A Cost Analysis of Three Popular Diets: the Mediterranean Diet, a Modified Paleo Diet and Intermittent Fasting

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Abstract

Background: Obesity, and resulting health problems, is a growing issue facing today’s society. Weight-loss diets are popular worldwide but have shown mixed health outcomes. Current research has shown that the Mediterranean (MED) and Paleolithic (Paleo) diets as well as Intermittent Fasting (IF) have positive health outcomes. However, there is very little research surrounding the cost of all three popular diets. One factor that may influence long-term adherence is the cost of the dietary regime. Little is known about the cost of the Paleo and IF plans, but some data is available in respect of the MED diet.

Objective: To compare the cost of three popular diets in today’s society - the MED diet, a modified Paleo diet and IF.

Design: This thesis uses interim data from a large randomised controlled trial known as SWIFT (Support strategies for Whole-food diets, Intermittent Fasting, and Training). SWIFT recruited 250 male and female participants aged 18 years and older, who were overweight or obese (BMI>27kg/m²). The randomisation referred to different support strategies for weight-loss, but as part of the study participants were able to choose one of three dietary plans to follow; the MED diet, Paleo diet or IF. Multiple-day diet weighed records (including two weekdays/one weekend day; IF plan included one fasting/two non-fasting days) were completed at six months. Completed dietary records were entered into the dietary analysis programme Kai-culator. Each specific food/beverage item was costed for 100g, using product weights or an average weight for those items sold by unit price, and conversion factors (USDA). Pricing data for individual food items was gathered using an online supermarket shopping website or instore, and entered into Kai-culator to gain an overall daily cost for each dietary regime.
**Results:** SWIFT included 250 participants; however only the first 112 dietary records collected from participants between June and October 2015 were used in this analysis. Thirty-two participants chose to follow the MED diet, which comprised a mean (SD) energy intake of 7531kJ (3143), with a mean protein intake equating to 18.5% of total energy, fat at 37.4% and mean carbohydrate intake at 43.3%. Sixteen participants followed the Paleo diet, which comprised a mean (SD) energy intake of 7173kJ (2706), a mean protein intake of 18.9%, a fat intake of 45.6% and mean carbohydrate intake of 34.1%. Sixty-four participants followed the IF plan, which comprised a mean (SD) energy intake of 7080kJ (4668) with mean values of 16.9% protein, 37.8% fat and 43.3% carbohydrate. The average (SD) daily cost the MED diet was NZ $11.27 (5.70), Paleo diet NZ $12.85 (5.43) and IF NZ $10.22 (6.40). There were no significant differences in costs per day between the diets (P=0.082). However, there was a significant cost difference between a non-fasting (mean (SD): $12.06 (6.55)) versus a fasting day ($6.38 (3.91)) for the IF group, (P<0.001).

**Conclusion:** Although these differences in costs were not significant, the analysis suggests the Paleo diet is a slightly more expensive plan, while the IF plan has emerged as a potentially cheaper weight-loss intervention. Small sample sizes in the Paleo diet plan limits the potential for comparison. Analysis of the total SWIFT cohort should provide more insight.

**Keywords:** Mediterranean diet, Med diet, Paleolithic diet, Paleo diet, Intermittent Fasting, IF, calorie restriction, cost, cost analysis, price
Preface

This project was led by Associate Professor Rachael Taylor of the Department of Medicine, University of Otago, and Dr Rachel Brown and Michelle Jospe of the Department of Human Nutrition, University of Otago.

This study gained ethical approval from the University of Otago Ethics Committee (H14/024). It is also registered with the Australian New Zealand Clinical Trials Registry ACTRN1261500010594 (8 January 2015). Written consent was obtained from all participants prior to randomisation.

The candidate was responsible for the following, with supervision:

- Conducting a literature review on the health effects and costing data for the Mediterranean diet, Paleo diet and Intermittent Fasting;
- Calculating a gram amount of individual food portions in the collected three to four-day weighed diet records;
- Entering all available diet record data into the University of Otago’s dietary analysis programme ‘Kai-culator’;
- Converting descriptive measures of food in three to four-day weighed diet records into a measurable gram amount;
- Creating recipe entries and analysing these recipes in Kai-culator based on participant dietary information;
- Researching nutritional information data online or instore if food products were not available in Kai-culator;
- Statistically analysing participant baseline data to produce a range, a mean and a standard deviation for these values;
- Sourcing individual food cost data through an online supermarket shopping website (Countdown, NZ) or instore if the information was not already entered into the dietary analysis programme;
- Calculating a price per 100 grams based on weight and price information available;
- Obtaining and recording appropriate conversion factors for food items that contained an inedible portion, therefore decreased in weight prior to consumption, or the edible product differed from the original bought weight due to the removal of a preserving brine;
- Applying costing data to the corresponding information entered into Kai-calculator; and
- Producing a cost per day for each dietary pattern, using statistical analyses.
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My thesis supervisors: Associate Professor Rachael Taylor (Department of Medicine, University of Otago), Dr Rachel Brown (Department of Human Nutrition, University of Otago) and Michelle Jospe (PhD student, Department of Human Nutrition, University of Otago). Thank you so much for all the support, feedback and Skype meetings throughout my thesis journey. I have thoroughly enjoyed working with you all and I wish you well with the remainder of the SWIFT study.

My placement tutors: Cathy Khouri (Registered Dietitian, Registered Nutritionist and Tutor Dietitian, Dietetic Programme, University of Otago, Hamilton) and Niki Russell (Registered Dietitian and Tutor Dietitian, Dietetic Programme, University of Otago, Hamilton). Thank you very much for all your support during my placement at Waikato Hospital. You both made my time there an excellent experience, which will be extremely valuable to my future dietetic career.

Participants of SWIFT (Support strategies for Whole-food diets, Intermittent Fasting and Training). Thank you very much to all those who participated in the study and for accurately completing your diet records for analysis.

Liz Fleming (SWIFT study coordinator). Thank you for your tutorials on Kai-culator and for your constant support and emails during my time entering diet records, both in Dunedin and Hamilton.

Melanie Remy (Divisional Librarian, Department of Science, University of Otago). Thank you for all your library expertise and for helping me to find all relevant journal articles for my literature review.
Mum, who spent many hours proofreading this document and for the emotional support during the past two years, with much needed weekly phone calls. Thank you also for helping me to make this journey a reality and constantly believing in me.

Dad, who has been a great supporter throughout my six years at university. Thank you also for your openness about how proud you are of my efforts and your constant encouragement.

Andrew (my brother), Pharmacy graduate of the University of Otago, who assisted me through my first year of Health Science. Thanks for the many hours you spent tutoring me and for the continued support since. Thank you also for all your advice and guidance during my university life; I really value your opinion.

My fellow peers: Kendall McCowatt, who was my partner in crime during my placement at Waikato Hospital. Thanks for all your support and hard work during the first semester.

Alex Tully, a fellow MDiet candidate working with me on the SWIFT project. Thanks for all your support and conversations during the long hours of diet record entry and throughout the second semester.

Also to all my friends that have been there every step of the way over these past six years, you know who you all are and I am very grateful for your love and support.
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<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>AA</td>
<td>African-American</td>
</tr>
<tr>
<td>ADF</td>
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<tr>
<td>ADRC</td>
<td>Alternate Day Calorie Restriction</td>
</tr>
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<td>AFRI-CARI</td>
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<tr>
<td>ALA</td>
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<td>AMDR</td>
<td>Acceptable Macronutrient Distribution Ranges</td>
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<td>Advanced Oxidation Protein Products</td>
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<tr>
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<td>Apo-Protein</td>
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<tr>
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<td>Brain-Derived Neurotropic Factor</td>
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<td>Beta-Hydroxybutyrate</td>
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<td>European Prospective Investigation Into Cancer &amp; Nutrition</td>
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<td>EUR</td>
<td>Euro (European Currency)</td>
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<td>Fasting Calorie Restriction – Food</td>
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<td>FCR-L</td>
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<td>FMD</td>
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<td>FPG</td>
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<td>Food Price Index</td>
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<td>HDL</td>
<td>High Density Lipoprotein</td>
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<td>High Fat</td>
</tr>
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<td>HISP</td>
<td>Hispanic</td>
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<td>Homoeostasis Model Assessment</td>
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<td>ICR</td>
<td>Intermittent Calorie Restriction</td>
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<td>kg</td>
<td>Kilogram</td>
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<td>Kilojoule</td>
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<td>Low Density Lipoprotein</td>
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<td>Large</td>
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<td>MAP</td>
<td>Mean Arterial Pressure</td>
</tr>
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<td>Acronym</td>
<td>Abbreviation</td>
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<td>MED</td>
<td>Mediterranean Diet</td>
</tr>
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<td>Medium</td>
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<td>MET</td>
<td>Muscle Energy Technique</td>
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<td>MI</td>
<td>Myocardial Infarction</td>
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<td>mJ</td>
<td>Mega-Joule</td>
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<td>MUFA</td>
<td>Monounsaturated Fatty Acids</td>
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<td>NB:</td>
<td>Nota Bene (Note)</td>
</tr>
<tr>
<td>NZ</td>
<td>New Zealand</td>
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<td>OGTT</td>
<td>Oral Glucose Tolerance Test</td>
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<tr>
<td>PA</td>
<td>Physical Activity</td>
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<td>PAD</td>
<td>Peripheral Arterial Disease</td>
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<td>PALEO</td>
<td>Paleolithic</td>
</tr>
<tr>
<td>PEF</td>
<td>Peak Expiratory Flow</td>
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<tr>
<td>PF</td>
<td>Protein/Fat</td>
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<td>pkFMD</td>
<td>Peak Flow Mediated Dilation</td>
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<td>PTCA</td>
<td>Percutaneous Transluminal Coronary Angioplasty</td>
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<td>PUFA</td>
<td>Polyunsaturated Fatty Acids</td>
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<td>QOL</td>
<td>Quality of Life Score</td>
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<td>RCT</td>
<td>Random Control Trial</td>
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<td>RMR</td>
<td>Resting Metabolic Rate</td>
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<td>Respiratory Quotient</td>
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<td>Relative Risk</td>
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<td>SAT</td>
<td>Subcutaneous Adipose Tissue</td>
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<td>Standard Deviation</td>
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<td>SWIFT</td>
<td>Support Strategies for Whole-food diets, Intermittent Fasting and Training</td>
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<td>T CHOL</td>
<td>Total Cholesterol</td>
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<td>Type One Diabetes Mellitus</td>
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<td>T2DM</td>
<td>Type Two Diabetes Mellitus</td>
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<tr>
<td>TAG</td>
<td>Triacylglycerol</td>
</tr>
<tr>
<td>TBW</td>
<td>Total Body Water</td>
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<tr>
<td>TE</td>
<td>Total Energy</td>
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<td>-------------</td>
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<tr>
<td>TFA</td>
<td>Trans- Unsaturated Fatty Acids</td>
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<td>TFP</td>
<td>Thrifty Food Plan</td>
</tr>
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<td>TNF-ALPHA</td>
<td>Tumour Necrosis Factor-Alpha</td>
</tr>
<tr>
<td>TRE</td>
<td>Time Restricted Eating</td>
</tr>
<tr>
<td>TRF</td>
<td>Time Restricted Feeding</td>
</tr>
<tr>
<td>UK</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>USA</td>
<td>United States of America</td>
</tr>
<tr>
<td>USD ($)</td>
<td>United States Dollar</td>
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<td>USDA</td>
<td>United States Department of Agriculture</td>
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<td>VAT</td>
<td>Visceral Adipose Tissue</td>
</tr>
<tr>
<td>W.</td>
<td>Women</td>
</tr>
<tr>
<td>WHO</td>
<td>World Health Organisation</td>
</tr>
<tr>
<td>WHR</td>
<td>Waist-To-Hip Ratio</td>
</tr>
<tr>
<td>wk.</td>
<td>Week</td>
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<td>wt.</td>
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1 Introduction

Obesity is a growing issue facing today’s society and is of concern as it increases the chances of a person developing other co-morbidities [1]. Obesity is characterised by an increased amount of body fat over and above the reference standards [1]. The standard method for measuring a person’s ideal weight is their weight to height ratio or Body Mass Index (BMI) [2]. A normal BMI is between 18.5 - 24.99 kg/m$^2$ and anything above this value is either considered to be overweight (25 - 29.99 kg/m$^2$) or obese (above 30 kg/m$^2$) [2]. Having a high BMI is associated with an increased risk of obesity related diseases such as Type Two Diabetes Mellitus (T2DM), stroke, heart disease, cancer and depression, which can lead to a reduced lifespan [1].

Weight reduction is often a clinician’s first line of treatment to reduce a person’s risk of co-morbidities or to alleviate current symptoms which are associated with excess weight [1]. Many of these so called “weight loss” diets show positive effects in the short-term due to decreased calorie intakes, but many people fail to sustain these plans long-term. Many people find it difficult to change lifelong behaviours and implement new lifestyle strategies over a longer period of time [3].

Several problems can occur with dieting including weight regain either long-term or after a period of short-term weight loss, body image issues and/or failing to meet goals, leading to depression and anxiety [3, 4]. Adherence to the diets is also another major issue which can prevent people from achieving their goals [5]. Many dieters are looking for a quick fix, but losing weight requires a long-term commitment and involves changing mindsets and lifestyle factors.
One factor that may influence long-term adherence is the cost of a dietary regime \(^6\). It is a common perception that a healthy diet that meets recommendations costs more than a less nutrient dense diet, and this increased monetary value is considered a barrier \(^7\)\(^\text{-}\)\(^9\). It is difficult to determine the actual cost of a dietary plan but a snapshot of daily intake and its cost can be determined using the gold standard three to four-day weighed diet record and an average supermarket price per 100 grams or kilogram \(^8\)\(^\text{-}\)\(^10\). This information can be useful at both a national level and an individual level when promoting a healthy diet and decreasing the risk of disease.

### 1.1 Aim of the Present Study

The Support strategies for Whole-food diets, Intermittent Fasting and Training (SWIFT) study is a two year randomised controlled trial (RCT) based in Dunedin, New Zealand, aimed at determining how best to support individuals to adhere to lifestyle change. SWIFT has recruited 250 overweight and obese individuals who are able to select one of three dietary plans including a Mediterranean (MED) diet, a modified whole food Paleolithic (Paleo) diet or an Intermittent Fasting or 5:2 plan (IF). As mentioned above, cost may be an important determinant of adherence to different diets. Therefore the primary aim of this research is to compare the costs of these three popular diets.
2 Literature Review

2.1 Literature Review Methodology

A search was conducted between September and November 2014, with an update conducted between July and September 2015, using the following databases: Medline (Ovid), CINAHL, Sports Discuss and Scopus. The following terms were used to gain articles on the Mediterranean diet - “Mediterranean diet”, “Med diet”; the Paleolithic diet - “Paleo diet”, “Paleolithic diet”, “Paleolithic-type diet”, “Stone Age diet”, Cave Man diet”, Hunter Gatherer diet”, “Old Stone Age diet”; and Intermittent Fasting - “Intermittent Fasting”, “IFCR or Intermittent Fasting Calorie Restriction”, “Calorie Restriction”, Alternate Day Fasting or ADF”, “Calorie Restriction diet”, “Time Restricted Eating or TRE”, “Fasting Calorie Restriction or FCR”. Cost was searched as “cost”, “cost analysis” and “price”. The search was restricted to articles published from 1940 to 2015, as some of the early Intermittent Fasting studies were written back in the 1940’s.

2.2 Different Dietary Approaches

2.2.1 Popular Diet Trends

Weight loss diets are popular worldwide, with some diets lasting a short time in the spotlight while others leave a more permanent mark on society. Three dietary plans that have grown in popularity in recent years are the MED diet (a moderate fat and a low to moderate calorie dense diet), Paleo diet (low carbohydrate, high protein diet) and IF (involves eating normally on some days and severely reducing intake on the other days). At present there is limited research on the long-term weight loss potential of all three diets. In addition, while there is strong evidence for the health benefits of the MED diet, there is limited research regarding health outcomes for the Paleo diet and IF dietary plan.
2.2.2 Mediterranean Diet

The MED diet is considered to be one of the most popular dietary plans worldwide \cite{11}. Several aspects of this diet have now become integrated into the western diet outside of the Mediterranean \cite{11}. There is a large diversity in Mediterranean culture and each region has its own unique dietary pattern, therefore there is no uniform MED diet \cite{12}.

The Seven Countries (United States of America (USA), Finland, Japan, former Yugoslavia, Netherlands, Italy and Greece) study by Ancel Keys ignited interest into the possible health benefits associated with consuming a MED based diet \cite{13, 14}. These countries were considered to be contrasting in lifestyle and dietary factors and presumably had different risk factors for many common diseases and rates of mortality. A major outcome of this study was that the Island of Crete where a MED diet was consumed had the lowest rates of mortality and cardiovascular disease (CVD). However in recent years much of Ancel’s work has been criticised due to poor study design as his trials did not control for many confounders, only recruited men and there was a sense of selective reporting of results in terms of the countries involved.

The MED diet is now followed by thousands of people and centralises around several major characteristics \cite{15}. The first is that the ideal MED diet should include a high intake of fruit and vegetables (including potatoes), breads and cereals, legumes, and nuts and seeds. Olive oil is considered to be a staple and should be consumed daily; there is also an emphasis on consuming other monounsaturated and polyunsaturated oils. Moderate amounts of dairy, poultry and fish should be consumed weekly and low amounts of red meat are generally included. If eggs are consumed, it is recommended that no more than three to four be consumed per week. If people choose to drink alcohol, wine is recommended, with a guideline of two glasses for men and one for women daily, ideally with the main meal.
2.2.2.1 Health Effects of the Mediterranean Diet

There has been significant interest and investigation into the potential health benefits of a MED style diet following the Seven Countries study, which showed a reduction in CVD and overall mortality \cite{13, 14}. Since then a large number of individual trials have been conducted, and due to this wealth of individual studies only 10 meta-analyses and one Cochrane review have been included in this section.

Recent meta-analyses have reported a wealth of positive health effects from following the MED diet including weight loss and a reduced risk of heart disease, neoplastic disease, cerebrovascular disease (CBVD) and overall mortality \cite{16-26}. The primary outcome measures that were investigated were anthropometric measures \cite{21, 24-26}, lipid profiles \cite{16, 21, 23-25}, certain cancers \cite{16, 18}, diabetes risk factors \cite{17, 20-25}, bone health \cite{19} and mortality rates \cite{16, 18, 23}.

One of the most significant outcomes reported in the largest of all analyses was that a two-point increase in adherence to the MED diet reduced the risk of CVD by 10\% \cite{16}. This improvement in risk factors was also reported in three smaller meta-analyses, with improvements in lipid profiles \cite{21, 23-25} and a reduction in systolic and diastolic blood pressure occurring \cite{23, 25}. These findings are significant as they back up the previous outcomes reported.

Consuming a MED diet also appears promising for both prevention and management of diabetes. Two meta-analyses found that high adherence to a MED diet was associated with a 19 – 23\% reduced risk of developing diabetes \cite{17, 20}. Two slightly older studies reported reductions in glycated Haemoglobin (Hba1c) \cite{22, 24} and a further trial reported a significant reduction in fasting plasma glucose (3.8 mg/dL 95\% confidence interval (CI) 7.0 - 0.6) \cite{25}.

However, a meta-analysis by Carter et al. including eight RCT and 1178 subjects found no significant reductions in glucose levels \cite{22}.
Promising research has also been reported in the area of prevention of certain cancers. A large meta-analyses show that a two-point increase in adherence score to the MED diet is associated with a 4% reduction in neoplastic disease (relative risk (RR) 0.96; 95% CI 0.95, 0.97)\textsuperscript{[16]}. The second study concluded that the highest adherence to a MED diet resulted in a significant reduction in risk in prostate cancer (4%), colorectal cancer (14%), aero-digestive cancer (56%) and overall cancer mortality/incidence (10%)\textsuperscript{[18]}. Non-significant changes were found in several other forms of cancer including breast, gastric and pancreatic, therefore it is less likely that adherence to a MED diet would be beneficial to prevent these cancers\textsuperscript{[18]}.

Other positively associated health outcomes with the consumption of a MED diet included an 8% reduction in overall mortality\textsuperscript{[16]} and modest reductions in BMI ranging from -0.29 kg/m\textsuperscript{2} to -0.6 kg/m\textsuperscript{2}\textsuperscript{[21,25,26]}. Reductions in weight loss were also reported, ranging from 1.75 kg to 2.2 kg compared to baseline\textsuperscript{[24-26]}. A further meta-analysis was unable to draw firm conclusions as to a beneficial effect on bone health with the consumption of a MED diet as all available studies showed conflicting results\textsuperscript{[19]}. Based upon the trials to date there is strong evidence to suggest that adherence to a Mediterranean diet is linked to beneficial health outcomes including a reduction of risk in overall mortality, some cancers, T2DM, heart disease and stroke. However further research is required in the areas of weight management and bone health to determine if these reported health outcomes would be seen in the wider population.
### Table 2-1 Mediterranean Diet and Health Effects

<table>
<thead>
<tr>
<th>Author(s), Year</th>
<th>Subjects/Study Demographics</th>
<th>Design</th>
<th>Outcome Measures</th>
<th>Key Findings</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sofi et al. (2014) [16]</td>
<td>Number (n=) 4,172,412 subjects</td>
<td>Study Design: Meta-analysis</td>
<td>1. Overall mortality</td>
<td>A 2-point increase in adherence score to the MED diet produced a reduction in mortality overall (8%) (Relative Risk - RR = 0.92; 95% Confidence Interval – (CI) 0.91, 0.93).</td>
<td>There was a lack of uniformity in the included data regarding the food groups. Some studies reported potatoes with vegetables, while some included them as a single food group. Some studies included legumes with nuts and not as a separate food group.</td>
</tr>
<tr>
<td></td>
<td>Sex: Female/Male</td>
<td>Number of Studies: 23 new, 35 total</td>
<td>2. CVD mortality</td>
<td>A 2-point increase in adherence score to the MED diet produced a reduction of CVD (10%) (RR = 0.90; 95% CI 0.87, 0.92).</td>
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<tr>
<td></td>
<td>Age: 25-74 years old</td>
<td>Type of Studies: Cohort</td>
<td>3. Stroke</td>
<td>A 2-point increase in adherence score to the MED diet resulted in a reduction of neoplastic disease (4%) (RR = 0.96; 95% CI 0.95, 0.97).</td>
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<td></td>
<td>Countries Involved: Greece, Australia, Spain, Belgium, Denmark, France, Hungary, Italy, The Netherlands, Portugal, Switzerland, Sweden, Germany, Norway</td>
<td>Aim: To update previous meta-analyses (cohort studies) that investigated the association between the MED diet and health.</td>
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<tr>
<td></td>
<td>Schwingshackl et al. (2014) [17]</td>
<td>Study Design: Meta-analysis</td>
<td>1. T2DM</td>
<td>The pooled risk ratio for the highest versus lowest adherence to the MED diet was 0.81 (95% CI 0.73, 0.90, P&lt;0.0001).</td>
<td>Non-homogeneous MED diet score. Two studies had different study and population design. Secondary prevention of CVD and volunteers with a history of gestational diabetes were included, therefore had a history of a disease, which may be associated with higher T2DM risk when compared to healthy people.</td>
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<td></td>
<td>n=122 810 subjects</td>
<td>Number of Studies: 9</td>
<td></td>
<td>Further analysis (including only longer term studies) confirmed the results of the first analysis (pooled risk ratio = 0.75; 95% CI 0.68, 0.83, P&lt;0.0001).</td>
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<tr>
<td></td>
<td>Sex: Female/Male</td>
<td>Types of Studies: One randomised controlled trial (RCT) and eight prospective cohort studies (between 2007 - 2014)</td>
<td></td>
<td>Greater adherence to a MED diet is associated with a significant reduction in the risk in T2DM (19%).</td>
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<td></td>
<td>Age: &gt;19 years</td>
<td>Duration of Studies + Follow Up: 3.2 + 20 years</td>
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<td>Cohort’s are at risk of various potential sources of bias.</td>
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<tr>
<td></td>
<td>BMI: Not reported</td>
<td>Aim: To summarise the effects of MED diet adherence on the risk of T2DM.</td>
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</tbody>
</table>
### Mediterranean Diet and Health Effects

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</table>
| Schwingshackl et al. (2014) [18] | n=Cohort 1,368,736 subjects, Case-control 62,725 subjects | Study Design: Meta-analysis  
Number of Studies: 33  
Type of Studies: Twenty-one cohort studies, 12 case–control studies  
Duration of Studies + Follow Up: Three to 40 years | 1. Cancer mortality  
2. Prostate cancer  
3. Colorectal cancer  
4. Breast cancer  
5. Gastric adenocarcinoma  
6. Esophageal and gastric cancer  
7. Oral/pharyngeal, esophageal, laryngeal cancer  
8. Pancreas cancer  
9. Gastric cancer | The highest adherence to a MED diet resulted in a significant reduction in risk for overall cancer mortality and incidence (prostate (cohort/case–control; RR: 0.96, 95% CI 0.92–0.99, p= 0.03), cohort; RR: 0.90, 95% CI 0.86–0.95, p < 0.0001), colorectal (cohort/case–control; RR: 0.86, 95% CI 0.80–0.93, p < 0.0001) and aero-digestive cancer (cohort/case–control; RR: 0.44, 95% CI 0.26–0.77, p=0.003). | The MED diet is not a homogenous dietary pattern and heterogeneity on the MED diet score items was present.  
Cohort studies can be unreliable with nutritional assessment methods and reliability is generally lower than a RTC.  
Case control studies are prone to error especially measurement and recall bias.  
Different adjustment for potential confounders was present. |
Number of Studies: Six  
Types of Studies: Not reported  
Duration of Studies + Follow Up: Not reported | 1. Bone Health | A small number of trials have investigated the relationship between MED Diet and bone health, and they report conflicting results. | Limited amount of studies with conflicting results. |
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<tr>
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</tr>
</thead>
</table>
| Koloverou et al. (2014) [20] | \(n= 136,846 \) subjects  
Sex: Female/Male  
Age: Not reported  
BMI: Not reported  
Countries Involved: Not reported | Study Design: Meta-analysis  
Number of Studies: 16  
Types of Studies: Observational (Nine prospective and seven cross-sectional)  
Duration of Studies + Follow Up: 3.5 + 10.5 years | 1. T2DM | High adherence to the MED diet was associated with 23% reduced risk of developing T2DM (combined relative risk for upper versus lowest available centile: 0.77; 95% CI: 0.66, 0.89). Subgroup analyses based health status, region and a number of controlled confounders, showed similar outcomes. | Variations in MED diet adherence assessment tools, adjustment for confounders and the duration of follow up and number of events associated with T2DM. Publication bias seemed to be present; therefore the results should be interpreted with some caution. |
| Huo et al. (2014) [21] | \(n= 1178 \) subjects  
Sex: Female/Male  
Age: 26-77 years  
BMI: Not reported  
Countries Involved: United States, Spain, Greece, Israel, Italy, Australia | Study Design: Meta-analysis  
Number of Studies: Nine  
Types of Studies: RCT  
Duration of Studies + Follow Up: Four weeks parallel + four years parallel. | 1. Glycaemic control (HbA1c, fasting plasma glucose (FPG), fasting insulin, homeostasis model assessment of insulin resistance  
2. Weight loss  
3. Cardiovascular risk factor | MED diet led to greater reductions in fasting insulin (-0.55 uU/ml; CI, -0.81 to -0.29), BMI (-0.29 kg/m²; CI, -0.46 to -0.12), HbA1c (mean difference, -0.30; 95% CI, -0.46 to -0.14), fasting plasma glucose (-0.72 mmol/l; CI, -1.24 to -0.21), and body weight (wt.) (-0.29 kg; CI, -0.55 to -0.04) compared to control diets. Concentrations of total cholesterol (T Chol) and triacylglycerol (TAG) were decreased (-0.14 mmol/l; CI, -0.19 to -0.09 and -0.29 mmol/l; CI, -0.47 to -0.10, respectively), and high density lipoprotein (HDL) was increased (0.06 mmol/l; CI, 0.02 to 0.10). The MED diet was associated with a reduction of 1.45 mm Hg (CI, -1.97 to -0.94) for systolic blood pressure (BP) and 1.41 mm Hg (CI, -1.84 to -0.97) for diastolic BP. | The MED diet is not a homogenous pattern. Control diets varied and included low fat, non-restricted calorie, low carb, high carb, and diabetic specific and regular diets. Some of these diets are recommended to diabetics and may have had a beneficial effect on metabolic indices. Therefore the effect on glycemic control, weight and CVD risk factors may be underestimated. Possible publication bias present for HbA1c as there was an insufficient number of studies to perform analysis. |
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| Carter et al. (2014)   | n= 1298 subjects           | Study Design: Meta-analysis | 1. Fasting blood glucose  
2. Fasting insulin  
3. HbA1c | None significant differences were found in interventions of terms of lowering glucose indices.  
The MED diet reduced HbA1c significantly compared to the diabetic diet but not compared to the Paleo diet.  
No dietary assumptions could be made in favour or improved glycaemic control from this analysis. | Potential publication bias  
Study length was only between 2-12 months.  
Significant heterogeneity existed.  
Trials not explicit in their diets or people contact time. |
| Rees et al. (2013)     | n= 52,044 subjects         | Study Design: Cochrane review | 1. CVD mortality  
2. All-cause mortality  
3. Non-fatal endpoints myocardial infarction (MI), coronary artery bypass graft (CABG), percutaneous transluminal coronary angioplasty (PTCA), angina, or angiographically defined CHD, stroke, carotid endarterectomy or peripheral arterial disease (PAD))  
4. Changes in blood lipids and BP  
5. Occurrence of T2DM as a major CVD risk factor  
6. Health-related quality of life score (QOL)  
7. Adverse effects (as defined by the authors of the included trials)  
8. Cost | Small reductions in T Chol (-0.16 mmol/L, 95% CI - 0.26 to -0.06;) and low density lipoprotein (LDL) (-0.07 mmol/L, 95% CI -0.13 to -0.01) were seen with the MED diet.  
Subgroup analyses revealed statistically significant greater reductions in T Chol in MED diet trials (-0.23 mmol/L, 95% CI -0.27 to -0.2) compared with control (-0.06 mmol/L, 95% CI - 0.13 to 0.01).  
Reductions in BP were seen in three out of five trials.  
No reports of cost in trial included. | There was a significant heterogeneity between diets, the participants recruited and the follow up periods of trials included.  
None of the trials reported health related QOL or adverse events or costs. |
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</tr>
</thead>
<tbody>
<tr>
<td>Ajala et al. (2013) [24]</td>
<td>n= 2129 subjects (822 subjects had MED diet interventions)</td>
<td>Study Design: Meta-analysis</td>
<td>1. Glycemic control (including HbA1c)</td>
<td>A low carb, low glycaemic index (GI) MED diet and high protein diet all led to a greater improvement in glycemic control (glycated hemoglobin reductions of -0.12% (P = 0.04), -0.14% (P = 0.008), -0.47% (P &lt;0.0001), and -0.28% (P &lt;0.00001), respectively) compared with control diets.</td>
<td>The control diets were different in terms of the nutrient composition. Participants had different baseline characteristics (weight, BMI and HbA1c).</td>
</tr>
<tr>
<td></td>
<td>Sex: Female/Male</td>
<td>Number of Studies: 16</td>
<td>2. Weight loss</td>
<td>The largest effect size was seen in the MED diet.</td>
<td>Some studies failed to report on potential bias and confounders.</td>
</tr>
<tr>
<td></td>
<td>Age: &gt;18 years</td>
<td>Types of Studies: RCT</td>
<td>3. Change in lipids</td>
<td>Low carbohydrate (carb) and MED diets led to greater weight loss [-0.69 kg (P = 0.21) and -1.84 kg (P &lt;0.00001), respectively].</td>
<td>The effect of weight change on the other measured variables was a possible limitation, as it was sometimes not controlled for.</td>
</tr>
<tr>
<td></td>
<td>BMI: Not reported</td>
<td>Duration of Studies + Follow Up: Six months + six months follow up</td>
<td>1. Cardiovascular risk factors</td>
<td>HDL increased in all diets except the high protein diet.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Countries Involved: Not reported</td>
<td>Aim: To assess the effects if any of various diets on lipids, wt. loss and glycemic control.</td>
<td>2. BMI, waist circumference</td>
<td></td>
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<td></td>
<td></td>
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<td>3. BP</td>
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<td>4. Lipid profile</td>
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<td>5. C – reactive protein (CRP)</td>
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<td></td>
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<td>6. Fasting plasma glucose, serum insulin</td>
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<tr>
<td>Nordmann et al. (2011) [25]</td>
<td>n= 2650 subjects</td>
<td>Study Design: Meta-analysis</td>
<td>1. Cardiovascular risk factors</td>
<td>After 2 years of follow-up, participants following a MED diet had more greater reductions in body wt. (-2.2 kg; 95% CI, -3.9 to -0.6), BMI (-0.6 kg/m2; 95% CI, -1 to -0.1), fasting plasma glucose (-3.8 mg/dL, 95% CI, -7 to -0.6), T Chol (-7.4 mg/dL; 95% CI, -10.3 to -4.4), systolic BP (-1.7 mm Hg; 95% CI, -3.3 to -0.05), diastolic BP (-1.5 mm Hg; 95% CI, -2.1 to -0.8), and CRP (-1.0 mg/L; 95% CI, -1.5 to -0.5).</td>
<td>The observed heterogeneity in trials with restriction of daily calories. It is based on only 6 trials, with 3 trials published by the same group of authors.</td>
</tr>
<tr>
<td></td>
<td>Sex: Female/Male</td>
<td>Number of Studies: Six</td>
<td>2. BMI, waist circumference</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Age: Mean age 35-86 years</td>
<td>Types of Studies: RCT</td>
<td>3. BP</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>BMI: Mean 29-35 kgm²</td>
<td>Duration of Studies + Follow Up: Intervention period not reported, follow up period two years</td>
<td>4. Lipid profile</td>
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<tr>
<td></td>
<td>Countries Involved: Italy, Spain, USA, Israel</td>
<td>Aim: To establish all RCTs comparing the MED diet to a low fat diet for overweight and/or obese individuals (minimum follow up 6 months), with an intention to treat data on CVD risk factors.</td>
<td>5. C – reactive protein (CRP)</td>
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<tr>
<td></td>
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<td>6. Fasting plasma glucose, serum insulin</td>
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<tr>
<td>Author(s), Year</td>
<td>Subjects/Study Demographics</td>
<td>Design</td>
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<td>Key Findings</td>
<td>Limitations</td>
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<td>Esposito et al. (2011) [26]</td>
<td>n= 3436 (1848 were assigned to a MED diet, 1588 to control diet)</td>
<td>Study Design: Meta-analysis</td>
<td>1. Weight loss in kilogram (kg) 2. BMI</td>
<td>The MED diet had significant effects on participant’s weight [mean difference between MED diet and control (-1.75kg; 95% CI, -2.86 to -0.64 kg] and BMI (mean difference, -0.57 kg/m2, and -0.93 to -0.21 kg/m2).</td>
<td>The interventional (MED diet) varied between trials. The control diet also varied between studies. The degree of heterogeneity was high (potential bias) about the generalisation of the outcomes.</td>
</tr>
<tr>
<td></td>
<td>Sex: Female/Male</td>
<td>Number of Studies: 16</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Age: 18-75 years</td>
<td>Types of Studies: RCT</td>
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<tr>
<td></td>
<td>BMI: 26.5-35 kg/m²</td>
<td>Duration of Studies + Follow Up: Four weeks to 24 months intervention (up to a five year follow up).</td>
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<tr>
<td></td>
<td>Countries Involved: USA, Italy, Spain, France, Israel, Greece, Germany, the Netherlands.</td>
<td>Aim: To assess the effect of MED diets on body wt.</td>
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</tbody>
</table>

1 (n=) - Number; BMI - Body Mass Index; CVD - Cardiovascular Disease; CHD - Coronary heart disease; CBVD - Cerebrovascular disease; MED - Mediterranean diet; EPIC - European Prospective Investigation into Cancer and Nutrition; RR - Relative risk; RCT - Random control trial; T2DM - Type two diabetes mellitus; HbA1c - Glycated haemoglobin; FPG - Fasting plasma glucose; NB – Nota bene (note); CABG - Coronary artery bypass graft; PTCA - Percutaneous transluminal coronary angioplasty; PAD - Peripheral artery disease; QOL - Quality of life; MI - Myocardial infarction; CI – Confidence interval; LDL - Low density lipoprotein; GI - Glycemic index; HDL - High density lipoprotein; USA - United States of America; CRP - C-reactive protein; kg – Kilogram; wt. – Weight; T Chol – Total cholesterol; TAG – Triacylglycerol; BP – Blood pressure; UK – United Kingdom.
2.2.3 Paleo Diet

The Paleolithic diet (Paleo), also known as the Stone Age diet, Cave Man diet and the Hunter-Gatherer diet, is a dietary plan that attempts to emulate that of our ancestral past \cite{27}. It is based on foods that were available during the Paleolithic period which began around two million years ago and ended around 10,000 years ago \cite{27}. It includes foods that were found in the wild during this era including wild animals, fruits, vegetables and eggs \cite{28} and excludes products that are available today due to the domestication of animals, such as dairy products \cite{28} as well as starchy vegetables and legumes or any form of grain or wheat or products containing these \cite{28}.

In the popular literature there are many different versions of the Paleo diet, with some versions allowing small exceptions to the above rules \cite{29}. However most versions of the Paleo diet predominantly focus on a higher amount of calories available from protein and a lower amount from carbohydrates, with a low to moderate amount from fats \cite{29}. The main concept that is central to the Paleo way of eating is the idea of consuming raw and whole foods wherever possible \cite{29,30}. These foods are generally high in potassium, protein, dietary fibre, phytosterols, monounsaturated and polyunsaturated fats, and long-chain omega-3 fatty acids and are low in sodium \cite{29,30}.

The modern Paleo movement started in 1985 when Boyd, Eaton and Konner suggested that since our genetic profile has varied little since the Paleolithic times we should be eating a diet similar in nature to that of our Paleolithic ancestors \cite{28} and that our current diets are a major cause of many of the co-morbidities and co-mortalities that exist in today’s society \cite{28,31}. Based on certain groups that still live as hunter-gatherers around the world, and the knowledge that scientists have gained from archaeological data, the authors suggested that a Paleo way of eating should include 35% of energy from animal sources and 65% from plant based sources \cite{28}.
These ranges differ from our current New Zealand (NZ) nutritional guidelines which suggest a slightly lower ratio of protein (15 - 25%), a modest amount more carbohydrate (45 - 65%) and somewhat lower amount of fat (20 - 35%) [32].

Kuiper et al. also suggested that the actual fatty acid composition should be modelled on a high amount of both polyunsaturated fatty acids (PUFA) and monounsaturated fatty acids (MUFA) and a comparatively high amount of saturated fatty acids (SFA) [33]. The PUFA should contain high amounts of omega-3 fatty acid, omega-6 fatty acid and α-Linolenic acid (ALA) but be low in linoleic acid (LA) [33]. This is dissimilar to current diets that generally contain low levels of PUFA and MUFA and a decreased omega-3 to omega-6 ratio [33].

### 2.2.3.1 Health Effects of the Paleo Diet

While evidence is limited regarding the effects of the Paleo diet on health, the existing research shows that Paleo diet followers may have a reduction in risk factors for CVD and the incidence of obesity, diabetes and possibly some cancers [34-39].

The five trials conducted to date report on separate health outcomes within the literature. These studies have investigated the effects of the Paleo diet on anthropometric measures [34, 36-39], blood pressure [34, 35, 37, 38], heart rate [34, 38], lipid profiles [34, 35, 37, 38], dietary intake [34-39], markers of inflammation [34, 38], circulatory measures [35], glucose and insulin levels [34-39] and several diabetic control indices [36, 37, 39].

These studies recruited between nine and 29 individuals, with a mix of both males and females, and the mean age of participants ranged from 13 to 67 years old [34-39]. Intervention periods ranged from 20 days to 26 weeks, however the largest trial conducted over 26 weeks involved a crossover design, therefore participants only consumed a Paleo diet for three months [37]. The subject’s ethnicity was not reported in any of the trials. Their BMI was 22.2 kg/m² (within normal range) [38] or ranged between 27.8 - 31.3 kg/m² (overweight/obese) [34-
Dropout rates ranged between 18.2 - 30% \[^{35-39}\] although one study did not report its dropout rate \[^{34}\].

Most interestingly, all trials involving the Paleo dietary plan reported that energy intake was reduced while participating in the intervention \[^{34-39}\]. Two of the trials reported reductions of 25% and 36% respectively in overall energy intake compared to a normal diet, however only six of the 14 participants completed dietary assessment in the latter trial \[^{34, 38}\]. It was reported in a further trial that a Paleo diet was as satiating as a MED dietary plan but energy intake was 24% lower in the subjects consuming the Paleo diet \[^{36, 39}\]. This study also reported that a Paleo dietary plan provided a greater amount of satiety per consumed calorie, which was determined by a satiety scorecard completed with a four day diet record \[^{36, 39}\]. Mean weight loss ranged from 2.3 - 4.5 kg (3.5 - 5.2%) compared to baseline, and weight reduction occurred in both normal weight and overweight participants. However three studies lacked control groups \[^{34, 35, 38}\], and the studies with controls, showed weight loss in both groups \[^{37, 39}\].

A study involving 29 patients with ischemic heart disease (IHD) experienced a decreased glucose tolerance and insulin levels by 37% and 38% respectively, compared to baseline measures \[^{39}\]. A further study reported greater reductions in mean HbA1c (-0.4 %) compared with a diabetes diet \[^{37}\]. These results appear promising for diabetics, however some of the study participants were consuming on average four medications per day prior to the start of the intervention, so it is possible the results are distorted due to possible drug interactions.

Several of the trials were conducted over very short periods of time with an intervention period of five weeks or less \[^{34, 35, 38}\]. Three out of the five current trials lacked control groups and all recruited a small amount of participants (less than 30), which are important limitations when considering the research to date. Subjects consuming a Paleo diet have shown reduced amounts of calories consumed daily when compared with some other dietary plans, so this
would explain some of the beneficial health effects stated above. However there is a suggestion that this dietary plan excludes many regularly consumed foods and therefore it would be difficult for people to adhere to a Paleo dietary plan long-term.

The longest trial involving Paleo diets was conducted over a three month crossover period, so further trials over longer periods of time, preferably including follow up data, are required to determine if the reported effects translate into long-term benefits. Some of the trials lacked a control group and all contained small sample sizes, so these factors need to be considered when interpreting the results. However the studies examining anthropometric measures all had positive outcomes [34, 36-39], suggesting further longer-term, adequately powered studies are warranted. Due to the limited volume of research examining the Paleo diet it is clear that further trials are required.
<table>
<thead>
<tr>
<th>Author(s), Year</th>
<th>Subjects</th>
<th>Intervention</th>
<th>Outcome Measures</th>
<th>Key Findings</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ryberg et al. (2013) [34]</td>
<td>n=10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sex:</strong> Female</td>
<td><strong>Subjects:</strong>  Paleolithic-type diet (30% energy from protein, 40% from fat (mainly MUFA), 30% from carbohydrate). Participants were given prepared meal portions.</td>
<td><strong>Outcome Measures:</strong></td>
<td><strong>Key Findings:</strong></td>
<td><strong>Limitations:</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Retention Rate:</strong> Not reported</td>
<td><strong>Study Design:</strong> Single intervention study</td>
<td></td>
<td></td>
<td>A single dietary treatment study lacks a control to compare so this study type has little statistical validity.</td>
</tr>
<tr>
<td></td>
<td><strong>Sex:</strong> Female</td>
<td><strong>Subjects:</strong>  PA diet</td>
<td></td>
<td></td>
<td>No control group.</td>
</tr>
<tr>
<td></td>
<td><strong>Sex:</strong> Male</td>
<td><strong>Subjects:</strong>  PA diet</td>
<td></td>
<td></td>
<td>Very small sample size n=10.</td>
</tr>
<tr>
<td></td>
<td><strong>Retention Rate:</strong> Not reported</td>
<td><strong>Study Design:</strong> Cross-over RCT</td>
<td><strong>Limitations:</strong></td>
<td></td>
<td>5 weeks duration.</td>
</tr>
<tr>
<td></td>
<td><strong>Age:</strong> Not reported</td>
<td><strong>Subjects:</strong>  PA diet, PA diet with ad libitum food intake</td>
<td><strong>Retention Rate:</strong> Not reported</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jonsson et al. (2009) [37]</td>
<td>n=17</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td><strong>Sex:</strong> Paleo Male six, Female one, Diabetes Male four, Female two</td>
<td><strong>Subjects:</strong>  PA diet and a diabetic diet on risk factors for CVD in patients with type 2 diabetes, not being treated with insulin.</td>
<td><strong>Outcome Measures:</strong></td>
<td></td>
<td>A single dietary treatment study lacks a control to compare so this study type has little statistical validity.</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Age:</strong> Mean Paleo 66±6, mean Diabetes 63±6</td>
<td><strong>Retention Rate:</strong> Not reported</td>
<td><strong>Limitations:</strong></td>
<td></td>
<td>No control group.</td>
</tr>
<tr>
<td></td>
<td><strong>Ethnicity:</strong> Not reported</td>
<td><strong>Subjects:</strong>  PA diet and a diabetic diet on risk factors for CVD in patients with type 2 diabetes, not being treated with insulin.</td>
<td><strong>Retention Rate:</strong> Not reported</td>
<td></td>
<td>Very small sample size n=10.</td>
</tr>
<tr>
<td></td>
<td><strong>Body wt.:</strong> Mean 86.4kg (range: 81.3-89.9kg)</td>
<td></td>
<td></td>
<td></td>
<td>5 weeks duration.</td>
</tr>
<tr>
<td></td>
<td><strong>BMI:</strong> Mean: 31.3kg/m² (range: 29.2-34.0kg/m²)</td>
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</tbody>
</table>

### Table 2-2: Paleo Diet and Health Effects

- **Retention Rate:** 76.5%
- **Duration:** Five weeks
- **Aim:** To evaluate whether a Paleo diet with ad libitum food intake could reduce organ fat content and increase insulin sensitivity in post-menopausal women.
- **Intervention:** Ad libitum
- **Outcome Measures:**
  1. Body weight, BMI, waist and hip circumference, waist-to-hip ratio (WHR), Abdominal sagittal diameter
  2. Energy intake, Protein, carbohydrates, total fat, SFA, MUFA, PUFA, cholesterol, fibre, alcohol, sucrose
  3. Total cholesterol, LDL, HDL, HDL %, TAG, Systolic BP, Diastolic BP, heart rate (HR), PA, energy expenditure
  4. Glucose, Insulin, C-peptide, Urinary C-peptide, Cortisol, Apo-protein (Apo) B, Apo A1, hsCrp, Adiponectin, Leptin, Homeostatic model assessment (HOMA), Tibialis ant, Soleus
- **Key Findings:** Mean energy intake reduced by 25% and weight reduced by 4.5 kg (81.8kg - 77.3kg).
- **Limitations:** Small study sample size.
- **Aim:** To compare the effects of a PA diet and a diabetic diet on risk factors for CVD in patients with type 2 diabetes, not being treated with insulin.
- **Intervention:** Randomised to start with either a PA diet or a diabetic diet. After three months all subjects switched diets. Provided with dietary advice and recipes and PA advice.
- **Outcome Measures:**
  1. Body wt., waist circumference, BMI
  2. Food groups, total weight of food, macro and micro nutrients, ash, water, cholesterol, alcohol, glycaemic load, glycaemic index
  3. Total cholesterol, LDL, HDL, TAG
  4. HbA1C, CRP, Systolic BP, Diastolic BP, FPP, IPA insulin, AUC glucose, AUC insulin, HOMA2 %B, HOMA2 %S, HOMA2 IR
- **Key Findings:** The PA diet resulted in lower means of wt. (-3 kg, p=0.01), BMI (-1 kg/m2, p=0.04) and waist circumference (-4 cm, p=0.02), and higher mean values of HDL (+0.08 mmol/L, p=0.03), HbA1c (-0.4% units, p=0.01), TAG (-0.4 mmol/L, p=0.003), diastolic BP (-4 mmHg, p=0.03) compared to the diabetes diet.
- **Limitations:** Did not reach the number of subjects required (from the pre-study power calculation). Crossover design not ideal for weight loss studies as washout may not be sufficient.
<table>
<thead>
<tr>
<th>Author(s), Year</th>
<th>Subjects</th>
<th>Intervention</th>
<th>Outcome Measures</th>
<th>Key Findings</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frassetto, et al. (2009) [35]</td>
<td>n=11</td>
<td><strong>Study Design:</strong> Single intervention study.</td>
<td>1. Systolic BP, Diastolic BP, mean arterial pressure (MAP), fasting glucose, fasting insulin, insulin AUC, HOMA</td>
<td>Compared to a usual diet, it was observed that (a) significant decreases in plasma insulin vs. time AUC, occurred during the oral glucose tolerance test (OGTT) (P=0.006); (b) significant drops in BP was associated with improved arterial dispensability (-3.1±2.9, P=0.01 and +0.19±0.23, P=0.05); and (c) a significant decreases in total cholesterol, LDL and TAG (-0.8±0.6 (P=0.007), -0.7±0.5 (P=0.003) and -0.3±0.3 (P=0.01) mmol/l respectively) occurred.</td>
<td>Not a RCT, No control group, Very small sample size n=9, Less than 3 weeks in length</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Sex:</strong> Female three, Male six</td>
<td></td>
<td>Eight participants had identical responses to the consumption of a Paleo diet in all the measured variables. Improved status of lipids and circulatory, carbohydrate was all found.</td>
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<tr>
<td></td>
<td></td>
<td><strong>Age:</strong> Mean 38±12</td>
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<tr>
<td></td>
<td></td>
<td><strong>Ethnicity:</strong> Not reported</td>
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<tr>
<td></td>
<td></td>
<td><strong>Body Weight:</strong> Not reported</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td><strong>BMI:</strong> Mean 27.8±2.4 kg/m2</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td><strong>Retention Rate:</strong> 81.8%</td>
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<tr>
<td>Osterdahl et al. (2008) [38]</td>
<td>n=20</td>
<td><strong>Study Design:</strong> Single intervention study.</td>
<td>1. Body weight, BMI</td>
<td>Mean weight reduced compared to baseline; waist circumference by 0.5cm (P=0.001), systolic BP by 3mm Hg (P=0.03) 2.3kg (P&lt;0.001), BMI by 0.8 (P&lt;0.001 and plasminogen activator inhibitor-1 by 72% (P=0.020) Intake of energy reduced by 36%. Other effects observed were; increases in unsaturated fat, antioxidants, potassium-sodium rate but reductions occurred in calcium.</td>
<td>No control group, High dropout rate – under powered, Short intervention period, Results may differ in overweight subjects</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Sex:</strong> Five Men and nine women</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td><strong>Age:</strong> 20-40yrs no mean reported</td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td><strong>Ethnicity:</strong> Not reported</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td><strong>Body Weight:</strong> Mean 65.2 kg</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>BMI:</strong> Mean 22.2 kg/m2</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td><strong>Retention Rate:</strong> 70%</td>
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</tbody>
</table>
Table 2-2: Paleo Diet and Health Effects

<table>
<thead>
<tr>
<th>Author(s), Year</th>
<th>Subjects</th>
<th>Intervention</th>
<th>Outcome Measures</th>
<th>Key Findings</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lindeberg et al. (2007) [39]</td>
<td>n=29, Paleo n=14 Consensus n=15</td>
<td>Study Design: Crossover RCT</td>
<td>1. Body wt., waist circumference, FM (kg and % of body mass), FFM, TBW</td>
<td>The Paleo diet was as satiating as Consensus diet but subjects consumed less total energy per day (5.8 mJ/day vs. 7.6 mJ/day, respectively, p=0.04).</td>
<td>High drop out rate in Paleo 21.4%.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Duration: 12 weeks</td>
<td>2. Food groups, macro and micro nutrients, times between meals, meals per day, weight of food, satiety</td>
<td>Satiety during a meal was higher in the Paleo diet group (p=0.03).</td>
<td>Crossover design not ideal for weight loss studies as washout may not be sufficient.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aim: To compare a Paleo style diet to a consensus diet in terms of glucose intolerance and T2DM, ratings of satiety at meals, leptin and the soluble leptin receptor.</td>
<td>3. AUC glucose, AUC insulin, fasting plasma glucose, fasting plasma insulin, HbA1c, Normal glucose levels, Diabetic glucose levels, In HOMA-IR, Insulin/glucose, Incremental glucose AUC, Incremental Insulin AUC</td>
<td>Leptin decreased by 31% in the Paleo participants, compared to 18% in the Consensus.</td>
<td>Small sample size n=29.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intervention Diet: Ad libitum consumption of a Paleo diet Control Diet: a consensus (MED-like diet).</td>
<td></td>
<td>A 26% decrease of AUC Glucose (p=0.0001) occurred in the Paleo group versus a 7% decrease (p = 0.08) in the Consensus. The larger (p = 0.001) increase in the Paleo group was independent (p=0.0008) of waist circumference (~5.6cm Paleo group) versus (~2.9 cm Consensus group; p=0.03).</td>
<td>Short intervention period (3 months).</td>
</tr>
<tr>
<td></td>
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<td>Long period of time between the two different subject reports of the trial (3 years).</td>
</tr>
</tbody>
</table>

Retention Rate: 78.6% Paleo, 100% Consensus

---

2 (n=) – Number; BMI – Body mass index; WHR – Weight to height ratio; SFA – Saturated fatty acid; MUFA – Monounsaturated fatty acid; PUFA – Polyunsaturated fatty acid; LDL – Low density lipoprotein; HDL – High density lipoprotein; TAG – Triacylglyceride; BP – Blood pressure; PA – Physical activity; Apo – Apo protein; HOMA - Homeostatic model assessment; FM – Fat mass; FFM – Fat free mass; TBW – Total body water; AUC - Area under the curve; mJ – Mega Joule; RCT – Randomised control trial; OGTT - Oral glucose tolerance test; GI – Glycemic index; PA – Physical activity; HbA1c - Glycated hemoglobin; BAD – Brachial artery diameter; MAP – Mean arterial pressure; HR – Heart rate; CRP – C-reactive protein; FPG – Fasting plasma glucose; fp – Fasting plasma; kg – Kilogram; TE – Total energy; wt. – Weight; pkFMD – Peak flow mediated dilation.
2.2.4 Intermittent Fasting

The origins of Intermittent Fasting (IF) date back to the mid 1940s when an IF regimen was shown to increase the lifespan of rats [40]. A subsequent study in a single human showed that IF reduced body weight in a morbidly obese patient, which sparked further interest [41]. Several trials have since been conducted which have also included lifestyle changes such as exercise [42-44].

Most current versions of IF involve the complete or partial restriction of energy intake on one to three days per week. There are three main types of IF: Alternate Day Fasting (ADF) or 4:3 dietary plan [43-46], the 5:2 dietary plan [42, 48, 49] and Time Restricted Feeding (TRF) [47]. The TRF plan indicates that all daily calories must be consumed during a predetermined time window (feeding period) usually between five and eight hours each day [47]. The remainder of the day (the fasting period) usually consists of 16 to 19 hours where all food is restricted and dieters are only allowed to consume water and non-calorie beverages [47]. The 4:3 and 5:2 plans consist of four or five days of regular eating and two or three days of fasting respectively [43-46, 48, 49]. During the fasting days energy is restricted to around 25% of regular daily intake, which equates to around 600 kcals for men and 500 kcals for women, while feeding days have no restrictions [43-46, 48, 49]. The 5:2 dietary plan may be easier to adhere to long-term as it has an additional non-fasting day.

2.2.4.1 Health Effects of Intermittent Fasting

The IF plan does not include guidelines on the types of foods to consume daily, rather it relies on a reduced dietary intake for its beneficial effects. To date there have only been 10 reported studies, excluding those involving Ramadan, which have investigated the effects of an IF diet on participants’ health and mortality risk factors [43, 44, 46, 48-58]. The main health effects investigated were anthropometry indices [43, 44, 46, 48-58], lipid profiles [43, 44, 46, 48-58], blood pressure [43, 44, 46, 48-55, 57, 58], heart rate [51-53, 55], inflammation indicators [43, 50-53], nutritional
intake [43, 50, 51, 54, 55], physical activity [52-54], hunger cues and satiety levels [43, 44, 48, 49, 57, 58], glucose and insulin levels [46, 50-54, 56-58], circulatory measures [44, 48, 49, 56] and diabetic control indicators [50].

The trials recruited between 14 and 115 participants and were conducted over periods between 22 days and 26 weeks [43, 44, 46, 48-58]. The studies reported a range of dropout rates between 0% and 35.7%, with plans involving the 4:3 plan generally having higher retention rates [43, 44, 46, 48-58]. Eight of the 10 trials recruited overweight or obese subjects (BMI >25 kg/m²) which tended to have a greater focus on anthropometry markers [44, 46, 48-56], while the trials that recruited normal weight individuals (BMI 20 - 29.99 kg/m²) focused predominantly on glucose tolerance and CHD risk [43, 57, 58].

The most positive outcome reported by all studies investigating IF was that participants lost an average 2.5% to 8% of their initial body weight [43, 44, 46, 48-58]. Greater reductions in body weight were reported compared to a control diet [43, 51], two continuous fasting plans [50, 54] and two liquid IF diets [44, 48, 49, 52, 53]. The majority of studies also reported reductions in fat mass and reductions in waist, hip, chest and thigh circumferences [43, 44, 46, 48-53, 55, 57, 58], however two trials reported reductions in fat free mass of around 1.5% [43] and 4% respectively [57, 58].

A trial by Kempel et al. reported that those receiving a high fat IF diet experienced greater weight loss than those receiving the low fat IF intervention, with participants having significant reductions in visceral fat relative to baseline [44, 48, 49]. Due to current recommendations to avoid high fat diets, this could be considered controversial in terms of promoting weight loss [44, 48, 49].

Several trials have reported that obese subjects following an IF diet plan can improve cardiovascular health. These improvements include a reduction of blood pressure, a decreased amount of low density lipoproteins (LDL), total cholesterol and triacylglycerol (TAG) molecules and an increased size of LDL molecules [44, 48, 49, 51, 55, 59]. A trial by Bhutani et al.
involved a combination of IF and endurance exercise, which reported significant decreases in LDL and increases in high density lipoproteins (HDL) compared to an IF intervention alone [51]. However, a trial that delivered either a high fat or a low fat intermittent intervention without exercise reported that both interventions improved lipid profiles significantly [44, 48, 49].

Other reported benefits following an IF plan include alleviated asthma related symptoms and improved control, as well as reported improvements in quality of life scores (QOL) [56]. Reductions in fasting insulin and insulin resistance were also found in several trials, suggesting potential benefits in diabetics [44, 48-50, 54, 57, 58]. It was reported that satiety and feelings of fullness were high, and increased over the three-month intervention period [43], suggesting a reduced calorie diet intermittently may be a feasible dietary plan long-term.

A suggested limitation of all types of Intermittent Fasting plans is poor adherence, especially greater than three months [47, 55]. Unfortunately the majority of Intermittent Fasting trials have been conducted over short-term periods, and dieters may find it difficult to adhere to severe dietary restriction over a longer period of time. Many trials included small sample sizes and a few lacked control groups. However most of the recent trials have shown reasonably high adherence rates (78 - 89%) at least over the short term (eight - 12 weeks) [44, 48, 49, 51, 55]. Many of the trials have also produced positive results in weight loss and anthropometric measures, which tends to suggest that Intermittent Fasting has some merit and may be a viable option for those seeking a reduction in body weight. The 5:2 dietary plan only involves two days of fasting and has shown similar benefits to other methods, therefore it is most likely to be the most effective plan as a long-term dietary intervention. Further research is required to confirm the positive outcomes of Intermittent Fasting reported in the literature.
**Table 2-3: Intermittent Fasting and Health Effects**

<table>
<thead>
<tr>
<th>Author(s), Year</th>
<th>Subjects</th>
<th>Intervention</th>
<th>Outcome Measures</th>
<th>Key Findings</th>
<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Varady et al. (2013) [43]</td>
<td>n=32 ADF: 10/15 (66.6%), Control: 12/15 (80%)</td>
<td><strong>Study Design:</strong> RCT, (4:3)</td>
<td>1. Body wt., FM, FFM</td>
<td>Body wt. decreased (P &lt; 0.001) by 5.2 ± 0.9 kg (6.5 ± 1.0%) ADF, compared with the control (wk. 12), FM decreased (P &lt; 0.001) by 3.6 ± 0.7 kg, compared with the control.</td>
<td>Low recruitment rate.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Duration:</strong> 12 weeks</td>
<td>2. Energy intake, hunger, satisfaction, fullness</td>
<td>Adherence to ADF fast days was (98±5%).</td>
<td>PA was not assessed.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Aim:</strong> To examine the effects of ADF on body wt. and CHD risk in non-obese participants.</td>
<td>3. Total cholesterol, LDL, HDL, TAGs, Non-HDL, LDL particle size</td>
<td>Satisfaction and feelings of fullness improved week (wk.) 12 ADF</td>
<td>Sample size small n=15 each group.</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Intervention Diet:</strong> ADF fast meal days: provided 400-600kcal; 30% kcal from fat, 15% kcal from protein, 55% kcal from carbohydrate, otherwise both groups ate ad libitum.</td>
<td>4. Systolic BP, Diastolic BP, Homocysteine, CRP, Adiponectin, Leptin, Resistin</td>
<td>TAG fell (20 ± 8%, P &lt; 0.05) and LDL particle size improved (4 ± 1 Å, P &lt; 0.01) in the ADF compared to controls.</td>
<td>Lack of power to detect changes in certain CVD risk factors.</td>
</tr>
<tr>
<td></td>
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<td>Compared to controls CRP declined (13 ± 17%, P &lt; 0.05) in the ADF (wk. 12). Plasma adiponectin improved (6 ± 10%, P &lt; 0.01), leptin declined by (40 ± 7%, P &lt; 0.05) ADF versus control.</td>
<td>Food records – under reporting possible.</td>
</tr>
<tr>
<td>Klempel et al. (2013) [44]</td>
<td>n=35</td>
<td><strong>Study Design:</strong> RCT, (4:3)</td>
<td>1. Body weight (BW), FM, fat FFMI, waist circumference</td>
<td>BW reduced (P&lt;0.001) by ADF-HF 4.8±1.1% or 4.4±1.0 kg versus ADF-LF 4.2±0.8% or 3.7±0.7 kg. Waist circumference fell (P&lt;0.01) by ADF-HF (7.2±1.5cm), ADF-LF (7.3±0.9cm).FM fell (P&lt;0.001) by ADF-HF (5.4±1.5kg), ADF-LF (4.2±0.6kg).</td>
<td>Small sample size.</td>
</tr>
<tr>
<td>Klempel et al. (2013) [48]</td>
<td>Sex: Female 32</td>
<td><strong>Duration:</strong> Consisted of 2 phases: 1) a two week weight maintenance phase (baseline), and 2) an eight week ADF weight loss phase.</td>
<td>2. Total cholesterol, LDL, HDL, TAGs, LDL particle size</td>
<td>ADF-HF was 96% compliant ADF-LF was 94% compliant during phase 1. ADF-HF was 87±9% compliant; ADF-LF was 78±8% compliant, during phase 2.</td>
<td>Both groups lost weight, no control group.</td>
</tr>
<tr>
<td>Klempel et al. (2013) [49]</td>
<td>Sex: Female 32</td>
<td><strong>Aim:</strong> To compare results of ADF with a high fat and a low fat dietary programme.</td>
<td>3. Hunger, satisfaction, fullness, steps per day</td>
<td>LDL and TAG reduced (P&lt;0.001) in both ADF-HF: 18.3%±4.6%, 13.7%±4.8%, ADF-LF: 24.8%±2.6%, 14.3%±4.4%. LDL particle size enlarged (P&lt;0.005) by 3±1 in both groups.</td>
<td>Potential misreporting of adherence, PA and participants may not have eaten all the food provided.</td>
</tr>
<tr>
<td></td>
<td>Age: ADF-HF 42.4±3.0, ADF-LF 43.2±2.3</td>
<td><strong>Intervention Diet:</strong> ADF-HF (high fat) 45% fat, ADF-LF (low fat) 25% fat. Nutrient profile of both diets was controlled for. All food was provided.</td>
<td>4. Systolic BP, Diastolic BP, Adiponectin, Leptin, Resistin</td>
<td>Adiponectin improved (P&lt;0.05) ADF-HF (43±7%), ADF-LF 51±7%. Leptin, resistin lessened (P&lt;0.05) ADF-HF (32±5%; 23±5%), ADF-LF (30±3%; 27±4%).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ethnicity: ADL-HF: African American 10/15, Hisp 5/15; ADF-LF African American 14/15, Hisp 3/15</td>
<td><strong>Body wt.:</strong> ADF-HF 91.5±2.6, ADF-LF 91.5±2.9 kg</td>
<td>5. Brachial-artery flow-mediated dilation (FMD)</td>
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<tr>
<td></td>
<td>BMI: ADF-HF 35.3±0.7, ADF-LF 35.5±0.7 kg/m² (30-39.9 kg/m²)</td>
<td><strong>Retention Rate:</strong> 91%</td>
<td></td>
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</tbody>
</table>

Klempel et al. (2013) [49] | Sex: Female 32 | **Age:** ADF-HF 42.4±3.0, ADF-LF 43.2±2.3 | **Ethnicity:** ADL-HF: African American 10/15, Hisp 5/15; ADF-LF African American 14/15, Hisp 3/15 | **Body wt.:** ADF-HF 91.5±2.6, ADF-LF 91.5±2.9 kg | **BMI:** ADF-HF 35.3±0.7, ADF-LF 35.5±0.7 kg/m² (30-39.9 kg/m²) | **Retention Rate:** 91% |
**Table 2-3: Intermittent Fasting and Health Effects**

<table>
<thead>
<tr>
<th>Author(s), Year</th>
<th>Subjects</th>
<th>Intervention</th>
<th>Outcome Measures</th>
<th>Key Findings</th>
<th>Limitations</th>
</tr>
</thead>
</table>
| Harvie et al. (2013) [50] | n=115 IECR n=37, IECR + PF n=38, DER n=40 | **Study Design**: RCT, (5:2) - 16 weeks, (6:1) – 4 weeks  
**Duration**: 16 weeks three month weight-loss period (2 day fast) and 1 month of weight maintenance (1 day fast)  
**Aim**: To compare two intermittent energy and carb restriction (IECR) programmes; one allowing ad libitum protein/fat (IECR + PF) and one daily energy restriction (DER), for changes in insulin sensitivity and weight control,  
**Intervention Diet**: IECR, DER 25% energy restriction, (5040 to 7560kJ/d). DER Med type diet protein 25%, carbs 45%, fat 30%. Both IECR (70% energy restriction, 40g carb) providing 2500 and 2717 kJ per day. | 1. Body wt., FM, FFM, waist, hip, bust circumference  
2. Energy, carbohydrate, total fat, SFA and alcohol intakes  
3. Total cholesterol, LDL, HDL, TAG  
4. Systolic BP, Adiponecin, Leptin, TNF-a, Insulin, IGF-1, IL-6, Glucose, HbA1c | The IECR groups both had bigger decreases in fat mass compared to DER (IECR: mean -3.7% (95% CI -2.5, -4.9kg), P=0.007; and IECR + PF: mean -3.7 (95% CI -2.8, -4.7kg), P=0.019; DER: mean -2.0 (95% CI -1.0, 3.0kg)).  
Insulin resistance decreased in IECR by (mean -0.34 (95% CI -0.66, -0.02) units), and by IECR + PF diet (mean -0.38 (95% CI -0.75, -0.01) units).  
Decreases in insulin resistance with the IECR diets were considerably greater compared with the DER diet (mean 0.2 (95% CI -0.19, 0.66) uU/unit, P=0.02).  
Adherence to diets during the two restricted nutrient days was reported at being74% (95% CI 64, 84) (IECR + PF) and 76% (95% CI 67, 85) (IEC). | 23% dropout.  
Anthropometric measures were conducted by research dietitians and not blinded to the diet group.  
Pre-menopausal women (48%) may experience cyclic variations in their levels of insulin, lipids, leptin and IGF-1, therefore effecting results.  
Body fat and FFM were assessed using bioelectrical impedance – can be prone to error. |
| Eshghinia et al. (2013) [46] | n=15 | **Study Design**: Single intervention study, (4:3)  
**Duration**: Eight weeks trial (Two weeks observed and six weeks ADF)  
**Aim**: To assess the capabilities of modified ADF to enable weight loss and decrease CVD risk factors in overweight/obese women  
**Intervention Diet**: Low calorie diet (25-30% energy) on three fast days (Sat, Mon, Weds); consume usual diet (1700–1800 Kcal/d) three alternate days a week. Friday consume ad libitum without limitation. | 1. Body wt., BMI, Waist circumference, FM  
2. Systolic BP, Diastolic BP, fasting blood sugar, Total cholesterol, LDL, HDL, TAG | Body wt. reduced (p<0.0001) from 84.3±11.44kg to 78.3±10.18kg. Waist circumference reduced from 87.87±9.74cm to 82.86±9.68cm (p<0.001).  
T Chol reduced from 227.73±49.96 to 214.67±43.27, TAGs from 160.5 ± 46.18 to 143.9±22.77, LDL from 149.46±49.81 to 131.3±50.97.  
Decreases in systolic BP occurred from 114.8±9.16 to 105.1±10.19mmHg (p<0.001) and diastolic BP altered from 82.86±10.6 to 74.5±10.8 (P<0.05). | Due to study type it has little statistical validity.  
No control group.  
Sample size small (n=15).  
Less than 8 weeks duration. |
### Table 2-3: Intermittent Fasting and Health Effects

<table>
<thead>
<tr>
<th>Author(s), Year</th>
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<th>Intervention</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Bhat et al. (2012) [51]</td>
<td>n=64</td>
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<tr>
<td>Sex: (F/M) Comb 18/0, ADF 24/1, Ex 23/1, C. 15/1</td>
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<tr>
<td>Age: Mean - Comb 45±5, ADF 42±2, Ex 42±2, Control 49±2</td>
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<tr>
<td>Ethnicity: AA/Caus /Hispanic - Comb 7/5/6/0, ADF 12/7/6/0, Ex 11/6/4/3, Control 11/3/2/0</td>
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<tr>
<td>Body wt.: Mean - Comb 91±6, ADF 94±3, Ex 93±2, Control 93±5</td>
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<tr>
<td>BMI: Mean - Comb 31±1, ADF 35±1, Ex 35±1, Control 35±1</td>
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<tr>
<td>Retention Rate: 70%</td>
<td>Study Design: RCT, (4:3)</td>
<td>Duration: 12 weeks,</td>
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<td></td>
<td>Groups: 1) Combination (ADF plus exercise), 2) ADF, 3) Exercise, 4) Control.</td>
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<tr>
<td></td>
<td>Aim: To assess whether the combination (ADF plus exercise) makes increased improvements in body composition and/or lipids, compared to each intervention by them selves.</td>
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<td></td>
<td>Intervention Diet: Two periods: 1) a four week controlled feeding period, 2) an eight week self-select feeding period. Controlled feeding ( week 1-4) participants instructed to eat 25% baseline energy on the “fast day” (24 hr.) and they could consume food ad libitum on non-fasting days.</td>
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<tr>
<td></td>
<td>1. Body wt., FM, FFM, BMI, waist circumference</td>
<td>Body weight decreased (P&lt;0.05) by 6±4kg combination, 3±1 kg ADF and 1±0 kg in the exercise group.</td>
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<td>Twelve weeks may not be not have been sufficient to observe changes in lipids.</td>
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<td></td>
<td>2. Energy intake, fat, cholesterol, protein, carbs, fibre, food intake</td>
<td>FM and waist circumference reduced (P&lt;0.001), while FFM was maintained in the combination group.</td>
<td></td>
<td>Exercise intensity (60-75% HR max) and freq. (3 days/week) may not have been adequate to change CHD risk factors.</td>
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<td></td>
<td>3. Total cholesterol, LD/L, HDL, TAGs, Non-HDL, LDL particle size (LG, Med, SM)</td>
<td>LDL particle size enlarged (P&lt;0.001) by 4±1 A' and 5±1 A in the combination and ADF groups, respectively. LDL decreased (12±5%, P&lt;0.05) and HDL increased (16±9%, P&lt;0.05) in the combination group only. The proportion of small HDL particles fell (P&lt;0.01) in the combination participants.</td>
<td></td>
<td>Bioelectrical impedance analysis (BIA) measured FM and FFM, however it may underestimate FM and overestimate FFM in obese subjects.</td>
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<td></td>
<td>4. Systolic BP, Diastolic BP, HR, fasting glucose/insulin, CRP, HOMA-IR</td>
<td>The combination and ADF groups complied with the regime on 81±7% and 80±9% of the fast days.</td>
<td></td>
<td>A large amount of dropouts occurred in ADF - exercise groups (29.7%).</td>
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<td>Adherence with the exercise programme remained high. The combination attended 95±2% of sessions while the exercise group attended 94±1% of lessons.</td>
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<tr>
<td>Kroeger et al. (2012) [52]</td>
<td>n=60</td>
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<tr>
<td>Sex: Female IFCR-L 28, IFCR-F 26</td>
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<tr>
<td>Age: Mean IFCR-L 47±2, mean IFCR-F 48±2</td>
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<tr>
<td>Ethnicity: AA/Asian/Caus /Hispanic - IFCR-L 16/3/4/5, IFCR-F 18/2/2/4</td>
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<tr>
<td>Body wt.: Mean IFCR-L 95±3, mean IFCR-F 94±3</td>
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<tr>
<td>BMI: Mean IFCR-L 35±1, mean IFCR-F 35±1</td>
<td>Retention Rate: 90%</td>
<td>Study Design: RCT, (6:1)</td>
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<td></td>
<td>Duration: 10 weeks</td>
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<td></td>
<td>Groups: Either the IFCR-liquid (IFCR-L) or IFCR-food based (IFCR-F) diet</td>
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<tr>
<td></td>
<td>Aim: To assess the outcomes of IFCR (with or without a liquid diet) on body weight and body composition, adipokine profile and markers of CHD risk in obese females.</td>
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<td></td>
<td>Intervention Diet: Two periods 1) a two wk baseline wt. stabilisation period, and 2) an eight week weight reduction period.</td>
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<tr>
<td></td>
<td>1. Body wt., FM, FFM, waist circ. BMI, Visceral adipose tissue (VAT), Abdom subcutaneous adipose tissue (SAT)</td>
<td>Body wt. reduced greater (P=0.04) in IFCR-L (3.9±1.4 kg) vs. IFCR-F (2.5±0.6 kg), VAT decreased (P&lt;0.001) IFCR-L (0.7±0.5 kg), IFCR-F (0.3±0.5 kg) diets. FM reduced (P&lt;0.0001) in IFCR-L (2.8±1.2 kg, IFCR-F 1.9±0.7 kg.</td>
<td></td>
<td>The study did not control for food/drink intake - participants were not provided with food (intervention).</td>
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<tr>
<td></td>
<td>2. T Chol, LDL, HDL, TAG, LDL peak size, SM, Med, LG LDL</td>
<td>LDL particle size enlarged (P&lt;0.01), while HR, homocysteine, glucose and insulin reduced (P&lt;0.05), in the IFCR-L. Decreases in T Chol and LDL values were greater (P=0.04) in the IFCR-L (19±10% versus 20±9%) versus IFCR-F (8±3% versus 7±4%).</td>
<td></td>
<td>Only female subjects.</td>
<td></td>
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<tr>
<td></td>
<td>3. Systolic/Diastolic BP, HR, glucose, insulin, CRP, homocysteine, Adiponectin, Leptin, IL-6, TNF-alpha</td>
<td>Adipokines, such as leptin, IL-6, TNF-alpha, and IG-F-1 had reductions (P&lt;0.05), in the IFCR-L group only.</td>
<td></td>
<td>Did not state the effect of IF and CR on body wt. and CHD risk.</td>
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<tr>
<td></td>
<td>4. Activity expenditure, PA variables, steps</td>
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</tbody>
</table>

This study used food records to estimate overall calorie restriction (fasting days) - obese individuals sometimes underestimate the amount of food consumed, therefore underestimating energy.
## Table 2-3: Intermittent Fasting and Health Effects

<table>
<thead>
<tr>
<th>Author(s), Year</th>
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<th>Limitations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Harvie et al. (2011) [54]</td>
<td>n=107</td>
<td>Study Design: RCT, (5:2)</td>
<td>Study Design: RCT, (5:2)</td>
<td>1. Body wt., body fat (kg and %), FFM, waist, hip, bust, thigh circumference, BMI, Total Chol, LDL, HDL, TAG</td>
<td>Adherence to the diet regimen was recorded: controlled food intake phase (days adherent: 86%) and the 89% days adherent: (self-selected food intake phase). Due to study type it has little statistical validity.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Duration: 26 weeks</td>
<td></td>
<td>Equally efficient for wt. loss: mean (95% confidence interval) wt. change for IER was -6.4 (-7.9 to -4.8) kg vs. -5.6 (-6.9 to -4.4) kg for CER (P-value - variance between groups = 0.4).</td>
<td>No follow up after 6 months for weight maintenance data.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aim: To compare the feasibility and effectiveness of Intermittent energy restriction (IER) regime with continuous energy restriction (CER) on anthropometric indices, insulin and other disease risk indices.</td>
<td></td>
<td>Both groups experienced similar decreases in leptin, total and LDL cholesterol, triglycerides, blood pressure, free androgen index, high-sensitivity CRP, as well as increases in sex hormone binding globulin, IGF binding proteins 1 and 2.</td>
<td>Less participants in IER (58%) indicated they would continue regime after the six month intervention, compared to CER (85%), suggesting poor with long-term adherence.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intervention Diet: IER (2710 kJ/day for two days/week) or CER (6278 kJ/day for seven days/week).</td>
<td></td>
<td>Reductions in fasting insulin and insulin resistance were small in both groups, but larger with IER than with CER; the variance between groups for fasting insulin was -1.2 (-1.4 to -1.0) uU/ml-1 and for insulin resistance was -1.2 (-1.5 to -1.0) uU mmol-1-1 (both P = 0.04).</td>
<td>Assessed the effects of two diets on a comprehensive range of serum biomarkers of disease risk, did not take into account any local changes in the creation of these factors.</td>
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<tr>
<td></td>
<td></td>
<td>BMI: Mean IER 30.7±4.1, mean CER 30.5±5.2</td>
<td></td>
<td>Adherence to the diet regime was recorded: controlled food intake phase (days adherent: 86%) and the 89% days adherent: (self-selected food intake phase). Due to study type it has little statistical validity.</td>
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<tr>
<td></td>
<td></td>
<td>Retention Rate: 83.2%</td>
<td></td>
<td>Adherence to the diet regimen was recorded: controlled food intake phase (days adherent: 86%) and the 89% days adherent: (self-selected food intake phase). Due to study type it has little statistical validity.</td>
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<tr>
<td>Varady et al. (2009) [55]</td>
<td>n=20</td>
<td>Study Design: Single intervention study, (4:3)</td>
<td>Study Design: Single intervention study, (4:3)</td>
<td>1. Body wt., body fat, FFM, Total Chol, LDL, HDL, TAGs</td>
<td>Adherence to the diet regimen was recorded at: controlled food intake phase (days adherent: 86%) and the 89% days adherent: (self-selected food intake phase). Due to study type it has little statistical validity.</td>
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<tr>
<td></td>
<td></td>
<td>Duration: 10 weeks</td>
<td></td>
<td>Adherence to the diet regimen was recorded at: controlled food intake phase (days adherent: 86%) and the 89% days adherent: (self-selected food intake phase). Due to study type it has little statistical validity.</td>
<td>No control group, small participant number and short intervention period.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aim: To look at the effects of ADF, administered under a control environment, compared with self-administered diet on body wt. and CAD risk factors in obese males and females.</td>
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<td>Weight losses are likely to influence blood lipids and they were not controlled for.</td>
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<tr>
<td></td>
<td></td>
<td>Intervention Diet: Three phases: 1) a two wk control phase, 2) a four wk wt. loss/ADF controlled food intake phase, and 3) a four wk wt. reduction/ADF self-selected food intake phase. 25% of their energy (fast day).</td>
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<td>20% dropout rate and did not control for PA.</td>
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<td></td>
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<td>BMI: Mean 33.8±1.0</td>
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<tr>
<td></td>
<td></td>
<td>Retention Rate: 80%</td>
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</table>
Table 2-3: Intermittent Fasting and Health Effects

<table>
<thead>
<tr>
<th>Author(s), Year</th>
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<th>Intervention</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Johnson et al. (2007) [56]</td>
<td>n=14</td>
<td>Study Design: Single intervention (4:3)</td>
<td>1. Body wt.</td>
<td>8% weight loss of initial body wt.</td>
<td>Due to study type it has little statistical validity.</td>
</tr>
<tr>
<td><strong>Sex</strong>: Seven women, two men</td>
<td><strong>Duration</strong>: 8 weeks</td>
<td>2. Total cholesterol, LDL, HDL, TAG, TAG/HDL</td>
<td>Asthma-related symptoms, control, and QOL improved significantly, and PEF increased significantly.</td>
<td>Very small sample size, no control group and short intervention period.</td>
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</tr>
<tr>
<td><strong>Age</strong>: Not reported</td>
<td><strong>Aim</strong>: To determine if overweight asthma patients would adhere to an alternate day calorie restriction (ADCR) dietary regimen, and to establish the effects of diet on their symptoms, pulmonary function, markers of oxidative stress.</td>
<td>3. Glucose, Insulin, mood/energy, hunger, leptin, ghrelin, ketones</td>
<td>Levels of serum β-hydroxybutyrate were increased and levels of leptin were decreased on CR days, indicating a shift in energy metabolism toward utilisation of fatty acids and confirming compliance.</td>
<td>Lack of subject data for comparison.</td>
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<tr>
<td><strong>Ethnicity</strong>: Not reported</td>
<td><strong>Intervention Diet</strong>: 14 day period recording baseline variables, W. (320 calorie), M. (380 calorie) 20% less (replacement shake). Other day’s ad lib. Repeating cycles of (approx.) 36 hr. period very low calorie, 12 hr. periods ad lib.</td>
<td>4. Peak flow, Forced expiratory flow (FEV1) QOL scores</td>
<td>Decreased levels of serum cholesterol and TAG, in markers of oxidative stress (8-isoprostane, nitro tyrosine, protein carbonyls, and 4-hydroxynonenal adducts), and increased levels of the antioxidant uric acid.</td>
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<tr>
<td><strong>Body wt.</strong>: Mean 104.9±6.2</td>
<td><strong>Retention Rate</strong>: 50%</td>
<td>5. Uric acid, lysine, histidine adducts of 4-hydroxynonenal, total protein carbonyls</td>
<td>Symptoms and pulmonary function improved, and oxidative stress and inflammation declined.</td>
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</tbody>
</table>
Table 2-3: Intermittent Fasting and Health Effects

<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Heilbronn et al. (2005) [57]</td>
<td>n=16</td>
<td>Study Design: Single intervention study (4:3)</td>
<td>1. Body weight, FM, FFM</td>
<td>Participants lost 2.5±0.5% of their initial body wt. (p&lt;0.001) and 4±1% of their baseline FM (p&lt;0.001).</td>
<td>Due to study type, it has little statistical validity.</td>
</tr>
<tr>
<td>Heilbronn et al. (2005) [58]</td>
<td></td>
<td>Duration: 22 days</td>
<td>2. Total cholesterol, LDL, HDL, TAGs,</td>
<td>FM lessened from 16.6kg (day 0) to 15.8kg (day 21) (p&lt;0.001) and FFM decreased from 53.4kg (day 0) to 52.8kg (day 21) (p&lt;0.001). Glucose reaction to a meal was slightly compromised in women after 3 weeks of intervention (p&lt;0.01). Fasting insulin reduced by 57±4% (p&lt;0.001) Men had a significant decline in insulin response (p&lt;0.03). Feelings of hunger were heightened on the first day of fasting and remained raised (p&lt;0.001). RQ fell on day 22 (p&lt;0.001), which resulted in an average daily rise in fat oxidant of ≥15 g.</td>
<td>Small sample size and no control group. Very short intervention period (22 days).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Aim: To establish if ADF is a practicable method of dietary restriction in non-obese subjects and whether it increases known biomarkers of longer life. To also assess the outcomes of 3 weeks of ADF on skeletal muscle appearance of genes which help to conduct fatty acid transport/oxidation.</td>
<td>3. Fasting glucose, fasting insulin, fasting B-hydroxybutyrate (BHBA), fasting-free fatty acids (FFA), ghrelin, Systolic BP, Diastolic BP</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Intervention Diet: 3 weeks ADF, with a &quot;feast&quot; day (day 21) and a &quot;fast&quot; day (day 22). Fast days (10–20% calories).</td>
<td>4. Hunger, RMR, RQ, fat oxidation, carbohydrate oxidation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Retention Rate: 100%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* (n=) – Number; Hisp – Hispanic; Caus – Caucasian; ADF – Alternate day fasting; RCT – Randomised controlled trial; wt.– Weight; AA – African American; BMI – Body mass index; BP – Blood pressure; CRP - C-reactive protein; FM – Fat mass; FFM – Fat free mass; wk. – Week; TAG – Triacylglyceride; PA – Physical activity; CVD – Cardiovascular disease; HF – High fat; LF – Low fat; FMD – Brachial artery flow mediated dilation; BW – Body weight; LDL – Low density lipoprotein; HDL – High density lipoprotein; IECR – Intermittent energy calorie regimen; PF – Protein/fat; DER – Daily energy restriction; IGF – Insulin-like growth factor; T Chol – Total cholesterol; LG – Large; Med. – Medium; SM – Small; BIA - Bioelectrical impedance analysis; SAT – Subcutaneous adipose tissue; IF – Intermittent fasting; IL-6 – Interleukin-6; CR – Calorie restriction; CHD – Chronic heart disease; IFCR-F – Intermittent fasting calorie restriction-food; IFCR-L- Intermittent fasting calorie restriction-food-liquid; TNF-alpha - Tumour necrosis factor-alpha; IER – Intermittent energy restriction; CER – Continuous energy restriction; HOMA - Homeostatic model assessment; BDNF - Brain-derived neurotrophic factor; AOPP - Advanced oxidation protein products; MET - Muscle energy technique; CAD – Coronary artery disease; ADFR – Alternate day calorie restriction; FEV 1 - Forced expiratory volume in one second; QOL – Quality of life; PEF – Peak expiratory flow; CR – Calorie restriction; M. – men/male; W. – women; F. – Female; BHBA - Beta-hydroxybutyrate; RMR – Resting metabolic rate; RQ - Respiratory quotient; FFA - Free fatty acids; Afri-Cari – African-Caribbean; freq. – Frequency; VAT – Visceral adipose tissue.
2.3 Cost of Dietary Plans

2.3.1 Methods Used to Determine Cost

It is a well-known fact that food choices are influenced by economic status \([6, 60, 61]\). Cade et al. reported that a higher level of adherence to a dietary plan is significantly associated with a higher level of income spent on food \([62]\). Two further studies reported that low socio-economic status usually leads to the consumption of poorer dietary choices which are generally higher in energy density \([63, 64]\). Furthermore, a study suggested that the diets of low income earners, for those who consider cost to be the major factor when sourcing food, may be higher in fat and sugar as these often equate to the cheapest sources of energy available \([65]\). Therefore cost is an important consideration when recommending any dietary plan.

There are several methods used in the literature to assess the cost of dietary plans \([61, 66-69]\), including obtaining dietary information from either Food Frequency Questionnaires (FFQ) or multiple day weighed diet records from participants. This data can be entered into an analysis programme that includes a cost per unit (usually per 100 grams), which is often obtained from online supermarket websites or instore, and can be used to determine an overall cost per day or per week \([61, 66-69]\). A household’s food expenditure can also be used but relies on gaining complete till receipt data and the ability and time to decipher receipt codes. This method can be problematic as some foods are priced per unit, and the price per 100 grams is not always clear \([8, 9]\).

An American study that examined a combination of these methods is summarised in Table 2-4 below \([9]\). The three methods used were a four day weighed diet record plus household expenditure: a four day weighed diet record plus online supermarket prices, and an FFQ plus online supermarket prices. The data from the FFQ produced a lower mean energy intake as well as a lower carbohydrate, protein and fat intake, when compared with a four day weighed diet record, suggesting this method may under-estimate intake and therefore affect total costs.
It was reported that using household food expenditure data may produce a more accurate assessment of cost, however it is difficult to extrapolate this information into actual foods eaten, and it is extremely labour intensive to link receipt data to dietary records.

Table 2-4 Daily Cost Using Three Different Methods of Analysis

<table>
<thead>
<tr>
<th>Method of Assessment</th>
<th>Range (USD)</th>
<th>Range (NZD)</th>
<th>Mean (SD) (USD)</th>
<th>Mean (SD) (NZD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 4 Day Diet Records + Household Food Expenditure</td>
<td>$2.09 - $24.90</td>
<td>$3.13 - $37.15</td>
<td>$10.04 (4.27)</td>
<td>$15.02 (6.39)</td>
</tr>
<tr>
<td>(Till Receipts)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. 4 Day Diet Records + Supermarket Prices (Via</td>
<td>$4.05 - $14.74</td>
<td>$6.06 – $22.05</td>
<td>$8.28 (2.32)</td>
<td>$12.36 (3.37)</td>
</tr>
<tr>
<td>Online Data Base)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. FFQ + Supermarket Prices (Via Online Data Base)</td>
<td>$2.03 - $18.11</td>
<td>$3.04 - $27.04</td>
<td>$7.66 (2.72)</td>
<td>$11.46 (4.07)</td>
</tr>
</tbody>
</table>

Another study involving the MED diet assessed participants’ FFQ responses and paired all individual foods with a price obtained from an instore supermarket. One to six product prices were obtained for each FFQ item and an average price per item and daily cost was calculated [65]. This seems to be a very popular method of establishing daily cost, with several other authors using the same approach [61, 69-71]. However using an FFQ to assess the cost of a diet can be difficult as it is entirely dependent on how many items the FFQ contains and if it lists foods commonly associated with the chosen dietary plan.

It is difficult to determine a daily cost of any dietary plan as it depends on the suggested items and the quantity of those items consumed. It appears that using an FFQ to record dietary intake is more commonly used when estimating cost due to the convenience compared to a multiple day weighed diet record, although it may under-estimate total cost. It has also been suggested that using expenditure data provides a more accurate assessment of cost, however this method is a very lengthy task and therefore applying costs from supermarket data may be a more appropriate method of analysis.
2.3.2 Cost Analysis of the Mediterranean Diet

There have been several studies that have investigated the cost of following a MED dietary plan \[61,65,69-71\]. The ATTICA study based in Greece assessed the cost of the Greek version of a MED diet by examining common food choices from an FFQ of over 3000 participants aged 18 years and over \[70\]. Based on data from the FFQ it was established that there was a large variation in the weekly cost of the diets, ranging from €5.35 - €83.57 EUR (NZ $9.12 - $149.24) per week in men and €10.89 - €55.49 EUR (NZ $18.56 - $94.57) per week in women \[70\]. It was also reported that based on the median cost per serving, multiplied by an interpretation of the recommended daily and/or weekly serves of each item, a total weekly cost of a MED diet was €31.20 EUR (NZ $55.17) per person per week \[70\]. This was higher than the reported mean expenditure of participants, suggesting it may not be an affordable option for more than half the population in Greece \[70\].

A further study was conducted on Canadian women (n=74) who followed a MED dietary plan \[65\]. Daily costs were assessed via an FFQ at zero (0), 12 weeks and 24 weeks and were reported as being ($8.75 CAD ($2.50)) ($10.03 ($2.87 NZD)), ($8.61 CAD ($2.13)) (NZ $9.87 ($2.44)) and ($8.84 CAD ($2.18)) (NZ $10.14 ($2.50)) per participant respectively. The change in daily cost was not statistically significant, however the individual cost of certain food items changed after 12 weeks. Increased amounts were spent on fruits and vegetables, legumes, nuts and seeds, whole grain products, low-fat dairy, olive and canola oil, poultry and fish. Participants spent less on refined grain products, red meat, sweets/desserts and fast food, which was most likely influenced by the recommendations in the dietary plan. This study tends to suggest that the MED diet is not more expensive than the participants’ usual diets.

Conversely, Lopez et al. reported a healthy MED diet was more expensive to follow when compared with a western-type diet \[71\]. This study included the diet analysis of over 17,000 participants via an FFQ, with food costs established by data from the Spanish Government \[71\]. The main finding from this study was that strictly following a MED diet was positively
associated with an increase in daily food costs (+€0.71 EUR (NZ $1.71)), whereas high adherence to a western-type diet was inversely associated with daily cost (-€0.64 EUR (NZ $1.09)) \[^{71}\]. A similar result was found in a cross-sectional study which concluded that consumers spend €1.2 EUR (NZ $2.05) more for their daily food with higher adherence to the MED diet when compared to those who had low adherence \[^{61}\].

Lastly, research conducted in New Zealand (NZ) reported that a model-based simplified low-cost MED diet for men would cost approximately $5.64 NZD per person per day \[^{67}\]. This included a reasonable proportion of fruits and vegetables and some fish, however it was limited to 14 food items. This diet was more expensive when compared to a basic NZ dietary plan that met nutritional requirements. However this study was model-based and used the NZ Food Price Index (FPI) that only includes 44 commonly used foods. Further research with actual participants and the inclusion of more MED style foods is required to determine if this cost is achievable.

Four out of the five studies assessing the MED diet suggest that following such a plan is more expensive than a typical westernised diet. The study reporting that participants’ dietary costs did not increase when implementing a MED diet may have been due to the participants including many typically MED-style foods in their usual diets. Additional research is required to substantiate these costing estimates above.

### 2.3.3 Cost Analysis of the Paleo Diet

To the best of the candidate’s knowledge only one study appears to have assessed the cost of a Paleo diet \[^{66}\]. This study used data from the United States Department of Agriculture (USDA) to estimate what Americans with low incomes spend on food and their daily nutrient intakes. It was reported that this group spends approximately $3.89 USD (NZ $5.82) per day on food. The authors proposed a Paleo model which included more calorie dense whole foods, increasing the amount of calories per 100 grams by 38.3%. Consequently the total gram
amount of food proposed fell by 27.8%. Overall food prices increased from $0.17 USD per 100 gram to $0.23 USD per 100 gram (NZ $0.25 to $0.34) due to the increased amount of animal protein included. However according to comparative data from the Thrifty Food Plan (TFP) this diet lacks some nutrients including calcium, fibre and iron. Therefore a 9.3% increase (a total of $4.25 USD (NZ $6.36)) in income would be required to purchase enough food to meet all nutritional requirements except calcium, which is to be expected given the restrictions on dairy. Currently there is no data in NZ reporting on Paleo diet cost, therefore further research is required to determine whether it is an affordable option in NZ.

2.3.4 Cost Analysis of Intermittent Fasting
To the best of the candidate’s knowledge there is currently no research regarding the cost of an IF dietary plan. This is most likely due to the fact that it focuses on the energy intakes of dieters and timing of food consumption rather than suggested individual food items. This makes it difficult to quantify the cost as this solely depends on the individual’s daily consumption. It is hypothesised that the IF plan would be cheaper than a normal western diet because less food is required during fasting days. This is however assuming that individuals do not over-compensate by consuming greater than normal intakes on non-fasting days. It is therefore of interest to examine the food choices and subsequent food costs of IF among those who follow this diet plan.

2.4 Summary
There is some evidence that these three popular diets may have beneficial effects in terms of health outcomes in humans. However only the MED diet has shown consistently positive effects in large populations. Important limitations of research examining the effects of the Paleo diet and IF include a lack of control groups, small study samples and short-term intervention periods. This makes it difficult to interpret the findings to date. In terms of cost, again only the MED diet has had a reasonable amount of research conducted into the actual
cost to consumers, and most research appears to indicate that it is an affordable dietary plan for the general population within the area’s studied. One such study was conducted in New Zealand but is lacking a full picture surrounding cost because it used a limited amount of items in its analysis. Therefore further research is required to determine the costs of these three diets in New Zealand. This research is important given that cost may influence adherence.
3 Objective Statement

The aims of this study are:

• To compare the daily cost of consuming the Mediterranean diet, the Paleo diet and Intermittent Fasting dietary plans in New Zealand.
4 Subjects and Methods

4.1 Overview

This thesis uses dietary data from the SWIFT study. SWIFT was a two year randomised parallel controlled trial based in Dunedin, New Zealand. The primary aim of this study was to assess the effectiveness of several support interventions to determine if they could aid in changing behaviour, and in turn help to promote weight loss. However, as part of the study participants were able to choose which diet and exercise plan they wished to follow rather than being assigned to specific diets. Thus Swift was a pragmatic real world trial aimed mainly at assessing the support strategies rather than the diets themselves. However it has also allowed us to examine these different dietary plans.

Once participants were screened, and completed all baseline requirements, they were given information on all the possible dietary and exercise options available. Participants were able to select one of three dietary plans: Mediterranean (MED) diet, a modified Paleo diet or Intermittent Fasting (IF); and one of two exercise plans: current NZ guidelines or high intensity interval training (HIIT). After the participants had decided which options would best suit their lifestyle, they were randomised to one of five support strategies including: control; brief support with a monthly weigh-in and meeting; daily self-weighing with a small amount of support monthly; an App (use of My Fitness Pal on the participant’s mobile); or hunger training (eating when hungry only) – each of which is followed for 12 months. For the purpose of this thesis dietary data from the first 112 participants from SWIFT has been used to analyse the cost of each of these dietary plans.

4.2 Participants

This study recruited both male and female participants by advertisements online and via written media such as flyers and newspaper articles. Inclusion criteria required participants to
be eighteen years or over, be overweight with a BMI of 27 kg/m² or greater, be currently residing in Dunedin and be planning on staying in the area during the two-year study period. Participants were excluded if they had Type One or Type Two Diabetes Mellitus (T1DM, T2DM), cardiovascular disease (CVD), endocrine disorders, inflammatory disease or who suffered from issues preventing exercise, or if they did not have access to the Internet (since one of the support groups required this).

4.3 Ethics

Ethical approval for this study was gained from the University of Otago Ethics Committee prior to the start of this project, as part of the SWIFT (Support strategies for Whole-food diets, Intermittent Fasting and Training) study (H14/024). It was also registered with the Australian New Zealand Clinical Trials Registry (ACTRN12615000010594) on 8 January 2015. Written informed consent was obtained from all participants before randomisation.

4.4 Study Design

Participants were randomised to one of four intervention groups or a control group, for a 12 month period, with a follow-up period of a further 12 months. The intervention groups included:

1) **Daily Self-weighing**: Participants were asked to weigh themselves every morning and text the SWIFT office with these values daily. They also received a monthly communication via email to discuss progress;

2) **Brief Support**: Participants were asked to visit the SWIFT office monthly where they were weighed, and received further advice and support generally lasting five to ten minutes;
(3) **Hunger Training**: Participants learned about emotional versus physical hunger, and tested their blood glucose levels before meals for the first three weeks of intervention;

(4) **Tracking**: Participants used an App (My Fitness Pal) on their smartphone (or a computer programme) to help track what they ate and how much exercise they completed;

(5) **Control Group - Usual Care**: Participants received all dietary and exercise information without any further support.

Participants were required to attend two clinic visits at each time point being baseline (0), six months, 12 months, and 24 months to assess a range of outcomes presented in the Table 4-1 below.

| Table 4-1 Timing of Outcome Measures for Participants Involved in the SWIFT Study |
|-----------------------------------------------|---|---|---|---|
| **Outcome**                                | **Month** |            |            |            |
|                                              | 0 (Baseline) | 6 | 12 | 24 |
| Weight                                      | ✓            | ✓ | ✓ | ✓ |
| Height                                      | ✓            |   |   |   |
| Bio-Impedance                               | ✓            | ✓ | ✓ | ✓ |
| Dual-Energy X-ray Absorptiometry (DXA Scan)  | ✓            |   |   |   |
| Blood Pressure                              | ✓            | ✓ | ✓ | ✓ |
| Blood Samples                               | ✓            | ✓ | ✓ | ✓ |
| 3 - 4 Day Diet Records                      | ✓            | ✓ | ✓ | ✓ |
| Accelerometry                               | ✓            | ✓ | ✓ | ✓ |
| Aerobic Fitness                             | ✓            | ✓ | ✓ | ✓ |
| Questionnaires                              | ✓            | ✓ | ✓ | ✓ |

4.5 **Diet and Exercise Plans**

Guidelines were given to participants to provide a brief overview of the dietary plans (see Appendix A). This outlined what the diet involved, foods to include or exclude, some recipes and a seven-day example meal plan. The three plans were outlined with the following information:
(1) The Mediterranean (MED) diet centred on larger amounts of fruit and vegetables, whole-grains, nuts and seeds, moderate amounts of fish, seafood, chicken, eggs and dairy, and only small amounts of meat and sweet based foods. Brief information on potential health effects was included as well as the Healthy Eating Pyramid (Department of Nutrition, Harvard School of Public Health) which is modelled on the MED diet. The booklet also contained meal ideas for breakfast, lunch and dinner and included foods such as avocado, beans, lentils and certain fruit. Ideas to easily increase the participant’s intake of wholegrain foods and vegetables and to reduce sugar in the diet were also included.

(2) The Modified Paleo diet allowed meat, vegetables, fruit, nuts and seeds and some oils. This modified version also allowed limited amounts of cheese and yoghurt and some legumes including beans and lentils. Foods that were not allowed were grains from bread and cereals, sugars in baked goods and highly processed oils. The information booklet included a traffic light guide with red, orange and green colours for foods that were recommended to eat mostly, eat sometimes and eat none respectively. It also contained meal ideas for breakfast, lunch and dinner and substitutions and advice to avoid grain products for those who find this difficult to achieve.

(3) The Intermittent Fasting (IF) plan allowed participants to eat normally for five days, then severely restrict food intake to 25% of usual intake (male 600 kcal, female 500 kcal per day) on two days per week. On fasting days participants could make up their calories with any type of food they desired. The information provided contained hints for fasting days and how to convert kilojoules (kJ) into calories. It also contained low kJ recipes, with the total amount of energy they contained listed. The booklet also contained ten days of restricted energy meal plans (600 kJ for males; 500 kJ for females) and 21 recipe
ideas for those who were unsure about would they should eat during the fasting days in order to adhere to the energy restriction.

Participants also received guidelines regarding the exercise options they were required to choose between. They were:

1. **Current New Zealand exercise guidelines** which recommends that participants engage in a minimum of 30 minutes of moderate intensity physical exercise each day. Typical activities suggested were walking, gardening or exercise classes but no mention was made of high intensity activities;

2. **Home based high intensity interval training (HIIT)** which involved a single one hour training programme and medical examination. Exercise plans were based on fitness levels and typically included three to 10 intervals of 10 seconds to four minutes of high intensity exercise aimed at raising the participants’ heart rate to 80 – 90% of their estimated maximum rate.

### 4.6 Dietary Records and Analysis

Participants were required to complete a three day diet record which included two week days and one weekend day at baseline (0), six months, 12 months and 24 months. An exception to this was that participants who chose to follow the IF dietary plan were required to complete a four day weighed diet record which included two fasting days and two non-fasting days. However it was decided that only two non-fasting days and one fasting day were to be used in the analysis to provide a better example of any given week.

For the purpose of this thesis the six month diet records were used to estimate the food cost of the diets. Participants were given written and verbal instructions on how to complete the weighed diet records. They were asked to record the time of day when food was consumed,
name and cooking method of food or drink, brand name, weight of plate/mug, and weight of plate/mug and food/drink.

Detailed instructions were also given on how best to describe recipes with the name, amount of each ingredient including liquids, cooking method, proportion of the recipe eaten, and time of day served. The diet record also included estimation guidelines on how best to describe foods with household measures, weights from packaged foods, using a ruler for foods with a length, width and depth, thickness of foods such as bread, and small, medium or large estimates for fruit. An example record sheet was provided with an additional note on reporting additions to food or drink such as milk, sugar, spreads or herbs and spices. Participants were provided with dietary scales (Salter Electronic, Salter Housewares Ltd, Kent, UK) accurate to within ± 1 gram, to weigh food and drink items.

A researcher reviewed all diet records on return for completeness. These checks included making sure that all details were correctly recorded including the day, dates and fasting days, amount eaten or able to be calculated from the given data, type of milk or beverages consumed, supplements taken and recipes used, as well as noting any missing data such as product name when only the brand name was given. If this information was not completed correctly the participant was contacted to confirm data.

All diet records were analysed for energy and nutrient intake using the dietary analysis programme, Kai-culator (Version v1.12s, 2010 - 2015, Department of Human Nutrition, University of Otago). Two trained researchers manually entered food record data into Kai-culator during the months of July to October 2015. To ensure consistency in data entry decisions and substitutions, both researchers checked each other’s diet records after completion. All assumptions and substitutions were recorded in an online spreadsheet, which was reviewed and updated daily. Kai-culator also contains information on the cost of food item per 100 grams, which has either been obtained from an online supermarket shopping
website (Countdown, NZ) or instore. The majority of the costing data was entered by a trained researcher prior to this study. Any incomplete data was completed via the same online supermarket search (Countdown, NZ) by the candidate.

4.6.1 Method of Gaining Food Costs
As mentioned above the majority of food costs were entered into Kai-culator as part of another research project at the University of Otago prior to this research project. The cost information was derived from a single major supermarket outlet (Countdown) as it was the only supermarket within New Zealand that provided an online shopping website. Instore prices were gained from a local Dunedin Countdown supermarket. By choosing a local outlet it provided a more accurate assessment of the participants’ actual spending because they were most likely to shop within the local area. Seasonal variation was also taken into account with prices being obtained during the months of May and August 2014 and February 2015. If a price was not available online, a price per 100 grams was obtained instore. If a fruit or vegetable was priced as a unit price rather than a price per kilo, an average weight was established by weighing five randomly selected items, and a price per item was then calculated based on this average. If an item was recorded in a prepared method such as skin removed or a cooked weight, conversion factors were used to convert items back to a raw weight. The researcher had to estimate some costs when either an item weight was not recorded or if an itemised recipe was not given in order to determine individual food weights. If a brand of item was not specified such as an apple, an average price of apples was used.

On completion of the diet record entry into Kai-culator a list with all unknown costs of food items was established. The price and weight for these items was either found online via the Countdown shopping website or instore (Countdown, Mount Maunganui as the candidate was based in the region). Fast food items were sourced from fast-food chains’ websites or established by contacting the local store (Mount Maunganui). A conversion factor (USDA,
2003) along with the prices and weights was then used to calculate a cost per 100 grams. Once the individual item cost (per 100 grams) was assigned to all foods the cost of each dietary plan was established and reported as a daily cost to consumers.

4.7 Statistical Analysis

Participant baseline data for the whole SWIFT study (n=250) was analysed through the spreadsheet software programme Microsoft Excel to gain a sum, range, mean and standard deviation (SD) for all appropriate variables. Participants who had not yet completed their six month dietary records were deleted from the overall sample and this sample (n=112) was re-analysed to provide further results, again providing a sum, range, mean and SD for all appropriate values. Further analysis was conducted on the participants’ waist circumference measurements to provide an individual value for both men and women.

Once food records were entered into Kai-culator, mean values for energy and macronutrient content were determined for each participant. Excel was then used to calculate a range and a mean value (SD) for the data set. Individual diet ranges and an average value (SD) were calculated for each of the three diets assessed - the MED diet, Paleo diet and IF. Once a cost per 100 grams was established for each day of diet record for each participant, calculations through Excel were conducted. A range, mean and SD was calculated for the total sample, the individual diets, the individual diets by sex, and the IF plan, for both fasting and non-fasting days.

Differences in mean cost per day were calculated using a one-way analysis of variance (ANOVA), with Bonferronni’s post-hoc tests for differences between groups if the overall trend was P < 0.05.
5 Results

5.1 Participants

5.1.1 Population Characteristics (SWIFT Overall)
The characteristics of the SWIFT study participants are presented in Table 5-1. There were a total of 250 participants included in this baseline analysis. There were fewer male than female participants recruited, however weight loss trials generally contain all women or a very small proportion of men, therefore the inclusion of 38% males in the total population allowed us to investigate outcomes in both sexes. The majority of participants were reported to be of NZ European descent, with a smaller proportion being of Māori, Asian or Pacific Island descent.

Table 5-1 Characteristics of SWIFT Study Participants (n=250)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>Male</td>
<td>95 (38.0)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>155 (62.0)</td>
</tr>
<tr>
<td>Education</td>
<td>School only</td>
<td>49 (19.6)</td>
</tr>
<tr>
<td></td>
<td>Post-secondary</td>
<td>63 (25.2)</td>
</tr>
<tr>
<td></td>
<td>University</td>
<td>138 (55.2)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td>NZEO</td>
<td>220 (88.0)</td>
</tr>
<tr>
<td></td>
<td>Māori</td>
<td>18 (7.2)</td>
</tr>
<tr>
<td></td>
<td>Pacific</td>
<td>7 (2.8)</td>
</tr>
<tr>
<td></td>
<td>Asian</td>
<td>5 (2.0)</td>
</tr>
<tr>
<td>Employment</td>
<td>Full-time</td>
<td>177 (70.8)</td>
</tr>
<tr>
<td></td>
<td>Part-time</td>
<td>51 (20.4)</td>
</tr>
<tr>
<td></td>
<td>Not employed</td>
<td>13 (5.2)</td>
</tr>
<tr>
<td></td>
<td>Not answered</td>
<td>9 (3.6)</td>
</tr>
<tr>
<td>Age (years)</td>
<td>20.3 - 73.9</td>
<td>43.7 (11.0)</td>
</tr>
<tr>
<td>Body Mass Index (kg/m²)</td>
<td>26.9 - 48.8</td>
<td>33.0 (4.4)</td>
</tr>
<tr>
<td>Waist Circumference Overall (cm)</td>
<td>73.4 – 138.4</td>
<td>101.5 (12.5)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>73.4 – 132.9</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>86.6 – 138.4</td>
</tr>
<tr>
<td>Body Fat Percentage (%)</td>
<td>22.5 – 53.4</td>
<td>40.0 (7.3)</td>
</tr>
<tr>
<td>Fasting Glucose (units)</td>
<td>3.6 - 7.2</td>
<td>5.5 (0.7)</td>
</tr>
<tr>
<td>Systolic Blood Pressure (mmHg)</td>
<td>91.0 – 189.0</td>
<td>123.9 (15.4)</td>
</tr>
<tr>
<td>Diastolic Blood Pressure (mmHg)</td>
<td>50.5 – 113.0</td>
<td>78.6 (9.9)</td>
</tr>
</tbody>
</table>

44
Over half the participants were university educated and the majority were in full time employment. The average age of participants was approximately 44 years, with an approximate age range of 20 to 74 years. The participants had a mean percentage body fat mass of 40% and an average BMI of 33 kg/m$^2$. The mean waist circumference for men was 108.7 cm, and 97.0 cm for women. The participants had a maximum fasting glucose level of 7.2 (indicating that they were non-diabetic) and had an average systolic BP of around 124 mmHg.

5.1.2 Participant Characteristics (Sample)

The participant sample used for this thesis (n=112) is shown in Table 5-2. All subsequent results relate to this cohort analysis unless otherwise stated.

Table 5-2: Characteristics of SWIFT Study Participants Sample (n=112)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Category</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sex</strong></td>
<td>Male</td>
<td>45 (40.2)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>67 (59.8)</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td>School only</td>
<td>25 (22.3)</td>
</tr>
<tr>
<td></td>
<td>Post-secondary</td>
<td>22 (19.7)</td>
</tr>
<tr>
<td></td>
<td>University</td>
<td>65 (58.0)</td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td>NZEO</td>
<td>99 (88.4)</td>
</tr>
<tr>
<td></td>
<td>Māori</td>
<td>10 (8.9)</td>
</tr>
<tr>
<td></td>
<td>Pacific</td>
<td>0 (0.0)</td>
</tr>
<tr>
<td></td>
<td>Asian</td>
<td>3 (2.7)</td>
</tr>
<tr>
<td><strong>Employment</strong></td>
<td>Full-time</td>
<td>84 (75.0)</td>
</tr>
<tr>
<td></td>
<td>Part-time</td>
<td>19 (17.0)</td>
</tr>
<tr>
<td></td>
<td>Not employed</td>
<td>7 (6.2)</td>
</tr>
<tr>
<td></td>
<td>Not answered</td>
<td>2 (1.8)</td>
</tr>
<tr>
<td><strong>Age (years)</strong></td>
<td>Minimum - Maximum</td>
<td>21.6 - 73.9</td>
</tr>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>45.9 (11.8)</td>
</tr>
<tr>
<td><strong>Weight (kg)</strong></td>
<td>Minimum - Maximum</td>
<td>70.1 - 148.1</td>
</tr>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>94.7 (15.9)</td>
</tr>
<tr>
<td><strong>Height (cm)</strong></td>
<td>Minimum - Maximum</td>
<td>152.0 - 189.6</td>
</tr>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>170.1 (9.7)</td>
</tr>
<tr>
<td><strong>Body Mass Index (kg/m$^2$)</strong></td>
<td>Minimum - Maximum</td>
<td>26.9 - 48.2</td>
</tr>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>32.7 (4.4)</td>
</tr>
<tr>
<td><strong>Waist Circumference Overall (cm)</strong></td>
<td>Minimum - Maximum</td>
<td>73.4 - 138.4</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>73.4 - 129.5</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>86.6 - 138.4</td>
</tr>
<tr>
<td><strong>Fasting Glucose (units)</strong></td>
<td>Minimum - Maximum</td>
<td>3.8 - 7.1</td>
</tr>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>5.7 (0.6)</td>
</tr>
<tr>
<td><strong>Systolic Blood Pressure (mmHg)</strong></td>
<td>Minimum - Maximum</td>
<td>93.0 - 189.0</td>
</tr>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>125.2 (15.9)</td>
</tr>
<tr>
<td><strong>Diastolic Blood Pressure (mmHg)</strong></td>
<td>Minimum - Maximum</td>
<td>56.5 - 113.0</td>
</tr>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>78.3 (9.5)</td>
</tr>
</tbody>
</table>
This cohort was generally representative of the total SWIFT study population, with a small difference in ethnicity (no Pacific Island participants). As was observed in the total population, this study sample weighed around 95 kg on average, with a BMI of 32.8 kg/m^2.

5.2 Diet and Exercise

5.2.1 Dietary and Exercise Plans Chosen By Participants (SWIFT Overall)

Table 5-3 shows the dietary and exercise choices of participants in the overall SWIFT study. The most popular dietary plan chosen was Intermittent Fasting (IF) with around 54% of the total sample, followed by the Mediterranean (MED) diet with around 27%, and the Paleo-type diet with around 18%. Once the participants had chosen their dietary plan, they were randomised evenly to one of five interventions (shown below) to be able to provide equally weighted comparisons between groups. The participants also nominated their preferred exercise plan, with 145 (58%) selecting the current NZ guidelines and 105 (42%) selecting the high intensity interval training programme (HIIT).

Table 5-3 Number of Participants Following Dietary and Intervention Plans (n=250)

<table>
<thead>
<tr>
<th>Dietary plan</th>
<th>App</th>
<th>Hunger</th>
<th>Self Weigh</th>
<th>Brief Support</th>
<th>Control</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mediterranean Diet</td>
<td>13</td>
<td>17</td>
<td>14</td>
<td>13</td>
<td>11</td>
<td>68 (27.2)</td>
</tr>
<tr>
<td>Modified Paleo Diet</td>
<td>10</td>
<td>9</td>
<td>8</td>
<td>10</td>
<td>9</td>
<td>46 (18.4)</td>
</tr>
<tr>
<td>Intermittent Fasting</td>
<td>27</td>
<td>24</td>
<td>29</td>
<td>28</td>
<td>28</td>
<td>136 (54.4)</td>
</tr>
</tbody>
</table>

5.2.2 Dietary and Exercise Plans Chosen By Participants

The participant sample (n=112) investigated in this thesis reported similar ratios in respect of the dietary plans chosen, shown in Table 5-4 below. Fewer participants chose the Paleo diet (around 14% of the sample), with slightly more choosing to follow an IF plan (57.1%), and around 29% of the sample selecting a MED dietary plan. Thirty-four females and 30 males chose to follow the IF plan, 23 females and nine males selected the MED diet, and 10 females and six males selected the Paleo dietary plan. This sample included the first 112 who had
completed their multiple day diet records, and therefore the sample is limited for those who followed a Paleo diet. The preferred exercise plan was similar to the preferred plan in the overall SWIFT study, with 66 (58.9%) following the current NZ guidelines and 46 (41.1%) choosing to follow the HIIT exercise plan.

Table 5-4 Number of Participants Following Dietary and Intervention Plans Sample (n=112)

<table>
<thead>
<tr>
<th>Dietary plan</th>
<th>App</th>
<th>Hunger</th>
<th>Self Weigh</th>
<th>Brief Support</th>
<th>Control</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mediterranean Diet</td>
<td>6</td>
<td>8</td>
<td>7</td>
<td>7</td>
<td>4</td>
<td>32 (28.6)</td>
</tr>
<tr>
<td>Modified Paleo Diet</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>4</td>
<td>3</td>
<td>16 (14.3)</td>
</tr>
<tr>
<td>Intermittent Fasting</td>
<td>15</td>
<td>6</td>
<td>16</td>
<td>11</td>
<td>16</td>
<td>64 (57.1)</td>
</tr>
</tbody>
</table>

5.3  Multiple Day Diet Records

5.3.1  Energy and Macronutrients Overall
Table 5-5 shows the mean energy intake and macronutrient intakes from the first 112 diet records collected from the SWIFT study participants. The comparison of dietary intakes of these diets is the focus of another MDiet, and so is only briefly described here.

Table 5-5 Total Energy and Macronutrient Intake From Multiple Day Diet Records (n=112), by Sex

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Minimum – Maximum</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Energy Overall (kJ)</td>
<td>753 – 25048</td>
<td>7222 (4035)</td>
</tr>
<tr>
<td>- Women</td>
<td>1375 – 15991</td>
<td>6417 (2922)</td>
</tr>
<tr>
<td>- Men</td>
<td>753 – 25048</td>
<td>8411 (5046)</td>
</tr>
<tr>
<td>Protein Overall (g)</td>
<td>5.3 – 272.2</td>
<td>75.1 (37.8)</td>
</tr>
<tr>
<td>- Women</td>
<td>8.5 – 154.5</td>
<td>67.9 (26.7) (18.0% TE)</td>
</tr>
<tr>
<td>- Men</td>
<td>5.3 – 272.2</td>
<td>85.8 (48.0) (17.3% TE)</td>
</tr>
<tr>
<td>Fat Overall (g)</td>
<td>1.5 – 325.3</td>
<td>75.7 (52.5)</td>
</tr>
<tr>
<td>- Women</td>
<td>4.9 – 214.2</td>
<td>67.8 (37.6) (39.1% TE)</td>
</tr>
<tr>
<td>- Men</td>
<td>1.5 – 325.3</td>
<td>87.4 (67.3) (38.5% TE)</td>
</tr>
<tr>
<td>CHO Overall (g)</td>
<td>0.7 – 572.1</td>
<td>178.6 (109.0)</td>
</tr>
<tr>
<td>- Women</td>
<td>3.6 – 495.4</td>
<td>157.6 (88.6) (41.8% TE)</td>
</tr>
<tr>
<td>- Men</td>
<td>0.7 – 572.1</td>
<td>209.4 (127.8) (42.3% TE)</td>
</tr>
<tr>
<td>Fibre Overall (g)</td>
<td>0.0 – 62.5</td>
<td>21.6 (11.4)</td>
</tr>
<tr>
<td>- Women</td>
<td>4.1 – 50.6</td>
<td>19.5 (8.8)</td>
</tr>
<tr>
<td>- Men</td>
<td>0.0 – 62.5</td>
<td>24.6 (13.8)</td>
</tr>
</tbody>
</table>
The range of intakes for all nutrients listed above varied considerably, with men recording an especially large variation in energy intakes. The mean protein intake for women was 67.9 grams (18.0% TE) and 85.8 grams (17.3% TE) for men, with an overall average intake of 75.1 grams. The mean fat intake was 67.8 grams (39.1% TE) for females and 87.4 grams (38.5% TE) for males, which appears fairly high. The mean carbohydrate amount consumed daily was 157.6 grams (41.8% TE) for females and 209.5 grams (42.3%) for males, which provided an average intake of 178.6 grams per day overall.

### 5.3.2 Mediterranean Diet

Table 5-6 shows the total energy (TE) and macronutrient distribution from 32 participants following the MED dietary plan.

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Minimum – Maximum</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Energy Overall (kJ)</strong></td>
<td>1914 – 18561</td>
<td>7531 (3143)</td>
</tr>
<tr>
<td>- Women</td>
<td>1914 – 11793</td>
<td>6604 (2164)</td>
</tr>
<tr>
<td>- Men</td>
<td>3939 – 18561</td>
<td>9900 (3787)</td>
</tr>
<tr>
<td><strong>Protein Overall (g)</strong></td>
<td>24.4 – 188.0</td>
<td>81.9 (33.2) (18.5% TE)</td>
</tr>
<tr>
<td>- Women</td>
<td>24.4 – 130.8</td>
<td>73.9 (24.0) (19.0% TE)</td>
</tr>
<tr>
<td>- Men</td>
<td>44.4 – 188.0</td>
<td>102.4 (41.7) (17.6% TE)</td>
</tr>
<tr>
<td><strong>Fat Overall (g)</strong></td>
<td>18.7 – 264.8</td>
<td>76.2 (43.2) (37.4% TE)</td>
</tr>
<tr>
<td>- Women</td>
<td>18.7 – 159.0</td>
<td>67.1 (31.4) (37.6% TE)</td>
</tr>
<tr>
<td>- Men</td>
<td>25.2 – 264.8</td>
<td>99.4 (58.3) (37.2% TE)</td>
</tr>
<tr>
<td><strong>CHO Overall (g)</strong></td>
<td>32.5 – 528.9</td>
<td>191.9 (85.7) (43.3% TE)</td>
</tr>
<tr>
<td>- Women</td>
<td>32.5 – 345.4</td>
<td>168.0 (63.7) (43.3% TE)</td>
</tr>
<tr>
<td>- Men</td>
<td>88.3 – 528.9</td>
<td>253.0 (100.0) (43.4% TE)</td>
</tr>
<tr>
<td><strong>Fibre Overall (g)</strong></td>
<td>4.1 – 62.5</td>
<td>24.6 (11.5)</td>
</tr>
<tr>
<td>- Women</td>
<td>4.1 – 50.2</td>
<td>21.5 (8.5)</td>
</tr>
<tr>
<td>- Men</td>
<td>10.7 – 62.5</td>
<td>32.6 (13.8)</td>
</tr>
</tbody>
</table>

The TE of participants following the MED diet was higher than the average means, especially in males who recorded a mean TE 17.7% above the average mean for males overall. The mean protein for females was around one percent higher than the average total mean (n=112), however males had similar intakes to the overall sample. The percentage of total energy from
fat was slightly less than the overall sample (1.5% less for females; 1.3% less for males). The mean carbohydrate intake was slightly higher in both males (1.2%) and females (1.5%) when compared to the overall total means stated above (Table 5.5). The MED dietary group reported a larger mean value for both sexes from fibre intake compared with the overall sample, with females consuming an average of 21.5 grams and males consuming an average of 32.6 grams per day. Again, this was not the main focus of this thesis but provides information on the nutrient composition of the diets which may then in turn influence cost.

5.3.3 Paleo Diet

Table 5-7 shows the total energy (TE) and macronutrient content from the modified Paleo diet used in the SWIFT study.

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Minimum – Maximum</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Energy Overall (kJ)</td>
<td>2772 – 14230</td>
<td>7173 (2706)</td>
</tr>
<tr>
<td>- Women</td>
<td>2772 – 14230</td>
<td>6502 (2730)</td>
</tr>
<tr>
<td>- Men</td>
<td>3522 – 13434</td>
<td>8255 (2441)</td>
</tr>
<tr>
<td>Protein Overall (g)</td>
<td>26.5 – 166.1</td>
<td>79.9 (30.6) (18.9% TE)</td>
</tr>
<tr>
<td>- Women</td>
<td>41.3 – 126.9</td>
<td>74.0 (22.7) (19.4% TE)</td>
</tr>
<tr>
<td>- Men</td>
<td>26.5 – 166.1</td>
<td>89.5 (39.9) (18.4% TE)</td>
</tr>
<tr>
<td>Fat Overall (g)</td>
<td>22.0 – 203.1</td>
<td>88.4 (40.0) (45.6% TE)</td>
</tr>
<tr>
<td>- Women</td>
<td>28.8 – 174.3</td>
<td>83.7 (41.5) (47.6% TE)</td>
</tr>
<tr>
<td>- Men</td>
<td>22.0 – 203.1</td>
<td>96.0 (38.6) (43.0% TE)</td>
</tr>
<tr>
<td>CHO Overall (g)</td>
<td>30.0 – 462.9</td>
<td>144.0 (88.3) (34.1% TE)</td>
</tr>
<tr>
<td>- Women</td>
<td>30.0 – 462.9</td>
<td>119.1 (94.9) (31.1% TE)</td>
</tr>
<tr>
<td>- Men</td>
<td>66.2 – 333.3</td>
<td>184.1 (62.8) (37.9% TE)</td>
</tr>
<tr>
<td>Fibre Overall (g)</td>
<td>8.7 – 50.6</td>
<td>23.5 (10.5)</td>
</tr>
<tr>
<td>- Women</td>
<td>8.7 – 50.6</td>
<td>21.6 (10.1)</td>
</tr>
<tr>
<td>- Men</td>
<td>9.2 – 48.5</td>
<td>26.4 (11.0)</td>
</tr>
</tbody>
</table>

This group had a reasonably small sample size (n=16) however it was still representative of the overall SWIFT study. The three means for energy intake from the Paleo diet group were very similar to those of the overall sample (within 200 kJ difference). The mean protein intake of women was 1.4% greater than the total sample. The proportion of fat from the total energy
was 8.5% higher than the overall average. There was a large difference between male and female carbohydrate intake, with females reporting significantly less than males (31.1%; 37.9%, respectively).

### 5.3.4 Intermittent Fasting

The final sample assessed for dietary intake in the SWIFT study was for those participants following the IF plan shown below (Table 5-8).

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Minimum – Maximum</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Energy Overall (kJ)</strong></td>
<td>753 – 25048</td>
<td>7080 (4668)</td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>1375 – 15991</td>
</tr>
<tr>
<td></td>
<td>Men</td>
<td>753 – 25048</td>
</tr>
<tr>
<td><strong>Fasting Day</strong></td>
<td>753 – 22490</td>
<td>4296 (3878)</td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>1375 – 9574</td>
</tr>
<tr>
<td></td>
<td>Men</td>
<td>753 – 22490</td>
</tr>
<tr>
<td><strong>Non-Fasting Day</strong></td>
<td>1999 – 25048</td>
<td>8590 (4402)</td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>2653 – 15991</td>
</tr>
<tr>
<td></td>
<td>Men</td>
<td>1999 – 25048</td>
</tr>
<tr>
<td><strong>Protein Overall (g)</strong></td>
<td>5.3 – 272.2</td>
<td>70.5 (41.0)</td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>8.5 – 154.5</td>
</tr>
<tr>
<td></td>
<td>Men</td>
<td>5.3 – 272.2</td>
</tr>
<tr>
<td><strong>Fat Overall (g)</strong></td>
<td>1.5 – 325.3</td>
<td>72.4 (58.7)</td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>4.9 – 214.2</td>
</tr>
<tr>
<td></td>
<td>Men</td>
<td>1.5 – 325.3</td>
</tr>
<tr>
<td><strong>CHO Overall (g)</strong></td>
<td>0.7 – 572.1</td>
<td>180.4 (121.9)</td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>3.6 – 495.4</td>
</tr>
<tr>
<td></td>
<td>Men</td>
<td>0.7 – 572.1</td>
</tr>
<tr>
<td><strong>Fibre Overall (g)</strong></td>
<td>0.0 – 58.6</td>
<td>19.6 (11.2)</td>
</tr>
<tr>
<td></td>
<td>Women</td>
<td>4.9 – 45.1</td>
</tr>
<tr>
<td></td>
<td>Men</td>
<td>0.0 – 58.6</td>
</tr>
</tbody>
</table>

Table 5-8 Total Energy and Macronutrient Intake From Multiple Day Diet Records – Intermittent Fasting (n=64), by Sex

This dietary group contained the most participants in this sample (n=64) but was proportionally representative of the total population of SWIFT. Total energy of this diet was lower than the average for the whole sample, which is not surprising since one out of three days was a fasting day and should have consisted of one quarter of the participants’ regular energy intake (around 500 kJ for women; 600 kJ for men). Mean energy intake of a fasting
day was half of that of a non-fasting day. Men recorded a slightly higher energy intake than women on fasting days, however they recorded a considerable difference (an increase of 2383 kJ) in the mean energy intake on non-fasting days. Mean carbohydrate intake was higher in females compared with males, mean fat intake was slightly higher in males than females, and both sexes reported similar intakes for protein. The IF participants recorded averages for fibre of 17.5 grams (females) and 21.9 grams (males), which were both lower than the overall sample mean (n=112).

5.4 Cost

5.4.1 Overall Diet Cost
A cost analysis was conducted based on the results from the multiple day weighed diet records which are summarised in Table 5-9 below. All costs in this section are in NZD unless otherwise stated. A total cost was calculated from the 112 diet records available from the SWIFT study, and included 331 days of diet records. The mean cost of food per day was $10.91 (SD $6.14). On average men spent $2.37 per day more than women, which is approximately $16.60 more a week. The sample produced a large range of daily costs ranging from $1.37 to $39.09 per day.

5.4.2 Mediterranean Diet
The MED diet participants provided a total of 96 days data for the cost analysis, which was twice the amount of days recorded for the Paleo. The means for cost in each sex differed by $4.16, as men spent on average an additional $29.12 per week to adhere to this dietary plan. The overall mean cost for this diet was $11.27 (SD $5.70) per day, which is approximately $79.00 per week.
5.4.3 Paleo Diet

The Paleo diet had the least amount of participants and therefore only provided 47 days in total for this analysis. The analysis produced the highest mean cost ($12.85 (SD $5.43)) compared with the other two dietary plans, with females tending to spend more than males. This equates to a mean total weekly cost of $90.00. Females spent on average $1.24 more per day than males to adhere to this dietary plan, being $8.68 more per week.

### Table 5-9 Daily Cost (NZD) of Mediterranean Diet, Paleo Diet and Intermittent Fasting, by Sex

<table>
<thead>
<tr>
<th></th>
<th>Minimum - Maximum</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Cost</td>
<td>1.37 – 39.09</td>
<td>10.91 (6.14)</td>
</tr>
<tr>
<td>- Women</td>
<td>1.37 – 27.88</td>
<td>9.93 (5.42)</td>
</tr>
<tr>
<td>- Men</td>
<td>1.55 – 39.09</td>
<td>12.30 (6.82)</td>
</tr>
<tr>
<td>Mediterranean Diet</td>
<td>3.43 – 27.88</td>
<td>11.27 (5.70)</td>
</tr>
<tr>
<td>- Women</td>
<td>3.43 – 27.88</td>
<td>10.10 (5.01)</td>
</tr>
<tr>
<td>- Men</td>
<td>3.93 – 26.05</td>
<td>14.26 (6.32)</td>
</tr>
<tr>
<td>Paleo Diet</td>
<td>3.07 – 26.18</td>
<td>12.85 (5.43)</td>
</tr>
<tr>
<td>- Women</td>
<td>5.82 – 26.18</td>
<td>13.33 (5.57)</td>
</tr>
<tr>
<td>- Men</td>
<td>3.07 – 22.85</td>
<td>12.09 (5.25)</td>
</tr>
<tr>
<td>Intermittent Fasting</td>
<td>1.37 – 39.09</td>
<td>10.22 (6.40)</td>
</tr>
<tr>
<td>- Women</td>
<td>1.37 – 24.66</td>
<td>8.84 (5.27)</td>
</tr>
<tr>
<td>- Men</td>
<td>1.55 – 39.09</td>
<td>11.76 (7.18)</td>
</tr>
<tr>
<td>Fasting Day</td>
<td>1.37 – 21.47</td>
<td>6.38 (3.91)</td>
</tr>
<tr>
<td>- Women</td>
<td>1.37 – 12.14</td>
<td>5.97 (2.61)</td>
</tr>
<tr>
<td>- Men</td>
<td>1.55 – 21.47</td>
<td>6.84 (4.81)</td>
</tr>
<tr>
<td>Non-Fasting Day</td>
<td>2.63 – 39.09</td>
<td>12.06 (6.55)</td>
</tr>
<tr>
<td>- Women</td>
<td>2.63 – 24.66</td>
<td>10.24 (5.60)</td>
</tr>
<tr>
<td>- Men</td>
<td>2.84 – 39.09</td>
<td>14.10 (6.96)</td>
</tr>
</tbody>
</table>

1. All values are NZD

5.4.4 Intermittent Fasting

The multiple day weighed diet records from the IF group produced the largest amount of days’ data that contributed to the costing analysis, with a total 191 days that included 129 non-fasting days and 62 fasting days. An overall daily amount of $10.22 was spent on
following the IF diet, which was equivalent to a weekly spend of $71.50. Men had a much greater range than that of women, and men spent an average of $2.92 more than women when following this intervention. Females therefore spent on average $20.44 less on their weekly shopping bill following this diet, when compared to the male participants.

There was a $37.72 difference between the highest and lowest daily cost of the IF plan, which was the largest range of all three dietary interventions. Fasting women reported the lowest mean cost ($5.97 per day), while non-fasting men reported a mean value ($14.10 per day) above the average overall for IF participants. If subjects followed the 5:2 weekly plan according to these results, it would cost women a mean value of $63.14 per week and men a mean value of $84.18 per week, which is cheaper than the respective outcomes in the other two dietary plans.

Fasting and non-fasting days of those following an IF plan differed significantly in terms of cost ($p<0.001), with a fasting day costing just under half ($6.38) than that of a non-fasting day ($12.06).

5.4.5 Comparison of Cost Between Dietary Plans
There was no significant cost difference between the three dietary plans ($p=0.082), however the trend indicates that following the IF plan was the cheapest, followed by the MED diet and then Paleo. The mean cost for the Paleo diet was $2.63 per day ($18.41 per week) more than the average cost of following the IF plan, and $1.58 per day ($11.06 per week) more than the MED diet. The IF plan cost $1.05 (or $7.35 per week) less than the MED dietary plan.

Figure 1 below shows the spread of cost data from the multiple day weighed dietary records of the SWIFT study (n=112). The means per day for the three dietary plans were as follows; IF plan $10.22; Paleo diet $12.85 and the MED diet $11.27 per day. The ranges for the three plans were $1.37 to $39.09 (IF); $3.07 to $26.18 (Paleo) and $3.43 to $27.88 (MED). It
shows that the IF dietary plan had a greater range of costings when compared to the MED or Paleo diet. There are also several outliers above the box and whisker plot for the MED diet, which shows these values were not typical of the rest of the data spread. The distribution of IF costs were skewed to the right.

Figure 1 Cost of the Intermittent Fasting Plan, Mediterranean Diet and Paleo Diet

<table>
<thead>
<tr>
<th>Diet Number</th>
<th>Cost ($) NZD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. IF Diet</td>
<td></td>
</tr>
<tr>
<td>2. MED Diet</td>
<td></td>
</tr>
<tr>
<td>3. Paleo Diet</td>
<td></td>
</tr>
</tbody>
</table>

Figure 2 below shows the average costs of the MED diet, Paleo diet, and the IF plan as well as the overall average cost for both men and women. The least expensive diet based on the overall average (combined both sexes) was the IF plan, followed by the MED diet, and the Paleo diet was the most expensive. It shows that men reported spending more money on average than women in all the dietary plans except the Paleo, where women spent a greater average amount. Men did however have smaller sample sizes in both the Paleo (n=6) and the MED (n=9) diets. The table also shows than men spent more on the MED dietary plan compared with the IF and Paleo plans. However women spent less when following the IF plan.
compared with the other two plans, and spent more when following a Paleo plan. The average cost of the IF plan best represented that of the total average cost gained from the diet records.

Figure 2 Costs of Dietary Plans from Multiple Day Diet Records per Day, by Sex
6 Discussion

To the best of the candidate’s knowledge this is the first study to compare the costs of the MED diet, Paleo diet and IF plan. The most important finding from this study was that there was no significant difference between the daily costs of all three diets, however there was a significant difference between the daily costs of a fasting day versus a non-fasting day in the IF group.

The candidate believes that this is the first study to directly examine the costs of the IF plan and the Paleo diet, and is particularly relevant for those following these dietary plans in New Zealand. All costs in this section are in NZ currency unless otherwise stated. This study found that the daily costs of following the three diets were $10.22 (SD 6.40) for the IF plan, $11.27 (SD 5.70) for the MED diet, and $12.85 (SD 5.43) for the Paleo diet.

6.1 Intermittent Fasting

The hypothesis from the candidate’s literature review was that it would be relatively cheaper to follow an IF diet compared to a typical western-type diet followed by New Zealanders. This study found that to follow an IF plan (5:2) would cost females an average amount of $63.14 per week and males $84.18 per week. This cost has been calculated by adding the cost of five non-fasting days plus two fasting days rather than using the total mean value, as this gives a more accurate indication of the total weekly cost. The 2015 NZ Food Cost Survey reported that it would cost females $73.00 per week in Dunedin to provide a ‘moderate’ level of food and it would cost males $85.00 per week \[72\]. This equates to a $9.86 difference in weekly costs for females and $0.82 for males. The Food Cost Survey defines a ‘moderate’ amount as being enough money to provide adequate nutrition (basic cost), plus an additional 30% to provide some better quality brands \[72\]. This cost bracket has been used for comparison purposes, as the target demographic used (medium income - living in Dunedin, NZ) would be reflective of the average demographic in SWIFT. This suggests that the IF
dietary plan may be a cheaper option for women (less $9.86 per week) but is likely to cost the same as a typical NZ diet for men.

Fasting and non-fasting days differed significantly in terms of cost, with an average fasting day costing almost half ($6.38) that of an average non-fasting day ($12.06), despite the participants having been advised to consume one quarter of their normal daily intake. This is particularly interesting as mean energy intake on a fasting day was also half (4296 kJ) that of a non-fasting day (8590 kJ). This implies participants did not adhere to the guidelines or they consumed more costly items on their fasting days such as pre-prepared items, protein foods and/or increased amounts of fruit and vegetables. From the analysis it was noted that some participants consumed products such as One Square Meal, pre-packaged fruit and nuts or bakery style pastry items on fasting days which would contribute to this cost disparity.

Females spent on average $10.24 per day on non-fasting days and males spent $14.10, being a difference of $3.86 per day. This equates to a difference of $19.30 per week, on the five days of non-fasting. This difference in cost outcomes between sexes is mostly likely due to women eating less than men on their non-fasting days, with both the cost and the energy intake of women around 75% that of men. Men tend to have higher energy intakes than females, as they have a bigger body mass.[73]

There was less of a difference in costs between sexes on fasting days, with females spending $5.97 per day and males spending $6.84 per day, equally a difference of $0.87 per day. This discrepancy can be explained by their different energy intakes, with women consuming 87% of that of men, and spending 88% of that spent by men.

6.2 Mediterranean Diet

Most research regarding cost had been conducted on the MED diet, however only one model-based study has been conducted in NZ.[67] The current study concluded that the weekly cost
of following the MED diet is $70.70 for females and $99.82 for males. Again there are differences between the sexes in term of cost. Females in the current study spent on average slightly less on a weekly food shop when compared with the relative reported food cost from the Food Cost Survey, NZ, while men spent an additional $15.00 \cite{72}. Three European studies \cite{61, 70, 71} reported that it was more expensive to follow a MED style diet. One study reported that it would cost an additional €1.2 EUR (NZ $2.05) per day \cite{61} based on increased adherence to a MED diet; another stated it would cost an additional €0.67 (NZ $1.71) per day \cite{71} compared to a western-style diet, and the third study reported that a MED diet would cost €31.20 EUR (NZ $55.17) per week, which was above the average spend on food within the area \cite{70}. The cost in the third European study is considerably less to that of the current study, which could be because certain items consumed in the MED diet are imported into NZ, therefore potentially costing more.

A Canadian study reported that it would cost $61.11 CAD (NZ $70.07) per week to follow a MED diet, which is very similar to the current study especially in females \cite{65}. A further study conducted in NZ suggested it would cost $39.48 per week to follow the MED diet, however this model-based analysis only included 14 food items and excluded many of the more costly MED diet products \cite{67}. This is nearly half of the cost of the current analysis but this method is likely to have under-estimated the cost of a MED diet because participants in the current analysis consumed a substantially greater variety of food items than in this research.

### 6.3 Paleo Diet

The mean cost of following the Paleo diet was calculated as being $93.31 per week for females and $84.63 per week for males, and was the most expensive of the dietary plans analysed. This shows that females following a Paleo diet on average spend approximately $20.00 more a week when compared to the proposed moderate cost from the 2015 Food Cost Survey, whereas men spend on average the same amount as this standard diet \cite{72}. A model-
based study conducted in America used data from the USDA to estimate what low-income Americans spend on food [66]. This data was then translated into a cost for a Paleo diet which had an increased caloric density of food with a smaller overall amount consumed [66]. It was reported that this model Paleo diet would cost $29.75 USD (NZ $44.52) per week, however this did not meet calculated calcium requirements [66]. This is substantially less than the current estimate produced by this study. There could be several reasons for the difference. A major reason is likely to be that food costs differ between the two countries, with the majority of food items costing less in the USA compared to NZ [6, 74, 75]. A further reason may be that the current study was conducted with actual participants rather than a model-based analysis. Information was computer generated and is not representative of what actually occurs in humans and therefore based on assumptions, so the current study potentially provides a more accurate assessment of cost. Furthermore the current study included one serve of calcium-containing dairy products, which may have increased costs as these products are relatively expensive in NZ compared to the USA [6, 74, 75].

6.4 Strengths

Strengths of this study include the fact that it comprised a relatively large sample size (n=112) which was part of a wider study known as SWIFT (n=250). This sample was somewhat representative of both the local Dunedin population and the wider NZ population in terms of ethnicity because it included a good representation of minority populations (including Māori and Asian participants). However the sample did not include any Pacific Islanders (PI) who make up 6.9% of the NZ population [76]. The sample included 40% males which is relatively unusual for weight loss studies which tend to be dominated by females [77]. It also included a wide range of ages (21.6 to 73.9 years).

Three to four day weighed diet records were used to collect dietary information. Weighed food records are considered a gold standard as the most accurate dietary tool for recording
actual intake compared with all other methods, as they contain high quality descriptive data [10]. Participants were provided with extensive instruction regarding both the chosen dietary plan and how to complete the diet record. The weighed diet records included one weekend and two weekdays on non-consecutive days to allow for different dietary patterns that may occur across the week.

Using an online shopping website (Countdown, NZ) to gain costs per 100 grams for individual food items was both quick and convenient. It also provided a current national cost, therefore this data is applicable to the whole of NZ and not just Dunedin. It has been reported that using online supermarket shopping website prices with multiple day diet records is the best method of gaining costing information [9].

6.5 Limitations

There are several limitations to consider when interpreting the results of the current study. A major issue was, that due to the timeframe of this thesis, not all participants from SWIFT could be included in this analysis. Although allowing participants to choose their diet was more pragmatic and real life, it did result in an uneven spread between the dietary groups with only 16 participants choosing the Paleo option. This study was also conducted in overweight and obese participants only, so that dietary costs may not be representative of persons of normal weight.

There were possible limitations associated with the weighed diet records including potential under-reporting which has been found to be common with overweight and obese subjects [75]. Completing multiple day weighed diet records takes time and therefore misreporting may have occurred, with some participants suspected of having copied information from a previous day to avoid weighing items each day. A basic level of literacy and numeracy is required to complete diet records which may have limited some participants’ entries, and some participants may have had difficulty with estimating portion sizes and item weights.
when dining out. Several assumptions had to be made by researchers when data (brand or weight) was not accurately recorded therefore researchers may have interpreted this data incorrectly. However an online spreadsheet was used to ensure consistent coding and assumptions, and a researcher re-checked each diet entry thoroughly.

Although instructed to complete one weekend day and two weekdays, the diet records of some participants included only consecutive days, non-fasting days and/or weekdays only. This may have affected the results as the dietary patterns of some individuals may have changed across the seven-day period, and fasting days had restricted energy intakes. The diet records completed by the IF participants were analysed with a 2:1 ratio (non-fasting: fasting days). However this does not entirely represent the 5:2 plan as the ratio over-compensates for the fasting days. Choosing this ratio allowed more accurate data to be collected over a shorter period without adding further respondent burden. Weighed diet records were also taken from one time point, which does not allow for seasonal differences when purchasing food and therefore may have affected cost.

Price data per 100 grams was gained from a single supermarket chain (Countdown, NZ) and therefore it may be more or less expensive at other food outlets. Countdown was used as it was the only outlet to provide an online shopping website. If information on price per weight was not available online the researcher gained price data from a single store, and therefore that data may not be comparable across the whole country.

6.6 Implications for Future Research

In light of the findings of this thesis, future analysis should include the remaining 138 participants from SWIFT, adding further weight to these results as well as additional Paleo participants. In the near future a cost analysis for the whole SWIFT cohort is likely to be undertaken. This analysis should include an average cost per food group (breads/cereals, milk/milk products, fruit/vegetables and meat/poultry/eggs nuts/seeds/lentils/non-meat protein
sources) and a cost per portion size of these main food groups should be calculated. It should also include a mean cost per kJ as both methods of presenting costs including a price per kJ and a price per food group have been used in other studies, therefore it would make for comparable analysis.

Further research should be conducted at later time points to assess changes in dietary intake over time and to allow for seasonal purchasing which could affect the cost of the various dietary plans. Adherence to the three diets should also be assessed on completion of the SWIFT study by assessing whether consumed items fall within the dietary guidelines given at the start of the intervention. These could be used to determine whether the three dietary plans can be adhered to long-term.

6.7 Conclusion

Based on the results from this study, it can be concluded that there are no significant differences in mean cost between the IF plan, the MED diet and the Paleo diet, however there was a trend that showed the IF diet cost the least amount ($10.22 (SD 6.40), followed by the MED diet ($11.27 (SD 5.70), and the Paleo diet was the most expensive overall $12.85 (SD 5.43). When compared to the average amount required to purchase food in Dunedin, NZ (moderate-based price bracket) it appears that females may spend less than this amount when following an IF plan, more than this amount following the Paleo diet and an equal amount for the MED diet. Males appeared to spend the same as a standard diet when following both the IF and Paleo diets but spent more when following the MED diet. Cost is often seen as a barrier to adhering to a healthy diet \[^6\], however as all three diets were comparable in price to a standard NZ diet, they may offer affordable alternatives for a healthy diet.
7 Application to Practice

Obesity is on the rise in New Zealand, especially amongst Māori and Pacific populations, with one third of all New Zealanders classed as being overweight and a further third classed as obese 78. Obesity is a major contributor to premature death and is related to many prominent health disorders that play a major role in this country and currently cost New Zealand millions of dollars each year 78. Some of the highest rates of obesity are in low-income earners who are often consuming low cost, energy dense foods rather than a balanced healthy diet 64, 78, 79. Those with higher incomes tend to spend more on fresh quality foods, in particular fresh fruit and vegetables, and tend to have better health outcomes 79. Therefore, it can be concluded that obesity rates tend to follow an economic gradient. One of the major factors adding to our current health issues is the perceived additional cost associated with eating a healthy diet 6-9. This poses the question: Is healthy eating an affordable option for the majority of New Zealanders?

Dietitians play a vital role in the promotion of health and nutrition especially within the public health sector. It is their role to be informed with the latest nutritional research and provide relevant, up-to-date, safe advice to their clients. The Mediterranean (MED) diet, Paleo diet and Intermittent Fasting (IF) plans have all gained popularity as healthy alternatives to our current government recommended diet but what do we actually know about these three diets in terms of cost?

This study found little difference in cost between the three dietary interventions and only small differences between the cost of a typical NZ diet and these plans. The IF plan was slightly cheaper ($10.22 NZD per day) than the MED diet ($11.27 NZD per day), while the Paleo diet was the most expensive ($12.85 NZD per day). The average cost of a typical NZ diet (Dunedin, NZ) is $11.29 NZD per day, therefore the writer believes that any of these three diets would be affordable options, and acceptable to budget conscious individuals.
However, a recent study conducted in Dunedin, NZ on low-income, food-insecure households with children, reported that a household spent on average $132.00 NZD per week on food, being $39.27 NZD per person per week (based on an adult female) [80]. This suggests that these three diets may not be feasible for those on very low incomes.

The IF studies reported weight loss [43, 44, 46, 48-58], improved lipid profiles [44, 48, 49, 51, 55, 59], reductions in fasting insulin and insulin resistance [44, 48-50, 54, 57, 58], increased satiety and fullness, [43] and most studies reported high adherence rates (over 8-12 weeks) [44, 48, 49, 51, 55]. It is suggested that dietitians could recommend the IF plan to clients who are looking to approve anthropometric measures and lipid profiles, and potentially improve some symptoms of diabetes or pre-diabetics. From the research it appears that participants found it easier to follow the IF plan, and therefore it seems like that this diet may be more acceptable to those who have been unsuccessful with other diets and subsequent weight loss. Clients only need to slightly modify their current diet by eating less (one quarter of usual intake) on two fasting days per week with regular intake on five non-fasting days. They do not need to purchase any costly special foods, which may appeal to many clients and therefore increase adherence long-term. The nutrient adequacy of such diets needs to be assessed.

The MED studies reported a reduced risk of CVD [16] and developing diabetes [17, 20], improvements in lipid profiles [21, 23-25], reductions in blood pressure [23, 25], HbA1c [22, 24] and certain cancers [18] and a reduction in overall mortality [16], with modest reductions in BMI [21, 25, 26] and weight loss [24-26]. Given the weight of these outcomes, dietitians could recommend this diet to those who wish to improve overall health and vitality, and those concerned about their risk of developing heart disease and/or diabetes. Due to the popular nature of this diet, many foods included are readily available in NZ and are competitively priced alongside other healthy foods. This may attract clients to the MED diet and may increase the likelihood of adherence to this plan long-term. This diet can be achieved at only a small amount more than
that spent on a typical NZ diet and therefore is likely to be attractive to the average person, especially those who enjoy eating this type of food.

Only five trials have investigated the Paleo diet, all of which had short intervention periods and minimal participant numbers. However all trials reported weight loss in both normal weight and overweight subjects \([34-39]\), reduced energy intakes \([34-39]\), high levels of satiety \([36, 39]\), decreased glucose tolerance and insulin levels \([39]\) and decreased HbA1c \([37]\). Considering the lack of strong evidence in respect of any significant health benefits, the candidate feels that the Paleo diet should be approached with caution, as further investigation into potential health effects is needed. However, in terms of cost, the results of the study showed that this diet was only slightly more expensive compared with a typical NZ diet (Dunedin, NZ).

The candidate believes that the MED diet appears to be the most promising overall as it costs a similar amount to that of the other two diets, and a typical NZ diet, and it has proven health benefits. The IF plan may be promising in terms of weight loss, as this study reported that energy intake on a fasting day was half of that on a non-fasting day, which is a combined reduction of 8600 kJ per week. However, the total average energy intake weekly was similar to that of the Paleo and the MED diets. The Paleo diet was the most expensive and had the least amount of data available. Dietitians generally recommend a combination of diet and exercise for an overall healthy lifestyle, and when discussing the various options available a focus on cost is good starting point in terms of encouraging long-term adherence. All three diets are affordable options for the majority of the NZ population to follow in terms of cost.
8 References:


71. Lopez, C.N., et al., Costs of Mediterranean and western dietary patterns in a
Spanish cohort and their relationship with prospective weight change. J 

72. Department of Human Nutrition, University of Otago., Information Package for
Users of the New Zealand Estimated Food Costs 2015, University of Otago.

73. Ministry of Health, University of Otago., A Focus on Nutrition: Key findings of the
2008/09 New Zealand Adult Nutrition Survey. 2011, Ministry of Health:
Wellington.

74. Carlson A, F.E., Are Healthy Foods Really More Expensive? It Depends on How

75. Statistics New Zealand., Food Price Index - information release. 2015 [cited 2015
20 November];
http://www.stats.govt.nz/browse_for_stats/economic_indicators/prices_indexes
/food-price-index-info-releases.aspx%5D.

76. Statistics New Zealand., Demographics of New Zealand's Pacific Population. 2006
[cited 2015 28th October];
http://www.stats.govt.nz/browse_for_stats/people_and_communities/pacific_pe
oples/pacific-progress-demography/summary.aspx%5D.

77. Young, M.D., et al., Effectiveness of male-only weight loss and weight loss
maintenance interventions: a systematic review with meta-analysis. Obes Rev,

78. Ministry of Health., Annual Update of Key Results 2013/14: New Zealand Health

1580-6.
9 Appendices

9.1 Appendix A: SWIFT Study Information Given to Participants;

- Mediterranean Diet
- Modified Paleo Diet
- Intermittent Fasting
Mediterranean Diet

* Adapted from http://oldwayspt.org/shopping-cooking-eating/eating-well-3-meals-day
Mediterranean - think blue skies, sand, sea, sun, delicious food and relaxation.

Actually the word ‘Mediterranean’ in this context refers to the origins of the diet, rather than specifically needing to eat Greek or Italian foods. However, experimenting with specific cuisines can be enjoyable and rewarding and there is no doubt that a Mediterranean diet is full of tasty foods.

There is no such thing as a single Mediterranean diet, with lots of variation around the world. However, in general you would be eating lots of fruits and vegetables, beans and nuts, some healthy grains, fish, and olive oil, small amounts of meat and dairy, and some red wine (if you want to). However the Mediterranean lifestyle also encourages daily exercise, and sharing meals with others.

Studies have shown that a Mediterranean diet is an effective diet for weight loss and it can also improve overall health. People who follow this type of eating over time see a reduction in their risk of cardiovascular disease, mainly through having lower blood cholesterol (the fats in your blood) or reduced blood pressure. Following the Mediterranean diet may also reduce your risk of cancer, stroke, Parkinson’s disease, and Alzheimer’s disease. It may also help you to live longer!

Fruit cooler (serves 1)
http://www.hsph.harvard.edu/nutritionsource/fruit-cooler/

½ cup ice
¾ cup soda water
1/3 cup melon or berries
Chopped mint leaves or citrus slices (optional)

Place ice, soda water, and fruit in a blender. Blend until slushy, pour into a glass and garnish with mint or citrus slices.

Sparkling iced tea with lemon, cucumber and mint (makes 2 litres)

1 litre water
2 tea bags (choose a green tea or a herbal tea that you like)
2 lemons
2 limes
¼ cucumber, sliced
1 bunch fresh mint leaves
1 litre soda water
Ice cubes

Boil water. Let it cool for 10 minutes. Add the tea bags and half of the mint leaves and let it steep for 5 to 10 minutes. This will make a less bitter tea infusion, which is perfect for iced tea.
Squeeze the lemons and limes, reserving a few slices for decoration. Add the lemon and lime juice to the tea infusion. When the mixture has cooled down, add the cucumber slices and the rest of the mint leaves.
Mix 1 part of the tea infusion with 1 part of the soda water just before serving. Decorate with mint leaves, a lime or lemon slice and some cucumber slices.
**Frozen fruit popsicles (serves 4)**

Fresh fruit with a splash of juice makes a fresh and healthy snack. Use whatever fruit you're heart desires. A perfect summer treat!

- 1/3 cup diced kiwi fruit
- 1/3 cup diced watermelon
- 1/3 cup diced strawberries
- 1/3 cup diced pineapple
- ¼ cup fresh pineapple juice or orange juice
- 4 disposable 150 ml cups and wooden craft sticks (or popsicle mold)

Combine diced fruit in a bowl and fill each 150ml cup with fruit. Add 1 tbsp of juice and insert craft sticks into each cup. They easily stay in place because of all the fruit. Place in the freezer a few hours until firm. To remove the pops from the cups, run under warm water a few seconds. Enjoy!

**Five minute hummus**

1 can chickpeas, drained and rinsed
1 clove garlic
¼ cup tahini
Juice of one lemon
Pinch ground cumin
Pinch ground pepper
1 Tbsp olive oil
1 Tbsp water

Place all ingredients in a food processor and blend until smooth.

**Lighter guacamole**

4 ripe avocados
2 Tbsp fresh lemon juice
3 Tbsp medium-hot salsa
1 cup lite, plain Greek yoghurt
salt to taste

In a large bowl, coarsely mash avocados, leaving some chunks. Add remaining ingredients and mix to blend.
Serve with toasted pita chips, rice crackers, or veggie sticks (e.g., carrot, celery, and capsicum).

Basically it is hard to fault this way of eating. It has many health advantages, it’s tasty, easier on the environment than lots of other meal plans, and it promotes family wellbeing through the sharing of meals. What’s not to love?

**Good resources you can access:**

Check out New Zealand’s Healthy Food Guide – this is a great magazine full of healthy, tasty meals and snacks. www.healthyfood.co.nz

Also, try these two for some other ideas and recipes:
http://oldwayspt.org/shopping-cooking-eating/eating-well-3-meals-day
http://www.hsph.harvard.edu/nutritionsource/recipes-2/
A basic outline of what is means to eat Mediterranean

1. Fruit and Vegetables: choose a wide variety of colours and make them the base of every meal – even breakfast. Aim to fill at least half of your lunch and dinner plate with vegetables. Potatoes don’t count as a vegetable, since they are mostly starch and act more like refined grains. Fruit is a fresh, portable snack and makes a great, healthy dessert – see our recipe section for ideas on incorporating fruit and vegetables more easily into your day.

2. Whole Grains: For weight loss and health, whole grain and high fibre varieties are best. These should make up about ¼ of your plate or a fist-sized amount. Choose wholegrain bread, brown or basmati rice, oats, or potato or kumara with skin. Experiment with other grains including quinoa, barley, bulgur, and millet. Use grains that are minimally processed (i.e. as natural as possible).

3. Protein: Choose primarily fish (ideally twice a week), chicken, tofu, eggs, and a variety of beans as regular protein sources. Red meat should be limited to about once a week, with portion sizes equal to the size and thickness of your palm.

4. Nuts: A handful of nuts per day (about 30 g) is a great boost to your health. Choose a variety of nuts, which can include peanuts, peanut butter or other nuts butters like almond butter.

5. Dairy: Choose lower fat and low-sugar options, such as trim milk, lite Greek yoghurt, cottage cheese, and low-fat ricotta. Try to limit your intake of hard cheese, and if you do eat some, choose Edam or Noble.

6. Olive Oil: Use liquid olive oil as your principal fat source, including in cooking (at a low to moderate temperatures), and as the base of salad dressings. Try dipping wholegrain bread in olive oil (mixed with balsamic vinegar) instead of adding butter or margarine. If you’re cooking at a high temperature, choose another vegetable oil such as canola or sunflower oil.

7. Wine: If you drink alcohol, enjoy one glass (or up to two for men) of wine per day with meals. However, if you don’t already drink alcohol, we don’t recommend that you start.

8. Sugary Drinks and Sweets: Limit to not more than a few times per week. This includes honey since it is also a source of sugar. Choose unsweetened drinks, such as water (add mint and/or lemon juice to flavour), soda water, tea (all kinds), and coffee. Instead of sweets, try fresh fruit or dark chocolate (containing over 50% cocoa).

Snacks

Rosemary roasted almonds – makes 2 cups (serving size: about 2 tablespoons)

Fresh rosemary gives wonderful fragrance and flavor to this roasted almond recipe, and chili powder provides just the right amount of spiciness. Serve to party guests or as an everyday snack.

1 Tbsp finely chopped fresh rosemary
1 Tbsp extra-virgin olive oil
1 tsp chili powder
¼ tsp sea salt
Dash of ground red pepper
2 cup (~300 g) whole almonds

Preheat oven to 160°C. Combine all ingredients in a medium bowl; toss to coat. Arrange nut mixture in a single layer on a baking sheet lined with foil. Bake at 160°C for 20 minutes or until lightly toasted. Cool to room temperature.

Sesame ginger baked tofu

http://vegetarian.about.com/od/tofurecipes/r/sesametofu.htm

2 containers firm or extra firm tofu, well pressed
1/3 cup soy sauce
¾ cup water
1 Tbsp fresh ginger, minced
3 cloves garlic, minced
1½ Tbsp sesame oil
2 Tbsp sesame seeds (optional)

First, prepare your tofu. Like most vegan tofu recipes, this one will taste best if you press the tofu first. [How to press tofu: http://vegetarian.about.com/od/cookingtipstools/ss/presstofu1.htm]. Slice each block of tofu into 4 or 5 slices. In a small bowl, whisk together the soy sauce, water, ginger, garlic and sesame oil. Pour mixture over each piece of tofu in a shallow bowl or pan, and allow to marinate for at least 30 minutes. Preheat the oven to 220°C and lightly grease a baking sheet. Carefully place each slice on the baking sheet and sprinkle with sesame seeds. Bake for 30 minutes, then rotate the sheet, if needed and drizzle with more marinade. Bake for another 15 minutes, or until liquid is almost dry.
Seasonal fruit compote with spices nuts (serves 8-10)
http://www.hsph.harvard.edu/nutritionsource/fruit-compote-spiced-nuts/

3 apples, peeled, cored and sliced
4 pears, peeled, cored and sliced
1 pineapple, peeled, cored and sliced
1/3 cup whole dried sweetened cranberries
1/2 cup dried apricots
1/4 cup olive oil
6 Tbsp brown sugar
1/2 tsp cinnamon
1/4 cup honey
1/4 tsp nutmeg
1/2 tsp pure vanilla extract
1/2 cup walnuts
1/4 cup pecans
1/4 cup sliced almonds
2 Tbsp water
8 to 10 cinnamon sticks
8 to 10 mint sprigs

Preheat oven to 160°C. In a large skillet, warm the olive oil and add the brown sugar. Add apples, pears, and pineapples. Sauté over low heat, stirring often. When fruit starts to get soft, add apricots, cranberries, and cinnamon. Remove from heat and set aside.

To make the spiced nuts, mix the honey with the water. Drizzle over the pecans, walnuts, and almonds, and add nutmeg. Line a cookie sheet with parchment paper or aluminum foil and spread out nuts in a single layer. Roast in a 160°C oven for 15 minutes. Move nuts around with a spatula for even roasting. Remove from oven. Sprinkle nuts with vanilla extract. Let nuts stand at room temperature until cooled completely.

To assemble, spoon compote into wine glasses or ramekins and top with nut mix. Garnish with cinnamon stick and mint sprig.

Meal ideas

Breakfast*
The perfect breakfast is made up of wholegrains, some healthy protein, and fruit and/or vegetables. For instance, top Weetbix with trim milk and sliced banana, or grainy bread with a poached egg or two and sautéed tomato and mushrooms.

- The right breakfast will keep you satisfied until lunch. If you’re hungry by mid-morning, experiment with adding some healthy protein like peanut butter, hummus, eggs, cottage cheese, or yoghurt to your breakfast to avoid that carbs-and-coffee crash mid-morning.
- Whole fruit has more fibre and satisfies you for longer than juice, even 100% fruit juice. (It takes 3-4 oranges to create one glass of juice, so you also cut your calories by up to 75%)! When you do drink juice, consider diluting it with soda water for a refreshing upscale “soda.”
- Leave butter and jam on white toast behind. Instead, try half a smashed avocado with tomato on wholegrain toast for a satisfying breakfast. Or top your toast with hummus, peanut butter, or cottage cheese for added protein and healthier fats.
- Buy a big container of plain instant oatmeal, rather than the more expensive flavoured packets that tend to be heavy on the sugar. Add your own cinnamon, apples and raisins, or a spoonful of your favourite jam. You’ll save money and empty calories, while starting your day with a delicious whole grain.
- Sauté onions, mushrooms, and a handful of spinach leaves, and add them to your scrambled eggs, for a quick Veggie Scramble good for any meal of the day. Or, scramble them with salsa, hot sauce, or a spoonful of olive tapenade as a great way to add flavour.
- Use over-ripe bananas to make smoothies. Put one banana in a blender with an equal amount of frozen berries. Add milk (or soy or almond milk) to cover, and blend. You can also add yoghurt, nuts/seeds, and oats.
- Consider adding a double handful of spinach or other greens to super-power your smoothie. We admit it sounds weird, and the colour can be a bit startling, but you’ll be surprised at how good it tastes!
- Flavoured yoghurts can be very high in added sugar – often about 5 teaspoons per cup. Buy plain yoghurt instead, and add your own fruit, muesli, or even a spoonful of jam or honey.

If you are on the run, then try pre-made healthy muffins or an egg frittata with vegetables (see our recipes section).
**Lunch***

The ideal lunch consists of wholegrains, plus veggies (strive to get as many colours as possible) and some lean protein:

- Wholegrain bread + lean protein (fish/chicken/eggs/beans/tafu) + lots of vegetables + healthy spreads
  - Use tapenades, avocado, chutney or hummus in place of mayonnaise, margarine or butter for sandwiches for healthier fats and protein.
- Super salad: lots of vegetables + wholegrains (brown rice or quinoa in the salad or wholegrain crackers or bread on the side) + lean protein (fish/chicken/eggs/beans/tafu) + dressing + sprinkle with nuts or seeds
  - Experiment with different types of greens, grains, protein, and dressings for lots of variety. Fruit in salads (e.g. strawberries, apples, grapes) adds a delicious, fresh flavour
- Vegetable based soups (without cream): vegetables + beans/tafu + wholegrains
  - Like split pea soup, lentil soup, minestrone

**Dinner***

- When filling your plate, make half of it vegetables, one-quarter grains (preferably wholegrain, such as brown rice, quinoa, wholemeal pasta, and kumara, etc) and one quarter protein. Increasing your vegetable intake is one of the easiest ways to improve your eating habits and enjoy better health.
- Eat fish or seafood 1-2 times a week, and choose baked, steamed, grilled, or poached ways of cooking your fish rather than frying it.
- For healthy homemade pizzas, top whole grain pita breads with tomato paste, cheese, piles of vegetables, and a little drizzle of olive oil. Cook at 180°C for about 20 minutes and you’ve got your own in-house pizza party!
- If you’re exploring wholemeal pasta for the first time, try several brands. Unlike white pastas, the tastes vary widely from mild and soft to chewy and nutty; by trying a variety you’re sure to find a taste and texture you enjoy. Barilla Integrale (available at supermarkets) is wholemeal pasta with a subtle flavour. Try to follow the healthy plate model when enjoying pasta – aim for ¼ of your plate or about a fist-size of pasta and fill up the rest of your plate with vegetables and lean protein.
- Add canned, rinsed beans (black, pinto, chickpeas, white) to pasta dishes, salsas, and salads to increase fibre and protein at very little cost!

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**Citrus salad with ginger lime dressing (serves 4)**

http://www.hsph.harvard.edu/nutritionsource/citrus-salad/

This is a very light, refreshing, beautiful salad that can be served as a side dish or dessert. The dressing for this salad also works well on salads made with mild flavored baby greens, like baby spinach.

For dressing

- Juice from 1 lemon (about 3 tablespoons)
- 2 Tbsp canola oil
- 1 tsp finely grated fresh ginger root, peeled before grating
- 2 Tbsp granulated sugar
- Zest from 1 lime (about 1 teaspoon very finely grated peel)
- 1/8 tsp salt

For salad

- 3 blood oranges, cut into segments
- 2 navel oranges, cut into segments
- 1 pink grapefruit, cut into segments
- ¼ cup chopped mint leaves

Combine all ingredients for the dressing in a small mixing bowl and whisk well. To make beautiful orange segments, use a sharp knife to cut the top (stem side) and bottom off the fruit. Set the fruit on its bottom and use your knife to cut away the rest of the peel, working from the top to bottom and rotating the fruit as you go until all of the peel has been removed. You want to remove all of the white pith as well. Cut out the segments, leaving behind the membrane that separates the segments. Place the segments in a medium mixing bowl.

Drain off any juice from the segments, and then add the mint and dressing. Use a spoon to mix gently. Serve immediately.
**Desserts**

**Fruit crumble (serves 8)**

http://ohsheglows.com/2014/05/02/springtime-strawberry-lime-mango-crisp-vegan-gf/

**Filling**
- Enough raw or canned fruit to fill the bottom of a casserole dish (e.g., sliced apples, pears, berries, mango, or a combination of fruits)
- Optional – fresh juice from 1 lemon or lime

**Topping**
- 1 cup rolled oats
- 1 cup seeds or thinly sliced nuts (e.g., almonds)
- 1/3 cup wholemeal flour
- 1/4 cup unsweetened shredded coconut
- 1 tsp cinnamon
- 1 tsp fine grain sea salt
- 1/4 cup honey
- 1/4 cup coconut oil, melted

Preheat oven to 180°C. Lightly grease an 8-cup (2 litre) casserole dish.

For the filling: Pour the fruit mixture into the prepared dish and spread out evenly. Drizzle lemon/lime juice, if desired.

For the topping: In a medium bowl, stir together the oats, almonds, almond meal/flour, shredded coconut, cinnamon, salt. Pour on the maple syrup and melted coconut oil and stir until combined.

Sprinkle the topping all over the fruit mixture in an even layer. Cover the dish with foil and poke a couple holes in the foil. Bake for 20 minutes, until the fruit is tender. Remove the foil and bake for another 15-20 minutes until the topping is golden and the filling is bubbling up around the sides.

- Love sausages? Try Heller’s precooked chicken sausages (available in 3 different flavours) and you’ll consume half the calories and a fraction of the saturated fat compared with pork sausages.
- Load up your baked potatoes, eggs, soups, and beans with salsa. It’s a great way to add flavour and lots of extra vegetables.
- Add frozen peas to just about anything—soup, pasta sauce, pasta, grains—for extra vegetables and fibre. Add at the end of cooking so they stay firm and sweet.
- Make one dinner per week a Veggie Feast: three or four nutrient-dense vegetables (carrots, broccoli, spinach, beets, squash, tomatoes), lightly steamed, with just a drizzle of extra virgin olive oil. This is particularly wonderful at the end of the harvest season with farmers-market-fresh vegetables, and is a great way to help ensure you’re eating enough of them over the week.
- Cut whole grain pita bread in wedges, top with a little grated Parmesan cheese, Italian herbs, and a drizzle of olive oil, then grill till golden brown, for a great crispy treat with soups.

**Snacks**

- Are you really hungry? If an apple or some other fruit doesn’t appeal to you, then you probably are not actually hungry – just bored or responding to external food cues.
- A handful (30 g) of nuts or seeds
- Fresh fruit. If you’re tired of apples and oranges, try an exotic fruit salad: at the beginning of the week, take 5 minutes to cut up some exotic fruits: mangoes, pineapple, and kiwifruit, with a splash of lime juice to prevent browning. Put in a large container and take to work for afternoon snacks for the entire week. Fruit satisfies your sweet tooth without the sugar crash of vending-machine sweets.
- Plain yoghurt flavoured with fruit, muesli, or a small amount of jam or honey
- Hummus/salsa/nut butter + raw vegetables sticks
  - Pick a different raw vegetable each week for afternoon snacking at the office: carrot sticks, red pepper strips, or cucumber slices. Enjoy with a small amount of hummus or nut butter if you’re heading for a post-work gym visit.
  - Try to make your own hummus (see our recipe section) – it’s cheap and often healthier than store-bought hummus.
• 1 cup of homemade vegetable soup (see our recipe section)
• A healthy muffin (see our recipe section)

Dessert*
• Dessert is anything that satisfies your sweet tooth. Enjoy fruit—fresh, baked, or poached—with a small amount of dark chocolate, or with some nice cheese (try ricotta for a lower fat option). Your sweet tooth will be blissed out and you won’t be uncomfortably full.
• For an apple-pie taste in just two minutes, microwave sliced, unpeeled apples with cinnamon, and top with a sauce of plain yogurt mixed with a little honey or real maple syrup.
• Dip ripe strawberries in a thin layer of melted dark chocolate, then let cool on wax paper, for an impressive and healthy dessert.

Drinks
• Choose unsweetened drinks, such as water (add mint and/or lemon juice to flavour), soda water, tea (all kinds), and coffee
• Fruit cooler recipe http://www.hsph.harvard.edu/nutritionsource/fruit-cooler/
• Sparkling iced tea with lemon, cucumber, and mint http://www.hsph.harvard.edu/nutritionsource/iced-tea-with-lemon-and-mint/

Eating out (in Dunedin)
• Takeaways or quick options
  • Pita Pit: whole grain pita, lots of vegetables + chicken/vegetarian, + a low fat sauce
  • Subway: 6” sandwich + lots of vegetables + 6g of fat or less choices + low-fat sauces
  • Brown rice sushi (try Savoury Japan)
  • Frankly’s (University of Otago in the Link): salad or sandwich (on wholemeal baguette or Vogel’s bread) with lots of vegetables + chicken + lower fat sauce (e.g., honey mustard, minted yoghurt, salsa, etc.)

Chicken and white bean casserole (serves 6)
6 skinless chicken thighs
1 Tbsp oil
1 medium carrot, diced
1 stick celery, diced
4 cloves garlic, crushed
2 tsp Worcestershire sauce
1 can crushed tomatoes
1 cup water
1 tsp brown sugar
1 can butter, haricot or cannellini beans, drained and rinsed

In a large casserole dish gently brown the chicken thighs with the oil. When browned remove from the casserole dish and set aside.
Gently sauté the onion, carrot and celery in the casserole dish until softened and lightly browned.
Add the garlic and mix through, do not allow garlic to brown.
Add remaining ingredients to casserole dish and bring to the boil. Reduce the heat and put the chicken back in.
Cover with a lid and gently simmer for approximately 45 minutes.
Winter stew (serves 4)

1 tsp of olive oil  
1 onion  
Handful of sage leaves  
400 g stewing steak, fat removed  
Pepper  
2 tsp plain flour  
2 parsnips, quartered  
4 carrots, halved  
½ small butternut, chopped  
3 artichokes (canned is fine)  
2 Tbsp tomato puree  
1 bay leaf  
250 ml red wine  
285 ml vegetable stock  
Zest of 1 lemon  
Rosemary leaves

Preheat oven to 170°C. Put oil in a casserole pan, add onion and sage leaves and fry for 3 minutes. Dust meat with seasoned flour and add to pan with the vegetables, tomato puree, bay leaf, wine and stock. Stir gently and season. Bring to the boil, cover with a lid, and cook in oven until meat is tender and falls apart – about 3 hours. Garnish with lemon zest and rosemary leaves.

Salmon and vegetables (serves 4)

400 g green beans, blanched  
200 g broccoli florets, blanched  
200 g asparagus spears, blanched  
Juice of 2 lemons  
2 Tbsp olive oil  
Pepper  
30 g black olives  
Cherry tomatoes (4 vines, around 32 tomatoes)  
4 salmon fillets (100 g each)  
2 cups cooked brown rice

Preheat oven to 200°C. Blanch the vegetables – place in boiling water and cook until the water starts to simmer again. Place blanched vegetables and seasonings in a large roasting pan, squeezing the juice of 1 lemon over them and drizzle with olive oil. Scatter in the olives and place vine tomatoes on top. Lay the fillets, skin side down, as a top layer, and squeeze over the second lemon before oven roasting for 20 minutes. Serve with brown rice.

- Most salads, but watch the dressing/sauce (and avoid bacon)
- Vegetable based soups (not creamy)
- Thai salads

- Dining:
  - Fish/chicken/occasional red meat as protein choice. Try to follow the plate guidelines as much as possible (½ vegetables, ¼ protein, and ¼ carbs)

Frequently Asked Questions

Q: I thought high fat food was fattening. Will I lose weight if I eat olive oil and nuts?
A: Olive oil and nuts do not tend to promote weight gain and might even help you lose weight. With nuts, there is evidence that people compensate (i.e., make up for it) by eating less at their next meal after eating nuts. For this reason, we recommend that nuts are eaten at any time during the day except after dinner.

Q: Can the rest of my family follow the Mediterranean diet?
A: Absolutely. The Mediterranean diet is healthy for your whole family, and will encourage your children to adopt healthy eating habits.

Q: How often should I eat?
A: The number one rule is to listen to your appetite. We recommend eating your meals, at a table, and taking your time to enjoy your meal – take at least 20 minutes, eating slowly. This allows your stomach time to sense that you have eaten enough food.

Q: What kind of bread should I eat?
A: When choosing bread, the main thing to look for on the nutrition label is fibre. Choose breads with more than 7g of fibre per 100g (often the second column). Some good choices are Burgen (wholemeal and seeds, pumpkin and chia, mixed grain, grains with barley); Freya’s (lower carb varieties, Dutch wholemeal grain, quinoa and flaxseed) and Vogel’s (chia and toasted sesame).
Recipes

Good websites for recipes
http://www.hsph.harvard.edu/nutritionsource/recipes-2/home-cooking/
http://www.appetiteforlife.org.nz/recipes/
http://www.healthyfood.co.nz/
http://oldwayspt.org/recipes

Breakfast

Healthy muffins (5 varieties from http://www.hsph.harvard.edu/nutritionsource/muffin-makeover/):

Whole wheat banana nut muffins (makes 18 muffins)
Recipe courtesy of The Culinary Institute of America
http://www.hsph.harvard.edu/nutritionsource/whole-wheat-banana-nut-muffins/
These are 100% wholemeal muffins. The yoghurt helps develop the delicate texture and the toasted walnuts and walnut oil provide an appealing flavour and texture. If you don't have walnut oil, just use all canola oil. You can enjoy these muffins warm or cool, but the banana flavour intensifies when the muffins cool to room temperature.

1 ½ cups walnuts, toasted and chopped
5 Tbsps canola oil
1 Tbsp walnut oil (or just use all canola oil)
½ cup brown sugar
1 egg
½ cup lite, plain Greek yoghurt
5 ripe bananas, mashed
1 ½ cups wholemeal flour
1 ½ tsp baking powder
½ tsp salt

Preheat oven to 180°C. Line muffin tins with paper liners. When the oven temperature reaches 180°C, place walnuts on a baking sheet and toast in the oven for 5 minutes. Remove from oven and chop. In a medium bowl combine the canola oil, walnut oil, brown sugar, egg, and yogurt. Whisk to combine, and then stir in the mashed banana and the toasted, chopped walnuts. Stir in the flour, baking powder, and salt. Use a ¼ cup measuring cup to portion out the batter into the 18 lined muffin cups. Bake for 25 minutes, or until the tops of the muffins are nicely browned. Cool on a wire rack.

Stir-fried shrimp with spicy greens (serves 4)

½ cup chicken or vegetable broth
1 Tbsp soy sauce (more to taste)
2 Tbsp Shao Hsing rice wine or dry sherry
½ tsp sugar
1 tsp cornstarch
2 Tbsp minced ginger
1 Tbsp minced garlic
1 chili, minced
350-450 g medium shrimp or prawns, shelled and deveined
Salt to taste
2 Tbsp peanut oil or canola oil
1 large red capsicum, cut in 5 cm pieces
1 bunch silverbeet (about 350 g or 8 cups), stemmed, washed, and roughly chopped
1 bunch green onions, white and light green parts only, cut in half lengthwise and cut in 3 cm lengths
½ cup chopped fresh coriander

Combine the broth, 2 tsp of the soy sauce, and 1 Tbsp of the rice wine or sherry and sugar in a small bowl. Combine the garlic, 1 Tbsp of the ginger, and the minced chilies in another bowl. Have all of your ingredients within reach of your wok or pan.

In a medium bowl combine the cornstarch, 1 tsp soy sauce, 1 Tbsp rice wine or sherry, and 1 Tbsp of the ginger. Stir together well. Lightly salt the shrimp and toss with the cornstarch mixture until coated.

Heat a large pan or wok over high heat until a drop of water evaporates within a second or two when added to the pan. Add in the oil by pouring it on the sides of the pan and swirling the pan. Add the garlic, ginger and chilies and stir-fry for no more than 10 seconds. Add the red pepper and stir-fry for 1 minute. Add the silverbeet and stir-fry for about 30 seconds, add the broth mixture and stir-fry for 1 minute, or until the greens have wilted. Add the coriander and stir-fry for another 30 seconds. Remove from the heat and serve with rice or noodles.
Main Meals
Spanikopita (spinach pie) – (serves 6-8)
Spanikopita is a traditional Greek spinach or silverbeet pie enveloped in crisp filo pastry

- 1 tbsp olive oil
- 2 cup onion, minced
- ¼ to ½ tsp salt
- 1 tsp basil
- 1 tsp oregano
- 1 kg fresh spinach, stemmed and finely chopped
- 5 medium cloves garlic, minced
- 3 Tbsp flour
- 2-3 cup (about 400 g) crumbled feta cheese
- 1 cup cottage cheese
- Freshly ground black pepper, to taste
- 1 packet frozen filo dough, defrosted
- Olive oil spray, for the filo

Preheat oven to 180°C. Heat 1 tbsp. olive oil in a large pot. Add onion, salt, and herbs, and sauté for about five minutes, or until onion softens. Add spinach, turn up the heat, and cook, stirring, until the spinach wilts. Stir in the garlic. Sprinkle in the flour, stir, and cook over medium heat 2 to 3 more minutes. Remove from heat. Mix in the cheeses. Taste to correct seasonings, adding lots of black pepper. Unwrap the thawed filo sheets. Place a sheet of filo in the oiled pan, letting the pastry edges climb up the sides. Spray lightly with oil, and add another sheet. Keep going until you have a pile of 8 oiled sheets. Add half the filling, spreading it to the edges, then repeat with 8 more sheets of oiled filo, followed by the remaining filling. Layer the rest of the filo over the filling, spraying oil in between. Oil the top, tuck in the edges, and bake, uncovered for about 45 minutes, or until golden and crispy. Serve hot or warm.

Blueberry muffins (makes 18 muffins)
Recipe courtesy of The Culinary Institute of America
http://www.hsph.harvard.edu/nutritionsource/blueberry-muffins/
If you buy a blueberry muffin when you are out, you’ll likely be buying a muffin that weighs 140 grams, contains 1800 kJ, and is made with refined flour and lots of added sugar. The muffins from this recipe weigh about 57 grams, contain 540 kJ, and are made with a mixture of wholemeal, white, and almond flour. Note that you don’t need to buy almond flour; you can make your own almond flour by grinding whole almonds in your food processor. All of the butter has been replaced with canola oil and the amount of fresh fruit has been doubled. Orange zest adds a zingy background note that contrasts nicely with the sweetness of the blueberries. The result is a moist, flavourful blueberry muffin that will provide longer lasting energy compared to the usual bought muffin.

- 1 cup wholemeal flour
- ¾ cup plain flour
- ¼ cup almond flour
- 1 tsp baking powder
- ½ tsp baking soda
- ½ tsp salt
- 1 tsp orange zest
- 2 cups fresh or frozen blueberries (or other fresh or frozen berries)
- 2 eggs, large
- 1 ¼ cups low-fat (1%) buttermilk (or add 2 tsp lemon juice to plain milk)
- ½ cup brown sugar
- 6 Tbsp canola oil
- 1 Tbsp orange juice
- ½ tsp vanilla

Place the rack in the top third of the oven and preheat the oven to 200°C. Line muffin tins with paper liners. In a large mixing bowl, combine the flours, baking powder, salt, baking soda, and orange zest. Add the fresh blueberries and toss gently to coat the blueberries in flour. This will help keep the blueberries suspended in the batter versus rather than them all falling to the bottom. In a medium mixing bowl, lightly beat the eggs, then whisk in the buttermilk, brown sugar, canola oil, orange juice, and vanilla. Don’t be concerned if the mixture looks curdled or lumpy. Pour the wet ingredients into the dry ingredients and stir until most of the flour is incorporated. The mixture can be slightly lumpy; don’t over mix. Divide the batter among the 18 prepared muffin cups. Bake 12 to 14 minutes, until the muffins are golden brown around the edges.
Lemon chickpea breakfast muffins (makes 12 muffins)

Recipe courtesy of The Culinary Institute of America

http://www.hsph.harvard.edu/nutritionsource/lemon-chickpea-breakfast-muffins/

Lemon and cardamom is a classic flavour pairing that make these muffins fragrant and delicious. Using pureed, canned chickpeas creates a very moist, tender muffin because the chickpea starch holds water so well. The addition of ground almonds to the batter contributes a hearty nuttiness as well as healthy fats. Pair these muffins with fresh fruit and yogurt for a satisfying breakfast. You can also grab a muffin and a cup of tea for an easy afternoon snack.

Ingredients:
- 1 can chickpeas, drained and rinsed
- Zest from two lemons
- Zest from one orange
- 2 Tbsp lemon juice, freshly squeezed
- 2 Tbsp orange juice, freshly squeezed
- ¼ cup extra virgin olive oil
- ½ cup granulated sugar
- 2 egg yolks
- 2/3 cup wholemeal flour, sifted
- 2 tsp baking powder
- ½ tsp salt
- ½ tsp ground cardamom
- 1/3 cup ground almonds
- 2 egg whites
- 1½ tsp granulated sugar
- ¼ tsp ground cardamom

Preheat oven to 160-170°C. Line muffin tin with paper liners. Purée the chickpeas in a food processor until smooth. Add the lemon and orange zest and juice, olive oil, sugar, and egg yolks and purée until smooth. Sift together the flour, baking powder, salt, and cardamom. Stir in the chickpea mixture, then add the ground almonds. Whisk egg whites until they hold semi soft peaks and fold into the batter. In a small bowl combine the ground almonds, sugar, and cardamom and set aside. Scoop batter into a 12 muffin tin and sprinkle with some of the almond-sugar-cardamom mixture. Bake 12 to 13 minutes, or until a toothpick inserted in the centre of a muffin comes out clean.

Chicken pitas (serves 2)

Ingredients:
- 2 wholegrain pita breads
- 2 Tbsp low fat plain yoghurt
- 2 tsp tomato puree
- 2 tsp tikka masala curry paste
- 150g skinless uncooked chicken
- 1 tsp vegetable oil
- Shredded lettuce
- Cherry tomatoes

Preparation:
Mix together the yoghurt, tomato puree and curry paste. Add the chicken and toss to coat. Cover and refrigerate for 15 minutes. Preheat a non-stick frying pan over a medium heat. Add oil. Put the marinated chicken pieces into the pan and stir-fry for around 8 minutes. Warm the pita breads and split them open. Fill with chicken, lettuce, tomatoes and cooked chicken.
Thai fish cakes (serves 4)
http://www.healthyfood.co.nz/recipes/2008/november/thai-fish-cakes

500 g potatoes (such as desiree), peeled, chopped
425 g can tuna in spring water, drained, flaked
1 red capsicum, finely chopped
6 spring onions, finely chopped
2 Tbsp chopped fresh coriander
1 tsp finely grated lime zest
1 egg
¼ cup flour
½ tsp olive oil

Dipping sauce
¼ cup (60 ml) salt-reduced soy sauce
1 Tbsp rice vinegar
2 tsp castor sugar
1 red chilli, deseeded, sliced
2 cups cooked rice
4 cups green salad
Lime wedges

Cook potatoes in a large saucepan of boiling water for 12 minutes or until tender. Drain, and return to pan. Mash roughly with a fork, and set aside to cool.
Add tuna, capsicum, spring onions, coriander, lime zest and egg to pan, and mix well.
Shape mixture into 12 patties. Place flour onto a large plate and lightly coat each patty.
Brush a non-stick frying pan with oil and heat over a high heat. Cook patties in 3 batches for 2–3 minutes each side or until golden.
To make dipping sauce, mix all ingredients in a bowl. Serve cakes with sauce, rice, salad and lime wedges.

Variations
Make it gluten-free: Replace flour with rice flour, and use gluten-free tamari in the dipping sauce.

Muffin frittata with vegetables
http://oldwayspt.org/recipes/muffin-pan-frittatas

Here’s a great way to use colourful vegetables such as courgette, onions, and capsicum and pair them with eggs for an appetizer or light lunch. For a quick breakfast, bake the night before and refrigerate. Quickly re-warm in the microwave in the morning.

6 eggs
½ cup milk
¼ tsp salt
1/8 tsp pepper
1 cup (100 g) shredded Edam or noble cheese
¼ cup chopped capsicum
¼ cup chopped courgette
2 Tbsp chopped red onion (optional)

Preheat the oven to 180°C.
Beat the eggs, milk, salt, and pepper in a medium bowl until blended. Add the cheese, zucchini, pepper and onion. Mix well.
Spoon evenly into 12 greased muffin cups which hold about ¼ cup each. Bake for 20-22 minutes, just until set.
Cool on a rack for 5 minutes. Remove from the cups and serve warm.

Fruity swiss muesli (serves 4)

¼ cup wheat germ
1 ½ cups rolled oats
1 ½ cups apple juice
2 Tbsp lemon juice
2 Tbsp honey
2 apples, grated with skin left on
½ cup sultanas
1 pear, chopped (leave skin on)
1 cup low fat, unsweetened yoghurt

Combine wheat germ, rolled oats and apple juice in a bowl; cover and refrigerate overnight.
In the morning, stir in lemon juice, honey, apples, pear, sultanas and yoghurt. Serve.
NB. More or less yoghurt may be added, depending on the consistency you desire.
Banana berry smoothie (serves 1)
1 medium-size or large, ripe banana
½ cup frozen blueberries
4 fresh or frozen strawberries, hulled
1 cup milk
1 tsp honey
2 or 3 ice cubes if desired or frozen spinach (if feeling adventurous)

Place all the ingredients in a blender and blend until smooth. Serve right away.

Light meals
Tuna salad (serves 1-2)
1 can of tuna in spring water
1 cup chopped lettuce
1 thinly chopped spring onion
1 tomato, chopped
100 g red capsicum, sliced
1 stem celery, sliced
1 carrot, grated
Parsley, torn
1 Tbsp low fat French dressing
Grainy bread, to serve

Combine all ingredients. Serve on grainy bread.

Poached eggs, mushroom and tomato (serves 1)
1 large Portobello mushroom
6 cherry tomatoes
Pepper
Oil for spraying
2 eggs
100 g spinach leaves
Pinch nutmeg
1-2 slices wholegrain bread, to serve

Season the mushroom and tomatoes with pepper, spray with oil and place under a hot grill for 5 minutes. Poach the eggs for 3-4 minutes. Wilt the spinach in a saucepan, drain well and add a pinch of nutmeg. Place mushrooms, tomatoes and eggs on spinach. Enjoy with toasted wholegrain bread.

Quinoa salad with beetroot, pumpkin and feta (serves 6)
800 g pumpkin, peeled, cut into 3cm pieces
1 Tbsp thyme leaves
1/3 cup olive oil
400 g quinoa, rinsed
2 oranges, peeled, white pith removed
1 Tbsp honey
1 tsp wholegrain mustard
1-2 cups grated beetroot
1/3 cup flat-leaf parsley leaves, chopped
½ cup walnuts, toasted, chopped
120 g feta, crumbled

Preheat oven to 200°C. Spread pumpkin over a lined baking tray. Top with thyme. Season. Drizzle over 1 Tbsp oil, toss to combine. Bake for 25 mins, turning once, until tender. Set aside to cool.
Cook quinoa following packet directions and set aside to cool.
Holding each orange over a bowl to catch juice, cut either side of membrane to release segments. Squeeze remaining juice into the bowl. Shake the honey, mustard, orange juice and remaining oil in a screw-top jar to combine.
Toss pumpkin, quinoa, orange segments, beetroot, parsley, walnuts and feta in a large bowl. Drizzle with dressing and season.

Roast pumpkin and lentil soup
2½ cups pumpkin, peeled and diced
2 Tbsp oil
1 cup dried red lentils
1 large onion, diced
2 cloves garlic, crushed
2 tsp curry powder
1 Tbsp fresh ginger, finely grated
2 Tbsp fresh coriander, chopped
½ cup reduced fat, unsweetened yoghurt

Heat oven to 225°C. Coat the pumpkin in 1 Tbsp oil. Spread out the pumpkin on a roasting tray and roast in oven for approximately 25 minutes or until browned and cooked though.
Heat a large saucepan with remaining oil. Sauté for 1 min. Add lentils and 4 cups water. Simmer gently for approximately 30 minutes or until the lentils are soft.
Remove from heat and add pumpkin. Puree to smooth consistency.
Garnish with yoghurt and coriander.
A Paleo-Type of Diet
What is “Paleo” and why should I think of eating this way?

You might have heard a lot recently about the benefits of eating a “Paleo” or “hunter-gatherer” type of diet. Basically, this means pretty much eating what we used to eat when humans first evolved, in other words, anything that could be caught or foraged. In reality, this means eating lots of vegetables and fruit, quite a bit of meat and fish, certain fats and oils, and some nuts and seeds. Foods to be avoided include anything that is heavily processed including grains (all breads, breakfast cereals, baked goods), refined sugar (sweets, spreads), and certain vegetable oils (the more processed ones).

There is a bit of disagreement among people who follow this way of eating over whether dairy foods (milk, cheese and yoghurt) and beans and legumes (lentils, baked beans) should be limited as well. This disagreement arises because we have to use different kinds of research to try and work out what our cavemen ancestors actually ate, which can be difficult.

However, all would agree that eating Paleo is about having a “whole-foods” approach to nutrition where all the foods you eat are as close as possible to their natural state. The main argument for following a Paleo diet is that because humans evolved eating this way, then it must be the best diet for our bodies. Supporters argue that human bodies weren’t designed to cope with lots of grains and sugar which were introduced into our diets only quite recently in terms of human history. Paleo followers believe that a more western way of eating, which tends to have high amounts of grains and sugar, is responsible for a lot of the adverse health issues we see today (like obesity and diabetes).

While there have been a few short-term studies lasting just a few weeks or months that have shown that a Paleo way of eating can have some health benefits, lots of questions remain including:

1) What are the longer-term effects of eating a Paleo type diet?
2) Can people stick to this way of eating long term?
3) Is it a more expensive way to eat?

We hope that our SWIFT study will answer these questions.

A note about our Paleo diet - our diet is modified from many that you will see online or in the bookstore. We believe that these minor modifications still follow the Paleo philosophy but allow people a little more leeway that will encourage better long-term adherence to this way of eating. Losing weight is about making appropriate lifestyle behaviour changes which are safe, feasible, and appropriate. After all, if it is too hard to fit into your normal daily

Dukkah

250 g hazelnuts
25 g cumin seeds
50 g sesame seeds
5–10 fennel seeds
50 g pistachio nuts
1 tsp salt (if nuts unsalted)
25 g coriander seeds
¼ tsp pepper

Roast all ingredients in oven at 180°C until pale golden, stirring often.

Parsley pesto

1 cup packed parsley
25 g parmesan
2 cloves garlic
60 ml olive oil
2 Tbsp sunflower seeds

Process dry ingredients then add oil slowly.

* Modified from Paleoleap.com
Snacks and dips

Roasted seeds
1 cup pumpkin seeds
1 cups sunflower seeds
1 cup sesame seeds
1/3 cup linseeds
1/3 cup almonds
1/4 cup soy sauce

Bake for 10 minutes at 180°C stirring every 2 minutes.

Spiced chickpeas
2 Tbsp olive oil
3 cloves garlic
½ tsp cumin seeds
1 tsp fennel seeds
1 tsp chilli
1 tsp curry powder
2 tins chickpeas
1 lemon

Cook onion, garlic and spices in oil, then cook chickpeas for a few minutes. Add zest and juice and season well.

Capsicum and chilli dip
3 red peppers
¼ cup olive oil
1 tsp chilli powder
1 Tbsp wine vinegar
1 tsp salt
1 cup nuts

Lightly rub peppers with oil and roast for 20 minutes at 200°C until skins blister. Remove, cover with a plate and let sweat and cool then peel off skins. Process all ingredients and serve with vegetable dippers.

life, you will not stick at it for long! If you are struggling to be strict about your approach to Paleo, we recommend the 80:20 rule. This means that 80% of the time, you follow the diet, and the other 20% of the time you can relax a little. In practice, this means that you really cannot forgo your porridge in the morning – then continue to have this a few days a week but try eat a more Paleo-friendly breakfast in the weekends, for example.

If you are interested in reading more about the Paleo diet you might like to try:

Online: www.marksdailyapple.com or www.thePaleodiet.com
Books: The Primal Blueprint by Mark Sisson

A basic summary of foods you can and can't eat

**Can eat:** vegetables, fruit, meat, fish, chicken, nuts, seeds,

**Can't eat:** grains, refined sugar, baked goods, sweets, artificial sweeteners

Remember the 80:20 rule. This means Paleo at least 80% of the time, with a bit of leeway the remaining 20%.

Vegetables

You can eat all vegetables including some starchy vegies like potatoes, pumpkin or kumara. However, restrict these starchy options to one serving (one kumara/potato or 1 cup mashed) a day unless you are very active (exercise more than 2 hours each day).

Corn is a grain rather than a vegetable so you need to avoid corn in any form (whole kernel, creamed corn, popcorn).
Fruit
You can eat all fruit including bananas. However, you might want to limit your fruit intake to three pieces a day if you are trying to lose weight.

Avoid dried fruit as it is easy to overeat this.

Avocados are a fruit and are fine to eat – enjoy (in moderation of course)!

Meat, fish and eggs
You can pretty much eat all types of meat, fish and eggs on this diet – although we suggest limiting the frequency of some types.

Focus on “whole-food” cuts of meat including beef, lamb, pork or venison (steak, roast, chops, schnitzel, mince), chicken (whole, pieces, breast and thigh meat), or fish (fillet, whole).

Limit more processed options like bacon, sausages, salami and other processed meats to once or twice a week in total.

Canned fish like tuna or salmon is okay on our more pragmatic Paleo diet – while these are processed foods, choose the plainer options (in brine, oil or water) rather than the flavoured varieties.

However, we do recommend that you avoid highly processed options like fish fingers, fish burgers, and bought meat patties. You can try making your own versions of some of these foods though.

Fats and oils
Coconut oil, coconut cream and coconut milk
Extra virgin olive oil (not the other types of olive oils as they are very highly processed which is against the Paleo philosophy)
Nut oils like walnut oil, avocado oil, macadamia oil, hazelnut oil
Butter

Drinks
Water
Herbal teas
Coconut water
Coffee
Caffeinated teas

Moroccan mince
500 g pork mince
1 tsp paprika
1 tsp ginger
1 tsp cumin
1 tsp cinnamon
1 onion
1 carrot
1 green pepper
400 g tin tomatoes

Brown mince, add spices and simmer all ingredients together.
Slow cooked spicy beef

500 g blade steak
¼ cup oil
1 onion
2 cloves garlic
½ tsp cumin
1 tsp coriander
1 tsp turmeric
½ tsp ginger
1 tsp pepper
1 tsp chilli
8 whole cloves
1 tsp cinnamon
125 g tin tomatoes or 3 fresh
1 Tbsp vinegar
1 tsp salt
150 ml yoghurt
1 fresh chilli

Sear meat and remove from pan. Cook onion and garlic for 2–3 minutes, add spices and cook a further 2 minutes. Add beef and tomatoes and bring to the boil. Cook at 150°C for 1–2 hours until tender. Add yoghurt and chilli near the end and adjust seasonings.

Chicken, kumara and lemon bake

6 potatoes
2 kumara
2 rashers bacon
8 pieces chicken
6 tomatoes
1 lemon, thinly sliced
1 tsp smoked paprika
1 Tbsp olive oil

Slice vegies and place in dish. Top with bacon and tomatoes and lemon and sprinkle with paprika. Top with chicken and drizzle with oil. Bake 60 minutes or so at 180°C.

Nuts and seeds

You can eat any nuts and seeds that you like – such as cashews, almonds, walnuts, sunflower seeds, pumpkin seeds – as well as any “butters” made from these including almond butter and so on.

Note that peanuts are not nuts, they are actually a legume! While some Paleo diets avoid legumes, our version includes a small amount as described below. Therefore you can have some peanuts and even peanut butter – but limit these choices to once or twice a week.

Dairy

Although a lot of Paleo diets avoid dairy, there is evidence that some of our early ancestors consumed limited amounts of dairy food, especially near the end of the Paleolithic period. Dairy foods are also a very important source of calcium and other nutrients.

On our Paleo diet you can have up to 1 serving of dairy foods per day (unless you are intolerant to dairy). This means:
- 1 cup of yoghurt (try unsweetened Greek yoghurt particularly) or
- 30 g cheese or
- 1 cup of milk

Full fat versions are fine, and you can include some cream/sour cream if you like.

Legumes

Many Paleo followers also remove all legumes from the diet. However, legumes are a very important source of fibre, protein, iron, calcium, zinc and some B vitamins.

Legumes include beans (like red kidney and haricot beans), peas (such as green peas or chickpeas) and lentils (red and brown).

These foods make great hummus and salads and can be part of a Paleo diet.
On our Paleo diet you can have up to 1 serving of legumes per day.

This means:

½ cup hummus
1 cup of beans, peas or lentils

For practical reasons, you can include canned varieties (like 4 bean mix or tinned lentils). However, we do not recommend highly processed options like baked beans or some of the new flavoured lentil mixes.

Sweeteners

Honey
Dark chocolate – the higher the cocoa content the better!

This seems a bit strange given chocolate is a pretty processed food. However, dark chocolate (not all the other varieties) contains lots of antioxidants and generally is quite low in sugar. The saturated fat in dark chocolate is also the type that doesn’t seem to have a bad effect on your cholesterol. This doesn’t mean go mad and eat heaps – but if you need a sweet treat now and then, dark chocolate is the answer.

Drinks

Freshly juiced fruits and vegetables
Nut milks (e.g., almond milk)

Seafood in slow roasted tomato sauce

2 Tbsp olive oil
3 cloves garlic
1 red onion
2 bay leaves
2 sprigs thyme
2–3 strips lemon peel
4 anchovies
800 g tinned tomatoes
1 punnet cherry tomatoes
2 cups fish stock
½ cup white wine or water
6 thick pieces meaty fish
12 prawns
12–18 mussels

Bake oil, garlic, onion, herbs, peel and anchovies and bake 15 minutes at 180°C. Add tomatoes, stock and wine, cover with foil and bake 45 minutes. Add seafood, cover and cook 20 minutes. Remove foil and bake until shells open.

Rogan josh

1 kg lamb
½ tsp ground cloves
1 Tbsp ghee
1 tsp turmeric
2 onions
3 cloves garlic
½ cup yoghurt
1 Tbsp fresh ginger
1 tsp chilli
1 tsp salt
1 Tbsp coriander
410 g tin tomatoes
2 tsp cumin
3 tsp garam masala

Cook onion until soft. Add yoghurt, spices, salt and tomatoes and simmer 5 minutes. Add browned meat, cover and cook on low heat 60–90 minutes until tender. Uncover and simmer until thick. Add garam masala.

There are a few foods you need to avoid wherever possible on a Paleo diet, even our more liberal one! The main type of food to avoid are the grain-based foods. This is fairly standard in Paleo diets, even though some anthropology researchers argue that grain based foods were around in the latter stages of the Paleo era. Because of this, we have said that you can include 3-4 servings of grains a week (following the 80:20 rules), if you cannot manage without them. But you certainly don’t have to include any grains.
Chicken tikka
750 g chicken fillets
3 tsp coriander
¼ onion
3 tsp cumin
2 cloves garlic
3 tsp garam masala
1 Tbsp fresh ginger
1/3 cup yoghurt
2 Tbsp lemon juice
1 tsp salt
Process all ingredients then add yoghurt. Marinate chicken at least 4 hours and BBQ.

Baked fish
Cover fillets with cream cheese, tomatoes, mushrooms, herbs, cheese and seasoning. Bake 20–30 minutes at 180°C.

Kofta kebabs
1 onion
2 Tbsp garlic
500 g mince
½–1 cup mint
¼ cup coriander
1 tsp cumin
1 tsp coriander
1 tsp salt
1 tsp pepper
1 egg
Sauce:
1 cup Greek yoghurt
1 Tbsp lemon juice
¼ cup mint
¼ cup cucumber
Salt and pepper
Blend all meatball ingredients together and squeeze tightly onto 6 skewers. Refrigerate for at least 1 hour. Barbeque. Mix all sauce ingredients together.

Grains
Grain based foods include flour and therefore anything made with flour – bread, pasta, wraps, cake, biscuits, bagels, muffins, scones and slices. It also includes things like corn chips and tacos since they are made from corn which is a grain.

This category also includes rice (white and brown), oats, quinoa, spelt, rye and all breakfast cereals.

Gluten-free grains are included in this group as well.

Fats and oils
Highly processed seed oils such as canola, safflower, sunflower, sesame, and soy oil or general ‘cooking oil’.

All margarines

Sweeteners
Refined sugar in all its forms (white, brown, raw).

This means you need to cut out all foods made with sugar such as cakes, biscuits, slices, muffins, scones, doughnuts, and lollies.

Don’t forget that a lot of processed foods contain sugar, even ones that don’t taste sweet such as baked beans, sauces, and packet mixes. Check the labels.

All artificial sweeteners should also be avoided – but if you have to have something sweet, these are preferred over the sugar versions.

Drinks
Diet or normal soft drinks are not recommended.

Avoid ready-to-drink (RTD) alcohol mixers and limit beer.
Meal ideas
Here are some meal ideas you can try. This resource also contains several recipes that meet our Paleo philosophy.

Breakfast
- Fresh fruit salad with yoghurt, topped with a sprinkling of nuts and/or seeds
- Omelette (you could add any vegetables or some ham or cheese), or scrambled or poached eggs
- Smoothie with fruit, yoghurt (preferably with little added sugar – try Greek). You could add a little cream or coconut cream for a richer smoothie

Lunches
- Fresh salads – include cheeses, meat or fish, seeds or nuts for variety – add avocado and dress with olive or avocado oil if you find you need extra energy
- Roasted vegetables (use olive oil) in salads are filling and tasty (make extra the night before)
- Soups – hearty ones containing some meat or beans are good – make a big batch and freeze for quick lunches
- Frittatas – can also be frozen in slices ready for a quick meal
- Fritters – yes these might include a little bit of flour to bind the filling, but it is usually pretty minimal. Use lots of vegetable based fillings like grated courgette or carrot, leftover cooked potato or pumpkin, and well as some protein source like ham, tuna, or salmon. Cook the fritters in olive oil or a little butter or coconut oil.

Dinners
You will probably find that dinner is the easiest meal for you to adapt as it might just involved removing the pasta or rice part of the meal and replacing it with a bigger serving of vegetables.

See our recipe section for some tasty dinner options.

Zucchini, carrot and peanut loaf
2 Tbsp oil
1 large onion
½ cup peanuts, chopped
1 cup grated zucchini
1 cup grated carrot
½ cup rolled oats
2 Tbsp coconut
1 Tbsp tomato puree
½ cup ground almonds
2 Tbsp fresh herbs
½ tsp salt
3 eggs


Baked eggs with chorizo
2 Tbsp tomato puree
4 Tbsp cream
Salt and pepper
16 thin slices chorizo
8 eggs
2 generous Tbsp cheese

Mix puree and cream and season well. Spoon half the mix into two dishes. Add some chorizo, break in two eggs, then top with chorizo, then remaining sauce. Top with cheese and cook 9–12 minutes at 230°C.

Chicken and chorizo fritters
1 cup cooked chicken
1 cup grated courgette
1 chorizo
¼ cup basil
Salt and pepper
2 egg whites
1/3 cup ground almonds

Mix all ingredients and shallow fry in oil.
Main meals

Zucchini and tomato gratin

- 5 Tbsp oil
- 600 g red onions
- 750 g tomatoes
- 750 g zucchini
- 1 tsp fresh marjoram
- 2 cloves garlic
- Salt and pepper

Cook onion and garlic in oil until soft. Layer in dish with sliced vegetables. Drizzle with oil and cook for 45 minutes at 200°C.

Potato crusted silverbeet and feta tart

- 800 g floury potatoes
- 1 egg
- 1 tsp cumin seeds, toasted
- 1 clove garlic
- 3 Tbsp melted butter
- Salt and pepper

Filling:
- 2 Tbsp oil
- 1 red onion
- 1 clove garlic
- 1 Tbsp fresh rosemary
- 3 cups packed shredded silverbeet
- 1 cup coconut cream
- 5 eggs
- 1 Tbsp wholegrain mustard
- 150 g feta cheese
- 10 cherry tomatoes
- ¼ cup Parmesan

Peel and coarsely grate potato. Whisk egg, cumin and garlic and mix through. Add melted butter and season. Press mixture firmly onto base and sides of very well greased 26cm tin. Bake 30 minutes at 180°C. While it cooks, take it out several times and press down to seal any holes. Filling: heat onion and garlic in oil until soft. Add silverbeet and cook until soft, cool for 10 minutes. Whisk cream, eggs, mustard and feta and mix together. Pour into potato, press in tomatoes and top with parmesan. Bake 25 minutes at 180°C.

Desserts

One of the main points of this diet is to remove refined sugar so this does remove a lot of what you might consider desserts. However, there are some good options.

- Choose fruit as a healthy dessert, or fruit with cheese.
- Try roasting fruits – this makes them very sweet, and a small amount of chocolate, nuts and cream added makes them even more delicious.
- Peel bananas, wrap them in glad wrap and freeze – then put them into a food processor and turn them into instant ice-cream.

Snacks

- Nuts preferably raw and a little bit of dried fruit
- Vegetable sticks with hummus or other vegetable or dairy based dip
- Slice of cheese
- Ham with other items rolled up in it such as melon, cottage cheese, or grated carrot

Are there some easy substitutions that I can make?

Definitely! Try some of the following:

- Some people like to make “noodles” out of zucchini and carrots to use as a base for a pasta sauce. They just need to be briefly cooked.
- Mashed cauliflower works well as a substitute for mashed potato if you like the taste of cauliflower (note that this works best with a stick blender if you have one).
- Supermarket ‘Paleo’ lunch – cooked chicken drumsticks from the deli or a small packet of smoked salmon or a tin of flavoured tuna with some fresh salad or fruit and a handful of raw nuts.
- Slices of cooked aubergine can be used instead of lasagne sheets.
- Some people like to make cauliflower “rice” to go under curries – put raw cauliflower florets into a blender (or grate), then sauté with a little oil or butter for a few minutes.
What if I am really struggling to avoid grains and sugar?

Some people do struggle, particularly in the early stages of adapting to this way of eating. It does become easier and many people report feeling better on this type of eating plan once they adapt to it.

However, here are some halfway measures if you are really struggling to adapt:

- The main way is to still have your bread or cereal, but to simply have a smaller portion of it. For example, if you must have rice with your curry, try and have half your normal serving, and then decrease this further over time. If you have to have muesli or porridge for breakfast then try and have a smaller serving.
- If you are out and having pizza, choose a thin crust one rather than a thick crust.
- Have an open sandwich – this is where you place your fillings on the bread but you don’t use a bread “top” – so you are only using half the amount of bread as usual.
- Try some of the new large crackers or crispbreads as your “bread” option.
- A diet soft drink is better than a regular soft drink.

Chicken gumbo

2 Tbsp oil
1 tsp Cajun seasoning
1 leek
2 spring onions
1 carrot, grated
1 kumara, grated
2 celery stalks
1 red capsicum
1 courgette
400 g chicken
2 cups chicken stock
400 g tin or 4 fresh tomatoes

Stir-fry vegies and seasoning in oil until soft. Add the remainder of ingredients and simmer for 40 minutes.

Spicy tomato soup with meatballs

300 g mince
1 onion
1 Tbsp oil
2 Tbsp fresh parsley
Chilli to taste
Salt and pepper
1 egg, beaten
3 Tbsp ground almonds
3 Tbsp oil

Soup:
1 Tbsp oil
2 onions
1 Tbsp smoked paprika
800 g tinned tomatoes
Juice and zest of 1 orange
500 ml chicken stock
Salt and pepper
3 Tbsp fresh parsley

Cook onion for 10 minutes, cool slightly then mix with mince, herbs, sauce, seasonings and beaten egg. Roll into tiny balls the size of a marble. Dust lightly with flour and brown. Soup: cook onion until brown. Add paprika and sizzle for 30 seconds, then add tomatoes and remainder and simmer for 30 minutes. Puree then return to heat and add meatballs.
Soups

**Pumpkin and coconut soup**
- 1 Tbsp oil
- 1 Tbsp green stock powder
- 1 onion
- 400 ml coconut cream
- 750 g pumpkin
- 1–2 tsp cumin
- 3 cups boiling water

Sauté onion until soft. Add water and spices and simmer pumpkin until soft. Puree then blend in coconut cream.

**Roasted pumpkin, garlic and rosemary soup**
- 1½ kg pumpkin
- 2 Tbsp fresh rosemary
- 12 cloves garlic
- 2 onions
- 100 g pumpkin seeds
- 50 ml olive oil
- 1 litre vegetable stock
- 100 g feta (if are eating dairy)

Roast first 6 ingredients for 45 minutes, stirring every 10 minutes or so. Blend with stock and simmer 5 minutes. Serve with feta.

**Frequently asked questions**

**Q: What are my macronutrient targets on this diet?**

Protein – a moderate protein intake is recommended. This ranges from 0.5-1 gram per kilogram of bodyweight. The higher value (1g/kg) is generally for more physically active people.

Carbohydrate – this kind of diet is naturally lower in carbohydrates as it is difficult to eat more than about 100-150g each day if you are not eating breads, cereals, baked goods or refined sugar.

Fats – add foods with fat to satisfy hunger and provide satiety. Use mostly foods that contain monounsaturated fats like olive oil in dressings or on vegetables, olives, and raw nuts. Adding some cheese, a splash of cream and using some butter in cooking is okay for most people when they are not consuming them with sugar or refined carbohydrate type food – i.e., the white fluffy stuff most of us adore!

**Q: What's wrong with some of the more common seed oils?**

Whole-food diets generally recommend avoiding polyunsaturated fats that have been commercially produced from seeds or grains. These include sunflower, safflower, canola, corn oils and all margarines.

The reasons for this are:
1. They require extensive processing to produce as they are not naturally occurring except in small amounts in seeds and nuts.
2. Most of them are higher in omega-6 fatty acids – and if these are too high relative to the amount of omega-3 fatty acids, this can increase the risk of inflammation in the body which can adversely affect your health.
3. They are prone to oxidation when heated (or exposed to light or air) which causes formation of lipid peroxides. These peroxides set up free radical induced damage our bodies.

**Q: I thought Paleo diets did not include dairy products?**

Many advocates of a Paleo approach to eating say that dairy must be avoided in the diet because it is bad for our health. Their argument is mainly to do with the belief that humans did not drink milk until relatively recently (10,000 years ago which in not much in terms of the two million years of human evolution). And we know this because it was not possible to milk wild animals.
They then promote this as good “evidence” that dairy foods are therefore bad for health, which we believe is inappropriate. Yes, some people are allergic to dairy foods, but true milk allergy is pretty rare – and most (80-90%) young children who are allergic to milk grow out of it by the time they are 2-3 years of age. Yes much of the world’s population has lactose intolerance where they can’t digest the sugar in milk which leads to stomach upset. However, lactose intolerance is much less common in European populations and lactose is also not present in all dairy foods. For example, cheese contain essentially no lactose, and yoghurts have lactase added to them – the enzyme required to digest the lactose.

Dairy foods are also a good source of calcium. While calcium can be obtained from other sources like fish (with small bones), green leafy vegetables, nuts and seeds, these foods generally do not provide as much calcium per serve as milk and other dairy options. One of the good things about a whole-foods diet like this one is that it should be much lower in sodium which lessens the amount of calcium to be excreted in the urine – all of which helps to ensure good calcium status in your body.

At the end of the day we think our modified Paleo diet promotes the whole-food philosophy while increasing the chance of you incorporating it into your everyday life AND sticking to it long term. Allowing a maximum of 1 serving of dairy foods a day should have no adverse health effects and certainly allows more choice and variety in your diet – essentially factors for long-term adherence.

Q: What about beans and legumes – we’re not supposed to eat those either are we?

Legumes are vegetarian sources of protein, fibre and minerals like iron and zinc, and are particularly important for much of the world’s population where high intakes of animal protein are simply not achievable. However, legumes also contain what we call “anti-nutrients” such as phytate. This means that our bodies generally can’t get as much of the nutrients out of these foods compared with something like steak.

While this is true, legumes remain an important and tasty addition to the diet and as long as they are cooked properly (they are pretty inedible if they are not) they are perfectly safe to consume.

You don’t have to add legumes on this whole-foods diet – but you can have up to 1 serving each day if you would like to.

Cauliflower and chickpea salad

½ small cauliflower
1 can (400 g) chickpeas, rinsed and drained (or use 2 cups cooked chickpeas)
½ red onion, thinly sliced
½ bag baby spinach leaves
1 pepper (any colour), thinly sliced

Dressing:
½ cup aioli (use any recipe)
1 tsp curry powder
½ tsp turmeric
Salt to taste
1 Tbsp lemon juice
Chili to taste

Combine all dressing ingredients and mix through salad ingredients.

Roast chicken and apricot salad

2–3 chicken breasts
6–8 ripe apricots
2 Tbsp olive oil
2 Tbsp honey
2 tsp wholegrain mustard
4 cups mesclun salad

Dressing:
2 Tbsp runny honey
2 tsp wholegrain mustard
2 Tbsp orange juice
½ cup ground roasted hazelnuts
¼ cup olive oil
Pepper

Combine oil, honey and mustard and pour over chicken and apricots. Roast 12–15 minutes at 180°C until chicken has cooked and apricots have caramelised. Spoon over warm dressing.

Dressing: warm honey, mustard and juice together and combine with remainder of ingredients.
Waldorf salad
2 cups diced apple (skin on)
1 ½ tsp lime juice
1/3 cup celery
¼ cup cranberries
¼ cup walnuts
1/3 cup unsweetened yoghurt
½ tsp lemon rind
1/8 tsp nutmeg

Mix all together after tossing the apples with lime juice.

Marinated seafood
Juice and rind of 6 limes
4 cups seafood
1 kg firm fish
200–300 ml coconut cream
¼ cup parsley
Seasonings

Cut fish into finger-thin strips. Mix in lime zest and juice and marinate fish for at least 4 hours. Drain and combine with remainder of ingredients and season to taste.

Lamb and vegetable salad
1 Tbsp olive oil
½ cup olive oil
1 kg lamb fillets
2 Tbsp white wine vinegar
250 g mushrooms
2 Tbsp fresh basil
2 peppers
2 cloves garlic
2 punnets cherry tomatoes
2 Tbsp parsley
4–6 courgettes
½ cup spring onions

Stir-fry lamb until seared. Cool. Combine all ingredients and marinate 2–3 hours.

Recipes
Breakfast
Nut porridge (serves 2)*
1 cup of pecans or almonds
1 cup of walnuts
¼ cup flax seeds
2 tsp cinnamon
¼ tsp nutmeg
1 tsp ginger
2 Tbsp butter
2 bananas
6 eggs
½ cup coconut milk

Place nuts, seeds and spices in a food processor and pulse until still coarse. Whisk eggs and coconut milk thoroughly. Add mashed bananas and melted butter, then add the ground nuts. Pour into a saucepan and heat over low heat, stirring all the time. Remove from the heat as soon as it is warm and serve with fruit and extra coconut milk.

Smoothies
½ cup seasonal fruit
1 banana
½ cup coconut milk or cream
½ cup Greek yoghurt (if you are eating dairy)
1 Tbsp flax seeds (optional)

Blend all ingredients and enjoy.

Nut and avocado smoothie*
½ cup coconut milk or cream
½ avocado
½ – 1 cup fresh or frozen berries
6 macadamia nuts (or 1 – 2 Tbsp macadamia nut butter) or any other nuts
4–6 Tbsp water
Ice

Blend all ingredients and enjoy.
**Omelettes**

2–3 eggs  
Vegetables of your choice – onion, mushroom, peppers, spinach  
1 Tbsp oil or butter.  
2–4 Tbsp coconut cream  
Seasonings

Beat eggs with coconut cream and seasonings until frothy. Cook vegies of choice in half the oil until tender then remove from pan and keep warm. Heat remaining oil or butter until hot then pour in eggs. Cook very gently over a low heat, lifting omelette as it sets and letting raw egg move into the middle. When almost cooked, top with warm vegies, fold over and serve.

**Salads**

**Roasted red onions and pine nuts**

1 kg red onions  
1/3 cup olive oil  
½ cup balsamic vinegar  
¼ cup raisins  
¼ cup pine nuts or cashew nuts

Peel onions and cut into eighths leaving root intact. Pour over vinegar and oil, cover and cook for 25 minutes at 200°C. Add nuts and raisins and cook a further 15-20 minutes until onions are soft.

**Marinated beef salad**

450 g cold cooked steak  
1–2 tsp mustard  
2 Red onions  
1 tsp oregano  
¼ cup oil  
1 tsp marjoram  
3–4 Tbsp wine vinegar  
1 tsp salt  
2 Tbsp parsley  
Tabasco sauce

Slice beef and onions thickly. Mix all remaining ingredients and pour over meat. Marinate at least 1–2 hours.

**Thai coleslaw**

4 cups mixed cabbage (mixture of red and white), thinly sliced  
3 grated carrots  
3 spring onions  
3 Tbsp toasted sesame seeds  
1 cup mung bean sprouts (optional)

**Dressing:**

2 Tbsp fresh ginger  
3 Tbsp lemon juice  
1 Tbsp lemongrass (optional)  
2 Tbsp runny honey  
Chilli to taste (powder or chopped)  
1 tsp salt  
2 Tbsp oil

Mix all ingredients.

**Chicken and feta salad**

3 courgettes  
2 red peppers  
1 red onion  
3 Tbsp olive oil  
1 cup cherry tomatoes

**Chicken:**

Zest of 2 lemons  
3 Tbsp lemon thyme  
Salt and pepper  
6 chicken breasts

**Dressing:**

100 g feta  
Zest and juice of 1 lemon  
6 Tbsp olive oil  
½ cup basil  
Salt and pepper

BBQ or grill vegetables until tender and add tomatoes. Coat chicken with marinade ingredients and grill until cooked. Process all dressing ingredients.
Intermittent Fasting
Overview

Generally when people try and lose weight, they need to reduce their energy intake by a small amount every single day (about 500 calories or 2000 kJ). For lots of people this is really hard because it means constantly thinking about what they are eating and always trying to eat a bit less every day.

There are lots of different ways of doing intermittent fasting, but we are going to use the 5:2 approach.

This means that for five days a week you eat normally.

For the other two days, you severely restrict your food intake to about one-quarter of your normal intake i.e. you “fast”. For most people, this might be having a small low-energy breakfast like porridge, nothing to eat during the day, and then a big plate of green vegetables with just a small portion of lean meat for dinner.

This resource will provide you with lots of ideas for what you can eat on your two “fasting” days to keep the energy intake right down. In theory, you can eat whatever you like on the other five days. However, we suggest that you still follow a sensible eating pattern – without worrying about every time you go to eat!

So what proof is there that this is a good way to manage your weight? There isn’t a lot of research in humans yet. However, what we do have suggests that intermittent fasting is just as good, if not better, than trying to limit your food intake every day. It might also be better for keeping hold of your muscle mass (which you lose along with body fat when you lose weight). Anecdotally, people report that it is easier to just fast two days a week than trying to limit their food intake every day. We hope that our SWIFT study will add to the current research.

So how can I limit my food intake to only 500-600 calories only a day ……

read on!
Hints for Fast Days

Remember you are aiming for 500 (women) – 600 (men) calories in total for the day.

500 calories is the same as 2100 kilojoules (kJ).

To convert calories to kilojoules multiply by 4.18
To convert kilojoules to calories divide by 4.18

Vegetables

These are your best option. Fill up on non-starchy vegetables (not potato, taro or kumara). Most vegetables are low in calories – see the options below:

<table>
<thead>
<tr>
<th>Vegetable</th>
<th>Calories per 100g</th>
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<tbody>
<tr>
<td>Artichokes</td>
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<td>Asparagus</td>
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<tr>
<td>Beans, green</td>
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<td>Broccoli</td>
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<td>Brussel sprouts</td>
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<td>Cabbage</td>
<td>31</td>
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<td>Capsicum (red)</td>
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<td>Capsicum (green)</td>
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<tr>
<td>Carrots</td>
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<td>Tomato</td>
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<td>Yams</td>
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</table>

You can add a low-calorie salad dressing to increase the flavour or try some of our other flavour-enhancing tips on page 4. You could also add a small serving of a high-protein food – like meat, fish or eggs. The NZ food composition tables (see page 26) can tell you how many kilojoules are in each food.

Additional Resources

Websites
- www.thefastdiet.co.uk
- http://www.closeronline.co.uk/2013/07/the-5-2-diet-what-is-it-and-how-does-it-work-plus-recipe-ideas#.U_a07kWGr8
- http://www.goodtoknow.co.uk/recipes/538311/5-2-diet-meal-plans-what-to-eat-for-500-calorie-fast-days

Books
- The Fast Diet by Michael Mosley and Mimi Spencer
- The fast diet recipe book by Mimi Spencer and Dr Sarah Schenker
Meat, chicken and fish
- Choose lean cuts of meat
- Remove skin after cooking as there is plenty of fat in skin
- Cooking meat and fish on the BBQ is a good fat-free option for summer
- Roast meat on a rack to allow fat to drip away

Eggs
Eggs are versatile and can be great for breakfast, lunch or dinner. Boiling and poaching eggs means you are adding no extra calories from fat. One egg only contains 314 kJ (75 calories).

Soup
Soups tend to fill us up and are therefore is great for the fast days. Vegetable-based soups are best. You can thicken soups with a handful of cooked lentils – these will give you lots of fibre (and therefore fill you up) but don’t contain many calories. If time is short, grab a commercial cup-of-soup for lunch.

Nuts and seeds
Nuts and seeds are full of fibre and help us to feel full. However, they are high in calories so you can only afford to eat small amounts on your fasting days. You might find that 6 almonds or 10 pistachios make a great snack.

Adding Flavour
Add flavour with spices, herbs and other low calorie options, such as:
- Garlic
- Ginger
- Onions
- Any herbs
- Any spices
- Vinegar
- Chili
- Tabasco
- Smoked paprika
- Stock cubes
- Marmite
- Mustard (but not honey mustard)
- Salsa

*Lemon roasted chicken with roast vegetables (serves 4)
1 medium chicken
2 lemons
1 Tbsp olive oil
2 red onions
1 yellow and 1 red capsicum, cut into chunks
2 vines cherry tomatoes
1 eggplant
1 tsp thyme
sprig of rosemary pepper

Preheat oven to 180°C. Place vegetables in roasting pan, season and place chicken on top rubbing oil into skin. Place one lemon into the cavity of the chicken. Squeeze the other lemon over the chicken and vegetables. Sprinkle with thyme and rosemary. Cook for around 90 minutes, until juices run clear.

*Winter stew (serves 4)
1 tsp of olive oil
1 onion
handful of sage leaves
400 g stewing steak, fat removed pepper
2 tsp plain flour
2 parsnips, quartered
4 carrots, halved
½ small butternut, chopped
3 artichokes
2 Tbsp tomato puree
1 bay leaf
250 ml red wine
285 ml vegetable stock
zest of 1 lemon
rosemary leaves

Preheat oven to 170°C. Put oil in a casserole pan, add onion and sage leaves and fry for 3 minutes. Dust meat with seasoned flour and add to pan with the vegetables, tomato puree, bay leaf, wine and stock. Stir gently and season. Bring to the boil, cover with a lid, and cook in oven until meat is tender and falls apart – about 3 hours. Garnish with lemon zest and rosemary leaves.

*Recipes modified from the Fast Diet recipe book by Mimi Spencer
*Meatballs (serves 2)

200 g lean pork mince
1 red onion
1 garlic clove, peeled and crushed
1 carrot, grated
1 courgette, grated
1 tsp thyme
1 egg, beaten
pepper
oil for spraying

For tomato sauce:
Oil for spraying
1 red onion
1 garlic clove, peeled and crushed
1 x tin of flavoured tomatoes
1 tsp tomato paste
pinch of sugar
200 ml water
1 tsp rosemary, chopped
dash of Worcestershire sauce

Place mince in a bowl with onion, garlic, carrot, courgette, thyme, egg, and pepper. Mix well and shape into 12 meatballs. Spray pan with oil and fry over a medium heat until browned. Set aside. Spray the pan with oil and fry onion until softened, add garlic, and cook for 3 minutes. Add the tomatoes, paste, sugar, water, rosemary and Worcestershire sauce. Simmer until reduced. Add meatballs, cover and simmer for 20 minutes. Serve with plenty of vegetables or a salad.

Tuna salad

1 185 g can of tuna in spring water
1 cup chopped lettuce
1 thinly chopped spring onion
1 tomato, chopped
100 g red capsicum, sliced
1 stem celery, sliced
1 carrot, grated
parsley, torn
1 Tbsp low fat French dressing

Combine all ingredients.

Eight things to keep in the fridge

- Eggs
- Lemons
- Non-starchy vegetables like
  - Celery
  - Carrots
  - Cucumber
  - Tomatoes
  - Mushrooms
  - Lettuce
  - Spinach
  - Broccoli
  - Cauliflower
  - Capsicums
- Low fat feta
- Cottage cheese
- Berries
- Low fat greek yoghurt
- Low fat hummus

Five things to keep in the freezer

- Berries
- Soups
- Stock
- Root ginger
- Green beans

Oils and Fats

If you need to use oil in cooking, use a spray oil as much as possible. A light spray can go a long way.

Drinks

The best drinks for the Fast days are water or soda water (add mint and/or lemon juice to flavor it), or tea and coffee with a dash of trim milk and no sugar. Low-calorie drinks can also be consumed. Sugary drinks will take too much of your calorie quota and will not fill you up.
FAQs

Q. Will I feel unwell when I am fasting?
A. Some people may experience headaches or constipation, particularly in the beginning. You can avoid these by drinking lots of calorie-free fluids and eating foods that are rich in fibre like vegetables.

Q. What should I do if I get hungry during the night?
A. If you find you get hungry late at night and can’t sleep well, try having a more substantial evening meal and less during the day.

Q. What sort of foods can I eat on a Fast day?
A. The best kinds of foods to eat are ones that are the most filling while containing only small amounts of energy (calories). In practice, this is usually lots of non-starchy (e.g. not potatoes or kumara) vegetables with small amounts of high-protein foods like eggs, fish or meat. Vegetable-based soups and salads are good choices to help fill you up without eating too much energy. Refined carbohydrates (e.g., most white or sugary foods and drinks) are not going to be the best choices, along with desserts or alcohol as these foods use up the allotted calories very quickly!

Q. What days should I choose for my fasting days?
A. The choice is entirely yours. Pick 2 days during the week which suit you best. These can days that you are busy and not surrounded by food. If you prefer you can fast on two days in a row, or split it up and do them at different times in the week. You can also choose different days each week if you want to. The 5:2 plan is very flexible.

Q. When should I eat?
A. The timetable is largely your own. Find a routine that suits you, your family, your lifestyle, and your day. Like we said, the 5:2 plan is very flexible. You may wish to skip lunch, or dodge dinner.

Q. When should I not fast?
A. If you are feeling unwell, it is better not to fast until you are better. Fasting during prolonged endurance exercise (e.g., exercising for more than two hours at a time) is also not recommended. We advise that you don’t exercise strenuously on your fasting days. A light walk would be fine however.

Q. What happens if I start getting shaky or faint?
A. Some people feel like this if they haven’t eaten for a long time. Unless you are a diabetic requiring medication, this is unlikely to be dangerous. However, if you experience these symptoms, have a snack such as some sliced raw apple or a small packet of raisins.

*Haloumi salad
2 sliced tomatoes
½ capsicum, sliced
50 g light haloumi cheese
75 g mixed salad leaves

Marinade:
½ clove of garlic, crushed
1 tsp chopped parsley
½ tsp chilli flakes
1 tsp olive oil

To make the marinade, combine all ingredients in a bowl and mix together. Add tomatoes to the marinade. Heat a large frying pan and fry the capsicum for about 5 minutes until slightly blackened, then add to the marinade. Fry the haloumi slices until golden on both sides (about 1 minute). When cooked add to the marinade and turn until the haloumi is coated all over. Arrange salad leaves on a wide serving plate and top with haloumi, capsicum, and tomatoes.

*Cottage pie (serves 4)
Oil for spraying
250 g of lean premium mince
1 large onion, diced
2 carrots, peeled and diced
1 x 400 g tin tomatoes
2 Tbsp tomato puree
1 Tbsp Worcestershire sauce
1 tsp dried thyme
pepper
300 ml boiling water
2 Oxo cubes
500 g celeriac, peeled and chopped
2 leeks
100 g low fat crème fraiche

Preheat oven to 200°C. Spray a large pan with oil and brown mince. Add onion and carrot and allow to soften for 10 minutes. Stir in tinned tomatoes, tomato puree, Worcestershire sauce, thyme, pepper, water and Oxo cubes. Bring to boil, cover and simmer for 30 minutes, stirring occasionally. Meanwhile, boil celeriac until tender, drain and mash with crème fraiche. Heat oil in pan and sauté leeks before adding to celeriac mash. Pour beef into a shallow oven proof dish and top with mash. Bake for 30 minutes.
**Chicken patties with salad**

- 125 g chicken mince
- 1 spring onion, finely chopped
- 1 garlic clove, peeled and crushed
- ½ tsp ground cumin
- ½ tsp ground coriander
- pepper

Combine all the burger ingredients and leave to marinate for ½ an hour in the fridge. Shape into 2 patties and grill for 7 minutes on each side, until cooked through. Serve with a green salad.

**Chicken parma (serves 2)**

- ½ tsp olive oil
- 1 clove garlic
- 2 x 150 g skinless chicken breasts
- 2 slices Parma ham (prosciutto)
- 20g feta cheese
- 2 sundried tomatoes (sliced)

Preheat the oven to 200°C. Heat the olive oil in a small frying pan and gently fry the garlic for 1-2 minutes. Remove from heat and stir in the feta cheese and sundried tomatoes. Prepare the chicken by making a slit down one side of the chicken breast to make a pocket, then fill each pocket with half the mixture. Wrap each chicken breast with a slice of Parma ham and put on a baking tray with baking paper. Cook in the oven for around 30 minutes until thoroughly cooked.

**Q. How do I know how much energy (calories) is in different foods?**

**A.** You can use food packaging labels or product websites. Also the calorie content of thousands of New Zealand foods can be found in the New Zealand Food Composition Tables at the following website: [http://www.health.govt.nz/system/files/documents/publications/concise-nz-food-composition-tables-8th-ed_0.pdf](http://www.health.govt.nz/system/files/documents/publications/concise-nz-food-composition-tables-8th-ed_0.pdf)

**Q. How easy will I find it to follow the 5:2 plan?**

**A.** That’s one of the things we are interested in knowing – how well people can fit this way of eating into their lifestyle. However, we know anecdotally that some people find it easy whereas others find it a bit more of a challenge. However, it seems that it will take pretty much everyone 4-6 weeks to get the handle of fasting days, and learning that it is ok to feel hungry for a short time.
Fast Day snack examples

Remember you are aiming for 500 (women) – 600 (men) calories in total for the day.

500 calories is the same as 2100 kilojoules (kJ).

To convert calories to kilojoules multiply by 4.18
To convert kilojoules to calories divide by 4.18

- 10 almonds (73 calories or 305 kJ)
- 10 pistachios (96 calories or 401 kJ)
- 1 Tbsp pumpkin and sunflower seeds (60 calories or 251 kJ)
- Vegetable sticks: carrot sticks, celery stalks, cucumber, sliced capsicum, cherry tomatoes (50 calories or 209 kJ)
- 2 Tbsp hummus, 2 celery sticks (50 calories or 209 kJ)
- 100g blueberries (40 calories or 167 kJ)
- 12 cherries (50 calories or 209 kJ)
- 10 fresh strawberries (40 calories or 167 kJ)
- 10 grapes (35 calories or 146 kJ)
- 1 small packet of raisins (42 calories or 176 kJ)
- 1 kiwifruit (47 calories or 196 kJ)
- 1 apple (40 calories or 167 kJ)
- 25 g Edam cheese (85 calories or 355 kJ)
- 20 g popcorn (78 calories or 326 kJ)
- 1 hard boiled egg (75 calories or 314 kJ)
- 1 cup of miso soup (36 calories or 150 kJ)

*Salmon, cucumber and dill

1 salmon fillet (100 g)
pepper
100 g lettuce
50 g baby spinach
¼ cucumber

Dressing:
2 Tbsp low fat yoghurt
juice of 1 lime
handful of dill

Season the salmon and steam until opaque. Set aside to cool. Mix the dressing ingredients. Put leaves and cucumber on a plate and place the salmon on top. Garnish with dill and lime wedges.

*Salmon and vegetables (serves 4)

400 g green beans, blanched
200 g broccoli florets, blanched
200 g asparagus spears, blanched
juice of 2 lemons
2 Tbsp olive oil
pepper
30 g black olives
cherry tomatoes (4 vines, around 32 tomatoes)
4 salmon fillets (100 g each)

Preheat oven to 200°C. Blanch the vegetables – place in boiling water and cook until the water starts to simmer again. Place blanched vegetables and seasonings in a large roasting pan, squeezing the juice of 1 lemon over them and drizzle with olive oil. Scatter in the olives and place vine tomatoes on top. Lay the fillets, skin side down, as a top layer, and squeeze over the second lemon before oven roasting for 20 minutes.
**Roast vegetables (serves 2)**

1 tsp cumin seeds
1 Tbsp olive oil
1 red onion, sliced
2 cloves garlic, peeled and crushed
1 red, 1, yellow, 1 orange capsicum, sliced
1 courgette, thickly sliced
1 eggplant, thickly sliced
1 small butternut, cubed
fresh marjoram
juice of a lemon
1 Tbsp balsamic vinegar

Preheat oven to 220°C. In a small frying pan, gently dry fry the seeds, then add oil and onion and cook until softened. Add garlic and cook for a further 2 minutes. Place the vegetables in a roasting pan and stir in the spiced onion mix, marjoram, lemon, and balsamic, making sure everything is well coated. Roast in the oven for 30 minutes.

**Smoked fish with spinach and poached egg**

100 g baby spinach leaves
pepper
pinch of nutmeg
75 g fillet of smoked fish
240 ml trim milk
1 egg
½ Tbsp low fat crème fraîche
½ spring onion
1 squeeze of lemon

Wilt the spinach leaves in boiling water and drain well. Stir in a pinch of nutmeg. Poach the fish for 10 minutes in milk (or in microwave for 3 minutes) and poach the egg (separately). Serve the fish and spinach topped with the egg and crème fraîche mixed with spring onion and a squeeze of lemon.

**Ten examples of Fast Day menu plans**

Remember you are aiming for 500 (women) – 600 (men) calories in total for the day.

500 calories is the same as 2100 kilojoules (kJ).

To convert calories to kilojoules multiply by 4.18
To convert kilojoules to calories divide by 4.18

See the recipe section for those meals coloured red.

**Females (500 calories, 2090 kJ)**

**Day 1**
- Breakfast: Porridge (99 calories or 414 kJ)
- Lunch: Chicken pita (162 calories or 677 kJ)
- Snack: 10 grapes (35 calories or 143 kJ)
- Dinner: Smoked fish with spinach and poached egg (211 calories or 882 kJ)

**Day 2**
- Breakfast: Scrambled eggs and mushroom (91 calories or 380 kJ)
- Snack: 6 almonds (80 calories or 334 kJ)
- Snack: 2 Tbsp hummus, 2 celery sticks, an apple (90 calories or 376 kJ)
- Dinner: Ratatouille (236 calorie or 986 kJ)

**Day 3**
- Breakfast: Pear porridge (221 calories or 924 kJ)
- Dinner: Roast vegetables (261 calories or 1091 kJ)

**Day 4**
- Breakfast: 40 g baked beans on 1 slice thin toast (97 calories or 405 kJ)
- Lunch: Vegetable sticks: carrot sticks, celery stalks, cucumber, sliced capsicum, cherry tomatoes, with 2 Tbsp hummus (100 calories or 418 kJ)
- Dinner: Eggplant curry (298 calories or 1246 kJ)

**Day 5**
- Breakfast: Kiwi fruit, blueberries, Greek yoghurt (95 calories or 397 kJ)
- Lunch: Fluffy omelette (207 calories or 865 kJ)
- Dinner: Chicken patties with salad (174 calories or 727 kJ)
Day 6
Breakfast: 1 poached egg with 1 tomato, 10 mushrooms (106 calories or 443 kJ)
Snack: 100 g blueberries with 50 g of low fat Greek yoghurt (110 calories or 460 kJ)
Dinner: Tortilla parmesan and pesto (282 calories or 1179 kJ)

Day 7
Breakfast: Sultanas, almonds and Greek yoghurt (94 calories or 393 kJ)
Snack: Apple (40 calories or 167 kJ)
Dinner: Couscous with lemon and feta (355 calories or 1484 kJ)

Day 8
Breakfast: Ham omelette (97 calories or 405 kJ)
Lunch: 1 slice thin wholegrain bread toasted and 40 g baked beans (97 calories or 405 kJ)
Snack: 1 small packet of raisins (42 calories or 176 kJ)
Dinner: Salmon, cucumber and dill (257 calories or 1074 kJ)

Day 9
Breakfast: Thin slice of bread with Tbsp avocado (131 calories or 548 kJ)
Lunch: 1 cup of miso soup with thin slice of wholegrain bread (111 calories or 464 kJ)
Dinner: Cottage pie (243 calories or 1016 kJ)

Day 10
Breakfast: Spinach omelette (94 calories or 393 kJ)
Lunch: Cup of soup (70 calories or 293 kJ)
Dinner: Salmon and vegetables (318 calories or 1329 kJ)

*Eggplant curry
1 eggplant
1 Tbsp curry paste
50 ml vegetable stock
200 g low fat natural yoghurt
1 handful of coriander

Preheat over to 200°C. Cut the eggplant in half length ways and score the inside deeply into cubes leaving the skin intact. Spread each surface with curry paste. Bake in a small roasting dish for 25 minutes or until soft. Remove from the oven and cut into cubes. Return to the pan and add the vegetable stock, yoghurt, and coriander. Stir to combine, and cook in the oven until sauce is heated through (around 10 minutes).

*Thai stir-fry
1 Tbsp oil
60 g red cabbage, thinly sliced
1 red onion, thinly sliced
1 carrot, julienned
60 g cauliflower florets
60 g broccoli florets
30 g bean sprouts
1 garlic clove, peeled and crushed
½ red chilli, finely sliced
1 tsp root ginger, peeled and grated
½ tsp coriander seeds
1 Tbsp soy sauce
1 tsp Thai fish sauce
Squeeze of lime

Heat oil in a wok on high, add vegetables and stir-fry for 4 minutes. Add garlic, chilli, ginger, and coriander seeds and cook for a few more minutes. Add soy sauce, fish sauce, and lime juice for the final minute of cooking and serve. Add 10 chopped peanuts for an extra 73 calories.
**Ratatouille (serves 2)**

2 onions  
1 ½ tsp olive oil  
2 cloves garlic, peeled and crushed  
1 celery stick, finely sliced  
2 capsicums, sliced  
2 aubergines, sliced  
2 courgettes, sliced  
2 x 400 g tinned chopped tomatoes  
1 tsp oregano  
pepper  
100 ml water  
handful of fresh basil

Fry the onion until softened then add garlic and celery, and cook for a further 2 minutes. Add capsicum and cook for 3 more minutes. Then add aubergine, courgette, tomatoes, oregano, pepper and water. Cook for 30 minutes, stirring occasionally. Serve topped with torn basil.

**Couscous with lemon and feta**

50 g couscous  
50 ml boiling water  
1 tsp lemon juice  
2 spring onions  
2 cherry tomatoes, quartered  
1 courgette, sliced  
2 Tbsp pine nuts  
pepper  
parsley chopped  
20 g feta cheese

Place couscous in a bowl and add boiling water. Cover with glad wrap and set aside for 5-10 minutes. When ready, add the remaining ingredients and mix through.

**Males (600 calories; 2508 kJ)**

**Day 1**

Breakfast: Porridge (99 calories or 414 kJ)  
Lunch: Chicken pita (162 calories or 677 kJ)  
Snack: 25 g Edam cheese with 6 rice crackers (125 calories or 523 kJ)  
Dinner: Smoked fish with spinach and poached egg (211 calories or 882 kJ)

**Day 2**

Breakfast: Scrambled eggs and mushroom (91 calories or 380 kJ)  
Lunch: 1 cup homemade pumpkin soup with thin slice bread (200 calories or 836 kJ)  
Snack: 6 almonds (80 calories or 334 kJ)  
Dinner: Ratatouille (236 calories or 986 kJ)

**Day 3**

Breakfast: Fruity porridge (173 calories or 723 kJ)  
Dinner: Roast vegetables and 100 g chicken (427 calories or 1973 kJ)

**Day 4**

Breakfast: 50 g baked beans on 1 slice thin toast (115 calories or 481 kJ)  
Lunch: Vegetable sticks: carrot sticks, celery stalks, cucumber, sliced capsicum, cherry tomatoes, with 2 Tbsp hummus, 2 crispbread crackers (140 calories or 585 kJ)  
Dinner: Eggplant curry with ½ cup brown rice (368 calories or 1538 kJ)

**Day 5**

Breakfast: Kiwi fruit, blueberries, Greek yoghurt (95 calories or 397 kJ)  
Lunch: Fluffy omelette (207 calories or 865 kJ)  
Dinner: Chicken patties with salad and small bun (303 calories or 1267 kJ)

**Day 6**

Breakfast: 2 poached eggs with 1 tomato, 10 mushrooms (190 calories or 794 kJ)  
Snack: 100 g blueberries with 50 g of low fat Greek yoghurt (110 calories or 560 kJ)  
Dinner: Tortilla parmesan and pesto (282 calories or 1179 kJ)

**Day 7**

Breakfast: Sultanas, almonds and Greek yoghurt (94 calories or 393 kJ)  
Lunch: 1 slice thin bread with 1 Tbsp avocado, apple (163 calories or 681 kJ)  
Dinner: Couscous with lemon and feta (355 calories or 1484 kJ)
Day 8
Breakfast: **Ham omelette** (97 calories or 405 kJ)
Lunch: 50g baked beans on 1 slice thin wholegrain toast, 1 kiwi fruit (165 calories or 690 kJ)
Dinner: **Salmon, cucumber and dill**, ½ cup brown rice (327 calories or 1367 kJ)

Day 9
Breakfast: Thin slice of bread with 1 Tbsp avocado (131 calories or 548 kJ)
Snack: Small packet of raisins (42 calories or 176 kJ)
Lunch: 1 cup of miso soup with 1 slice thin wholegrain bread (111 calories or 464 kJ)
Snack: 10 almonds (73 calories or 305 kJ)
Dinner: **Cottage pie** (243 calories or 1016 kJ)

Day 10
Breakfast: **Spinach omelette** (94 calories or 393 kJ)
Lunch: Cup of soup with 1 slice thin wholegrain bread (145 calories or 606 kJ)
Snack: 10 strawberries (40 calories or 167 kJ)
Dinner: **Salmon and vegetables** (318 calories or 1329 kJ)

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**Fluffy omelette**

1 thin slice of ham, chopped
½ courgette, grated
2 medium eggs, separated
pepper
oil for spraying
parsley to serve

Squeeze grated courgette to remove excess moisture and mix with ham. Whisk egg whites until stiff peaks form. In a separate bowl, beat the egg yolks with pepper after cleaning the beaters. With a metal spoon, gently fold the egg yolk into the whisked whites. Heat pan and spray with a little oil. Fry ham and courgette mix for 2 minutes, then add egg mixture and cook until the omelette is set. Serve with chopped parsley.

**Tortilla parmesan and pesto**

1 wholegrain tortilla
2 Tbsp pesto
Basil leaves, torn
2 tsp grated Parmesan cheese

Use the tortilla as the base. Top with pesto, basil and Parmesan cheese. Grill for 5 minutes.

**Courgette, feta, and red onion omelette**

2 eggs
1 courgette, grated
30 g feta cheese
½ small red onion
pepper

Beat the eggs and add remaining ingredients. Cook over a gentle heat.
21 recipes you can use for Lunch or Dinner

**Chicken pitas (serves 4)**
2 wholegrain pita breads
2 Tbsp low fat natural yoghurt
2 tsp tomato puree
2 tsp tikka masala curry paste
150 g skinless uncooked chicken
1 tsp vegetable oil
shredded lettuce
cherry tomatoes

Mix together the yoghurt, tomato puree and curry paste. Add the chicken and toss to coat. Cover and refrigerate for 15 minutes.

Preheat a non-stick frying pan over a medium heat. Add oil.

Put the marinated chicken pieces into the pan and stirfry for around 8 minutes until well cooked.

Warm the pita breads and split them open. Fill with chicken, lettuce, tomatoes and cooked chicken.

**Poached eggs, mushroom and tomato**
1 large Portobello mushroom
6 cherry tomatoes
pepper
oil for spraying
1 or 2 eggs
100 g spinach leaves
pinch nutmeg

Season the mushroom and tomatoes with pepper, spray with oil and place under a hot grill for 5 minutes. Poach the eggs for 3-4 minutes. Wilt the spinach in a saucepan, drain well and add a pinch of nutmeg. Place mushrooms, tomatoes and eggs on spinach.

**Fast Day Recipes**

The following recipes have been split into breakfast, and lunch or dinner. However you can use these for whichever meal you wish.

tsp = teaspoon (5ml)
Tbsp = tablespoon (15ml)

10 Breakfast recipes

**Porridge**
25 g of oats (¼ cup)
½ tsp honey
Pinch of cinnamon
½ cup water

Place oats, honey, water and spices in a saucepan and simmer, stirring until porridge is thickened to your liking. Alternatively you can cook this in the microwave on high, in 30 second bursts until cooked.

**Fruity porridge**
30 g oats (1/3 cup)
150 ml trim milk
50 g berries

Place oats and milk in a saucepan and simmer, stirring until porridge is thickened to your liking. Alternatively you can cook this in the microwave on high, in 30 second bursts until cooked. Add berries.

**Pear porridge**
20 g of oats (just under ¼ cup)
250 ml of trim milk
½ pear, sliced
¼ tsp cinnamon
¼ tsp nutmeg

Place oats, milk, pear and spices in a saucepan and simmer, stirring until porridge is thickened to your liking. Alternatively you can cook this in the microwave on high, in 30 second bursts until cooked.