The long term effect of the Create Our Own Kai intervention on diet quality amongst New Zealand adolescents

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Abstract

**Background:** A high consumption of convenience and take-away foods are thought to be a major contributor to obesity amongst New Zealand adolescents. Additionally, due to changes within the New Zealand school curriculum, adolescents may be missing the opportunity to learn how to cook. Foods cooked from scratch are generally healthier, containing more vitamins and fibre and less saturated fat, salt and sugar. Cooking interventions in the northern hemisphere have shown that they can increase fruit and vegetable consumption in the shortterm. However, no study has looked at the long term effects a cooking intervention has on overall diet quality and Body Mass Index (BMI) within adolescents.

**Objective:** To investigate the long-term effects of a cooking intervention on diet quality in New Zealand adolescents.

**Design:** The study used a randomised controlled trial time series design. Participants were randomly allocated by block randomisation to either the control or the intervention group, with a total of 118 participants completing the full study. Questionnaires and anthropometric measurements were completed by participants at baseline, end of intervention, seven-week follow-up and 12-months follow up. Participants in the intervention group completed a one-week cooking program (COOK week) followed by the support phase, which supplied meal kits, one weekly for six weeks. The New Zealand Adolescent Food Frequency Questionnaire (NZAFFQ) was used to calculate The New Zealand Diet Quality Index-Adolescents (NZDQI-A). Effects of the intervention on Diet Quality Index (DQI) and fruit and vegetable subscales were estimated using linear regression adjusted for baseline values.
**Results:** After seven weeks the change in DQI score was significantly greater in the intervention compared to the control group. At 12 months follow up the intervention group still scored an average total DQI score of four points higher than the control group, but this was not statistically significant. Changes for the ‘fruits’ and ‘vegetables’ sub scores from baseline to the seven week follow up was significantly different between the intervention and control group. These changes were not maintained at the 12 month follow up. There were no changes observed in BMI for either group at 12 month follow up.

**Conclusion:** Participants in the intervention group showed significant improvements in diet quality and fruit and vegetable intake for the duration of the intervention, this was not maintained after 12 months.
Preface

This candidate was supervised by Paula Skidmore and Katherine Black. This candidate’s supervisors and other members of the COOK research team were responsible for the concept of the research that was conducted for this thesis. They were also responsible for the process of ethical approval, study design, study population and research protocols. Statistical analysis was conducted by biostatistician Dr. Jill Haszard. Sarahmarie Innes, a Master of Science colleague who worked closely on collecting and inputting data and whose results is reported in a separate thesis.

Along with the research team, the candidate was responsible for completing the following task under supervision:

- Assisting with anthropometric and questionnaire data collection
- Contribution to the scope/content of the group discussions with COOK study participants
- Assisting with group discussions with COOK study participants
- Transcribing of group discussions
- Data entry of anthropometric measurements and questionnaire scores

The candidate was responsible under supervision for the following tasks:

- Review of the relevant literature in this area
- Interpretation of results
- Writing of this thesis
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List of Abbreviations

BMI        Body Mass Index
COOK      Create Our Own Kai
CVD           Cardiovascular Disease
DQI            Diet Quality Index
EAT        Eat Amongst Teens
FFQ          Food Frequency Questionnaire
HEI        Healthy Eating Index
NZAFFQ    New Zealand Adolescent Food Frequency Questionnaire
NZDQI-A      New Zealand Diet Quality Index- Adolescents
NZEO        New Zealand European
SD            Standard Deviation
SES       Socioeconomic Status
T2DM       Type 2 Diabetes Mellitus
USA        United States of America
WHO        World Health Organisation
4DFR            4 Day Food Record
1. Introduction

The prevalence of childhood and adolescent obesity is a major issue worldwide (1). In New Zealand, childhood obesity rates have remained stable since 2011/2012, with 11% of children aged 2-14 years classified as obese (2). Obesity during childhood and adolescence is associated with musculoskeletal problems, asthma and various psychosocial problems including decreased self-esteem, depression and suicidal tendencies (3). The onset of obesity in late childhood and adolescence increases the likelihood of obesity persisting later in life, with the more severe the obesity, the greater the likelihood of persistence in adulthood (4). Obesity as an adult is strongly correlated with an increased risk of developing Type 2 Diabetes Mellitus (T2DM) and Cardiovascular Disease (CVD) which can contribute to early mortality (5). Therefore, the prevention or attenuation of obesity alongside the development of healthy eating behaviours in adolescence is critical for the future health of today’s youth.

Diet and physical inactivity are two key determinants of obesity and overall well-being, especially among adolescents (3, 6). Current research shows an association between energy dense, high fat diets and the development of obesity during childhood (7). Additionally, poor diet quality has also been linked to chronic diseases such as CVD and certain types of cancers (8). Despite this, the food industry is still heavily promoting energy dense convenience and takeaway foods that are a major contributor to the global obesity epidemic (9).

Factors such as food availability and accessibility largely influence family dietary choices (10). Research in parents has shown that fast food consumption is driven by a lack of cooking confidence, time pressure and perceptions of convenience (11). Therefore, it is not surprising convenience and takeaway foods appeal to families and are dominating food markets worldwide (12). Unfortunately, convenience and takeaway foods are more likely to be high in saturated fat, sugar and salt and low in important micronutrients (13). They often come in
prepacked portions which can encourage overconsumption and can lead to individuals exceeding their energy requirements (9). The use of these foods has reduced the need for individuals to prepare meals at home from raw ingredients (14). This may mean that traditional passing on of cooking knowledge from one generation to the next is no longer occurring (14). Concerns are rising that young people are no longer learning the basic skills of cooking food. This is important from a nutritional perspective as having an active role in meal preparation is associated with greater intake of fruit, vegetables, fibre, folate and vitamin A and a lower intake of saturated fats, fried foods and carbonated beverages in young adults (15).

The aim of the current study is to determine the long-term effects of a cooking intervention on Body Mass Index (BMI) and diet quality in adolescents in Dunedin, New Zealand. The Create Our Own Kai (COOK) study is a one-week cooking program followed by a support phase with six weeks of meal kits that focus on increasing cooking skills, cooking self-efficacy, diet quality and wellbeing. This is the first randomised control study in New Zealand to provide a cooking intervention, followed by the six weeks of meal kits that follows up participants one year post intervention.
2. Literature Review

2.1 Search strategy of literature review

Literature for this review was found by searching the databases PubMed, Medline via Ovid, ScienceDirect and Google Scholar for papers published prior to 2018 over the period of October 2017 to July 2018. The following keywords were used in varying combinations: adolescent(s), teenagers, cooking, cooking intervention, diet quality, nutrition, weight and Body Mass Index (BMI). Further literature was sourced from the reference lists of relevant articles. The World Health Organisation (WHO) and New Zealand Ministry of Health websites were accessed for demographic data.

2.2 Defining adolescence

There are numerous ways of defining adolescence (16). Generally, the timing of adolescence is thought to begin with puberty (17, 18). The onset of puberty can vary widely between individuals and there is often no single event to indicate its cessation, making it difficult to define the period of adolescence using this biological method (19). Adolescence can also be defined socially and cognitively, with the first stages of adolescence involving frequent changes in mood, inability to foresee consequences of actions and an increase in interdependence (20). The later stage consisting of more long-term goals and plans for the future and a change from a parent-child relationship to more of an adult-adult relationship (20). A limitation of using this to define adolescence is that it is hard to measure cognitive and social developments and they can vary depending on the individual. Age is the most convenient marker to define adolescence (21). The WHO defines adolescence as the period between the ages of 10-19 years (22). For the purpose of this study the age span of adolescence is defined according to the WHO as between 10-19 years of age.


2.3 Adolescent health and cooking

Adolescence is a period of many physical, psychosocial changes and increased independence that can ultimately impact on an individual’s dietary habits (23). In the United States (US), studies have shown that an increased consumption of energy dense foods such as sugar-sweetened beverages and a decrease in the consumption of nutrient dense foods such as fruits and vegetables is prevalent during adolescence (24, 25). Similar patterns have been seen in New Zealand in 2003, with approximately 40% of children aged 5-14 years meeting the fruit recommendations and only 60% meeting the vegetable recommendations (26). During adolescence it is also common to see an increase in behaviours such as snacking, missing meals and eating food prepared outside the home more frequently (27). Eating behaviours are thought to be affected by the surrounding environments with various research investigating the characteristics of the food environment in particular fast food outlets. In New Zealand, the food environments particularly surrounding secondary schools are promoting the consumption of these high energy dense foods. A nationwide spatial analysis, published in 2016 revealed that 68.5% urban and 14.0% of rural schools have a convenience store within 800 m and 62.0% of urban schools have a fast food or takeaway outlet within 800 m (28). Considering this, it is not surprising that New Zealand adolescents are struggling to make healthy food choices with 36.1% of adolescents aged 10-14 years, and 43% aged 15-17 years either overweight or obese (2).

A study published in 2016, conducted in New Zealand reports that 15% of female adolescents and 22% of male adolescents reported never having cooked a meal in the past year (29). Opportunities for adolescents to learn how to cook may be diminishing with less skills being passed down through the generations and due to changes within the New Zealand school curriculum. Subjects like home economics which had previously focused on the “teaching of life skills” including cooking, have shifted its focus towards helping students to make more
informed consumer decisions (30). Teaching students about nutrition, the food industry and the factors influencing our food choices is important, yet the decrease in time spent practically learning how to cook makes it difficult for adolescents to put their nutrition knowledge into real life practice. Research has also shown that adolescents who are involved in food preparation are more likely to enjoy cooking in adulthood, so providing adolescents with the opportunity to cook earlier in life could result in the continuation of cooking in adulthood (31).

Around 80% of obese adolescents will remain obese as adults, therefore strategies that can reduce obesity during adolescence are crucial for improving lifelong health outcomes (4). Adolescents are also an ideal group to target as they are gradually transitioning into taking full responsibility for their own eating habits. Increasing adolescent’s ability to cook and prepare food is one strategy that can help to improve adolescents diet quality and reduce the risk of obesity. Larson et al. (15) has shown that adolescents and young adults who are involved more frequently in meal preparation are more likely to have better diet quality and consume less convenience foods. In a New Zealand study, adolescents who reported the highest cooking ability were less likely to frequently consume fast food and more likely to meet the recommendations for fruit and vegetable consumption (29).

### 2.4 Cooking skills and cooking efficacy

Cooking skills can be defined as a set of physical or mechanical skills used in the production of a meal, including cooking methods and food preparation techniques (32). Traditionally, the process of cooking food involved preparing and transforming raw ingredients into an edible meal. However, with the changing food environments and the increase in pre-prepared and ready-made foods, physical or mechanical skills are no longer needed to produce a meal at home. Short, an expert in this area looks at cooking in a more holistic manner stating that there
are five different components of cooking. He describes academic and planning skills as components of cooking explaining that cooking incorporates an understanding of food safety, nutrition as well as having the ability to plan meals within budgets and around time constraints (32). The perceived cost of healthy food, the time to plan and prepare food and a lack of skills to do so have all been identified as barriers to cooking in the literature (33, 34). Therefore, helping adolescents to develop the skills needed to not only cook a meal, but helping them to have the ability to plan and prepare a meal within a budget and timeframe may help to overcome the barriers stopping them from cooking. Having the necessary skills and knowledge are vital to performing a task and achieving behaviour change. Although, another important concept in achieving sustained behaviour change is self-efficacy (35). Self-efficacy is known as the belief that a person has that they can achieve a specific task (35). Without confidence in their cooking ability, adolescents may be less motivated and less likely to attempt it. As previously mentioned, adolescents are more likely to have a better diet quality the more frequently they are involved in meal preparation (15). Therefore, to increase involvement in home cooking and meal preparation and improve diet quality, empowering adolescents with the confidence to prepare and cook a meal at home is imperative. While the theory of self-efficacy is underpinning the COOK study, this component of the study is outside the scope of this thesis, as it is being investigated by another student.

2.5 Diet quality

There are numerous different ways to assess dietary intake including different objective and subjective measures (36). The most common dietary assessment tools used are food records, 24 hour recalls or a validated Food Frequency Questionnaire (FFQ) (37). Food records can be obtained over a period of generally three to seven days using food scales (weighed food record) or by estimating portion sizes (estimated food record). However, both types place a
high burden on the respondent (36). Using a 24-hour recall method has a lower respondent burden but requires trained interviewers to administer which can increase cost and time (36).

Due to the considerations of participant burden and the requirement of multiple records required in order to get a reliable usual intake, food records and 24 hour recalls are not the most pragmatic approach to assessing dietary intake in a cohort of adolescents. Conversely, FFQs do not require trained interviewers to administer them, have a low respondent burden and can assess total diet or can focus on specific foods and nutrients in a single questionnaire (36). However, they need to be validated in the population group for whom they designed for which can be timely (38). A validated FFQ is the most common method used to calculate a Diet Quality Index (DQI). Diet quality can be measured using a DQI which evaluates the adherence to specific dietary guidelines (39). This enables the assessment of the entire diet taking into account the nutrients, how they interact and can reflect a risk gradient for diet related chronic disease (40, 41). Higher DQI scores mean that an individual’s diet adheres more closely to the specific dietary guidelines than an individual with a lower DQI score. A higher DQI has also been associated with a better cardiovascular profile in adulthood (41). It is important that the dietary guidelines used are country specific as each country has the most appropriate information for its population such as the bioavailability of the nutrients and clinical signs of subpopulation groups whose intake level is known (42). Several DQIs have been developed within different countries around the world (43, 44). The majority of the DQIs used in adult populations have used validated FFQs as their methodology to collect population data (43-45). The Healthy Eating Index (HEI) in America originally used a combination of 24-hour recall and diet records to collect its dietary intake data (46). In order for this DQI to be used in adolescents and older children, it was modified and a FFQ method was adopted to collect dietary intake data. Despite the HEI being commonly used worldwide, this DQI still requires modification for use in other populations.

An example of a DQI developed specifically for use in New Zealand is the New Zealand Diet
Quality Index for Adolescents (NZDQI-A). The NZDQI-A is derived from the New Zealand Adolescent Food Frequency Questionnaire (NZAFFQ), which is a non-quantitative FFQ developed for intended use in New Zealand adolescents. The NZAFFQ has shown good short term test-retest reliability and when compared to a four-day estimated food record (4DFR) and reasonable validity in establishing the majority of the food group intakes among adolescents aged 14 to 18 years (47). The NZDQI-A derived from the NZAFFQ has also shown good reliability and comparability with scores derived from a 4DFR making it a valid and reliable method of measuring diet quality in adolescents at a group level (48). The NZDQI-A measures intake of the five food groups of fruit, vegetables, milk and milk products, breads and cereals and meat and meat alternatives to assess overall adequacy and variety in their diet. The NZDQI-A was used in this study to measure diet quality as it is the only DQI based on New Zealand dietary guidelines and specifically validated in an adolescent population.

2.6 Observational studies

In New Zealand, an observational study has looked at the relationship between cooking frequency and ability with selected measures of diet quality, mental well-being and family relationships (29). This study used data from Youth ’12, a nationally representative health and well-being survey, which includes 8,500 secondary school participants. Of the 8,500 participants, 80% reported that they could cook a meal with relative ease and 15% reported that they could not cook a meal without help. Those participants with greater cooking abilities were significantly more likely to meet recommendations for fruit and vegetable intake and significantly less likely to frequently consume fast food. There was also a significant relationship between cooking frequency and fruit and vegetable consumption, with students reporting the greatest frequency of cooking being more likely to eat ≥ 5 fruits and vegetables daily compared with students who never cook (29). However, interestingly participants with the highest frequency and ability of cooking, regardless of the aforementioned improvements...
in diet quality, were more likely to have a higher BMI. This remained statistically significant after controlling for sociodemographic students (29). Similar results were observed in a cross-sectional study using data from the project Eat Amongst Teens (EAT) survey in Minneapolis, USA. The survey was completed by 4,746 teenagers aged 11-18 years old. The study looked at adolescent involvement in preparing and shopping for food and examined if the extent of involvement in these two areas is related to diet quality. Higher frequency of preparing foods was related to lower intakes of fat, and higher intakes of fruit, vegetables, fibre and vitamin A. Surprisingly but consistent with the previously mentioned observational study, greater involvement in preparing dinner and grocery shopping was related to being overweight (15).

2.7 Intervention studies

Teaching individuals to cook is the primary focus of many studies (49-53) yet there is limited research, particularly in adolescent populations, of the effect this has on their diet quality and BMI. Many previous interventions focused on confidence and self-efficacy for cooking (5256). No previous studies looked at the effects on BMI. All of the intervention studies found were located in the northern hemisphere with the majority being in North America, this makes it hard to compare them to a context in New Zealand as the price and availability of fruits and vegetables in particular are likely to differ. Studies rarely measured diet quality, instead the majority of the studies only looked at changes in fruit and vegetable consumption (50, 51, 55, 57, 58). Narrowing down dietary assessment to exclusively fruit and vegetable intake does not provide an accurate representation of someone’s diet, as it is possible to meet the recommendations for fruits and vegetables while not meeting the guidelines for other food groups. The only study that did claim to measure diet quality was the “Pink Chef’s” culinary program conducted in a group 12-14-year-old females in California, USA. (52). The program provided two-hour practical cooking and nutrition classes, twice weekly over six weeks. The
classes were designed to increase the student’s confidence in cooking with the intention of improving diet quality. However, using The Nutrition Quest’s previously validated Fat Screener tool, this study looked only at consumption of percent fat from total daily caloric intake rather than overall diet quality (52). No change in the amount of fat consumed by participants was found. Studies that measured changes in the fruit and vegetable consumption (50, 51, 54, 55, 57, 58) all reported a positive increase in consumption post intervention. Albeit, no studies assessed variety of fruit and vegetable consumption and without any long term follow up it is impossible to know if changes have been sustained. There is also a large variety in the duration and intensity of the cooking interventions, ranging from week long cooking camps consisting of four to six hours per day (49, 50) to delivering shorter classes over a longer period. Due to the wide variations in study population (age range, ethnicity, gender, socioeconomic status) and the methodology of the studies (cooking intervention, follow-up and evaluation) comparison of the studies has proven difficult.

Many of the studies including a cooking intervention did so in combination with other components such as gardening. The Sprouting Healthy Kids five month, multi-component garden based intervention included after school cooking classes, farm visits and an after school gardening program. This was conducted in 246 middle school students aged 10 to 14 years in USA. Using a pre and post-test design they measured fruit and vegetable consumption. Results showed that exposure to two or more intervention components reported an increase in fruit and vegetable intake per day (54). Similar increases were found in the ‘Gimme 5’ study, a school based multicomponent intervention designed to increase daily fruit and vegetable consumption by high school students to five or more servings (55). The intervention consisted of exposure to school social media campaigns, teaching on cooking skills and fresh choices in regards to purchasing food and parental involvement to assist with fruit and vegetable consumption. This is the only study found that includes a follow up over six months, as
it looks at changes two years post intervention. The results reported an increase in fruit and
vegetable intake in the intervention group by 14% compared to the control group, which indicated
there is some evidence that behavioural changes originated from these programs can be sustained
long-term (55).

2.8 Conclusion

As previously mentioned, worldwide, many studies have been conducted providing cooking
classes or interventions to youth. To our knowledge, in New Zealand, the current study will
be the first randomised control trial that will assess the long term effects (one year) of a
cooking intervention on diet quality and BMI in adolescents. There is a noticeable gap in the
literature where: 1) cooking studies are not randomised or controlled, 2) follow up
postintervention is six months or less and 3) there are limited studies appropriately assessing
diet quality and changes in consumption of fruit and vegetables, with most of the evidence on
diet quality comes from observational studies. Considering the current health status and
cooking behaviours of adolescents there is great need for interventions to investigate the
impact of cooking on diet quality and BMI in adolescents.
3. Objective Statement

The aim of this Create Our Own Kai (COOK) Study is to investigate using a randomised controlled trial the effect an intensive week long cooking program, followed by six weeks of meal kits (one per week) would have at seven weeks and 12 month follow up on:

1) Cooking skills
2) Cooking confidence
3) Diet quality
4) BMI
5) Fruit and vegetable intake
6) Well-being

The primary aim of this thesis is to:

1) Investigate if a cooking intervention can result in changes in diet quality index score.
2) Examine the intake of fruit and vegetable and their association with participation in the cooking intervention.

The secondary aim of this thesis is to:

1) Investigate the effect a cooking intervention has on participants Body Mass Index status.
4. Subjects and Methods

The methods section of this thesis has been adapted from two other Master of Dietetics theses on the COOK project by Rosie Jackson and Olivia Toldi.

4.1 Study design

The Create Our Own Kai (COOK) study was a parallel randomised-control trial conducted with adolescents from Dunedin, Otago. The intervention consisted of two components. Component one (COOK week) was an intensive one-week hands-on cooking and education program held in a teaching kitchen. Component two (meal kits) was a home-based six-week period, where recipes and ingredients were provided weekly. This was to support the transition of skills and behaviours learned during the COOK-week into the home environment. Figure 4.1 shows the COOK study timeline. Participants were randomised to either the intervention group who were involved in both the COOK week and the meal kit component, or the control group. The same anthropometric measures and questionnaires were completed at the same time points for each group; baseline (T1), post-intervention (T3), and at 12 months post-intervention (T4). Participants in the intervention group also completed an additional questionnaire at the end of the COOK week program (T2). The COOK week program was divided into four streams (A, B, C, D) with participant’s availability considered when allocating them to a stream. Stream A, B and C began one week apart during the school summer holidays (January and February 2017) and Stream D began in the school holidays in July 2018.

The outcomes analysed in this thesis are changes in diet quality score, fruit and vegetable score and Body Mass Index (BMI) from T1 to T4 and from T3 to T4. Several other outcomes such as cooking skills, confidence, mental wellbeing and psychosocial determinants of diet were also analysed during the COOK study but are outside of the scope of this thesis. Group discussion sessions were also held with participants from control and intervention groups to...
better understand barriers and facilitators to cooking at home and to gather participant’s feedback on the COOK program.

4.2 Ethics
Ethical approval was obtained from the Otago University Human Ethics Committee (reference number 16/126) for all components of the COOK study. Two information sheets were provided to every potential participant, one written specifically for the parent/guardian, and the other written specifically for the adolescent. The participant and their legal guardian both provided written informed consent prior to participating in the study. The ethical approval documentation can be found in Appendix A.
Figure 4.1. Cook study design timeline. Note: Figure 1 was adapted from Sarahmarie Innes MSc thesis (2018) which focuses on different COOK study outcomes.
4.3 Participant recruitment and criteria

Participants were recruited through social media (Facebook and Twitter), local schools and advertisements and posters on community boards. Adolescents who would be in years 9 and 10 (approximate age of 12-14 years) at the time of intervention, i.e. due to start these years in February 2017, were eligible to participate in this study. This age-range was selected rather than older adolescents, as students from year 11 onwards begin working to achieve national secondary qualifications, and recruitment may have been more difficult as these pupils are likely to have less time outside of school hours. The COOK study was designed for secondary school students therefore students studying below year 9 were not eligible. They were also required to be available in Dunedin, New Zealand for the COOK week and throughout the meal kit phase, and able to attend the clinic for all follow-up visits. Exclusion criteria were that only one child per family was eligible to enroll in the study and having a disability that would prevent them from safely working in a kitchen. Adolescents with special dietary requirements due to allergy/ethical/religious reasons, as well as learning disabilities were all eligible to participate. Participants were required to have their own transport to and from the COOK study program.

4.4 Randomisation

Block-randomisation by stream was used for streams A, B and C, since they occurred over a three-week period, in order to accommodate as many students as possible, and simple randomisation was used for the Stream D, which ran six months later. The number of participants enrolled in each stream varied, with 24 participants per stream assigned to the intervention group, and remaining participants assigned to the control group. The number of participants in the intervention group was kept constant, rather than having a consistent allocation ratio. This was to ensure practical aspects of COOK week could be completed successfully and that the participants’ experiences would be the same across streams. Random
allocation to a group was done by placing pieces of paper reading “intervention” or “control”, in a container, with the required number and ratio for each stream. The papers were folded so that the writing was not visible. One researcher pulled out an allocation paper, while the other researcher assigned that participant to its condition. Some participants declined to participate further once they had been informed of which group they were in. For those participants that did not want to continue at this pre-baseline point, or at any time during the study, their reason for discontinuing was recorded if it was able to be determined.

4.5 Intervention

COOK week was a five-day cooking program held in teaching kitchens at the University of Otago and a local school. The kitchen equipment found in the teaching kitchens were ensured to be the same one would find in a domestic kitchen. The program focused on practical cooking lessons and meal demonstrations but included other non-cooking talks and presentations spread out during the week. These included nutrition, hygiene, food safety, 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.

4.5.1 Development of intervention

The COOK week program was based on a similar program developed for Australian school children by Sprout (Sprout Cooking School, Adelaide, Australia), which co-created by a MasterChef Australia finalist and dietitian duo, Callum Hann and Themis Chryssidis, is a cooking education and catering organisation. The Sprout and COOK teams modified the program so that it was suitable for New Zealand and culturally appropriate (such as not allowing sitting on tables). The COOK week was then piloted with 21 Dunedin adolescents (59). During
this week the Sprout team trained four researchers including a dietitian and a chef to instruct the program. Participants and research assistants discussed their experiences at the end of the pilot week, which led to changes in certain aspects of the program (such as logistical issue around the weighing and portioning of ingredients).

4.5.2 Recipes

Recipes for the intensive cooking week were adapted from the Australian program (Appendix B). Recipe ingredients were substituted to use seasonal produce and other ingredients which were affordable and readily available in Dunedin (for example, tofu was used for the jungle curry instead of prawns, which are more expensive in New Zealand) and culturally appropriate food names and usage. The recipes had no added salt apart from a few dishes using soy sauce and desserts were mostly fruit based with small but appropriate amounts of sugar. Participants were given a book that contained all the recipes made in COOK week. The book included modifications to the recipes such as substitutions for cheaper vegetable alternatives and making meals vegetarian. To save time and to make each cooking session run more efficiently, participants were provided with a tray containing pre-measured ingredients required for that recipe. Vegetables and fruit were left whole and unwashed, so that participants could practice preparing them. Larger amounts of herbs and spices were provided so that participants could season according to their own taste preferences. The COOK instructors gave a full demonstration of the dish where any difficult parts were explained, and participants could ask questions. Once participants returned to their work stations to cook the dish, instructors and other research assistants were available to answer questions, and offer help. Before people could eat their meal it was compulsory that all work stations were clean before and that everyone in the room sat down and ate together.
4.5.3 Week layout

The COOK week program went from Monday to Friday, 9am until approximately 3:15pm daily (Appendix C). They were all run by the trained chef-dietitian pair, as well as other research assistants. On most days, three different dishes were cooked. Participants worked in pairs for the week, with two pairs at each work station. Most recipes were cooked in pairs, but some were made as a group of four. COOK instructors designated the pairs and work stations before the beginning of each COOK week, taking into account which school participants attended, along with food dislikes or special dietary requirements. Where possible, people with similar dietary requirements or food dislikes were paired. Throughout the week, participants were given time to work in their pairs on designing the two-course meal they would cook for a family member on the Friday. The planning for this involved selecting and/or adapting recipes, pricing them out and writing a shopping list, and writing a schedule for the day of what would be done at certain times, by whom. Participants needed to use recipes they had not cooked before. They were encouraged to look through recipe books and online for ideas, although modified versions of COOK week or home recipes were permitted. Ingredients for this meal had to cost less than $25, but they also had access to an “open pantry” of basic ingredients which they did not have to buy (Appendix D). On the day before cooking their menus, participants went as a group to the supermarket to purchase ingredients. 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). Each pair of participants were given a $25 grocery voucher to buy these ingredients with. Stream D’s supermarket day was cancelled due to snowfall, so research assistants bought ingredients they needed on their behalf. Participants were given all of Friday morning to prepare their two-course meal. The families arrived at around 12pm, and were served by their children. Participants returned for a group lunch which was prepared by the COOK instructors, then filled out their T2 questionnaires and had a feedback discussion about the week.
4.5.4 Meal kits

The second component of the intervention was the meal kits, which participants received upon completion of Friday’s COOK week session. They would continue to receive these kits, one per week over the following five weeks. The first meal kit also contained cupboard staples such as flour that would be needed over the next five weeks along with the first recipe and its ingredients. The other five meal kits contained new recipes, which were collected by parents during designated pick-up times. Each meal kit was designed to make an entire meal for a family of four and aimed to cost around $12 or less. The recipes provided were adapted from several sources, which are shown in Table 4.1 (Appendix E) The recipes were chosen with the intent that they reinforced skills and techniques learned during the COOK week.

<table>
<thead>
<tr>
<th>Week</th>
<th>Recipe</th>
<th>Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tofu jungle curry</td>
<td>Sprout Cooking School (Australia)</td>
</tr>
<tr>
<td>2</td>
<td>Deep-crust pizza with sausage</td>
<td>Australian Women’s Weekly (Australia)</td>
</tr>
<tr>
<td>3</td>
<td>Meatballs with tomato sauce and spaghetti</td>
<td>Beef and Lamb (New Zealand)</td>
</tr>
<tr>
<td>4</td>
<td>Mexican nachos</td>
<td>FoodShare Dunedin (New Zealand)</td>
</tr>
<tr>
<td>5</td>
<td>Tuna pasta bake</td>
<td>Sealord (New Zealand)</td>
</tr>
<tr>
<td>6</td>
<td>Pasta and bean soup</td>
<td>Alison and Simon Holst (New Zealand)</td>
</tr>
</tbody>
</table>
4.5.5 Social media

A private Facebook group was created for each intervention stream on the first day of the COOK week. Participants were encouraged to join and post photos, comments or any recipe modifications on the page. While the primary reason for the Facebook page was to help retain participants’ interest and motivation during the meal kit phase, it also allowed research assistants to see what sorts of cooking participants were doing at home. This page was also used by research assistants as a communication, who posted notices and offered encouragement and weekly prizes. A research assistant posted weekly during meal kit period, encouraging participants to upload a photo of that week’s meal once they had made it.

4.6 Data collection

Anthropometric measurements and the same set of questionnaires were given to both the intervention and control groups at time-points T1, T3 and T4 (Figure 4.1). Only the intervention participants were given the T2 questionnaire, which was given at the end of COOK week. This repeated some questions from the T1/T3/T4 questionnaires on areas which possibly changed over that week (e.g. cooking self-efficacy and confidence), as well as questions evaluating their experience and feedback of COOK week.

Control participants had anthropometric measures taken and completed their T1 and T3 questionnaires during private appointments at the Department of Human Nutrition clinic. Intervention participants completed their T1 and T2 questionnaires together in the teaching kitchen. The intervention group’s T3 questionnaires were completed during private clinic appointments for the first three streams, but this was modified for Stream D as a result of difficulties experienced with the other streams. Stream D was given their questionnaires with their final meal kit, to complete at home and bring back when they returned for their
anthropometry appointment. Participants received a $20 voucher (Foodstuffs, New World) for each full set of measures (questionnaires and anthropometry) that they completed, except for intervention participants’ T1 and T2 measures, which were completed as part of COOK week.

A range of outcomes were investigated with the COOK study, many which are outside of the scope of this thesis but are analysed in separate theses. Measures used in this thesis are described below.

4.6.1 Anthropometry

All measurements were carried out by trained research assistants at private appointments held in Otago University’s nutrition clinic or in a side room during COOK week. Height was measured with participants in bare feet, erect, standing with their heads in the Frankfort plane. A portable stadiometer was used to record height to the nearest 0.1cm (Wedderburn portable height rod: WS-HRP, Dunedin). Measurements were repeated, and a third measurement was taken if the first two differed by 0.5cm or more. Height was calculated as the mean of two measurements or the median of three. Weight was measured to the nearest 0.1kg using bioelectrical impedance analysis (BIA) scales (C418, Tanita, Tokyo, Japan). Participants had bare feet and wore light clothing. A male/female standard, their age and height to the nearest centimetre were inputted into the scales, and a standardised clothing adjustment of 0.5kg was applied to all measurements. Body Mass Index (BMI, kg/m$^2$) was calculated for each participant at all three time points, and corresponding World Health Organisation (WHO) age- and sex-specific BMI z-scores were calculated using the WHO Anthro package in Stata. Age in complete years was used for assigning z-scores (e.g. a participant who was 13 years and eight months old was considered 13 years old). BMI was categorised according to WHO criteria, where children below the WHO’s BMI value corresponding to sex and age-specific Z-
score of -2 standard deviations (SD) were classified as underweight, and overweight and obese were classified as above 1SD and 2SD, respectively.

4.6.2 Demographics

Demographic questions were asked at time-points T1 and T4, as it was considered unlikely that this information would have changed over the seven weeks between T1 and T3. Living situation was assessed using questions about where participants normally lived (with family/school board/private board), and the size and composition of their household. Participants were asked their date of birth, age, sex and ethnicity. The ethnicity question from the New Zealand census was used, which lists the eight largest ethnicity groups in New Zealand, as well as having an “Other: please specify” option (60). Participants could tick as many boxes that applied to them, and the data was coded according to the New Zealand census method, which prioritises ethnicity category assignment in the order of Māori, then Pacific, then New Zealand European (NZEO) and Other (60).

Participants’ Socio-Economic Status (SES) was estimated from their residential addresses, using the NZDep2013 system of categorising neighbourhood deprivation level (61). This system assigns a number from “1”, or least deprived, through to “10”, or most deprived, for each neighbourhood mesh-block, with each assignment category representing 10% of the New Zealand population. The assignment of deprivation index to each mesh-block is based on data from the 2013 New Zealand census on a range of SES indicators, including income, home ownership, and qualification levels.
**4.6.3 Diet quality**

Information about dietary habits was collected using the New Zealand Adolescents’ Food Frequency Questionnaire (NZAFFQ) (Appendix F). This questionnaire was administered at time-points T1, T3 and T4. The NZAFFQ is appropriate for looking at frequency of consumption of food groups and specific foods and the NZDQI-A has been calculated from it.

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) (Appendix G). 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. To examine the association of fruit and vegetable intake with participation in the COOK intervention the fruit and vegetable component scores were analysed individually. These are shown in Table 5.2 Higher frequency of intake is associated with a higher score for most of the food groups with the exception of meat. This is due to the ‘U-shape’ association, where both excessive and inadequate consumption is associated with adverse health outcomes therefore, the category ‘meat’ is allocated the highest score of 20 for moderate intake (62).

This questionnaire does not quantify serving sizes so instead this data will reflect the two aspects of diet variety and diet 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. (Appendix H) Fruit and vegetable variety was calculated by the number of fruit and vegetables subgroups consumed in a week with a maximum score of each being six.
4.6.4 Group interviews

To help understand the results in more depth, group discussions about participants’ perceived barriers and facilitators towards cooking at home were conducted. These discussions for Streams A, B and C took place during the school holidays, after the 12 month T4 anthropometry measurements and questionnaires had been collected. Due to Stream D starting six months later, it was not practical for this to be held within the given time-frame. Instead, a group interview was held with Stream D following post-intervention data collection (ten weeks from baseline), to gather feedback of the COOK program. All participants were invited to attend a group discussion and afternoon tea. Control and intervention participants were in separate interviews, which were each attended by between six and ten people. Participants in streams A, B and C were not segregated by stream so they could attend the one that best suited them. The facilitator worked through a question schedule in a relaxed manner, often asking unscripted questions in order to better understand individual’s responses. An assistant took notes, and these sessions were audio-recorded. Interviews were transcribed ad verbatim, however a thematic analysis was not undertaken, as the primary objectives of this thesis were quantitative. The only group discussion analysed in this thesis is from a group of eight Stream D intervention participants that was conducted after the completion of their 12 month follow up.

4.7 Statistical analysis

All statistical analyses were undertaken using Stata 15.1 (StataCorp, Texas, USA). Participant characteristics are described using means and standard deviations, except where stated in this case variables were not normally distributed, and medians and interquartile ranges are presented instead. Categorical variables are presented as n (%). The focus of this thesis is on the changes that occur from baseline (T1) to 12-month follow-up (T4). Changes between T1 and T3 are also reported here for comparison. Between group differences were estimated
using mixed effects regression models with an interaction term between group and time, adjusted for baseline value. Stream was included as a random effect. Mean differences, 95% confidence intervals and p-values were calculated. A two-sided p-value of <0.05 was considered statistically significant for all tests.

5. Results

Baseline characteristics are shown in Table 5.1. Of those that were eligible to participate, a total of one hundred and eighteen students completed the COOK study. The control group was much smaller (n= 27) compared to the intervention (n=91), this is mainly due to high dropout rates of control participants once they had been told they would not participate in the cooking classes. Both groups had a small but similar percentage of Maori and a similar percentage of New Zealand European (NZEO) participants. All of the participants attended schools with a decile of five or above. Baseline BMI z scores were similar for each group.

Changes in total DQI scores from baseline to seven week follow up were significantly greater in the intervention compared to the control group (Table 5.2). At 12 months follow up the intervention group still scored an average total DQI score of four points higher than the control group, but this was not statistically significant. Similar to the total DQI score, change for the ‘fruits’ and ‘vegetables’ sub scores from baseline to seven week follow up was significantly different between the intervention and control group. Again, these changes were not maintained at the 12 month follow up. Analysis of the variety of fruit and vegetable sub scores showed no change in fruit and vegetable variety from baseline to seven weeks and to 12 month follow up for both intervention and control groups.
### 5.1: Demographic characteristics of COOK study participants

<table>
<thead>
<tr>
<th></th>
<th>Control Group n (%)</th>
<th>Intervention Group n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participant numbers</td>
<td>27</td>
<td>91</td>
</tr>
<tr>
<td>Age (years), mean (SD)</td>
<td>13.9 (0.77)</td>
<td>13.6 (0.75)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>6 (22)</td>
<td>36 (40)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NZEO</td>
<td>23 (85)</td>
<td>78 (86)</td>
</tr>
<tr>
<td>Maori</td>
<td>4 (15)</td>
<td>13 (14)</td>
</tr>
<tr>
<td>Socio-economic status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Low deprivation</td>
<td>15 (56)</td>
<td>40 (44)</td>
</tr>
<tr>
<td>Medium deprivation</td>
<td>8 (30)</td>
<td>39 (43)</td>
</tr>
<tr>
<td>High deprivation</td>
<td>4 (15)</td>
<td>12 (13)</td>
</tr>
<tr>
<td>School decile</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium (5-7)</td>
<td>10 (37)</td>
<td>49 (54)</td>
</tr>
<tr>
<td>High (8-10)</td>
<td>16 (59)</td>
<td>41 (45)</td>
</tr>
<tr>
<td>BMI z score, mean (SD)</td>
<td>0.9 (1.2)</td>
<td>0.6 (1.2)</td>
</tr>
<tr>
<td>(n=116)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BMI classification</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Underweight</td>
<td>1 (4)</td>
<td>6 (7)</td>
</tr>
<tr>
<td>Normal weight</td>
<td>16 (59)</td>
<td>54 (61)</td>
</tr>
<tr>
<td>Overweight</td>
<td>6 (22)</td>
<td>25 (28)</td>
</tr>
<tr>
<td>Obese</td>
<td>4 (15)</td>
<td>4 (4)</td>
</tr>
</tbody>
</table>
### 5.2: Diet quality index, individual fruit and vegetable group score and variety

<table>
<thead>
<tr>
<th></th>
<th>Control (n=27)</th>
<th>Intervention (n=91)</th>
<th>Mean difference (95% CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DQI</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>57.1 (14.2)</td>
<td>59.8 (14.3)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7 week</td>
<td>54.8 (13.9)</td>
<td>61.8 (14.3)</td>
<td>5.2 (0.2 - 10.2)</td>
<td>0.040</td>
</tr>
<tr>
<td>12 month</td>
<td>54.9 (16.2)</td>
<td>59.2 (12.2)</td>
<td>2.0 (-3.0 – 6.9)</td>
<td>0.438</td>
</tr>
<tr>
<td><strong>Fruit score</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>10 (4.9)</td>
<td>11.6 (5.7)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7 week</td>
<td>9.7 (5.3)</td>
<td>12.5 (5.6)</td>
<td>2.3 ( 0.0 – 4.7)</td>
<td>0.046</td>
</tr>
<tr>
<td>12 month</td>
<td>9.8 (5.6)</td>
<td>11.4 (5.9)</td>
<td>1.0 (-1.3 – 3.3)</td>
<td>0.374</td>
</tr>
<tr>
<td><strong>Vegetable score</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>14.1 (6.2)</td>
<td>13.9 (5.7)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7 week</td>
<td>13.3 (5.9)</td>
<td>15.4 (5.1)</td>
<td>2.2 ( 0.2 – 4.2)</td>
<td>0.035</td>
</tr>
<tr>
<td>12 month</td>
<td>13.6 ( 6.3)</td>
<td>15.1 (5.2)</td>
<td>1.3 ( -0.5 – 3.5)</td>
<td>0.139</td>
</tr>
<tr>
<td><strong>Fruit variety</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>3.3 (1.3)</td>
<td>3.7 (1.5)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7 week</td>
<td>3.4 (1.3)</td>
<td>4.1 (1.5)</td>
<td>0.48 (-0.1 - 1.1)</td>
<td>0.126</td>
</tr>
<tr>
<td>12 month</td>
<td>3.4 (1.4)</td>
<td>3.7 (1.6)</td>
<td>0.2 (-0.5 – 0.7)</td>
<td>0.632</td>
</tr>
<tr>
<td><strong>Vegetable variety</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline</td>
<td>5.2 (0.9)</td>
<td>5.3 (1.0)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7 week</td>
<td>5.3 (1.0)</td>
<td>5.5 (0.9)</td>
<td>0.1 (-0.2 – 0.4)</td>
<td>0.413</td>
</tr>
<tr>
<td>12 month</td>
<td>5.4 (0.9)</td>
<td>5.5 (0.8)</td>
<td>0.0 (-0.3 – 0.3)</td>
<td>0.953</td>
</tr>
</tbody>
</table>
### 5.3: BMI z scores

<table>
<thead>
<tr>
<th>BMI z score</th>
<th>Control (n=27)</th>
<th>Intervention (n=91)</th>
<th>Mean difference (95% CI)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>0.9 (1.2)</td>
<td>0.6 (1.2)</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7 week</td>
<td>0.8 (1.2)</td>
<td>0.7 (1.2)</td>
<td>0.1 (-0.1 – 0.2)</td>
<td>0.377</td>
</tr>
<tr>
<td>12 month</td>
<td>0.9 (1.2)</td>
<td>0.6 (1.2)</td>
<td>-0.0 (-0.1 – 0.1)</td>
<td>0.940</td>
</tr>
</tbody>
</table>

In both the intervention and the control group there were no changes in BMI from baseline to seven weeks and to 12 months, with no significant differences between the groups (Table 5.3). However, this study was not powered to detect BMI changes as BMI was initially collected to describe participants.

### 5.1 Group discussion analysis

The feedback gathered from one group discussion was analysed in this thesis. The group consisted of eight Stream D participants, two males and six females, and was conducted after their 12 month follow up. Results showed that they all felt their interest in cooking had increased after the COOK week program and during the meal kit phase period but now at twelve months follow up, their interest returned back to where it was prior to the intervention. One student said that “Straight after the course I probably did a bit more than I do now, well at least different dishes but as time went on I probably went back to the dishes I was more used to cooking”. Most participants felt the duration of the meal kit phase was sufficient. However, one participant suggested interest in cooking could be kept longer if they “extended it [meal kits] out further but just had a bag a month just to see if they were continuing with the interest of cooking it”. One participant stated that her interest in cooking had stayed the same and said that she will “cook to eat, I have to just grab the quick things that you really
don’t need to do much with”. Most of the participants are still cooking, usually once to twice a week with the majority of meals being “something quick and easy”. The main reason for cooking for the family is because the participant has been asked or told to by their parents. All of the cooking participants are doing is inside the home with none of the participants currently involved in any cooking or meal preparation outside of home. Common meals participants reported cooking were generally higher fat meals such as “fried noodles”, “two minute noodles” and “nachos”.

All participants agreed that when they are cooking for themselves or their families, the meals they cook are usually determined by their parents and are dependent on what food is already available in their house. This suited the majority of the participants as all except one preferred being told what to cook rather than choosing themselves. One participant explained this it was easier to be told because it meant “now I know what ingredients to grab but when I’m going to do it myself it’s just stuff that I know is there and I don’t have to really prepare too much for it”. When they do get the opportunity to choose what to cook, aside from choosing “whatever’s easiest”, participants also have to consider the food that is available to them. A participant said that “I generally see what meat we have got available and go from that” with another agreeing “yeah I’ll do that too with the meat available or just whatever I feel like”.

Some barriers to cooking were “when younger siblings come and annoy you”, and “if I have something else that I need to be doing”. One participant also reported that the reason why he doesn’t cook is because “I don’t really need to cos Mum just normally cooks all the time.” Some factors that made cooking more enjoyable were ”If there is set instructions I find it a lot better rather than having to guess how long to cook something for” and being able to be
creative with the presentation of the meal. All of the participants did not feel like their families or siblings had learnt any tips from then but one participant agreed that they have eaten and enjoyed foods they hadn’t tried before.
6. Discussion

6.1 Main findings

The overall aim of this thesis was to determine the long-term (after 12 months) effect of a cooking intervention on adolescents’ diet quality and Body Mass Index (BMI). This is the first study worldwide that combines a cooking program with meal kits and follows participants up at 12 months. The cooking program (COOK week) was essential for providing participants with the experience to learn practical cooking skills while the meal kit phase provided them with opportunity to apply skills they learnt during COOK week at home. The results of this study showed that at the end of the intervention period, overall Diet Quality Index (DQI) scores and fruit and vegetable group scores significantly increased more in the intervention group, compared to the control group. However, these changes were not sustained at 12 months follow up. The only exception to this was the vegetable score. From baseline to 12 months follow up, intervention participants showed an increase in vegetable score from 13.9 to 15.1 (9% increase). While the difference in scores between groups was not statistically significant, it could indicate a small, sustained dietary change and that the intervention may have influenced vegetable intake as vegetable scores in the control group decreased by 5%. Previously published studies have found similar short-term results, showing that immediately after a cooking intervention, there is an increase in fruit and vegetable intake (54, 55, 57). Yet none of these studies have used a DQI to measure diet quality, rather only measuring fruit and vegetable consumption. Assessing intakes of individual nutrients or foods for health outcomes can be misleading, because as humans we do not consume single foods but a combination of foods. Therefore, limiting dietary measures to fruit and vegetable consumption does not allow the assessment of other foods, especially foods high in saturated fat and sugar which are known to contribute to development of chronic diseases (63, 64). Of
the previous literature containing a cooking intervention with dietary changes or fruit and vegetable consumption outcomes, very few also provide more than one post intervention follow up. The majority of the follow ups occurring immediately after the intervention (51, 53, 54, 57). This makes it difficult to attribute any dietary changes to genuine dietary behaviour change as any increases in fruit and vegetable consumption may be a result of the artificial environment of the study. For example, in the current study, increases in overall diet quality and fruit and vegetable consumption at seven weeks may be attributable to the provision of the weekly meal kits that are supplying participants and their families with a meal that contained a variety of vegetables. Although adolescents are becoming more responsible for their food choices, compared to younger children, they are not in sole charge of what food is purchased and what food is available for them to cook. Research has shown that taste preferences (65) and availability (66) are two of the strongest and most consistent correlates of fruit and vegetable intake in children and adolescents. Findings from the Project Eat Amongst Teens (EAT) study, which was conducted exclusively in adolescents identified home availability as the strongest predictor of fruit and vegetable intake (67). The home availability of fruit and vegetables even appeared to influence taste preferences as the relationship indicated that when availability of fruits and vegetables is low in the home, regardless of taste preferences, no changes in intake occur. Conversely, even when taste preferences for fruits and vegetables are low, if they are available within the home, intake increases (67). This may be why after the intervention ended, and meal kits were no longer provided their diet quality decreased back to baseline values because fruits and vegetables were less available to them.

Feedback gathered from the group discussion shows a similar pattern to the quantitative findings. Participants felt their interest in cooking had increased immediately after the intervention and with the meal kits, but at 12 months, interest in cooking returned to where it
was prior to the intervention. This is similar to the increases in DQI scores shown in the intervention group during and immediately after the support phase and the lack of any sustained increases at 12 months. The feedback from the group discussion could help to explain the main quantitative findings, as if the participants were no longer interested in cooking, they are less likely to do so. Results from another study have shown adolescents who are more involved in cooking are more likely to have a better diet quality (31). Therefore, at 12 months post intervention the lack of changes in DQI scores could be due to participants interest in cooking decreasing and subsequently the frequency in which they do so.

As previously mentioned, most cooking intervention studies only have one follow up immediately post intervention. The few cooking intervention studies that follow up participants longer than immediately post intervention show varying results. Results from a feasibility study showed a similar trend to the current study when measuring a type of behaviour change. This study looked at self-efficacy for cooking and cooking methods self-efficacy. Both outcomes increased from baseline to first follow up but significantly decreased from immediately post intervention to three months, and furthermore at six-month post intervention (56). One study that did show an increase in fruit and vegetable consumption long term was the Gimme 5 study (55). The Gimme 5 program is a multicomponent, school-based dietary intervention for high school students that focuses on increasing fruit and vegetable consumption. Results after two years showed that fruit and vegetable consumption increased in the intervention group compared to the control group. However, at three years follow up the intervention group intake was maintained but did not increase and because the control groups intake did increase in the last year, no significant differences were found between the groups. The difference in this study compared to the current and other studies, was that the intervention was continued over the three years.
Interestingly the study authors also admitted that the intervention was more aggressive and active in the first two years, which is where the increase in fruit and vegetable intake in the intervention group is seen. By the final year of the study, the intervention components reduced and this is where you see no further increase in the intervention group. These results mirror results in the current study where when the intervention is active and providing participants with meal kits, they improve their diet quality compared to baseline but when the intervention tapers off, so do the dietary changes (55). There were no changes observed in fruit and vegetable variety for either group. This could be a result of the cost of non-seasonal fruits and vegetables in Dunedin and that families may eat a smaller variety of fruit and vegetables due to seasonal availability and affordability. The method in which fruit and vegetable variety was scored may have not also allowed detection of all changes. Fruits and vegetables were divided into six sub-groups (found in Appendix G), so if a participant reported consuming fruits such as plums and strawberries, they would only get one point because they are both in the “other fruits” category.

No changes in BMI were detected in either group after seven weeks or at 12 months. This may have been partly due to the fact that this study had insufficient statistical power to detect changes in BMI as this information was collected for the purpose of describing the participants, and to provide data for sample size calculations for future studies. The percentage of participants with a normal BMI was the same in each group (59%), and the percentage of those in the overweight or obese BMI category was also similar between the control (37%) and intervention group (31%). This study was not designed specifically to reduce overweight and obese participants BMI, rather it focused on improving their diet quality to create healthier long-term eating habits. The theory behind why overweight or obese participants in the intervention group may decrease their BMI was that this intervention aimed to provide adolescents with the ability and confidence to cook healthy meals from
scratch and subsequently increase their diet quality. Consuming a diet with more fruits and vegetables and less energy-dense, high fat foods can result in weight loss (68). The weekly meal kits provided to families included meals that were low in saturated fat and high in vegetables and improvements were seen in their diet quality after this phase of the intervention. However, for any changes in BMI to be seen, diet quality improvements would have needed to be maintained for a longer period. The seven-week period from baseline to the completion of the intervention is unlikely to be enough time to assess any changes in BMI. The reason no long-term changes were seen in BMI may also be due to the many other factors surrounding weight during adolescence such as greater energy requirements needed for growth and peer pressure (69). Results from observational studies in New Zealand and the United States of America (USA) have shown that although greater involvement in cooking was associated with a higher intake of fruits and vegetables and diet quality, it was also associated with a higher BMI (15, 29). The feedback from the group discussion supports this as participants reported at 12 months follow up that they were still cooking generally once a week yet they were making meals such as “two minute noodles” and “fried noodles” which are typically energy-dense meals that are higher in fat (70).

6.2 Strengths and limitations
This is the first randomised controlled trial worldwide that looks at the effect of a cooking intervention on adolescent’s diet quality and BMI that includes a 12 month follow up. The combination of the week long cooking program and the meal kit phase also makes it the first of its kind. The long-term follow up allows investigation of whether changes in behavior caused by the intervention are sustained long-term. Strengths of this study include the COOK week that was designed to be engaging and appealing for this age group. Additionally, it was trialed and tested with similar age groups in Australia as well as previously being piloted on
adolescents in Dunedin, New Zealand. The meal kit phase supported the continuation of cooking at home. No expensive domestic equipment was required and along with the provision of the food staples bag, it reduced any financial barriers to home cooking. It is also the first of its kind to assess diet quality using a DQI that has been tested for reproducibility and validity in adolescents living in Dunedin, New Zealand. The New Zealand Adolescent Food Frequency Questionnaire (NZAFFQ) does not assess portion size directly rather it contains five questions, which give some information on portion sizes of the five food groups for which there are national recommendations for intake. The NZFFQA has been tested against a four day estimated food record in which the results have shown good validity and reliability (48). Literature suggests that adolescents struggle to estimate portion sizes with some studies showing even with the support of visual aids such as photographs and utensils only around 60% of the time, food was classified correctly (71, 72). Considering this, even if the Food Frequency Questionnaire (FFQ) did assess portion sizes directly, reporting errors may have still occurred so this limitation is unlikely to alter results majorly. A common error associated with FFQs and other dietary assessments are underreporting of foods perceived as relatively less healthy (takeaways) and over reporting of dietary components perceived as more healthy (fruit) (73). There is evidence that overweight and obese adolescents are more likely to underreport their energy intake, however the amount of overweight and obese participants is similar in each group therefore will not impact the results. (74)

The size of the control group is small as there were a high number of dropouts due to the nature of randomised control trials and this study in particular. As participants signed up wanting to be part of the cooking program, many of those that got assigned to the control understandably did not want to participate any further. Therefore, it is likely that the sample of this study are biased towards New Zealand adolescents that already held some cooking interest. The control group had more participants with a higher Socio-Economic Status (SES)
(55%) than the intervention group (44%), although those participants with a low SES are similar. Studies have shown that families in lower SES groups have less fruit and vegetables available in their homes and eat fast-food more frequently than those families with a higher SES (75). However, this current study aimed to reduce the financial barrier with the meal kits supporting the continuation of healthy home cooking and demonstrating to families that healthy eating does not have to be expensive. The ingredients provided in the meal kits aimed to be affordable and information on how to bulk out recipes cheaply, or how to substitute cheaper ingredients, such as inexpensive seasonal vegetables, or tinned or frozen alternatives was also provided.

6.3 Conclusion
This study has shown that cooking interventions amongst adolescents are effective at improving diet quality while the intervention is continued. Yet after completion of the intervention, increases in diet quality are not maintained. No changes in BMI were seen in this current study but this is as expected as the short term improvements in diet quality did not remain long enough to influence any changes in body weight within the study participants.

7. Application to Practice
From a dietetics and public health perspective, there is a need for the development of prevention strategies to reduce the incidence of obesity in adolescents and all age groups. Participation in cooking programs have been proven to increase fruit and vegetable consumption in adolescents. Although studies including this one have struggled to find a significant long term effect, significant improvements in diet quality and fruit and vegetable intake have been shown in the short term. The increases in diet quality are only sustained for the length of the intervention. Therefore, implementing a program such as an extended version of the COOK study into the school curriculum may produce similar dietary benefits and could work towards the final goal
of reducing obesity amongst adolescents. The current New Zealand school curriculum has reduced the amount of time dedicated in home economics classes, to practically teaching students how to cook. Implementing the COOK program throughout secondary schools nationwide could be an effective way of ensuring that New Zealand adolescents acquire necessary cooking skills along with learning financial management skills and education about nutrition required for the promotion and maintenance of their health. The other aspects included in the COOK week program such as food shopping and budgeting, nutrition and sustainability lessons are all valuable learning for adolescents and are important for them to learn as they approach adulthood. Enhancing today’s youth with a greater understanding of cooking and nutrition may help to increase adolescents interest and awareness in their own nutrition and health and may help to empower them to make better dietary choices throughout their lifespan.

Dietitians spend a lot of time advising patients how to prepare and cook foods that are healthier for them or are necessary to improve their health. However, in order for the patient to do this, they must hold some level of cooking skills. The COOK program aims at increasing adolescents cooking ability but the reach is much further than that due to the meal kit phase. This provides an opportunity for the whole family to prepare healthy meals from scratch. From a dietitian’s perspective, it is a lot easier to help and educate patients that have some level of cooking skill and means that we can give more comprehensive tips that may enhance the effectiveness of our service.
8. References


9. Appendices

Appendix A: Ethical approval documentation
Appendix B: Recipes for COOK week
Appendix C: COOK week layout
Appendix D: Open pantry staples
Appendix E: Meal kit recipes
Appendix F: NZAFFQ
Appendix G: NZDQI-A food components
Appendix H: Scoring system of the NZDQI-A
Appendix I: Group discussion question schedule  Appendix A: Information for ethical approval

UNIVERSITY OF OTAGO HUMAN ETHICS COMMITTEE
APPLICATION FORM: CATEGORY A

NB. AMENDMENTS MADE TO THIS BASED ON ETHICS COMMITTEE FEEDBACK AND REQUESTS MADE BY STUDY TEAM.

ETHICAL APPROVAL GIVEN FOR SEPARATING OUT PHASE 1 AND 2. PHASE 2 PARTICIPANTS ENROLLED VIA SCHOOLS AND SOCIAL MEDIA, NOT THROUGH PHASE 1.

COOKING CLASSES TO TAKE PLACE OVER 1 WEEK (MON TO FRI) RATHER 5 SATURDAY/SUNDAYS. SIX WEEKS OF BAGS PROVIDED NOT FIVE. FOLLOW AT END OF WEEK ONE, AT END OF TAKE HOME BAG PHASE AND ONE YEAR (WEEK NUMBERS WILL DIFFER FROM THA ON APPLICATION)

1. University of Otago staff member responsible for project: Skidmore, Paula, Dr

2. Department/School: Human Nutrition

3. Contact details of staff member responsible (always include your email address):
   e-mail: paula.skidmore@otago.ac.nz    phone: 479 8374

4. Title of project: Cooking with confidence: Providing adolescents with tools for a healthy life.

5. Indicate project type and names of other investigators and students:
   Project type: Intervention study
   Staff Co-investigators
   Names: Dr Katherine Black, Carla Thomson, Amber Robertson, Mary Spiers
Student Researchers

3 x MDiet Students, names TBC

External Researchers

Name: Themis Chryssidis

Institute/Company: Sprout Cooking and Health School, Adelaide, Australia

6. Is this a repeated class teaching activity? No

7. Fast-Track procedure No

8. When will recruitment and data collection commence? 1st September 2016

When will data collection be completed? 31st March 2018

9. Funding of project

Is the project to be funded by an external grant? YES

Funding has been obtained from Lotteries Health and Foodstuffs Community Trust.

If commercial use will be made of the data, will potential participants be made aware of this before they agree to participate? If not, explain: N/A

10. Brief description in lay terms of the purpose of the project:

Involvement in preparing family meals in adolescence has been shown to improve body composition and overall health. Given the high levels of obesity and the poor diets consumed by many New Zealand adolescents, taking a novel approach based around cooking to improve diet has the potential to be beneficial to both current and long term health. Therefore, we will implement a pilot community-based cooking programme focusing on affordable, nutritious meals made from readily available ingredients that will specifically appeal to teenagers and will also provide other cooking and health related skills. We will investigate if this programme improves cooking skills and confidence, increases involvement in family meal preparation and cooking, selected known psychosocial determinants of food choice and dietary quality.

11. Aim and description of project:
This project comprises two phases.

Phase 1 is an online survey to be conducted in Year 10 pupils from Otago secondary schools to describe dietary quality, attitudes to and beliefs about healthy eating and weight, self-efficacy for cooking, confidence in food preparation and cooking skills and physical activity.

In phase 2 we will implement and deliver an interactive intensive cooking programme to 100 Year 11 students from Dunedin schools, followed by a five week social-media led programme, followed by gradually decreasing social media content over the following year, so that students:
(a) have increased self-efficacy for cooking.
(b) want to, and are able to cook affordable, nutritious and appealing meals.
(c) have confidence to cook for their family and,
(d) have improved dietary quality.

We will follow up participants directly after completion of the intensive programme and at one year after completion of the five week social media programme to assess changes from baseline in self-efficacy for cooking, attitudes to and beliefs about healthy eating, confidence in food preparation and cooking skills, and dietary quality. We will also recruit an additional group of 100 year 11 students to act as a control group.

12. Researcher/instructor experience and qualifications in this research area

Dr Paula Skidmore is an epidemiologist with 15 years experience in designing and conducting studies in children, adolescents and adults. She has extensive experience in the design and use of all major dietary assessment methodologies, physical activity and body composition measurements.

Dr Katherine Black is also experienced in the design of and conducting studies in adolescents, particularly with regard to the assessment of fitness and physical activity.

Carla Thomson and Amber Robertson’s teaching and research specialty is in foodservice and they are responsible for the delivery of this component in the Human Nutrition undergraduate degree. Carla and Amber are both qualified chefs. Carla has extensive experience in delivering community cooking classes in adults.

Mary Spiers is a registered dietitian with extensive experience in delivering community cooking classes in adults.

Themis Chryssidis is a registered dietitian and director of Sprout. Sprout have developed and delivered intensive cooking classes for this age group in Australian schools.

13. Participants

13(a) Population from which participants are drawn:
Phase 1: Students in Year 10 (age 14 to 15) from all participating secondary schools in Otago.

Phase 2: Students from Dunedin schools participating in phase 1 who indicated that they would like to take part in phase 2.

13(b) Inclusion and exclusion criteria:

Phase 1 and 2 Inclusion criteria:
- Boys and girls attending Secondary Schools in the Otago area;
- Aged between 14 to 15 years old and in school year 10

Phase 1 Exclusion criteria:
- Boys and girls under the age of 14 and over the age of 15;
- Those whose parents return the reply slip indicating they do not wish their children to take part in the survey.
- Students who do not give informed consent;

Phase 2 Exclusion criteria – from those indicating in phase 1 that they would like to take part in phase 2
- Students who do not give informed consent;
- Students whose parents do not give informed consent.

13(c) Estimated number of participants:

Phase 1: 2000

Phase 2: 300

13(d) Age range of participants: 14 to 15 years and in year 10 during phase 1 of the project.

13(e) Method of recruitment:

Phase 1: All Secondary Schools in Otago will be invited to participate in the study. Principals of all these schools will receive an official letter with detailed information about the study and an invitation to participate. An appointment will be scheduled with each school principal in which members of the study team will discuss the study. In each school, all those in Year 10 will be invited to take part. Members of the study team will visit each school to explain the study to Year 10 classes. This school visit will take place at least one week prior to the scheduled date for data collection. Information packs including invitation letters from the study team and the school principal will be given to students at these visits. The pack will also contain a reply
Application Form for ethical consideration of research and teaching proposals involving human participants

slip for parents/guardians to return to the school if they do not wish their children to take part in the study.

The last section of the Phase 1 survey will contain a description of phase 2 (the cooking intervention) and participants will be asked to talk to the researchers to obtain a copy of the information sheet and consent form for phase 2 and their name, postal address, e-mail address and cellphone number will be recorded if they indicate that they would like to take part in phase 2. Participants for Phase 2 will be drawn from these participants.

13(f) Specify and justify any payment or reward to be offered

Phase 1: Participants will be entered into a draw to win one of twenty sets of $30 movie vouchers.

Phase 2: Intervention group - $20 voucher at weeks 11 and 62

Control group - $20 voucher at weeks 0, 6, 11 and 62.

We will also offer two $25 vouchers for each of the six weeks of the social media phase of the intervention as a prize, drawn from those who submit pictures of the food made to the study Facebook page.

14. Methods and Procedures:

Phase 1: Students will be surveyed only once and data will be collected using an online survey. The questionnaire will be delivered and completed during class time and the questionnaire should take around 45 minutes to complete. The questionnaires include previously validated questions on demographics, dietary quality, attitudes to and beliefs about healthy eating and weight, self-efficacy for cooking, confidence in food preparation and cooking skills and physical activity. These questionnaires have already been modified for use in NZ, and where appropriate, have been tested in NZ adolescents and show good reproducibility and validity. The data collection for Phase 1 will take place during Term 4 (October to December) of 2016.

The questionnaire is currently being formatted and prepared for online use. Apologies for the differing formats/text size in the paper copy attached. This contains the questions being asked but the final version will be consistent in format and text size.
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Phase 2: Baseline (Week 0). Participants will complete the same questionnaire administered in phase 1, but in paper format. Participant height and weight will be measured. They will also wear an accelerometer for seven days to record physical activity and sleep.

Cooking classes intervention (weeks 1 to 5): This cooking intervention comprises five days of interactive lessons where participants (in classes of around 20) will learn to become active in the kitchen by preparing and cooking at least one new recipe every day, in small groups. These classes consist of a mixture of cooking demonstrations, hands-on experience of cooking meals and informal nutrition and health information sessions. Informal question and answer/discussion sessions with local role models such as members of local sports teams will also be held. Participants will be provided with all necessary ingredients to cook their dishes during the classes and will be provided with copies of recipes and additional ingredients so that they can continue to cook these recipes at home, if they wish. As part of the five-session programme participants will also be asked to set their own personal cooking goals, which they will try to achieve in the following five weeks. On the last day of the intervention, participants’ families will be invited to the class and participants will show their new culinary skills by cooking for their families and eating together as part of the final class. This final class will also allow for parents of participants to ask any questions they have about food, cooking and health.

Social media/home based intervention (weeks 6 to 10): Participants will be provided with ingredients and a recipe to cook at least one meal for their family every week for the next five weeks. A Facebook group/page will be set up to allow participants to socially engage with each other about their cooking skills/experiences, to view other recipes and videos and for mini food challenges to be posted regularly. Participants will be encouraged to post photographs of the food they have prepared (where possible) and to post comments on the foods they have prepared and any other food experiences/recipes they would like to share. Regular reminders to visit the Facebook page will be sent to participants and Facebook polls will be conducted to assess whether participants have met their own personal weekly goals over this five week period. Random weekly prizes ($25 supermarket vouchers) will be awarded to participants who meet their personal goals, to those posting pictures of the meals they have created, or who have shared food experiences/challenges or recipes. As all participants may not have internet access at home we will ask schools to allow participants access to the Facebook page at certain times during the school day.

First follow-up (Week 11): The study co-ordinator and trained research assistants will visit schools of participating pupils to administer the Phase 1 questionnaire. Height and
weight will be measured. Participants will be asked to wear an accelerometer for the following week. All participants will also fill in a feedback questionnaire on the intervention. As an incentive, all participants who complete these questionnaires and return the accelerometer will receive a $20 supermarket voucher. Focus groups will be conducted with a sub-set of 24 participants after the end of the six-week intervention period to assess satisfaction with the intervention and to identify areas of the programme that were most and least successful, in order to modify the programme for future use. (Information and consent forms for these focus groups to be submitted for Ethics consideration in February to allow investigators to identify any potential issues/topics that they may wish to cover in the focus groups).

Follow-up period (Week 12 to week 61): Participants will be encouraged to continue using the Facebook page and sent regular reminders to do so but site updates and competitions will be phased out throughout the year. The page will be maintained and moderated by a research assistant and the study co-ordinator.

Second follow-up (Week 62): Trained research assistants will visit schools to administer the Phase 1 questionnaires to all participants. Height and weight will be measured. Participants will also be asked to fill in feedback questionnaires on their use of the Facebook site during weeks 12 to 61 and to wear an accelerometer for the following week. As an incentive, all participants who complete these questionnaires and return the accelerometer will receive a $20 supermarket voucher.

Control group: We will also recruit an additional 100 students from the same schools as the intervention group to form a control group for the study. These participants will not receive any intervention but will complete all study questionnaires and accelerometry at the same time points as the intervention group.

15. Compliance with The Privacy Act 1993 and the Health Information Privacy Code 1994 imposes strict requirements concerning the collection, use and disclosure of personal information. The questions below allow the Committee to assess compliance.

15(a) Are you collecting and storing personal information (e.g. name, contact details, designation, position etc) directly from the individual concerned that could identify the individual?

Yes: We will be collecting personal information including name, age, gender, ethnicity, home address, and self-reported height and weight.

If you are collecting the information indirectly, please explain why:
Participants will be asked questions directly. The only indirect information that will be collected is the home address of participating children. This data will be used solely for determining neighbourhood deprivation index (NZdep) scores.

15(b) Are you collecting information about individuals from another source?

NO

15(c) Collecting Personal Information (Delete the answer that does not apply):

- Will you be collecting personal information (e.g. name, contact details, position, company, anything that could identify the individual)?
  
  YES

- Will you inform participants of the purpose for which you are collecting the information and the uses you propose to make of it?
  
  YES

- Will you inform participants of who will receive the information?
  
  YES

- Will you inform participants of the consequences, if any, of not supplying the information?
  
  YES

- Will you inform participants of their rights of access to and correction of personal information?
  
  YES

If you are NOT informing them of the points above, please explain why: N/A

15(d) Outline your data storage, security procedures and length of time data will be kept (Mark Borrie, ITS Security Manager, can provide data security and storage options in particular while in the field):

Anonymised electronic responses will be stored on a secure sever belonging to Lime Survey (the survey provider). Data will be downloaded from this server as soon as possible after collection and these responses will be identifiable by ID number only. Height, weight and accelerometer data will be entered in a database using study IDs only and stored under
password protection on the departmental computer system. Upon completion of the study, as required by the University’s research policy, data will be stored in a locked room and on a departmental computer for ten years. Dr Paula Skidmore or the relevant Head of Department will destroy the original data.

15(e) Who will have access to personal information, under what conditions, and subject to what safeguards? If you are obtaining information from another source, include details of how this will be accessed and include written permission if appropriate. Will participants have access to the information they have provided?

what safeguards against unauthorised disclosure?
Dr Paula Skidmore will have access to the personal information collected from the participants. The information will be securely stored and disposed as mentioned above in 15(d) to prevent any unauthorized disclosure. Participants’ data will be entered in a research database using a unique participant identifier (study ID). Upon request, participants and their parents/guardians will have an access to their own data in its raw format. The results of the research will be made available to participants and their parents/guardians when the project is completed.

15(f) Do you intend to publish any personal information they have provided?

No

15(g) Do you propose to collect demographic information to describe your sample? For example: gender, age, ethnicity, education level, etc.

Yes, we will collect information on gender, age and ethnicity and to obtain NZDep information as described previously.

15(h) Have you, or will you, undertake Māori consultation? Choose one of the options below, and delete the option that does not apply:

(Refer to http://www.otago.ac.nz/research/maoriconsultation/index.html).

We have initiated consultation and will forward a letter stating the outcome of this to the committee once it is available.

16. Does the research or teaching project involve any form of deception?

NO
Appendix B: Recipes for COOK week
Sweet Corn Fritters with Avocado Salsa & Smoked Salmon

**Ingredients:** (Serves 2)
1 Cob corn kernels removed (or 100g frozen corn, defrosted)
5 Tablespoons wholemeal flour
½ Teaspoon baking powder
1/6 Bunch coriander, stems and leaves (reserve some leaves for salsa)
1 Small Egg
Pinch chilli flakes
½ Avocado, diced
1/6 Red onion, sliced as thinly as possible
1 ½ Teaspoons olive oil
1 ½ 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 fritters and serve immediately with salmon.

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Asparagus, Chicken & Chorizo Cous Cous

Ingredients: (Serves 2)

- 3/4 Tablespoon olive oil
- 3/4 Chorizo sausage, thinly sliced
- 1 Chicken breast, cut into 2.5cm dice
- 3/8 Bunch Asparagus, sliced into thirds
- 1 Spring onions; finely sliced
- 2 Cloves garlic, sliced thinly
- 1 Teaspoon smoked paprika
- 1 Teaspoon ground cumin
- 1/3 Cup wholemeal cous cous
- 1/3 Cup chicken stock; salt reduced
- 1/4 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 ½ Teaspoons low fat cream

**Malt Crumble:**
- 1/6 Cup roasted peanuts
- ⅙ Tablespoon plain flour
- 1 Tablespoons milk

**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.
# 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  
- ¼ Lemon  
- ½ Cup arborio rice  
- 1 Teaspoons rice bran oil  
- 2 x 120g Pieces fish  
- ¼ 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
- ⅛ Granny smith apple, finely juliened 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 casters sugar
- Caster sugar, for dusting
- Spray oil, for ramekins

**Method:**

1. Preheat oven to 180C. 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 ¾ 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!
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
- ¼ Stick lemongrass, bruised
- 1 ½ Teaspoons fish sauce
- 1 ½ Teaspoons of brown sugar
- 2 Kaffir lime leaves
- ¾ Medium head broccoli
- ½ Punnet cherry tomatoes, halved
- ¼ Cup freshly diced pineapple
- 140g Tofu
- ¾ 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 leaf 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 1/2 lemon
1 Punnets strawberries, tops sliced off and halved
1/2 Cup of cream
1/2 Cup thick Greek yoghurt
1 Teaspoon sumac
Basil leaves, to serve (optional)

Pepita brittle:
1/4 Cup caster sugar
1 Teaspoon butter
1/2 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
- ½ Carrot, julienened 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.

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Summer Parfait

**Ingredients:** (Serves 4)

1. Cup thick Greek yoghurt
2. 2 Teaspoons vanilla bean paste (substitute vanilla extract)
3. Finely grated zest of a lemon
4. 3 Egg whites
5. ¼ Cup caster sugar
6. ½ Cup frozen raspberries
7. 1 Peach, diced into 1cm pieces
8. 1/4 Cup pistachios, roughly chopped
9. 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.

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## Appendix C: COOK week layout

<table>
<thead>
<tr>
<th>Day</th>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>9.30am</td>
<td>Introduction</td>
</tr>
<tr>
<td></td>
<td>10.00am</td>
<td>Cook: Corn fritters with avocado salsa</td>
</tr>
<tr>
<td></td>
<td>11.00am</td>
<td>Nutrition, hygiene, food safety</td>
</tr>
<tr>
<td></td>
<td>11.30am</td>
<td>Cook: Chicken and chorizo couscous</td>
</tr>
<tr>
<td></td>
<td>12.00pm</td>
<td>Lunch</td>
</tr>
<tr>
<td></td>
<td>1.30pm</td>
<td>Cook: Banana and peanut butter ice cream with malt crumble</td>
</tr>
<tr>
<td></td>
<td>2.00pm</td>
<td>Recipe ideas and development</td>
</tr>
<tr>
<td></td>
<td>3.00pm</td>
<td></td>
</tr>
<tr>
<td>Tuesday</td>
<td>9.30am</td>
<td>Basic skills: Cooking techniques</td>
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<tr>
<td></td>
<td>10.30am</td>
<td>Seasonality: Nutrition, shopping list, and shopping tips</td>
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<tr>
<td></td>
<td>11.00am</td>
<td>Cook: Fennel, dill, and white fish risotto</td>
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<tr>
<td></td>
<td>11.30am</td>
<td>Break</td>
</tr>
<tr>
<td></td>
<td>12.00pm</td>
<td>Cook: Tofu jumble curry</td>
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<tr>
<td></td>
<td>12.30pm</td>
<td>Lunch</td>
</tr>
<tr>
<td></td>
<td>1.30pm</td>
<td>Cook: Korean Beef with pickled cucumber and sesame sauce</td>
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<td></td>
<td>2.00pm</td>
<td></td>
</tr>
<tr>
<td>Wednesday</td>
<td>9.30am</td>
<td>Recipe preparation</td>
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<td>Shopping list for Tuesday</td>
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<tr>
<td>Thursday</td>
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<td>Yoghurt parfait with Summer fruit</td>
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<td></td>
<td>10.00am</td>
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<td>11.00am</td>
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<td>Friday</td>
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<td>Main course</td>
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<td>12.30pm - 12.30pm</td>
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<td>Feedback, results and conclusion</td>
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<td>Write plan and preparation list</td>
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### Appendix D: Open pantry items

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<td>Rosemary</td>
<td>White wine vinegar</td>
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<td>Brown Sugar</td>
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<td>Mirin</td>
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<td>Baking Powder</td>
<td><strong>Dried Herbs/Spices</strong></td>
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<td>Oregano</td>
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<td>Reduced salt vegetable stock</td>
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<td>Sesame seeds</td>
<td>Paprika</td>
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<td>Ground coriander</td>
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<td>Eggs (for back-up)</td>
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<td>Ginger</td>
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</table>
Appendix E: Meal kit 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)
- ½ Teaspoon freshly ground white pepper
- 1 Stick lemongrass, bruised
- 1 Tablespoon soy sauce
- 1 Tablespoon brown sugar
- 3 Lime leaves
- 1 Medium head broccoli
- 1 Puntet cherry tomatoes, halved
- 1 Cup freshly diced 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 ½ 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 1/2 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 27cm in diameter. Place on a greased baking sheet.
4. Spread the base with 3/4 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
- ½ 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 ¼ 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.
Create Our Own Kai Project

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
1tsp sugar
1tsp chilli powder
½ tsp dried oregano
2 tsp paprika
1 ¼ 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
⅓ 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
⅓ 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 and 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.
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

- 1 don’t eat fruit
- Less than 1 per day
- 1 serving

☐ 2 servings
☐ 3 servings
☐ 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

- 1 don’t eat vegetables
- Less than 1 per day
- 1 serving

☐ 2 servings
☐ 3 servings
☐ 4 or more servings

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

- 1 don’t eat bread or toast
- Less than 1 per day
- 1 - 2

☐ 3-4
☐ 5-6
☐ 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**  **Weekends**

☐ I never have breakfast during weekdays  ☐ I never have breakfast during the weekend
☐ One day
☐ Two days
☐ Three days
☐ Four days
☐ Five days

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.**

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<thead>
<tr>
<th>Weekdays</th>
<th>Weekends</th>
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<tbody>
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<td>I never have lunch during weekdays.</td>
<td>I never have lunch during the weekend.</td>
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<tr>
<td>One day</td>
<td>I usually have lunch on only one day of the weekend (Saturday OR Sunday).</td>
</tr>
<tr>
<td>Two days</td>
<td>I usually have lunch on both weekend days (Saturday AND Sunday).</td>
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<tr>
<td>Three days</td>
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<td>Four days</td>
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<tr>
<td>Five days</td>
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</tbody>
</table>

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.**

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<thead>
<tr>
<th>Weekdays</th>
<th>Weekends</th>
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<tbody>
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<td>I usually have an evening meal on only one day of the weekend (Saturday OR Sunday).</td>
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<td>Two days</td>
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<tr>
<td>Four days</td>
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<tr>
<td>Five days</td>
<td></td>
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</tbody>
</table>
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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<th>Once a week</th>
<th>2 to 4 days a week</th>
<th>5 to 6 days a week</th>
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<tbody>
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</tr>
<tr>
<td>Vegetables</td>
<td></td>
<td></td>
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<tr>
<td>Lollies (e.g. Jelly Beans, marshmallows, wine gums, licorice, Minties)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Chocolate confectionery (e.g. Dairy Milk, Moro, Crunchy, Roses, Chocolate Fish, M&amp;M’s, Jaffas)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Standard milk (dark blue)</td>
<td></td>
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<tr>
<td>Low fat milk (light blue) / Trim milk (green) / Calci Trim milk (yellow) / rice milk / soy milk</td>
<td></td>
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<tr>
<td>Cheese</td>
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</tr>
<tr>
<td>Breakfast cereals (all kinds)</td>
<td></td>
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</tr>
<tr>
<td>White bread</td>
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<tr>
<td>Brown / wholegrain bread</td>
<td></td>
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</tr>
<tr>
<td>Potato crisps / corn chips</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Foods</td>
<td>None</td>
<td>Less than once a week</td>
<td>Once a week</td>
<td>2 to 4 days a week</td>
<td>5 to 6 days a week</td>
<td>Once a day</td>
<td>More than once a day</td>
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<tr>
<td>--------------------------------------------</td>
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</tr>
<tr>
<td>Rice / pasta / noodles</td>
<td></td>
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<tr>
<td>Yoghurt</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Fish (including canned tuna or salmon, fish cakes, fish fingers, fish pie, battered fish)</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Other seafood (including mussels, oysters, prawns)</td>
<td></td>
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<td></td>
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<tr>
<td>Eggs</td>
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<td></td>
<td></td>
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</tr>
<tr>
<td>Chicken, turkey, duck (including chicken nuggets)</td>
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</tr>
<tr>
<td>Beef (including mince, corned beef, roast and steak)</td>
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<td></td>
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<tr>
<td>Lamb or mutton (including roast, and chops)</td>
<td></td>
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</tr>
<tr>
<td>Processed meat (including sausage, salami and luncheon)</td>
<td></td>
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</tr>
<tr>
<td>Pork (including roast, chops, ribs, ham and bacon)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nuts and seeds</td>
<td></td>
<td></td>
<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>
<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>
<td>Sports drink</td>
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<tr>
<td>(e.g. Powerade, Mirinda)</td>
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</tr>
<tr>
<td>Tea or coffee (including Ice Tea)</td>
<td></td>
<td></td>
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<tr>
<td>Milky or chocolate drink</td>
<td></td>
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<tr>
<td>(e.g. Milo, Ovaltine, Nesquik)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Fruit juice / fruit drink / cordials</td>
<td></td>
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</tr>
<tr>
<td>(e.g. GForce, Raro, Refresh, Lemonade, Keri, Twist, Ribena, Golden Circle)</td>
<td></td>
<td></td>
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<tr>
<td>Regular soft drinks</td>
<td></td>
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</tr>
<tr>
<td>(e.g. Coke, Pepsi, Sprite, L&amp;P, Fanta, Ginger Beer)</td>
<td></td>
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<tr>
<td>Alcoholic drink</td>
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</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>
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<td></td>
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<tr>
<td>Pears</td>
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</tr>
<tr>
<td>Oranges / Mandarins</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bananas</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Peaches / Nectarines</td>
<td></td>
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<td></td>
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<tr>
<td>Apricots</td>
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<td></td>
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<tr>
<td>Plums</td>
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<tr>
<td>Kiwifruit</td>
<td></td>
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<tr>
<td>Strawberries or other berries</td>
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<tr>
<td>Grapes</td>
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<tr>
<td>Melons (including watermelon, rockmelon, honeydew)</td>
<td></td>
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<tr>
<td>Pineapple</td>
<td></td>
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<tr>
<td>Avocado</td>
<td></td>
<td></td>
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<tr>
<td>Potatoes (not fried, e.g. boiled, mashed, baked)</td>
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<td></td>
</tr>
<tr>
<td>Potatoes (hot potato chips, French fries, wedges, hash brown, roasted)</td>
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<td></td>
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<tr>
<td>Carrots</td>
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<tr>
<td>Mixed vegetables (e.g. stir-fried, frozen)</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>
<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>
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<td>-----------------------------------------------</td>
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</tr>
<tr>
<td>Corn</td>
<td></td>
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<tr>
<td>Broccoli / cauliflower / broccoli</td>
<td></td>
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</tr>
<tr>
<td>Lettuce / salad greens</td>
<td></td>
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<tr>
<td>Tomatoes</td>
<td></td>
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<tr>
<td>Silverbeet / spinach</td>
<td></td>
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<tr>
<td>Watercress / puha</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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<tr>
<td>Kumara</td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Taro</td>
<td></td>
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<tr>
<td>Cabbage / coleslaw</td>
<td></td>
<td></td>
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<tr>
<td>Brussel sprouts</td>
<td></td>
<td></td>
<td></td>
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</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>
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<td></td>
<td></td>
</tr>
<tr>
<td>Cucumber</td>
<td></td>
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<td></td>
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<tr>
<td>Celery / asparagus</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Onion / leek</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mushrooms</td>
<td></td>
<td></td>
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</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>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>Savoury biscuits / snacks (e.g. crackers, Shapes)</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
### Appendix G: NZDQI-A food components

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

^33 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.

### Appendix H: Scoring system 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>v/6</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>v/6</td>
<td>Consumed at least 3 daily servings of vegetables from 3 varieties in a week.</td>
</tr>
<tr>
<td><strong>CEREAL</strong></td>
<td>v/3</td>
<td>Consumed at least 6 daily servings of cereals from 3 varieties in a week.</td>
</tr>
<tr>
<td><strong>DAIRY</strong></td>
<td>v/4</td>
<td>Consumed at least 3 daily servings of milk or milk products from 3 varieties in a week.</td>
</tr>
<tr>
<td><strong>MEAT</strong></td>
<td>v/7</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 = \[ \Sigma (v/V) \times A = \text{FRUIT} + \text{VEGGIE} + \text{CEREAL} + \text{DAIRY} + \text{MEAT} \]**

1. Ratio calculated as the different sub groups (v) consumed at least once in a week (as indicated in the NZAFFQ) divided by the total sub groups (V) in a food group. The food sub groups are outlined in Additional file 1.
2. Refers to questions in the FQ.
3. Based on achievement of the recommended daily servings as suggested by the Ministry of Health (33).
4. For each component, a total score is calculated by multiplying ‘Variety’ (v/V) 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 = (2/6) \( \times \) 20 = 10.
5. Include fresh, frozen and canned vegetables, including potatoes.
6. Weekly frequency of intake (times per week) for the four sub groups as reported in the NZAFFQ. Weekly frequencies were summed and converted into daily frequencies. One time per day was equivalent to one serving.

Appendix I: Group discussion question schedule

Icebreaker/what you like to cook:

- Name + favourite thing to cook

- Food you make most often
  - For yourselves only
  - For other people

General cooking situation:

- Who does the cooking at home? Parents, siblings, you, someone else?

- How often do you cook at home? Do you help your parents/siblings when they cook?
  - Do your parents/siblings help you when you’re on cooking?

- Who are you normally cooking for? Yourself only, family, friends?

- What food do you normally organise for yourselves, what’s done by someone else? – drinks, snacks, breakfast, lunch, dinner

Choosing what to cook

- How much choice do you get with what food you make?
  - Do you get more choice when organising food just for yourselves, or when cooking for your families?

- How do you choose what to make?
  - Do you prefer getting to choose or being told what to make?

Cooking for self vs others

- Thinking about how much time and effort you’d normally put into making something for just you vs for the family
  - Would it be about the same? Different?
    - If it’s different, what things are different about it?

Reasons why you cook:

- When you organise food that’s just for yourself, why do you do that? – e.g. it’s your responsibility now, you want to, by doing it yourself you get to choose

- When you make food that’s shared with other people, why do you do that?
  - Like to/have to
  - When you want to/when you’re told to

Facilitators & barriers
• What are some of the reasons why you don’t cook? – for yourselves or for family

• When you do cook, what are some of the things that make it harder or less enjoyable for you?

• What are some of the things that make cooking easier or more enjoyable for you?

• What are your families like when you’re cooking?
  o Are there things they do which you find helpful or encouraging?  o
    Are there things they do which you find unhelpful or discouraging?

**Interests & skills development**

• Where did you learn most of your cooking skills? From who?

• Where do you get ideas from about what to cook, and recipes etc.?  
  When deciding to experiment- facebook, pinterest, just craving something – not wanting to google how to make it so will just work it out.

• Have you been doing any cooking things at school? After school classes? Helping with food at events like sausage sizzles etc.?

• Is there anything you want to make but haven’t? Why?

**Intervention group only**

• How interested are you in cooking now compared to when you’d just finished the cooking course?

• Do you think you needed more lessons or support afterwards, or was this enough to keep you going?

• Have your parents/siblings gotten any tips or learnt anything from you?

**Summary – anything to add?**