable and validated method for scoring diet quality in our target audience (36) and is derived from the New Zealand Adolescent Food Frequency Questionnaire (NZAFFQ) (37). The NZDQI-A is validated in adolescents 14-18 years old and assesses the adequacy and the variety of their diet based on the five food groups of fruits, vegetables, bread and cereals, milk and milk products and meat and meat alternatives (36). The combined food group scores result in a total diet score (DQI) of 0-100. The NZDQI-A has shown that higher scores reflect higher diet quality in smaller (non-population) sized cohorts (36). NZDQI-A uses a valid NZAFFQ to gather information for calculating the indices. This NZAFFQ incorporates two previously trialled and tested FFQs as well as incorporating changes to make the questions relevant to NZ adolescents.

2.4 Observational Studies

Cross-sectional data has been gathered through the Project EAT (Eating Among Teens) survey which observed associations between adolescents’ ability and frequency of meal
preparation and cooking over the previous week and its effects on diet quality as one aspect of the study. The survey included 4,746 adolescents from public middle schools from Minnesota, USA, aged 11 – 18 years old (mean age 14.9 years) with an equal split of males and females. The majority of participants in Project EAT helped to prepare a dinner meal (68.6%) and nearly half assisted in grocery shopping (49.8%). The benefits of more frequent involvement of food shopping, preparation and cooking included making healthier food choices and an increased consumption of fruit (males and females P<0.01) and vegetables (females P<0.01) (8). Greater involvement in food preparation was also related to lower intake of fat and higher intake of some key nutrients, including fibre, Vitamin A and Folate. Other benefits associated with food preparation included an inverse relationship in soft drink consumption among females (P=0.01) and consumption of fried foods among males (P<0.01) (8).

In New Zealand, an observational study has also been used to look at the effects of cooking abilities and nutrition (18). This study used data from the nationally representative health and well-being survey, Youth ’12, which includes 8,500 participants from secondary schools (school years 9-13). Eighty percent of participants reported that they could cook a meal with relative ease and 15% reported that they could not cook a meal without help. Similar associations reported in Project EAT were found in Youth’12 which included; those with greater cooking abilities were significantly more likely to meet recommendations for fruit and vegetable intake (P<0.001) and significantly less likely to frequently consume fast foods (P<0.003) and soft drinks (P<0.001). There was also a strong significant relationship with cooking frequency and intake of fruit and vegetables, where students who reported the highest frequency of cooking were significantly more likely to consume 5 or more serves of fruit and vegetables per day than those who reported the lowest frequency of cooking. Surprisingly, students who had the highest frequency and
cooking ability were positively associated with a higher BMI (Body Mass Index) which is counter intuitive given the previously mentioned benefits of cooking at home.

The undesirable association between cooking and BMI speaks to the complexity of internal and external factors in this age group and may be due to a lack of education of healthy choices. Laska et al. (38) hypothesise that adolescents who are involved with shopping could benefit from interventions that teach strategies to shop, prepare and cook healthier options.

2.5 Intervention Studies

Limited data is available amongst adolescents for the long-term effects of cooking interventions specifically on diet quality. Adolescents are a particularly challenging group to study due to the multiple influences on their eating habits including body image, peers, snacking, eating in and away from the home and known underreporting of food intake in overweight adolescents (21, 27, 39, 40). Adolescents are the ideal target audience for tackling obesogenic habits as they are on the cusp of the independence of adulthood, which is when they will gain the sole responsibility for their own nutrition. It has been shown that those who learn cooking skills as adults are twice as likely to use pre-prepared ingredients to cook with than those who learnt to cook at a younger age (41). Teaching adolescents to cook is the focus of several interventions (Appendix A). The majority of published cooking interventions with adolescents have been conducted in the USA (42-52) and a couple originating from the UK (53, 54). All of the interventions vary greatly in their cohort characteristics (ages, gender ratio, socio-economic status, ethnicity) and the methodology (intervention duration, intensity, content, follow-up, location, hands-on components and data collection). This heterogeneity makes comparing interventions challenging. As shown in Appendix A, many interventions do not measure diet quality explicitly. Rather, they focus on individual food groups of fruit and vegetables and
disregard using the term diet quality or using a diet quality index. Cooking interventions targeting adolescents appear to be less focused on diet quality and more concerned with outcomes regarding self-efficacy/confidence and well-being which is outside of the scope of this thesis. National surveys and large cohort studies (for example Youth 12 (NZ) and Project Eat (USA) have taken the diet quality index concept and used it at a population level to assess adequacy of intake compared to their respective national dietary guidelines. Another drawback when comparing the studies is that many do not provide adequate information detailing the type of “hands-on experience” or “cooking skills” the participants actually used throughout the intervention.

The review of published data revealed other aspects of comparative differences. Methodology was found to be inconsistent and lacking reproducibility which limits the opportunity to extrapolate data. These limitations may be due to some of the studies being conducted as pilots to test intervention methodology and content. In respect to study outcomes, the term ‘diet quality’ may appear in the introduction and the conclusion to discuss how well the target audience is performing against a dietary population standard; however, it is inadequately quantified in the methods or in the results. This may be due to the fact that diet quality is lacking an international standardised definition or an agreed upon framework as different measures are used to determine a diet quality index internationally.

Some studies have measured changes in fruit and vegetable intake as a result of the intervention although none have measured diet quality. Out of those interventions which focused on adolescents and on fruit and vegetable consumption only two had intervention weeks that were intensive i.e. close to 30 hours over 5 days. The aforementioned observational studies have shown that intensive cooking programs can result in greater intakes of fruit and vegetables. The first of these studies by Condrasky
et al. (47) reports on the findings from a repeated Cooking Camp ‘Cook Like a Chef’ pilot study that ran annually from 2002 to 2005. This study describes a 23% increase in reported daily fruit and vegetable consumption of its participants pre- to post-intervention. As the questionnaires were administered directly after an intensive week of nutrition education and cooking twice daily it is plausible that the increased consumption of fruit and vegetables could be caused by the consumption of the meals provided rather than a changed behaviour in their usual environment. Condrasky et al. (48) used the evaluated methodology and structure from Condrasky 2007 to conduct an intervention in 2009 focusing on food preparation skills, food safety practices and basic nutrition principles. Questionnaires were administered before and directly after completion of the five full days of the intervention, with no further follow-up being published. Unlike the previous ‘Cook like a Chef’ camps, the 2009 intervention did not measure food intake, rather nutrition knowledge, which is another area of study and beyond the scope of this thesis. Six studies have measured fruit and vegetable intake (43, 45, 47, 49-51) with only one conducting long term follow-up(51).This study by O’Neil and Nicklas (51) was a multi-component school environment program ‘Gimme 5’ aimed at increasing servings of fruit and vegetables amongst high school students in the United States of America. Of the four components, one focused on delivering five, fifty-five-minute hands-on workshops with food where basic food preparation was conducted and cooking was completed in microwaves. This program ran for two years and showed that 2 years after initiating the program, between 1994-1996, there was a 14% increase in fruit and vegetable consumption in the intervention group, suggesting that long-term benefits can be produced by such an intervention. To our knowledge, no study has assessed the combined intervention components of fruit and vegetable intake, diet quality index and long term follow up (at 12 months post intervention) as this study was designed to do.
2.6 Other outcomes associated with cooking interventions

Other important influences in adolescent cooking and dietary behaviour include the involvement of the family, cooking at home and school curriculum. Berge et al. (60) showed that there was a significant association between adolescents preparing meals and an increase in fruit and vegetable consumption. The influence the home environment plays in diet quality is complex and environments conducive to engagement in food preparation have been associated with a positive influence on adolescents’ dietary intake (61). Those who reported a higher frequency of cooking and food preparation were also more likely to eat shared meals with their families (18). Qualitative data from a feasibility study conducted in New Zealand in 2015 (15), provided families with ingredients and recipes to cook together. These meals were perceived by the families as ‘healthier’, with less meat and larger vegetable portions. Having the ingredients ready at home was reported in the study to have reduced the impulse of eating out, although some participants found that having a new recipe to follow every night was tiresome and time consuming. Cooking frequency and health is not necessarily a linear relationship as there appears to be a ‘U-shaped’ association. Those who do not cook and those who report the highest levels of cooking participation are at greater risk of making poorer food choices. These adolescents are also more likely to experience depression and stress (18).

Adolescents’ exposure to cooking is limited especially with the decreasing role of cooking in schools (62). The school curriculum is the ideal forum to reach the largest audience of adolescents to teach them cooking skills. A recent survey across year 7 and 8 students in New Zealand reported that there was a need for more support for teachers to integrate meal planning, food preparation and health into the curriculum. Teachers also reported that inconsistent exposure to cooking education resulted in students forgetting ideas/concepts from previous classes (9).
2.7 Conclusion

To the best of our knowledge there have been no studies which have conducted a randomised control trial to assess the long-term effects (with an interim analysis) of a cooking intervention on adolescents’ diet quality in New Zealand. As the aforementioned literature suggests, there are a multitude of ways to approach cooking interventions with adolescents in an attempt to increase fruit and vegetable consumption. There is a noticeable gap in the literature where: 1) cooking studies are not randomised or controlled, 2) most of the evidence on diet quality and cooking comes from observational studies, and 3) adolescent data are not studied, even though adolescents are at a crucial nutritional and decision-making stage in their lives. As the literature reflects there is great need for interventions to investigate the impact of cooking on diet quality in adolescents.
3 Objective Statement

Building on previous research, the aim of the Create Our Own Kai (COOK) Study was to investigate, using a randomised control trial, whether a one-week intensive cooking intervention, followed by provision of bags for participants to cook one meal per week for six weeks leads to an increase in:

1) Cooking skills

2) Cooking confidence

3) Well-being

4) Fruit and vegetable intake and Diet Quality

The specific focus of this thesis is:

1) To examine if a cooking intervention is associated with an increase in diet quality index.

2) To examine intake of selected food groups (fruit and vegetables) and their association with exposure to a cooking intervention.
4 Participants and Methods

4.1 Study Participants and Recruitment

Adolescents who would be in years 9 and 10 at the time of intervention, i.e. due to start these years in February 2017 (approximate age of 13-15 years old) were eligible to participate in this study and were recruited through local schools, social media groups, advertisements and flyers in Dunedin, Otago, New Zealand. Participants were required to have their own means of transport to and from the Create Our Own Kai (COOK) Study kitchens and only one child per family was permitted to be involved in the study. There were no other enrolment exclusions. Parent and child consents were required for participation. Once consent was received participants were allocated into either control or intervention groups by block randomisation. The study received Māori consultation and the Human Ethics Committee of the University of Otago (Reference 16/126) approved study protocol.

4.2 Study Design

The COOK Study is a randomised control trial- time series design (Figure 1).

Measurements and questionnaires completed at T1 and T3 will be investigated in this thesis. Questionnaires did not contain the NZAFFQ at T3 as no behavioural change is likely to have occurred after such minimal time.
Figure 1. Cook Study Design Timeline. Week 0 (T1) = Monday of cooking week where baseline measurements were taken. Week 1 (T2) = Friday, end of week one and end of cooking intervention. T3 = seven-week follow-up and T4 = 12-month follow-up.
4.3 Intervention

Participants were block randomised by week of availability, i.e. all those available in week one of the intervention were randomised into either the control or the intervention (26 randomised into the intervention and the rest were allocated to the control group). This protocol was repeated for the following two weeks to provide three separate streams of students (A, B and C). Those in the intervention group were paired for the week, avoiding pairing those who knew each other and purposely pairing those with the same allergies, dislikes or food requirements based on religious beliefs. An allergen management plan was developed to minimise risk of cross-contamination of allergens (Appendix B).

4.3.1 Intervention Week Design

The intervention group (n = 66) completed a one-week cooking program that was conducted from 9am – 3:15pm (approximately) Monday to Friday (Appendix C). Each six-hour day consisted of watching demonstrations of each meal (up to three recipes per day), cooking the meal in allocated randomised pairs and eating together as a group. Non-cooking talks and demonstrations were dispersed throughout the week. These included nutrition, hygiene, food safety, basic skills and cooking techniques, food preparation, seasonality of food and shopping local. There were also recipe ideas and development, selecting ingredients, how to shop, writing a plan and preparation list and budgeting. A guest talk from FoodShare staff was conducted once per intervention week. This talk covered topics of food waste, best before and used-by dates, re-using food and reducing the amount of food that is sent to landfill. For each recipe, participant pairs received pre-prepared trays of portioned raw ingredients prepared by the study assistants. The trays included a recipe to serve two people, with spices and herbs allocated more liberally so the students could adjust to their own taste preferences.
<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
<th>Description</th>
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<tbody>
<tr>
<td>9am</td>
<td>Introduction</td>
<td>- Baseline measurements taken (T1)</td>
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<tr>
<td></td>
<td></td>
<td>- Outline the week</td>
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<tr>
<td></td>
<td></td>
<td>- Expectations</td>
</tr>
<tr>
<td>10am</td>
<td>Recipe 1 demonstration</td>
<td>- Participants view the dish cooked in its entirety by COOK Instructors.</td>
</tr>
<tr>
<td>10:15am</td>
<td>Participants cook recipe 1</td>
<td>- Each pair moves to their allocated stations and makes the dish.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Once the dish is ready they must completely clean their station and wait for the rest of the class to be finished before they are allowed to eat.</td>
</tr>
<tr>
<td>11am</td>
<td>Nutrition, Hygiene and food safety talk</td>
<td>- These were taken by a registered dietitian with professional experience in Food Service.</td>
</tr>
<tr>
<td>11:30am</td>
<td>Recipe 2 demonstration</td>
<td>- As “recipe 1”</td>
</tr>
<tr>
<td>11:45am</td>
<td>Participants cook recipe 2</td>
<td>- As “recipe 1”</td>
</tr>
<tr>
<td>12:45pm</td>
<td>Break</td>
<td>- Free time.</td>
</tr>
<tr>
<td>1pm</td>
<td>Recipe 3 demonstration</td>
<td>- As “recipe 1”</td>
</tr>
<tr>
<td>1:15pm</td>
<td>Participants cook recipe 3</td>
<td>- As “recipe 1”</td>
</tr>
<tr>
<td>2pm</td>
<td>Recipe ideas and development</td>
<td>- During the intensive cooking week participants are required to cook a two-course lunch meal for their parents on the Friday.</td>
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<tr>
<td></td>
<td></td>
<td>- All recipes used must be created by the participant using cook books as inspiration and help from the instructors.</td>
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<tr>
<td></td>
<td></td>
<td>- Each pair must develop a main dish and a dessert recipe, write up shopping lists, budget of $25 per pair to shop for ingredients.</td>
</tr>
<tr>
<td>3-3:15pm</td>
<td>Completion of day</td>
<td>- Participants picked up by parent/guardians</td>
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<tr>
<td></td>
<td></td>
<td>- Study coordinators, instructors and assistants meet for debrief.</td>
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*Figure 2. Example Daily Schedule (Monday)*
### 4.3.2 Recipes

Recipes for the intensive cooking week were adapted from a program developed for Australian schools by Sprout Cooking School, Adelaide, South Australia. The recipes had no added salt and contained appropriate levels of sugar for the types of dishes where required i.e. desserts. Small adaptations to these set recipes were made to incorporate seasonal fruit and vegetables, cost effective ingredients that were easily available in Dunedin and culturally appropriate food names and usage (Appendix D). Food bag recipes described in section 4.3.4.

### 4.3.3 Cooking for Family

Throughout the intensive cooking week, time was set aside to develop, adjust and finalise recipes for a two-course meal to be made by the participants for their family members on the last day of the intervention. These recipes were sourced, adapted, planned and shopped for by the participants. Guidance was provided by the COOK Study Instructors on acceptability of nutrition, palatability, costs and cooking techniques that were not taught in class. Participants were not permitted to purchase any pre-packaged or processed food. Therefore, participants were required to hand-make pasta, pizza dough, bread and desserts from scratch (‘raw’ ingredients). Instructors encouraged the participants to extend their skills and try new and interesting recipes. On the Thursday before the family meal, participants were accompanied to the grocery store to purchase the required ingredients for the following day’s lunch (Friday family lunch). In pairs, they were given a $25 New World Gift card to purchase the ingredients need for the two-course meal and a range of cupboard staples were provided from an ‘open pantry’ (Appendix E). Participants were given two and a half hours of preparation and cooking time before their guests, one family member per participant, arrived for their first course to be served at 12pm. The second
course was then served at 12:30pm, followed shortly after by a brief wrap up by the
COOK Study Team and distribution of the first take home food bag.

4.3.4 Take home food bags

Upon completion of Friday’s class, participants received the first of six take home food
bags (THFB), which they would continue to receive, one per week, for the following five
weeks. The first bag included extras that would be considered cupboard staples for the
duration of the intervention, as well as the first recipe and its raw ingredients. Each bag
thereafter consisted of a recipe and its ingredients to make an entire meal for a family of
four. Each recipe was designed to cost around $12 per meal. The THFB recipes used were
sourced and adapted from the sources shown in Table 1 (Appendix F).

Table 1. Take-home bag Recipes

<table>
<thead>
<tr>
<th>Week</th>
<th>Take home food bag Recipe</th>
<th>Appropriated from:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tofu Jungle Curry</td>
<td>Sprout AUS</td>
</tr>
<tr>
<td>2</td>
<td>Deep Crust Pizza</td>
<td>Australian Women’s Weekly</td>
</tr>
<tr>
<td>3</td>
<td>Beef Meatballs</td>
<td>Beef and Lamb NZ</td>
</tr>
<tr>
<td>4</td>
<td>Nachos</td>
<td>FoodShare, Dunedin, NZ</td>
</tr>
<tr>
<td>5</td>
<td>Tuna Pasta Bake</td>
<td>Sealord: <a href="http://www.sealord.com/nz/recipes/all-recipes/tuna-bake/">http://www.sealord.com/nz/recipes/all-recipes/tuna-bake/</a></td>
</tr>
<tr>
<td>6</td>
<td>Pasta Bean Soup</td>
<td>Alison and Simon Holst.</td>
</tr>
</tbody>
</table>

The recipes were chosen with the intent to reflect the skills they had learnt throughout the
week as well as being inexpensive, accessible and appealing to a wide audience. Bags
were distributed from a central location in Dunedin, where participant’s parents/caregivers
were required to pick them up weekly.
4.3.5 Social Media

Each of the intervention streams were encouraged to join and participate in online social media interactions on a closed group Facebook page. Photos, comments, recipe alterations and study communications were discussed across the page as well as weekly prizes for participants based on their social media interactions. Analysing the impact of this social media interaction is outside of the scope of this thesis.

4.4 Measures

4.4.1 Questionnaires

Baseline questionnaires and body measurements were taken before commencement of intervention (T1) and T3 measurements (repeat of baseline) occurred any time after the participants had completed their last week of their 6-week food bags (from week 7-10). Follow up two (T4) will be implemented at one-year post intervention and therefore is outside of the scope of this thesis. Participants completed two questionnaires at T1 and repeated them at T3. The first half of questionnaire one (Q1) is a compilation of multiple questionnaires that addressed an array of topics including: home life, cooking frequencies, cooking and food safety knowledge, well-being and self-efficacy which is outside of the scope of this thesis. The second half of Q1 consists of the NZAFFQ (Appendix G). The NZAFFQ consists of three sections: general eating habits (Appendix G, Section 1), types of foods usually eaten and frequency and types of fruit (Appendix G, Section 2), vegetables and other foods eaten in the last week (Appendix G, Section 3) (36).

Questionnaire two is the Youth Physical Activity Questionnaire (YPAQ) which is outside the scope of this thesis. T3 questionnaire data was used for qualitative feedback combined with informal verbal feedback sessions.
Controls (n= 18) completed T1 and T3 questionnaires and anthropometry was collected at each of these time points. Controls were reimbursed with a Foodstuffs New World gift voucher at both time points.

4.4.2 Anthropometry

Standing height was measured in duplicate to the closest 0.1cm using a Wedderburn portable stadiometer (Portable Height Rod Model: WS-HRP, Dunedin, New Zealand), with 2 repeat measures. If a 0.5cm difference occurred between measurements, a third standing height was taken. Participants were barefoot and heads in the Frankfurt plane position. Weight was recorded with participants wearing light clothing and a 0.5kg adjustment for clothes on a bioimpedance scale (BC418, Tanita, Tokyo Japan) with an accuracy of 0.1kg. The same equipment was used throughout the entirety of the study and study assistants received anthropometry training by Level 1 ISAK accredited persons to ensure standardisation.

4.4.3 Socioeconomic status

Participants’ socioeconomic status (SES) was estimated using the Mashblock online resource (63) which uses the data from New Zealand Deprivation Index 2013(NZDep2013) (64) based on their residential address. NZDep2013 index is a scale which ranges from 1 to 10, where 1 represents the areas with the least deprivation score and 10 with the most. This scale divides the NZ population into tenths, for example a value of 10 would indicate the top 10 percent of deprived New Zealanders. The deprivation scores are combined data from nine variables of deprivation from the 2013 census including: communication, income, employment, qualifications, home ownership, support, living space and transport. Each neighbourhood as defined by statistics New Zealand (meshblock) which is allocated an NZDep2013 Index. SES was categorized into 3 groups; low SES (NZDep 8-10), medium SES (NZDep 4-7) and high SES (NZDep 1-3).
4.4.4 School Decile

School deciles are determined by the NZDep13 of their students (65). School deciles use the same census data as SES although it is scaled in the opposite direction, a school decile of 10 will have the 10 percent of pupils with the lowest levels of deprivation. In other words, the population with the highest deviation index (10) and the lowest school decile (1) will represent the lowest socioeconomic status in both categories.

4.4.5 Ethnicity

As participants could report and specify multiple ethnicities, ethnicity was categorised by prioritisation into Maori, Pacific, or New Zealand European or Other (NZEO) which included all other ethnicities with data too small to analyse separately.

4.4.6 Diet Quality

The NZDQI-A consists of five components which represent the five food groups: fruit, vegetables, cereals (bread and cereal), dairy (milk and milk products) and meat (including meat alternatives), the allocation of food items into each group are listed in Appendix H.

Each of these categories can gain a possible score of 0-20, where 20 represents the most desired adherence to the guideline for that food group. Higher frequency of intake is associated with a higher score for each food group except meat. This is due to the ‘U-shape’ association, where both inadequate and excessive intake is associated with adverse health outcomes (66) therefore, the category ‘Meat’ is allocated the highest score of 20 for moderate intake. As serving sizes could not be quantified from this questionnaire, this data will reflect the two aspects of diet variety and adequacy within diet quality. The five aforementioned components are scored based on variety, in regards to the number of different subgroups consumed in a week and adequacy, relating to compliance to the recommended amount of servings per food group. The summation of these results is converted to produce a possible score of diet quality from 0 – 100 (36) (Appendix I).
4.4.7 Statistical Analysis

All statistical analysis was undertaken on Stata 14.2 (StataCorp, Texas) by a qualified biostatistician. As the results presented in this thesis are interim, no p-values are reported to limit premature conclusions however, 95% confidence intervals were calculated to indicate the precision of each estimate.

The differences between the control and the intervention groups in change in DQI scores and subscales scores between T1 and T3 were estimated using linear regression and adjusted for baseline.
5 Results

One hundred and thirty-five students of those who applied were eligible for participation in the COOK Study. Of those who were allocated to the control group 33.9% (18 of 53 participants) completed the study. Those allocated to the intervention streams 80.5% (66 of 82 participants) completed the study.

5.1 Diet Quality Index

The final number of participants that completed baseline and follow-up was 84, with the majority identifying as NZEO. Seventy eight percent and 62% of participants’ in the control and intervention groups respectively were females. The control and intervention subjects were of similar age; however, a greater percentage of the intervention group had medium to low SES (55%) compared to the control (45%) (Table 2).
Table 2. Demographic characteristics of COOK Study participants

<table>
<thead>
<tr>
<th></th>
<th>Control Group</th>
<th>Intervention Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participant Numbers</td>
<td>18 (21)</td>
<td>66 (79)</td>
</tr>
<tr>
<td>Age (years), mean (SD)</td>
<td>13.9 (0.8)</td>
<td>13.7 (0.8)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>4 (22)</td>
<td>25 (38)</td>
</tr>
<tr>
<td>Female</td>
<td>14 (78)</td>
<td>41 (62)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NZEO</td>
<td>18 (100)</td>
<td>60 (91)</td>
</tr>
<tr>
<td>Maori</td>
<td>0</td>
<td>6 (9)</td>
</tr>
<tr>
<td>Socio-economic status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low (high deprivation 8-10)</td>
<td>1 (6)</td>
<td>9 (14)</td>
</tr>
<tr>
<td>Medium (medium deprivation 4-7)</td>
<td>7 (39)</td>
<td>26 (41)</td>
</tr>
<tr>
<td>High (Low deprivation 1-3)</td>
<td>10 (56)</td>
<td>29 (45)</td>
</tr>
<tr>
<td>School decile</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium (4-7)</td>
<td>6 (35)</td>
<td>35 (53)</td>
</tr>
<tr>
<td>High (8-10)</td>
<td>11 (65)</td>
<td>31 (47)</td>
</tr>
<tr>
<td>Weight (kg)</td>
<td>66 (19)</td>
<td>58 (11)</td>
</tr>
<tr>
<td>Height (cm)</td>
<td>165 (9)</td>
<td>166 (8)</td>
</tr>
<tr>
<td></td>
<td>Control (n=18)</td>
<td>Intervention (n=66)</td>
</tr>
<tr>
<td>----------------</td>
<td>----------------</td>
<td>---------------------</td>
</tr>
<tr>
<td></td>
<td>Baseline Mean (SD)</td>
<td>Follow-up Mean (SD)</td>
</tr>
<tr>
<td>DQI</td>
<td>54.4 (15.5)</td>
<td>51.7 (14.8)</td>
</tr>
<tr>
<td>Fruit²</td>
<td>8.9 (5.1)</td>
<td>8.3 (4.9)</td>
</tr>
<tr>
<td>Vegetables²</td>
<td>13.9 (7.0)</td>
<td>12.2 (6.3)</td>
</tr>
</tbody>
</table>

¹Mean difference between the groups in their total DQI score change using linear regression adjusted for baseline total DQI score.

²Fruit and vegetables are reported as the subscale scores for the DQI for each food group, i.e. out of a maximum score of 20.

Between baseline and the seven-week follow-up there was a decrease in total DQI scores in the control group and an increase in the intervention group, with a significant difference in total DQI score change seen between groups (7.7 points) (Table 3). As explained in the methods, the total DQI is made up of the five food groups (sub scores), two of these are ‘Fruit’ and ‘Vegetables’ sub scores. As with the total DQI score, results for the ‘Fruit’ and ‘Vegetables’ sub scores also show a significant difference in change between the control and intervention groups. Results of the analyses investigating the variety and adequacy components of the ‘Fruit’ and ‘Vegetables’ sub scores show that no change in variety was seen as a result of the intervention (results not shown). Differences were seen between the two groups for adequacy (Table 4).
Table 4. Adequacy component of Fruit and Vegetable scores

<table>
<thead>
<tr>
<th>Adequacy score</th>
<th>Control (n=18)</th>
<th>Intervention (n=66)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Number (%) at baseline</td>
<td>Number (%) at baseline</td>
</tr>
<tr>
<td>Fruit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>2 (11)</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>3 (17)</td>
<td>17 (26)</td>
</tr>
<tr>
<td>20</td>
<td>13 (72)</td>
<td>49 (74)</td>
</tr>
<tr>
<td>Vegetables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>1 (6)</td>
<td>0</td>
</tr>
<tr>
<td>10</td>
<td>7 (39)</td>
<td>28 (42)</td>
</tr>
<tr>
<td>20</td>
<td>10 (56)</td>
<td>38 (58)</td>
</tr>
</tbody>
</table>

In the control group, there was little movement in adequacy scores, with one person moving up one category and three moving down a category.

Fifteen percent (n = 10) of the total intervention group moved up to the next category (moving from 10 to 20 points) for fruit and 18% (n = 12) for the vegetables category. In the intervention group, there were no participants in the lowest category (score = 0) and those in the highest category could not move up another category. Therefore, the only participants able to improve adequacy category were those that scored 10 at baseline. For fruit, this means 10 out of the available 17 participants (58.8%) able to move up a category did so. The same pattern is apparent in vegetable adequacy categories where 12 of the 28 participants (42.9%) able to move up a category did so.

5.2 Group Interview Analysis

During the Friday group interviews, participants indicated that all of the recipes they had eaten in the past week contained either new foods or food cooked in a new way that they had tried for the first time. With regards to fruit and vegetables, avocado was tried the
most for the first time during the intervention, closely followed by fennel and zucchini. Participants found that they were “trying new foods”, “buying a greater variety of fruit and veg” and had “many healthier snack alternatives to consider now”. Participating in the budgeting and shopping activities also provided new lessons for many including, “How to shop properly on a budget” and “Identifying new foods at the supermarket that they had never looked at before”. Trying new foods was a common theme in the responses to the question “What was your favourite part of your week and why?” (Appendix J). Specific comments from participants included; “Cook more food, try more, learn new skills and meet new people”, “challenging new foods, trying new foods”, “Tasting new dishes and food combinations” and “Making new dishes and ate foods I don’t usually eat”. Other common themes noted as participants’ favourite parts included cooking, learning and grocery shopping as shown in Table 5.
Table 5. Participant feedback on “favourite” intervention components

<table>
<thead>
<tr>
<th>Theme</th>
<th>Comments from Adolescents</th>
<th>Comments from Parents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grocery Shopping</td>
<td>Going grocery shopping, because we could choose and play around with what we wanted to buy.</td>
<td>Identifying new foods at the shops and asking for them, especially new fruit and vegetables</td>
</tr>
<tr>
<td></td>
<td>Going to the supermarket because I have never been shopping before.</td>
<td>Great for confidence and budgeting</td>
</tr>
<tr>
<td>Friday Family Meal</td>
<td>Cooking for the parents because they got to see the progress we made.</td>
<td>Delicious</td>
</tr>
<tr>
<td></td>
<td>Going grocery shopping and cooking for our parents because it was kind of like our own master chef.</td>
<td>Better than expected</td>
</tr>
<tr>
<td>Learning</td>
<td>Cooking for parents to show them what we learnt.</td>
<td>Enjoyed learning new skills and trying out new dishes</td>
</tr>
<tr>
<td></td>
<td>Learning about combinations of foods and herbs/spices that work well together. Learning to make risotto.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Try new things and learn new skills.</td>
<td></td>
</tr>
<tr>
<td>Meet new people</td>
<td>The start of the week, learning new skills, trying new foods and meeting new people.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Making new friends over the week as well as constantly learning new things.</td>
<td></td>
</tr>
<tr>
<td>Cooking and Eating</td>
<td>Cooking for everyone because everyone got to try each other’s foods.</td>
<td>They are cooking for their extended family members on the weekend</td>
</tr>
<tr>
<td></td>
<td>Making the soufflé on Tuesday as it tasted really nice and it was something that I thought I would not be able to make because it was too difficult.</td>
<td>Dishes that they learnt at the COOK Study are now being cooked at home</td>
</tr>
<tr>
<td></td>
<td>Eating the food because some I hadn’t had in that way or at all.</td>
<td></td>
</tr>
</tbody>
</table>

The main reason the participants would recommend the COOK Study to their peers was that it was fun and it taught appropriate life skills that they felt would be beneficial for their peers to learn.
6 Discussion

6.1 Main Findings

The overall aim of the COOK Study is to determine the effect of a cooking intervention on adolescents’ long-term diet quality (12 months). This interim analysis (seven-weeks post intervention) showed that the cooking intervention significantly increased total DQI scores amongst adolescents and specifically increased fruit and vegetable intake. This finding reinforces the results from previously published studies which have provided a cooking intervention and measured changes in fruit and vegetable intake (43, 45, 47, 49-51). To our knowledge this is the first study that combines an intensive one-week cooking intervention with take home food bags which shows that the gains in diet quality achieved as a result of the program can be maintained with the short-term provision of ingredients to continue cooking. The long-term findings of this study should hopefully answer the question whether these increases in diet quality are maintained after the provision of ingredients are removed.

6.2 Diet Quality Index

We found a statistically significant difference in the change in DQI score between the groups. The intervention group showed an increase of 7.7 in DQI score, while the score actually decreased for the control group. The score for each food group within the DQI (Section 4.4.6) is calculated based on the parameters of variety and adequacy (Appendix I). The results show that there was no significant change in variety score. This is likely due to the structure of the score itself and possible the fact that we are lacking power in this incomplete sample. From the results it can be seen that 15% and 18% of participants changed their adequacy category for fruit and vegetables respectively, moving from a score of 10 up to a maximum score of 20 for adequacy (Table 3). Adequacy refers to the
level of adherence to the serving recommendations of each food group and an increase in frequency of consumption, although not the amount, of a particular fruit or vegetable should be picked up using the FFQ.

However, it is possible that the structure of the DQI scoring system may not allow for detection of increased variety in all cases. For example, each component of variety is made up of several fruit or vegetables. If someone reported eating asparagus for the first time but had already indicated that they eat other vegetables within the ‘Other Vegetables’ category (including: onion or leek, mushrooms, corn, taro, peas or green beans, celery or asparagus) then their variety score based on the ‘Other Vegetables’ category would not change. Additionally, some other foods commonly tried for the first time, such as fennel, are not included in the FFQ. Therefore, the observed increase in fruit and vegetable DQI sub-score is due to a greater intake (adequacy) rather than a greater variety of different fruit and vegetables at seven weeks post-intervention (Appendix H).

Other interventions have reported similar results associated with improvements in FV intake. Condrasky et al. (47) showed a 20% increase in frequency of FV consumption compared to pre-test and O’Neil and Nicklas (51) reported a similar finding of a 14% increase in FV intake over two years during their intervention.

The qualitative data was only gathered at the end of the intervention week (Table 4), where participants reported trying new food and asking for new fruit and vegetables from their parents. This behaviour would be allocated to the DQI subscale ‘variety’. The shift from reporting greater ‘variety’ at the end of the intervention week to the data displaying greater ‘adequacy’ at the seven-week follow-up may be directly due to the intervention week ingredients and exposure to new foods. Additionally, the results from the seven-week follow-up could have been influenced by availability of different fruit and vegetables in the home and seasonality between the end of the intervention and the seven-
week follow up, as Dunedin moved from Summer to Autumn. One way to assess whether or not the intervention affected the variety of fruit and vegetables consumed would be to investigate the frequency of individual fruit and vegetables. Although this is outside of the scope of this thesis, this data is available and will be considered in future analysis of this study.

Other studies that have reported FV intake have conducted the intervention over a longer period of time ranging from ten weeks to four years and then measured FV intake directly after completion of the program (43, 45, 47, 49, 50). Post-intervention reporting could influence the results by the exposure of the intervention itself, where these foods are provided and these dietary changes are consequently captured by the post-intervention questionnaire. Therefore, it is difficult to ascertain whether these changes will be sustained long-term.

The data for the results of FV in this thesis were collected at seven weeks post intervention but this was at the conclusion of Take Home Food Bags (THFB), which may still be influencing the adolescents’ intake behaviour and hence the data collected at 12 months is most likely to be representative of any potential and sustainable behaviour change.

Adequacy of both fruit and vegetables improved at the seven-week follow-up post intervention however; there was no change in either of these food groups for the control. The increase in adequacy rather than variety may be attributed to the contents of the THFB. Described in section 4.3.4, these bags provided ingredients that would appeal to a large audience and therefore consisted of items that were cheap, familiar and accessible fruit and vegetables that could be found in Dunedin grocery stores. Providing THFB and cooking a meal for family member are novel components that have been incorporated into the COOK Study, which to the best of the researcher’s knowledge, have not previously been integrated into a single cooking intervention assessing diet quality in adolescents.
The COOK Study intervention component of the THFBs endeavours to promote further cooking. Each week the THFBs were provided for the participant to cook for their family. To our knowledge no other research has assessed the impact of an intensive week cooking intervention combined with a 6-week take-home bag. Family meal time frequency has been associated with a number of positive behaviours and nutritional benefits including limiting television use, consuming breakfast, greater intake of fruit and vegetables (67), increased calcium, folate, fibre and iron as well as some vitamins (61). A recent feasibility study in New Zealand reported the results of providing food bags to families for eight weeks. Families reported feeling that their eating was healthier with an emphasis on increased intake of fruit and vegetables (15). These factors are not analysed in this thesis but would be of interest for future research to determine if there are any similar effects of take home bags on diet quality at twelve months follow-up.

As this thesis has reported the results of the interim analysis at seven weeks post-intervention the one-year post-intervention follow-up will provide an opportunity for further analysis of this data to determine whether the increase in intake of fruit and vegetables displaced any other foods i.e. takeaways or junk food, or whether the increase in DQI was simply due the addition of more recommended foods and, therefore, could consequently increase the participants’ total energy intake.

### 6.3 Strengths and Limitations

This study’s strength lies in it being the only randomised controlled cooking intervention to assess diet quality in New Zealand, and to the best of our knowledge world-wide. Additionally, the combination of this studies components: intensive cooking week, THFB with social media support, cooking for the family and long-term follow up make this research the first of its kind internationally. It is also one of the few that has used a DQI to assess total food intake. The NZAFFQ (36) and the NZDQI-A (37) were both tested and
validated in Dunedin, New Zealand adolescents which adds strength to the reliability and reproducibility of these results. The provision of THFBs reduced the financial barrier of continuing cooking at least once per week for six weeks post-intervention. Furthermore, the intervention content was previously trialled and tested with comparable age groups in Australia as well as piloted with adolescents in Dunedin, New Zealand.

While the interim analysis of this study presents promising results, there are limitations which should be noted. The sample size of the intervention and control group does not include the entire cohort so interpretation of results should be done with caution as these interim analysis results may change when the final analysis is undertaken. Control participation and follow-up was extremely challenging. Due to the nature of randomised controlled trials, participants who enrolled in the COOK Study did so as they wanted to participate in the cooking intervention and receive the THFBs which in itself could have provided a biased sample that already had an interest in cooking. Of the fifty-three participants randomised into the control group 45% withdrew at baseline after being allocated into the control group. Even the incentive of grocery vouchers at both time points (baseline and seven-week follow-up) for completed questionnaires showed little effect on increasing control numbers at the time. This high withdrawal rate may provide a reason for the dissimilarities of the control and intervention groups. Due to the low control participation rate the control group may have captured a bias sample which has resulted in a NZEO female dominated group who reduced their total DQI over 7 weeks. This may be due to changes in holiday eating habits compared to school days or may have been more heavily influenced by one or two outliers as the sample size was so small. Randomised control trials with cooking interventions are scarce and the inability to recruit sufficient control numbers may be one of the contributing reasons. Allocation of intervention or control by schools is one-way other studies have overcome control participation (49, 51, 57).
Future studies could evaluate the success of school-based interventions. This would allow greater scope for recruitment and potentially reduce control attrition.

The baseline results show that the control and intervention groups were already dissimilar before intervention. The control group had a lower DQI than the intervention group, however, upon follow-up at seven weeks the data shows that the controls’ eating habits may have become worse showing a slight decline in DQI. This may have also been influenced by a change in reporting, seasonality of food and the changing seasons between the two timepoints or a combination of both. There is evidence that over-weight adolescents are more likely to underreport their energy intake (14). Further analysis of this data should consider analysing BMI z-score to ascertain if there were inter-group differences and, therefore, determine if this may be an underlying factor in the inter-group differences observed.

A greater percentage of the intervention group had medium to low SES (55%) compared to the control (45%), which could be another underlying factor in the intergroup baseline differences. Conklin et al. (68) showed that adults’ fruit and vegetable variety is negatively associated with lower SES while adequacy is not effected and middle to high SES households reported much higher variety of fruit and vegetables available in the home (69). This could support the findings of this interim analysis fruit and vegetable intake finding as adults are primarily responsible for food shopping and, therefore, are the gatekeepers to food availability and influence what their children eat in the home (70).

Limitations of continued cooking in the home post-intervention include access to cooking equipment including the provision of basic equipment such as measuring cups and spoons, mixing bowls and food processors.
Due to the time constraints of this study there are areas of assessment which would valuable for future studies including BMI z-scores, individual fruit and vegetable comparisons and associations of DQI with SES, frequency of cooking and BMI.

6.4 Conclusion

This interim analysis confirms that participation in a cooking intervention results in a significant difference change in DQI and fruit and vegetable intake. It also shows the strengths of using validated DQI in a notoriously difficult study population. Furthermore, this analysis highlights the increase in adequacy as a key component of fruit and vegetable intake.
7 Application of Research to Dietetic Practice

It has been established that participation in cooking interventions can increase fruit and vegetable intake (43, 45, 47, 49-51), but the importance of evidence to confirm that this association is directly attributed to cooking interventions can only be done so by randomised control trials.

Providing evidence that shows the positive effect of cooking interventions on diet quality and fruit and vegetable consumption will help strengthen the case for implementing a more effective cooking education through the school curriculum. The impact of successfully implementing a program such as the COOK Study into the school curriculum has implications for public health. Learning about cooking, budgeting, nutrition and sustainability can be used and applied throughout many aspects of adolescents’ lives, as they grow into young adults and further throughout their lifespan. The ideal application for the COOK Study program would be to integrate it into schools throughout New Zealand to capture the largest audience of adolescents. The New Zealand school curriculum has been highlighted as an area which is currently lacking an effective standardised cooking and nutrition program (9). Allowing children and adolescents a point of access to valuable and trustworthy nutritional information paired with cooking skills can help shape the way food and nutrition is viewed in society. Furthermore, allowing nationwide access to gain a foundation in cooking skills will help bridge the gap for further education throughout their lives whether it is for health or managing disease states.

Clinical dietitians invest extensive time and effort into explaining and sourcing practical healthy ways of preparing and cooking foods to fit the needs of their patients. If these patients have an understanding of basic cooking skills and previous hands-on cooking practice the barriers to achieving recommended dietary requirements would be lessened. Although it is outside the scope of this thesis, one of the most common themes arising was
increase in confidence and creativity in cooking, as well as the social aspect if the intervention, therefore for a dietitian working in clinical practice who is advising patients to improve diet quality/fruit and vegetable intake it is important to consider a more holistic approach. For example, it might be appropriate to refer a patient to an already available free community class where they can gain confidence in their skills amongst the natural social aspect of creating and eating healthy meals.

Therefore, the addition of an effective cooking and nutrition program like the COOK Study, would help to empower New Zealand adolescents to make the right dietary choices which in turn will impact on their health throughout their lifespan as well as highlight the need for dietitians to have a greater understanding of their clients cooking skills and knowledge to enable them to access local services to increase their confidence through social cooking experiences.
8 References


9 Appendices

Appendix A: Summary of Peer-Reviewed Literature on Cooking and Diet Quality

Appendix B: Allergy management Plan

Appendix C: Weekly Sprout Program

Appendix D: Intervention Week Recipes

Appendix E: Pantry Staples

Appendix F: Take Home Food Bag recipes

Appendix G: NZAFFQ

Appendix H: Food Components of the DQI

Appendix I: Scoring of the DQI

Appendix J: COOK Study Feedback Form
9.1 Appendix A: Summary of Peer-Reviewed Literature on Cooking and Diet Quality

<table>
<thead>
<tr>
<th>Author(s), year and country</th>
<th>Study Population</th>
<th>Intervention Components</th>
<th>Areas addressed/ measured</th>
<th>Explicitly measured Diet Quality</th>
<th>Evaluation Design</th>
<th>Key Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evans A, et al. 2012. (49) (USA)</td>
<td>Age=12-14 years n=214</td>
<td>The Sprouting Healthy Kids (SHK), Multi-component garden-based intervention 5-month intervention including: cafeteria, vegetables, farmer visits, taste-testing, after-school classes (hands-on) and farm field trips.</td>
<td>Student SHK Questionnaire: Measured- FV consumption, motivation for eating FV, self-efficacy, preference, knowledge.</td>
<td>No</td>
<td>Pre- and post-test non-equivalent group design. 4 x intervention schools, 1 x control school.</td>
<td>Students who were exposed to one or more of the SHK components scored significantly higher on the knowledge measure at post-test (p=0.02) and marginally lower on the preference for unhealthy foods (p = 0.07). Exposure to two or more intervention components reported an increase in FV per day (p&lt;0.05).</td>
</tr>
<tr>
<td>Gatenby LA, et al. 2011. (53) (UK)</td>
<td>Age=12-13 years n=55</td>
<td>Cooking Communities 10 x 1.5-hour cooking clubs, one per week over 10 weeks. Cooking and cultural events.</td>
<td>Cooking skills, healthy eating and multicultural cohesion.</td>
<td>No</td>
<td>Pre- and post-test questionnaire</td>
<td>Reported increase in of the pupils cooking skills in cooking a meal, simmering food and healthy cooking). Cultural awareness improved (doubled) as participants could match 7 out of 10 cultural foods with their events (compared to 3/10 at baseline).</td>
</tr>
<tr>
<td>Thomas HC and Irwin JD, 2011. (55,57) (CANADA)</td>
<td>Age=13-18 years n=8</td>
<td>Cook it up! Program for at risk youths, twice a month for 2 hours for 18 months.</td>
<td>Focus on food, awareness of agriculture including field trips, healthy eating, food preparation and food purchasing.</td>
<td>No</td>
<td>Pre- and post-test cooking skills questionnaire and qualitative and photovoice used.</td>
<td>Qualitative data from photovoice resulted in four major themes of; food literacy, aptitude, connectedness and local and fresh ingredients. The only barrier identified was access to unhealthy foods.</td>
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<table>
<thead>
<tr>
<th>Author(s), year and country</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Condrasky MD, et al. 2010. (48) (USA)</td>
<td>Age= 10-14 years n=99</td>
<td>Cooking camp. <em>Cook like a Chef</em> 6 hrs per day x 5 days across one week.</td>
<td><em>Let’s Eat Healthy!</em> questionnaire. Modified <em>Cooking up fun</em> survey was administered after the intervention to assess cooking skills and knowledge. Confidence and Motivation survey used to measure behavioural changes.</td>
<td>No</td>
<td>Pre- and post-test quantitative and qualitative feedback.</td>
<td>Students had a significant increase (p&lt;0.05) in knowledge related to questions about food groups, MyPyramid and healthy food choices.</td>
</tr>
<tr>
<td>Chessen J, et al. 2009. (46) (USA)</td>
<td>Age= 12-14 years (all female) n=22</td>
<td>Cooking classes and teaching cooking skills. 2x2 hr classes weekly for 6 weeks, during school term. Each class consisted of 30min nutrition education and 90 minutes cooking practical.</td>
<td>Questionnaire used not stated. With a focus on self-efficacy, knowledge, barriers and diet quality pre- versus post- intervention</td>
<td>No</td>
<td>Pre- and post-test questionnaires.</td>
<td>Post-intervention measures demonstrated a significant (P &lt; 0.005) increase in self-efficacy for cooking. No significant increase for knowledge, barriers or diet.</td>
</tr>
<tr>
<td>Beckman and Smith 2008. (43) (USA)</td>
<td>Age= 8-15 years Pre n= 96 Post n= 66</td>
<td>Youth Farm and Market Project (YFMP) 10-week garden program 3 days per week.</td>
<td>YMFP Survey. Nutrition and Garden knowledge, nutrient and food-group means, dietary intake.</td>
<td>No</td>
<td>24-hr recall at pre- and post-survey.</td>
<td>Males intake increase from pre- to post survey 24-hr recall for fruit (p=0.030) and vegetables (p=0.007). Female meat consumption increased (p=0.041) and so did their cholesterol intake (p=0.015) from pre- to post- survey.</td>
</tr>
<tr>
<td>Author(s), year and country</td>
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<tr>
<td>Meehan M, 2008. (52) (USA)</td>
<td>Age= 6-20 years, Pre-test n=20 Post-test n=16</td>
<td>Pilot study: Camp-cooking and field trips to community gardens. Twice a week for 7 weeks. Activities included cooking lunch each of the days, field trips to the community gardens, guess the fruit or veg, internet scavenger hunts on food safety.</td>
<td>Questionnaire used not stated. Topics: -1. FV attitude and behaviour -2. Food Source knowledge -3. Food preparation Assessed by the FV attitude and behaviour questionnaire</td>
<td>No</td>
<td>Three questionnaires administered pre- and post-intervention.</td>
<td>When considered together, there was a significant improvement in attitudes, behaviours, and knowledge about fruit and vegetable consumption (p = 0.03) for all participants. More-so in participants aged 15 and over (p=0.01). Qualitative data used to give feedback as it was a pilot study.</td>
</tr>
<tr>
<td>Condrasky M, et al. 2007. (47) (USA)</td>
<td>Age= 11-14 years n=24</td>
<td>Cooking Camp, <em>Cook Like a Chef.</em> Covered: menu planning, food safety, nutrition and food prep. Made a meal for the family at the end and received a certificate. 6 hrs per day x 5 days across one week.</td>
<td>Campers completed <em>the Eating Right is Fun: Food and Me</em> Survey which measured food skills. As well as qualitative interviews.</td>
<td>No</td>
<td>Pre- and post-intervention. A modified <em>Cooking up is Fun!</em> evaluation tool was used to assess food prep skills.</td>
<td>Majority reported learning new skills (no stat sig stated). There was a 20% increase in frequency of vegetable consumption from pre- to post test results.</td>
</tr>
<tr>
<td>Beets MW, et al. 2007. (44) (USA)</td>
<td>Young adolescents n=20</td>
<td>Culinary Camp. 4 hours per day x 8 days</td>
<td>2 Week cooking camp pilot—Tuesday to Friday 4 hours per day.</td>
<td>No</td>
<td>Pre- and post-intervention questionnaires</td>
<td>Primary indicator of increased meal preparation was not significant. Other markers like confidence showed an increase.</td>
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<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>McAleese JD and Rankin LL 2007. (USA)</td>
<td>Age=10-13 years n=99</td>
<td>Used Nutrition in the Garden curriculum. Combining nutrition and horticulture 12 weeks of the Nutrition in the Garden curriculum.</td>
<td>Food choices, cooking skills. FV intake, Vitamin C, Vitamin A and fibre collected through 24-hr food recall workbooks.</td>
<td>No</td>
<td>Randomised control, schools with matched pairs. Qualitative data collection with group and individual interviews. With parents and participants.</td>
<td>Fruit consumption significantly increased between pre- and post-test by 1.13 servings (P&lt;0.001) for students at experimental school 2, and vegetable consumption significantly increased by 1.44 servings (P&lt;0.001) pre- and post-test.</td>
</tr>
<tr>
<td>Hyland R, et al. 2006. (UK)</td>
<td>Age= 12-13 years Low income areas n= 98 (attended at least 1 session)</td>
<td>After school food club. Promote food preparation skills and healthier food choices. Weekly 2 hr intervention for 20 weeks.</td>
<td>Food club impact on their own diet. Parent perspectives, reactions to the food club foods, support at home. Qualitative investigation techniques used. Both group and individual interviews conducted and recorded.</td>
<td>No</td>
<td>Randomised control, schools with matched pairs. Qualitative data collection with group and individual interviews. With parents and participants.</td>
<td>Qualitative: Learning to cook and staying off the streets were big incentives.</td>
</tr>
<tr>
<td>Thonney PF and Bisogni CA 2006. (USA)</td>
<td>Age= 9-15 years n= 128</td>
<td>Cooking Up Fun! 6 x 90-minute sessions</td>
<td>Activities built around reading recipes and food labels, food safety, cooking science, and nutritional choices.</td>
<td>No</td>
<td>Participants were assessed pre-, during and post-intervention.</td>
<td>Reported success in gaining skill, knowledge and improved behaviour but no data provided.</td>
</tr>
<tr>
<td>Author(s), year and country</td>
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<tr>
<td>Brown BJ and Herman JR, 2005. (45) (USA)</td>
<td>Age= 12 (youth cohort average) n= 602 (Youth= 229 Adults= 373)</td>
<td>Cooking classes included Food prep skills, food safety and nutrition. 8 classes were conducted over a two-month period.</td>
<td>Fruit and vegetable preparation. Skills included microwaving, stir-frying, baking, pressure cooking, steaming, grilling, and slow cooking, and on incorporating fruits and vegetables into meals, smoothies, salads, snacks, desserts and soups.</td>
<td>No</td>
<td>Pre- and post-intervention questionnaire.</td>
<td>Sig. increased in the amounts of FV consumed were observed in both youth and adults. Fruit servings per day sig increase (P &lt; .0001) from 1.1 to 2.3 servings per day for youth. The average number of vegetable servings significantly increased (P&lt; .0001) from 1.4 to 2.4 servings per day for youth.</td>
</tr>
<tr>
<td>O'Neil CE and Nicklas TA, 2002. (51) (USA)</td>
<td>Age= 14-15 years (at baseline) 17-18 years at final follow up. n=2213</td>
<td>Gimme 5: a multicomponent program. Including, social media campaign, workshops, fresh choices in purchasing and parental involvement 4 years. Workshops 55mins.</td>
<td>Knowledge, attitude and behaviour towards FV.</td>
<td>No</td>
<td>12 high schools (6 matched pairs)</td>
<td>Self-efficacy increased in both groups between pre- and post-test. Reported FV intake sig. increased in the intervention group 14% compared with the control group from 1994 to 1996.</td>
</tr>
<tr>
<td>Utter J et al. 2016. (18) (NZ)</td>
<td>Age=13-17 years n= 8,500</td>
<td>Questionnaire Youth '12 NA</td>
<td>BMI, social demographics, cooking ability and frequency, mental well-being.</td>
<td>Diet quality indicators used: Consumption of: FV &gt;5/day, Fast Food &gt;4/week, Soft Drink &gt;1/day and Family Meals &gt;5/wk.</td>
<td>Two stage sampling design</td>
<td>Reported cooking ability was associated with better indicators of diet quality. Strong significant assoc. with increased frequency of cooking and greater veg and fruit intake.</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Laska MN et al. 2012. (38)  (USA)</td>
<td>Minnesota Public Secondary Schools I-15.8 years II-20.4 years III-26.2 years n=1321</td>
<td>Questionnaire, <em>Project EAT</em> I, II &amp; III 10-year longitudinal.</td>
<td>Food preparation practices, inclusion of vegetables in cooking meals, liking cooking, dietary behaviours and intake.  Food preparation practices, dietary behaviours, meal frequencies, gender, ethnicity.</td>
<td>Better diet quality five years later in the mid-to-late twenties, including higher intakes of fruit, vegetables and dark green/orange vegetables, and less sugar-sweetened beverage and fast-food consumption was associated with young adults, but not significantly with adolescents.</td>
<td>Population-based longitudinal cohort study.</td>
<td>Food prep in adolescents was associated with food prep in emerging adulthood. Adolescents that were involved with cooking was associated with enjoying cooking 10 years later.</td>
</tr>
<tr>
<td>Larson NI et al. 2006. (8)  (USA)</td>
<td>Age = 11-18 years n =4206</td>
<td>Project EAT Survey and YAQ. 10-year longitudinal To describe adolescent involvement in preparing and shopping for food and examine if extent of involvement is related to diet quality.</td>
<td>Sex, grade level, race/ethnicity, mother’s employment status, and socioeconomic status were based on self-report and BMI calculated from research assistants' weight and height measurements.</td>
<td>In general, preparing meals was associated with healthier food choices</td>
<td>Population based longitudinal cohort study</td>
<td>Frequency of preparing food was related to lower intakes of fat (P=0.01) and higher intakes of fruits and vegetables, fibre, folic acid, and vitamin A. Preparing was related to lower intakes of carbonated beverages among female adolescents (P=0.01) and lower intakes of fried foods among male adolescents (P=0.01).</td>
</tr>
</tbody>
</table>

Inclusion criteria:

1. Must include participants aged between 13-18 years which categorises adolescents in New Zealand.
9.2 Appendix B: Allergen Management Plan

COOK Study
College of Education Food Technology Suite 2016

Allergen Management Plan

The nine most common food allergens are
- Peanuts
- Tree nuts
- Sesame Seeds
- Milk
- Eggs
- Fish
- Shellfish
- Soy
- Wheat

Food preparation

Food is weighed out and portioned prior to giving all ingredients to the participants. Food is to be weighed out with all low allergen risk foods being weighed first, and the high-risk foods and above allergens being weighed out last.

Weighed out foods are stored in disposable containers and set out on trays. Any containers holding the above 9 allergens or high risk ingredients must be thrown away after use. Containers holding any other foods may be washed and reused. Hands must be washed before and after weighing out ingredients, particularly the allergens or high risk foods.

The food trays for all students with food allergies will be completed first and all foods covered before handling the allergens.

Allergen Identification

All participants are asked before attending for their dietary requirements which is then documented onto the role of all participants and also onto the room layout for easy identification.

Food Storage

All foods containing the above common allergens must be in sealed containers to prevent any possible cross contamination with other ingredients.

V1 December 2016
## Appendix C: Sprout Weekly Timetable

<table>
<thead>
<tr>
<th>Time</th>
<th>Monday</th>
<th>Tuesday</th>
<th>Wednesday</th>
<th>Thursday</th>
<th>Friday</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.00am</td>
<td>Introduction</td>
<td>Basic skills</td>
<td>Recipe preparation</td>
<td>Cook: Yoghurt parfait with Summer fruit</td>
<td>Recipe review</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cooking techniques</td>
<td>Shopping list for Thursday</td>
<td></td>
<td>Hosting guests</td>
</tr>
<tr>
<td>9.30am</td>
<td></td>
<td>Seasonality</td>
<td></td>
<td></td>
<td>Meal preparation</td>
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<td></td>
<td></td>
<td>Nutrition</td>
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<td></td>
<td></td>
<td>Selecting ingredients</td>
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<tr>
<td></td>
<td></td>
<td>How to shop</td>
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<tr>
<td>10.00am</td>
<td>Cook: Corn fritters with avocado salsa</td>
<td>Cook: Fennel, dill and white fish risotto</td>
<td></td>
<td>Cook: Tofu jungle curry</td>
<td>Market tour</td>
</tr>
<tr>
<td>10.30am</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>11.00am</td>
<td>Nutrition, hygiene, food safety</td>
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<tr>
<td>11.30am</td>
<td>Cook: Chicken and chorizo cous cous</td>
<td>Break</td>
<td>Break</td>
<td></td>
<td>Parents or Invited guests arrive</td>
</tr>
<tr>
<td>12.00pm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lunch commences</td>
</tr>
<tr>
<td>12.30pm</td>
<td>Cook: Pork tacos with apple and cabbage salsa</td>
<td>Cook: Roasted strawberry fool</td>
<td>Market lunch</td>
<td></td>
<td>12.00 pm - Main course</td>
</tr>
<tr>
<td>1.00pm</td>
<td>Cook: Raspberry soufflé</td>
<td></td>
<td></td>
<td></td>
<td>12.30pm - Dessert</td>
</tr>
<tr>
<td>1.30pm</td>
<td>Cook: Banana and peanut butter ice cream with malt crumble</td>
<td>Cook: Korean Beef with pickled cucumber and sesame slaw</td>
<td></td>
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<tr>
<td>2.00pm</td>
<td>Recipe ideas and development</td>
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<tr>
<td>2.30pm</td>
<td></td>
<td>Review recipes and shopping lists for market tour</td>
<td></td>
<td>Write plan and preparation list</td>
<td>Feedback, results and conclusion</td>
</tr>
<tr>
<td>3.00pm</td>
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9.4 Appendix D: Intervention Week Recipes

**Sweet Corn Fitters with Avocado Salsa & Smoked Salmon**

**Ingredients** (Serves 2)
- 1 Cob corn kernels removed (or 100g frozen corn, defrosted)
- 5 Tablespoons wholemeal flour
- ⅛ Teaspoon baking powder
- ⅛ Bunch coriander, stems and leaves (reserve some leaves for salsa)
- 1 small Egg
- Pinch chilli flakes
- ⅛ Avocado, diced
- ⅛ Red onion, sliced as thinly as possible
- 1 ⅔ Teaspoons olive oil
- 1 ⅔ Teaspoons lime juice
- 50g Smoked salmon, to serve

**Method:**

1. Combine half the corn, flour, coriander, egg, chilli flakes and salt in a small food processor and blitz to combine. Stir in remaining corn.

2. Heat a non-stick pan over high with the oil. Divide the batter into equal amounts and cook for 1-2 minutes each side or until golden brown and cooked through.

3. Combine avocado, onion and remaining coriander leaves in a small bowl. Drizzle with olive oil and lime juice. Spoon onto corn fitters and serve immediately with salmon.

www.sprout.edu.au
Asparagus, Chicken & Chorizo Cous Cous

Ingredients: (Serves 2)

1/4 Tablespoon olive oil
1/4 Chorizo sausage, thinly sliced
1 Chicken breast, cut into 2.5cm dice
1/4 Bunch Asparagus, sliced into thirds
2 Spring onions, finely sliced
2 Cloves garlic, sliced thinly
1 Teaspoon smoked paprika
1 Teaspoon ground cumin
1/3 Cup wholemeal cous cous
1/2 Cup chicken stock, salt reduced
1/2 Cup baby spinach
Zest and juice of 1/2 a lemon
2 Tablespoons kalamata olives, pitted
1/4 Bunch basil, leaves picked

Method:

1. Heat a wide frying pan with the olive oil. Add chorizo and chicken. Cook, turning occasionally, for 2-3 minutes or until browned. Remove from the pan and add asparagus, spring onions and garlic. Stir for 2-3 minutes until lightly browned.

2. Add garlic, paprika and cumin. Stir to coat. Return chicken and chorizo to the pan. Add cous cous, stock and baby spinach. Simmer until cous cous has absorbed the liquid and is tender.

3. Stir through lemon zest and juice. Remove from heat, top with olives and basil to serve.
Banana & Peanut Butter Ice-cream with Malt Crumble

**Ingredients:** (Serves 2)
- 2 Bananas, peeled, thickly sliced and frozen in a plastic bag or container
- 2 Tablespoons peanut butter
- 1 1/2 Teaspoons low fat cream

**Malt Crumble:**
- 1/2 Cup roasted peanuts
- 1/3 Tablespoon plain flour
- 1 Tablespoons milo

**Method:**
1. First, make the crumble. Combine all ingredients in a small food processor and blitz until fine. Heat a non-stick frying pan over high heat. Add crumble and stir constantly for 1-2 minutes or until golden brown and fragrant. Remove from heat.

2. To make the instant banana ice-cream, combine frozen banana, peanut butter and cream in a food processor and blend until smooth and creamy. Scrape the mixture down with a spatula if there are any lumps and blend briefly again. Return mixture to the freezer until serving, or use immediately.

3. Serve banana ice-cream topped with malt crumble.

www.sprout.edu.au
Fennel, Dill and Fish Risotto

**Ingredients:** (Serves 2)

- 500 ml Good quality low salt chicken stock
- ½ Tablespoon olive oil
- ½ Brown onion, finely diced
- 3 Sprigs thyme, leaves picked
- 2 Cloves of garlic, sliced
- ½ Lemon
- ¾ Cup arborio rice
- 1 Teaspoons rice bran oil
- 2 x 120g Pieces fish
- ½ Fennel bulb, sliced thinly, fronds reserved
- ½ Bunch broccoli, sliced into 2cm pieces
- ¼ Cup frozen peas
- Small handful fresh dill, roughly chopped
- 25g Feta, crumbled

**Method:**

1. Bring stock to the boil in a saucepan, set aside and keep warm.

2. Fry onion, thyme and garlic in a large pot with the olive oil, stirring, until translucent. Add rice and stir for 30 seconds to toast the rice. Zest the lemon and add to the pan along with the juice. Add a ladleful of hot stock and simmer. Add more stock as required throughout the process to make sure the rice is just covered with liquid. Stir occasionally. The risotto will take about 16-18 minutes to cook. If you run out of stock before this time use a little hot water.

3. Once your risotto is happily cooking away, get a large frying pan on high heat and add the rice bran oil. Add fish and cook for 2-3 minutes each side or until just cooked through. Remove fish from pan, add the sliced fennel and broccoli and stir for 2 minutes or until vegetables are bright in colour but snap-tender. Add the frozen peas and revered fennel fronds and stir for a minute to defrost them. Remove from heat.

4. When the rice is al dente, stir in the vegetables. Stir through dill. Divide amongst bowls, top with fish and feta and serve.
Pork Tacos with Apple and Cabbage Salsa

**Ingredients:** (Serves 2)
- 100g Pork loin steak
- 1 ½ Teaspoons ground cumin
- 1 ½ Teaspoons ground coriander
- 1/8 Bunch coriander, leaves picked
- 1 ½ Spring onions, finely sliced or grated
- ½ Granny smith apple, finely julienned or grated
- 1/8 Purple cabbage, sliced
- Juice of half a lemon
- 1 ½ Teaspoons olive oil
- ½ Avocado
- 2 Corn tortillas

**Method:**
1. Combine pork with cumin and ground coriander in a bowl.
2. Combine coriander leaves, spring onions, cabbage and apple in a bowl. Squeeze over the juice of quarter of a lemon. Stir to combine.
3. Preheat a non-stick frying pan over high heat. Add one oil, then pork and cook for 2-3 minutes each side or until just cooked. Remove pork from heat.
4. In a bowl mash avocado and remaining lemon juice together with a fork.
5. Warm tortillas if desired. Spread with guacamole, top with pork, cabbage and green apple salad. Serve immediately.

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Raspberry Soufflé

**Ingredients:** (serves 4)

- 120g Frozen raspberries, defrosted
- 60g Caster sugar
- 4 Teaspoons water
- 2/3 Teaspoon (rounded) corn flour
- 2 Egg whites
- 10g (2 Teaspoons) extra caster sugar
- Caster sugar, for dusting
- Spray oil, for ramekins

**Method:**

1. Preheat oven to 180°C. Use a spatula to force defrosted raspberries through a fine sieve. Discard seeds.

2. Place the sugar and water in a small saucepan over low heat and stir until the sugar is dissolved, brushing down any sugar crystals from the sides of the pan.

3. Meanwhile, add the corn flour to the raspberry puree and stir until the corn flour is dissolved. Add the raspberry mixture to the sugar syrup, increase heat to high and bring to the boil, stirring until thickened slightly. Remove from the heat and cool slightly.

4. Whisk the egg whites until soft peaks form. Gradually add the extra sugar and whisk until stiff peaks form. Fold through the raspberry syrup. Spray four ramekins with oil and dust with sugar. Spoon the soufflé mixture into the dishes until ⅓ full, place the dishes on a baking tray and bake for 12 minutes or until risen and golden. Serve immediately, soufflés don’t wait for anyone!

www.sprout.edu.au
Tofu Jungle Curry

Ingredients: (Serves 2)

100ml Can low-fat coconut milk
150ml Salt-reduced chicken stock
2 Cloves garlic, finely sliced
Half a thumb-sized piece ginger, grated
2 Coriander roots and stems, Cleaned and finely sliced (reserve leaves for serving)
1/8 Teaspoon freshly ground white pepper
½ Stick lemongrass, bruised
1 ½ Teaspoons fish sauce
1 ½ Teaspoons of brown sugar
2 Kaffir lime leaves
½ Medium head broccoli
½ Punnet cherry tomatoes, halved
½ Cup freshly diced pineapple
140g Tofu
½ cup of uncooked rice, to serve
Basil, to serve

Method:

1. Pour just the creamy white top of the coconut milk into large frying pan or saucepan over high heat. Cook until the coconut splits and looks oily, about 1-3 minutes. Add the garlic, ginger, coriander, pepper and lemongrass. Cook, stirring, for 1-2 minutes or until fragrant.

2. Add the fish sauce and palm sugar, stir to dissolve, then add remaining contents of coconut milk and the chicken stock. Add tomatoes, broccoli and pineapple. Cook until broccoli and tomato softens but still retains its colour, then add tofu. Cook a further two minutes or until tofu is cooked. Add a little water at any stage if the curry is lacking moisture.

3. Serve curry with ½ cup of cooked rice, fresh coriander leave and basil.

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# Roasted Strawberry Fool with Pepita Brittle

**Ingredients:** (Serves 2)
- 1 Tablespoons caster sugar
- 3 Black peppercorns
- Zest and juice of ½ lemon
- 1 Punnets strawberries, tops sliced off and halved
- ½ Cup of cream
- ¼ Cup thick Greek yoghurt
- 1 Teaspoon sumac
- Basil leaves, to serve (optional)

Pepita brittle:
- ¾ Cup caster sugar
- 1 Teaspoon butter
- ½ Teaspoon bicarb soda
- 2 Tablespoons pepitas (pumpkin seeds)

**Method:**

1. To make the brittle, heat a saucepan over high heat and line a tray with baking paper. Add a teaspoon of sugar and cook until starting to melt. Add another teaspoon and repeat process, stirring occasionally until it forms into a caramel. Whisk in butter and once melted whisk in bicarb soda. Pour brittle onto tray, sprinkle with pumpkin seeds and allow to cool before snapping into pieces.

2. Combine sugar, peppercorns, lemon zest and juice in a saucepan. Bring to the boil, turn down heat and simmer for 1-2 minutes or until sugar has dissolved.

3. Preheat oven to 200°C. Line a tray with baking paper. Place half the strawberries onto the tray and pour over the syrup. Mix briefly to combine. Transfer to the oven and cook for 10-15 minutes or until tender. Check the strawberries after five minutes; if they are starting to colour or burn too much, cover them with a piece of foil. Remove from oven and allow to cool slightly. Transfer to a small blender and puree until smooth.

4. Whip cream to stiff peaks, then whisk through the yoghurt. Fold through strawberry puree. Toss reserved fresh strawberries with sumac. Serve fool topped with shards of pepita brittle, sumac strawberries and basil if using.

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Korean Beef with Sesame Slaw & Pickled Cucumber

**Ingredients:** (serves 2)
- ½ Lebanese cucumber, thinly sliced
- 2 Tablespoons rice wine vinegar
- 1 ½ Teaspoons caster sugar
- 1 ½ Teaspoons rice bran oil
- 1 x 200g Beef steak
- 1/8 Chinese cabbage, finely sliced
- ¼ Carrot, juliened or grated with a mandolin
- 1 ½ Spring onions, finely sliced on an angle
- 1 Tablespoons pickled jalapenos, roughly chopped
- ½ Teaspoon sesame oil
- 1 Teaspoons sesame seeds (white or black)

**Ginger sauce:**
- 1 Tablespoons salt reduced soy sauce
- 1 Tablespoons Chinese cooking wine
- 1 Tablespoons mirin
- ½ Tablespoon honey
- 1cm piece ginger, grated

**Method:**
1. Place cucumber in a small bowl. Combine rice wine vinegar and caster sugar in a small saucepan and heat until sugar dissolves. Pour pickling liquid over cucumber and set aside to cool.

2. In the same saucepan, make the ginger sauce. Combine all ingredients in the saucepan and simmer until aromatic, about 30 seconds. Set aside.

3. Heat a large heavy-based frying pan over high heat with the rice bran oil. Add the steaks and cook for 2-3 minutes each side or until cooked to your liking. Remove the pan from heat and pour in the ginger sauce. Turn the beef until it is coated in the sticky reduced sauce then remove to a chopping board to rest.

4. Combine Chinese cabbage, carrot, spring onion, jalapenos, sesame oil, cucumber and the pickling liquid in a large bowl. Divide slaw between serving plates. Slice beef thinly and arrange on plates. Top with sesame seeds then serve.
Summer Parfait

**Ingredients:** (Serves 4)

1 Cup thick Greek yoghurt
2 Teaspoons vanilla bean paste (substitute vanilla extract)
Finely grated zest of a lemon
3 Egg whites
1/4 Cup caster sugar
1/2 Cup frozen raspberries
1 Peach, diced into 1cm pieces
1/4 Cup pistachios, roughly chopped
4 Peaches, sliced into wedges, to serve

**Method:**

1. Line a 12cm x 22cm loaf pan with cling film. Stir together yoghurt, vanilla and lemon zest.

2. Place egg whites in a large bowl. Use electric beaters or a whisk to whip eggs to soft peaks, then slowly add the sugar, whisking all the time, until a stiff, shiny meringue is reached.

3. Use a whisk to fold egg white mixture and yoghurt mixtures together. Carefully fold through peach, pistachios and then the raspberries. Try not to over mix as the raspberries will bleed and turn the parfait pink.

4. Spoon mixture into the loaf pan and smooth with a spatula or knife. Freeze for 4 hours or overnight until firm.

5. Turn parfait out, remove cling film and cut into slices. Divide parfait slices between plates and serve.
## Appendix E: Pantry Staples

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### Other

- Eggs (for back-up)
- Garlic
- Ginger
Appendix F: Take Home Food Bag recipes

Tofu Jungle Curry

**Ingredients:** (Serves 4)

- 200ml Can low-fat coconut milk
- 300ml Salt-reduced vegetable stock
- 3 Cloves garlic, finely sliced
- Thumb-sized piece ginger, grated
- 4 Coriander roots and stems, Cleaned and finely sliced (reserve leaves for serving)
- ¾ Teaspoon freshly ground white pepper
- 1 Stick lemongrass, bruised
- 1 Tablespoon soy sauce
- 1 Tablespoon brown sugar
- 3 Kaffir lime leaves
- 1 Medium head broccoli
- 1 Punnet cherry tomatoes, halved
- 1 Cup freshly sliced pineapple
- 140g firm tofu
- Rice, to serve
- Basil, to serve

**Method:**

1. Pour just the creamy white top of the coconut milk into large frying pan or saucepan over high heat. Cook until the coconut splits and looks oily, about 1-3 minutes. Add the garlic, ginger, coriander, pepper and lemongrass. Cook, stirring, for 1-2 minutes or until fragrant.

2. Add the soy sauce and brown sugar, stir to dissolve, then add remaining contents of coconut milk and the vegetable stock. Add tomatoes, broccoli and pineapple. Cook until broccoli and tomato softens but still retains its colour, then add tofu. Cook a further two minutes or until tofu is cooked. Add a little water at any stage if the curry is lacking moisture.

3. Serve curry with ¾ cup of cooked rice, fresh coriander leaves and basil if using.
Deep crust pizza with sausage

Ingredients: (Serves 4)

- 3 sausages
- 2 cups self-raising flour
- 1/2 tsp salt
- 2 tbsp olive oil
- 1/2 cup cold water to mix (approximately)
- 1/2 cup tomato paste mixed with 1/3 cup cold water
- 1 tsp dried oregano
- 1 onion, chopped
- 1 small carrot, grated
- 1 small courgette, grated
- 1 cup sliced mushrooms
- 1 cup grated cheese

Method:

1. Preheat the oven to 220°C.
2. Split the skins of the sausages with a knife and squeeze the filling into a small pan. Brown the sausage meat, crumbling it with a potato masher as it cooks. Once browned, set aside.
3. While the sausage meat is cooling make the base. Mix the flour, salt and oil in a bowl or food processor and add just enough cold water to form a dough. Turn onto a lightly floured bench and roll out to a circle approximately 27 cm in diameter. Place on a greased baking sheet.
4. Spread the base with 1/3 the tomato paste mixture. Sprinkle with oregano then add the onion. Squeeze the grated carrot and courgette firmly to release the excess moisture, then sprinkle over the base and add the crumbled sausage.
5. Spread the remaining tomato mixture over the top, then add the mushrooms, cheese, capsicum and then olives. Bake in the preheated oven for 20-25 minutes, or until golden and bubbling.

Any variety of cold meat could be used on this pizza, as well as any selection of vegetables. For example, ham, cooked bacon, chicken or salami, capsicum, roasted pumpkin, red onions, spinach.
Lamb meatballs with tomato sauce and spaghetti

**Ingredients:** (Serves 4)

- 400g lamb mince
- ½ cup rolled oats
- ⅓ cup onion, finely chopped
- 3 cloves garlic, crushed
- 1 egg, lightly beaten
- 2 tablespoons parsley, finely chopped
- 1 tablespoon fresh thyme leaves, finely chopped
- 2 tablespoons tomato paste
- 1 tablespoon olive oil
- 2 cups liquid Beef stock
- ½ cup tomato paste
- 400g can chopped tomatoes in juice
- 1 tablespoon dried oregano
- 1 tablespoon balsamic vinegar
- 2 teaspoons brown sugar
- 1 x 500g pack of dried spaghetti

**Method:**

**Meatballs**

1. Add the mince to a large bowl with the rolled oats, onion, garlic, egg, herbs, tomato paste, olive oil and season. Mix gently to combine using clean hands. Shape the mixture into golf ball sized balls. Cover and refrigerate for 20 minutes to set.
2. Heat a little oil over a medium-high heat in a large frying pan and brown the meatballs all over (do this in batches). Once browned, remove carefully with tongs and set aside on a plate.

**Sauce**

1. Drain any oil from the pan and return it over a high heat. Add ⅔ of the stock and let it bubble for 30 seconds, scraping the pan with a wooden spoon to incorporate all those crunchy caramelised meat juices from the meatballs.
2. Add the remaining stock, tomato paste, tomatoes, oregano, balsamic vinegar and sugar. Stir. Add the meatballs back to the pan and simmer uncovered for 15-20 minutes, or until the sauce has thickened to a pasta sauce consistency (turn the meatballs over once). Taste and season as required.
3. While the meatballs and sauce are simmering cook the spaghetti as per the instructions on the packet. When cooked drain the spaghetti.

To serve

Toss the meatballs and sauce through the just-cooked drained spaghetti in the spaghetti cooking pot. Add to serving bowls and sprinkle with grated cheese if desired.

The meatball recipe could be bulked out with grated carrot or courgette or even grated broccoli to make it go further and also to get more vegetables into fussy eaters.
Mexican nachos

Ingredients: (Serves 4)
2x 400g can of kidney beans drained
1x bag of 8 tortillas

For the nacho sauce:
1 onion finely diced
1 carrot diced
400g canned tomatoes
200ml water
1 tsp sugar
1 tsp chilli powder
½ tsp dried oregano
2 tsp paprika
1½ tsp ground cumin

Method:

1. Preheat oven to 180°C.
2. Brush the top of each tortilla with a small amount of oil and stack on top of each other. Cut tortillas into quarters or eights.
3. Combine all the ingredients for the nacho sauce in a pot and bring to a boil, then turn down the heat and simmer for 30 minutes stirring often.
4. Arrange the tortilla wedges in a single layer on an oiled tray and bake for 8-10 minutes, checking regularly. Remove from oven and let cool.
5. Add the drained red kidney beans top the nacho mixture and allow the beans to heat through.
6. Serve the nacho beans over the corn chips.
7. Serve with sour cream and grated cheese if desired.
Tuna pasta bake

**Ingredients:** (Serves 4)

- 2 x 185g cans of tuna
- 4 cups large shell pasta
- 100g butter
- 1 white onion, sliced
- 1 cup plain flour
- 4 cups milk
- 1 cup courgettes, diced
- 1 broccoli, sliced
- 1/4 cup grated cheese
- 1 cup breadcrumbs

**Method:**

1. Pre-Heat Oven to 180°C.
2. Cook pasta according to packet instructions. Once pasta is cooked, drain and place in an ovenproof dish and mix tuna through.
3. Melt butter in a medium saucepan and lightly cook onion for 1-2 minutes, add flour and mix thoroughly. Slowly add milk, whisking to form a smooth sauce. Stir through courgettes and broccoli and cooking for a further 2 minutes.
4. Pour sauce and vegetables over tuna and pasta.
5. Sprinkle breadcrumbs and grated cheese on top then bake for 15-20 minutes, or until top is golden in colour.

Any tinned fish could be used in this recipe, e.g. salmon or smoked fish
For a non seafood version you could also use cooked bacon or left over ham.
And for a vegetarian version any cooked left over vegetables e.g. cooked pumpkin, spinach, broccoli etc., could be used.
Pasta and bean soup

Ingredients: (Serves 4)

- 3 tablespoons of olive oil
- 1 clove of garlic peeled and chopped
- 1 onion peeled, quartered and sliced
- 2 bay leaves
- ½ teaspoon dried thyme
- 2 x 400g tin Italian style tomatoes
- 1 x 400g tin Mexican Chilli beans
- 1 x 400g four bean mix
- 4 cups of vegetable stock
- 100g macaroni pasta
- ½ teaspoon of salt
- Basil to garnish

Method:

1. Heat the olive oil in large pot, add the garlic and onion and sauté until softened and clear.
2. Stir in the bay leaves and thyme cook for a few minutes longer.
3. Add the chopped tinned tomatoes, the rinsed drained beans and the stock. Heat until boiling then add the pasta. Allow to boil gently until the pasta is cooked (about 10-15 minutes) then add salt and pepper to taste.
4. Serve with fresh basil and grated cheese if desired.

Many different vegetables or meat could be added to this soup. It is perfect for using up left over ham or cooked bacon, or cooked vegetables such as corn, carrots, capsicums etc.
9.7 Appendix G: NZAFFQ

(Section 1)

Section 4: The food that you eat

First of all, we would like to know about your general eating habits.

33. On average, how many servings of fruit (fresh, frozen, canned or stewed) do you eat per day? Tick one box

A ‘serving’ = 1 medium piece or 2 small pieces of fruit or ½ cup of stewed fruit
E.g. 1 apple + 2 small apricots = 2 servings

☐ I don’t eat fruit  ☐ 2 servings
☐ Less than 1 per day  ☐ 3 servings
☐ 1 serving  ☐ 4 or more servings

34. On average, how many servings of vegetables (fresh, frozen, canned) do you eat per day? Tick one box

A ‘serving’ = 1 medium potato/ kumara or ½ cup cooked vegetables or 1 cup of salad vegetables
E.g. 2 medium potatoes + ½ cup of peas = 3 servings

☐ I don’t eat vegetables  ☐ 2 servings
☐ Less than 1 per day  ☐ 3 servings
☐ 1 serving  ☐ 4 or more servings

35. On average, how many slices or rolls of bread (or toast) do you eat per day? Tick one box

☐ I don’t eat bread or toast  ☐ 3-4
☐ Less than 1 per day  ☐ 5-6
☐ 1 - 2  ☐ 7 or more
36. On average, how many servings of meat, chicken, seafood, eggs or meat alternatives (e.g. tofu, beans, peas and lentils) do you eat per day? Tick one box.

A ‘serving’ = 2 slices of cooked meat or 2 drumsticks or ¾ cup mince/ cooked beans or 1 medium fillet of fish/steak or 1 egg

e.g. 2 slices of roast beef = 1 serving

☐ Less than 1 per day       ☐ 3 servings
☐ 1 serving                 ☐ 4 or more servings
☐ 2 servings

37. On average, how many servings of foods such as pasta, rice, muesli, porridge, or breakfast cereals do you eat per week? Tick one box.

☐ I don’t eat these foods   ☐ 10-12 per week
☐ Less than 4 per week     ☐ 13-15 per week
☐ 4-6 per week             ☐ 16 or more per week
☐ 7-9 per week

38. How often do you usually have FOOD for breakfast (more than a DRINK)?

Please tick one box for weekdays and one box for weekends.

**Weekdays**  
☐ I never have breakfast during weekdays
☐ One day
☐ Two days
☐ Three days
☐ Four days
☐ Five days

**Weekends**  
☐ I never have breakfast during the weekend
☐ I usually have breakfast on only one day of the weekend (Saturday OR Sunday)
☐ I usually have breakfast on both weekend days (Saturday AND Sunday)
39. How often do you usually have lunch (more than a drink or snack)?

**Please tick one box for weekdays and one box for weekends.**

**Weekdays**
- I never have lunch during weekdays
- One day
- Two days
- Three days
- Four days
- Five days

**Weekends**
- I never have lunch during the weekend
- I usually have lunch on only one day of the weekend (Saturday OR Sunday)
- I usually have lunch on both weekend days (Saturday AND Sunday)

40. How often do you usually have a meal in the evening (more than a drink or snack)?

**Please tick one box for weekdays and one box for weekends.**

**Weekdays**
- I never have an evening meal during weekdays
- One day
- Two days
- Three days
- Four days
- Five days

**Weekends**
- I never have an evening meal during the weekend
- I usually have an evening meal on only one day of the weekend (Saturday OR Sunday)
- I usually have an evening meal on both weekend days (Saturday AND Sunday)
41. On school days during lunch break do you generally: 
   *Tick one box*
   - Eat food bought at school
   - Eat a packed lunch brought from home
   - Go home for lunch
   - Eat food bought on the way to school
   - Don’t eat lunch

42. How often do you eat takeaways (such as McDonalds, KFC, Fish ‘n’ Chips, Domino’s Pizza, Hell Pizza, Pizza Hut, Country Fried Chicken, Asian takeaways) when you are on your own or with your friends? *Tick one box*
   - Never
   - Less than once a week
   - Once a week
   - 2 to 4 days a week
   - 5 to 6 days a week
   - Once a day
   - More than once a day

43. How often do you eat takeaways (such as McDonalds, KFC, Fish ‘n’ Chips, Domino’s Pizza, Hell Pizza, Pizza Hut, Country Fried Chicken, Asian takeaways) when you are with your family? *Tick one box*
   - Never
   - Less than once a week
   - Once a week
   - 2 to 4 days a week
   - 5 to 6 days a week
   - Once a day
   - More than once a day

44. When you eat takeaways, do you usually pick healthier food options if these are available?
   - Yes
   - No
Now, we would like to know about the types of foods that you USUALLY eat and how often you eat them.

45. On average, how many times a week do you USUALLY eat or drink any of the following foods? *Please tick one box for each item.*

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<tr>
<td>Beef (including mince, corned beef, roast and steak)</td>
<td></td>
<td></td>
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<tr>
<td>Lamb or mutton (including roast, and chops)</td>
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<tr>
<td>Processed meat: (including sausage, salami and luncheon)</td>
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<td></td>
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<tr>
<td>Pork (including roast, chops, ribs, ham and bacon)</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Nuts and seeds</td>
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<td></td>
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</tr>
</tbody>
</table>
Meat alternatives
(e.g. tofu, vegetarian sausages, falafel)
Next, we would like to know in more detail about the type of drinks, fruits, vegetables and other foods that you ate in the LAST WEEK.

46. On how many days did you consume the following drinks, over the past seven days? Please tick one box for each item.

<table>
<thead>
<tr>
<th>Drinks</th>
<th>None</th>
<th>One</th>
<th>2 to 4 days</th>
<th>5 to 6 days</th>
<th>Every day, once a day</th>
<th>More than once a day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artificially-sweetened drinks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(e.g. Diet coke, Pepsi Max, Sprite Zero, and any other ‘light’ and ‘sugar-free’ varieties)</td>
<td></td>
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<tr>
<td>Energy drinks</td>
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<tr>
<td>(e.g. V, Lift Plus, Mother, Red Bull)</td>
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</tr>
<tr>
<td>Sports drink</td>
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<tr>
<td>(e.g. Powerade, Mizone)</td>
<td></td>
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</tr>
<tr>
<td>Tea or coffee (including Ice Tea)</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Milky or chocolate drink</td>
<td></td>
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</tr>
<tr>
<td>(e.g. Milo, Ovaltine, Nesquik)</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Fruit juice / fruit drink / cordials</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>(e.g. GForce, Raro, Refresh, Lemonade, Keri, Twist, Ribena, Golden Circle)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regular soft drinks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(e.g. Coke, Peps, Sprite, L&amp;P, Fanta, Ginger Beer)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Alcoholic drink</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
47. On how many days last week have you eaten the following fruits and vegetables (fresh, frozen, canned, stew, cooked or raw) **over the past seven days?** Please tick one box for each item.

<table>
<thead>
<tr>
<th>Fruits and Vegetables</th>
<th>None</th>
<th>One</th>
<th>2 to 4 days</th>
<th>5 to 6 days</th>
<th>Every day, once a day</th>
<th>More than once a day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apples</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pears</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Oranges / Mandarins</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bananas</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peaches / Nectarines</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apricots</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Plums</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Kiwifruit</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Strawberries or other berries</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grapes</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Melons (including watermelon, rockmelon, honeydew)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pineapple</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avocado</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Potatoes (not fried, e.g. boiled, mashed, baked)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Potatoes (hot potato chips, French fries, wedges, hash brown, roasted)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carrots</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Mixed vegetables (e.g. stir-fried, frozen)</td>
<td></td>
<td></td>
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<tr>
<td>Peas / green beans</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Fruits and Vegetables</td>
<td>None</td>
<td>One</td>
<td>2 to 4 days</td>
<td>5 to 6 days</td>
<td>Every day, once a day</td>
<td>More than once a day</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>Corn</td>
<td></td>
<td></td>
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<tr>
<td>Broccoli / cauliflower, broccoflower</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Lettuce / salad greens</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Tomatoes</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Silverbeet / spinach</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Watercress / puha</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Legumes (e.g. baked beans, chickpeas, lentils, kidney beans)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Kumara</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Taro</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Cabbage / coleslaw</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brussel sprouts</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pumpkin / squash</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peppers / capsicum (green, red, or yellow)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zucchini / courgette</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cucumber</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Celery / asparagus</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Onion / leek</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mushrooms</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>
48. On how many days last week have you eaten each of the following food / drink items **over the past seven days**? Please tick one box for each item.

**Please tick one box for each item.**

<table>
<thead>
<tr>
<th>Other foods</th>
<th>None</th>
<th>One</th>
<th>2 to 4 days</th>
<th>5 to 6 days</th>
<th>Every day, once a day</th>
<th>More than once a day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peanut butter or nut spread</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweet biscuits / cakes / muffins / doughnuts / fruit pies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweet snack bars (e.g. muesli bar, fruit bar, rice bubble bar)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ice-cream</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pies / sausage rolls</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pizza</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Savoury biscuits / snacks (e.g. crackers, Shapes)</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Appendix H: Food Components of the NZDQI-A

<table>
<thead>
<tr>
<th>Food group (COMPONENT)</th>
<th>Food sub groups</th>
<th>Name of items in the NZAFFQ&lt;sup&gt;1&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fruits (FRUIT)</td>
<td>1 Pineapple</td>
<td>Pineapple</td>
</tr>
<tr>
<td></td>
<td>2 Apples and pears</td>
<td>Apples, Pears</td>
</tr>
<tr>
<td></td>
<td>3 Oranges and mandarins</td>
<td>Oranges or mandarins</td>
</tr>
<tr>
<td></td>
<td>4 Bananas</td>
<td>Bananas</td>
</tr>
<tr>
<td></td>
<td>5 Kiwifruit</td>
<td>Kiwifruit</td>
</tr>
<tr>
<td></td>
<td>6 Other fruits</td>
<td>Peaches or nectarines, Apricots, Plums, Strawberries or berries, Grapes, Melons (including watermelon, rockmelon, honeydew)</td>
</tr>
<tr>
<td>Vegetables (VEGGIE)</td>
<td>1 Cruciferous vegetables</td>
<td>Broccoli or cauliflower, Cabbage or coleslaw, Brussel sprouts</td>
</tr>
<tr>
<td></td>
<td>2 Green leafy vegetables</td>
<td>Lettuce or salad green, Mixed vegetables, Watercress or puha, Silverbeet or spinach</td>
</tr>
<tr>
<td></td>
<td>3 Root-like vegetables</td>
<td>Cucumber, Zucchini or courgette</td>
</tr>
<tr>
<td></td>
<td>4 Red or yellow vegetables</td>
<td>Pumpkin, Kumara, Carrots, Capsicums, Tomatoes</td>
</tr>
<tr>
<td></td>
<td>5 Potatoes</td>
<td>Hot chips or wedges or French fries, Potatoes (not fried)</td>
</tr>
<tr>
<td></td>
<td>6 Other vegetables</td>
<td>Onion or leeks, Mushrooms, Corn, Taro, Peas or green beans, Celery or asparagus</td>
</tr>
<tr>
<td>Bread and cereals (CEREAL)</td>
<td>1 Breakfast cereals</td>
<td>Breakfast cereals (all kinds)</td>
</tr>
<tr>
<td></td>
<td>2 Bread or buns</td>
<td>White bread or roll, Brown or wholemeal bread or roll</td>
</tr>
<tr>
<td></td>
<td>3 Rice, pasta or noodles</td>
<td>Rice/ pasta/ noodles</td>
</tr>
<tr>
<td>Milk and milk products (DAIRY)</td>
<td>1 Milk (standard and non-standard)</td>
<td>Standard milk (dark blue), Low-fat milk (light blue)/ trim milk (green)/ calcium trim milk (yellow)/ rice milk/ soy milk</td>
</tr>
<tr>
<td></td>
<td>2 Flavoured milky drink</td>
<td>Milky or chocolate drink</td>
</tr>
<tr>
<td></td>
<td>3 Cheese</td>
<td>Cheese</td>
</tr>
<tr>
<td></td>
<td>4 Yoghurt</td>
<td>Yoghurt</td>
</tr>
<tr>
<td>Meat and alternatives (MEAT)</td>
<td>1 Poultry</td>
<td>Chicken/ turkey/ duck</td>
</tr>
<tr>
<td></td>
<td>2 Eggs</td>
<td>Eggs</td>
</tr>
<tr>
<td></td>
<td>3 Nuts or seeds</td>
<td>Nuts or seeds</td>
</tr>
<tr>
<td></td>
<td>4 Meat alternatives</td>
<td>Tofu/ vegetarian sausages/ falafel</td>
</tr>
<tr>
<td></td>
<td>5 Legumes</td>
<td>Baked beans/ chickpeas/ lentils/ kidney beans</td>
</tr>
<tr>
<td></td>
<td>6 Red meats</td>
<td>Beef, Lamb or mutton, Pork</td>
</tr>
<tr>
<td></td>
<td>7 Fish and seafood</td>
<td>Fish, Other seafood (including mussels, oyster, prawns)</td>
</tr>
</tbody>
</table>

<sup>1</sup> 53 food items in the New Zealand Adolescent Food Frequency Questionnaire (NZAFFQ, Sections 2 and 3 of the Food Questionnaire) that were included in the scoring of the NZDQI-A.

### 9.9 Appendix I: Scoring of the NZDQI-A

#### Table 1 Components and scoring of the New Zealand Diet Quality Index for Adolescents (NZDQI-A)

<table>
<thead>
<tr>
<th>Component</th>
<th>Elements of NZDQI-A</th>
<th>Criteria to achieve maximum component score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FRUIT</strong></td>
<td>Servings of fruit per day</td>
<td>Consumed at least 2 daily servings of fruits from 6 varieties in a week.</td>
</tr>
<tr>
<td><strong>VEGGIE</strong></td>
<td>Servings of vegetables per day</td>
<td>Consumed at least 3 daily servings of vegetables from 6 varieties in a week.</td>
</tr>
<tr>
<td><strong>CEREAL</strong></td>
<td>Servings of bread per day</td>
<td>Consumed at least 5 daily servings of cereals from 3 varieties in a week.</td>
</tr>
<tr>
<td><strong>DAIRY</strong></td>
<td>Frequency intake of milk (standard and non-standard milk), flavoured milk, drink, cheese and yoghurt</td>
<td>Consumed at least 3 daily servings of milk or milk products from 4 varieties in a week.</td>
</tr>
<tr>
<td><strong>MEAT</strong></td>
<td>Servings of meat, chicken, seafood, eggs or meat alternatives per day</td>
<td>Consumed 1 or 2 daily servings of meat or alternatives (not including processed meats) from 7 varieties in a week.</td>
</tr>
</tbody>
</table>

Total Score = Σ (v/W) x A = FRUIT + VEGGIE + CEREAL + DAIRY + MEAT

Food Questionnaire (FQ): Fruits (FRUIT), Vegetables (VEGGIE), Bread and cereals (CEREAL), Milk and milk products (DAIRY), Meat and alternatives (MEAT).

1. Scores calculated as the different sub groups: v/W consumed at least once in a week (as indicated in the NZAFQ), divided by the total sub groups (W) in a food group. The food sub groups are outlined in Additional file 1.
2. Refer to questions in the FQ.
3. Based on achievement of the recommended daily servings as suggested by the Ministry of Health [13].
4. For each component a total score is calculated by multiplying “variety” (v/W) by “adequacy” (A). The possible score range is 0 to 20. E.g. For a person who consumes at least two daily servings of fruits from three varieties in a week, FRUIT score = (3/6) x 20 = 10.
5. Include fresh, frozen, canned and stewed fruits.
6. Include fresh, frozen and canned vegetables, including potatoes.
7. Weekly frequency of intake (times per week) for the four sub groups as reported in the NZAFQ. Weekly frequencies were summed and converted into daily frequencies. One time per day was equivalent to one serving.

Your Week

How much did you enjoy the week?

Not at all  1  2  3  4  5  6  7  Loved it

What was your favourite part of the week, and why?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

Was there a part of the week that you would like to change? If so, what would you change and why?

________________________________________________________________________

________________________________________________________________________

How much did you like each dish?

Asparagus, Chicken & Chorizo Cous Cous

Not at all  1  2  3  4  5  6  7  Loved it

Fennel, Dill and Fish Risotto

Not at all  1  2  3  4  5  6  7  Loved it

Korean Beef with Sesame Slaw & Pickled Cucumber

Not at all  1  2  3  4  5  6  7  Loved it

Pork Tacos with Apple and Cabbage Salsa

Not at all  1  2  3  4  5  6  7  Loved it
<table>
<thead>
<tr>
<th>Dish</th>
<th>Rating 1</th>
<th>Rating 2</th>
<th>Rating 3</th>
<th>Rating 4</th>
<th>Rating 5</th>
<th>Rating 6</th>
<th>Rating 7</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raspberry Soufflé</td>
<td>Not at all</td>
<td>1 2 3 4 5 6 7</td>
<td>Loved it</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roasted Strawberry Fool with Pepita Brittle</td>
<td>Not at all</td>
<td>1 2 3 4 5 6 7</td>
<td>Loved it</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tofu Jungle Curry</td>
<td>Not at all</td>
<td>1 2 3 4 5 6 7</td>
<td>Loved it</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Summer Parfait</td>
<td>Not at all</td>
<td>1 2 3 4 5 6 7</td>
<td>Loved it</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Banana &amp; Peanut Butter Ice-cream with Malt Crumble</td>
<td>Not at all</td>
<td>1 2 3 4 5 6 7</td>
<td>Loved it</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweet Corn Fritters with Avocado Salsa &amp; Smoked Salmon</td>
<td>Not at all</td>
<td>1 2 3 4 5 6 7</td>
<td>Loved it</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Which was your favourite dish of the week, and why?

________________________________________________________________________

________________________________________________________________________

________________________________________________________________________

How much did you enjoy developing your own recipes?

| Not at all | 1 2 3 4 5 6 7 | Loved it |

How much did you enjoy shopping for your own recipes?

| Not at all | 1 2 3 4 5 6 7 | Loved it |
How much did you enjoy cooking your own recipes?

Not at all 1 2 3 4 5 6 7 Loved it

Did you enjoy the talk about Foodshare? Why/Why not?

Did you learn something new from the Foodshare talk? If so, what was this?

How much has this course improved your confidence in the kitchen?

Not at all 1 2 3 4 5 6 7 Lots

Have you learnt new skills this week?

None 1 2 3 4 5 6 7 Lots

Has this course made you want to cook more?

Not at all 1 2 3 4 5 6 7 Definitely

Do you think you are going to cook a meal for your family soon?
Circle one answer: Yes    No

Did you try new foods this week?
Circle one answer: Yes    No

If yes: What were these and did you like them?
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________

Would you recommend this course to a friend?
Circle one answer: Yes    No
Why/why not
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________

If this course was available through your school would you encourage your friends to attend?
Circle one answer: Yes    No

Any other feedback: is there anything else you want us to know about the week?
_________________________________________________________________
_________________________________________________________________
_________________________________________________________________