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Is there really an optimal diet for fat-loss?

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Abstract

According to current statistics 45 million Americans venture on a new diet each year and Americans spend a staggering $33 million each year on weight loss products (BMC Nutrition)[1], despite the ever-growing amount of people attempting to lose weight, the success rates are staggering low with the fact that 95% of people regain the weight that they had previously lost (Langeveld & de Vries, 2013) [2]. With the constant, transitioning from one fat-loss fad to another, the public's diet has seen more change in correlation with this. This project evaluates whether, with the current research available, if there is a diet that will cause the greatest fat-loss in the majority of individuals. The dieting world is shown to be ever-growing, with the constant production of so-called 'new' diets that are described as being the most optimal for both health and body composition; but it is clear, from the literature, that these diets are simply tools, based on individual preferences, that help secure the underlying principle that is needed to lose weight, a calorie deficit. Although that it can be drawn to a conclusion that there is not an optimal diet which will cause sustainable fat-loss in all people; there are however components that have been proven time and time again (such as adequate protein and fiber intake) by the magnitude of research, which could be incorporated in a successful and long lasting fat-loss diet, to improve results, the process and hopefully prevent the occurrence of weight regain following.

[1] "Weight Management | Nutrition and Weight ...." https://www.bmc.org/nutrition-and-weight-management/weight-management. Accessed 23 Feb. 2019.
This source is fairly reliable as it is from Boston Medical Center website so would have been qualified professionals.
[2] "[The mediocre results of dieting]. - NCBI." https://www.ncbi.nlm.nih.gov/pubmed/23859104. Accessed 23 Feb. 2019.
This source is reliable because it is another peer-reviewed paper evaluated by other scientific researchers and thus the reliability can be confirmed.

Introduction

The phenomenon of dieting has been constantly present in society but now the need for successful weight loss methods has never been more persistent. The shocking statistics that worldwide more than 1.9 billion adults (18 or over) were found to be overweight or obese in 2014, furthermore, worldwide statistics also exposed the fact that greater than 40 million children (5 years or under) were classed as overweight or obese in 2014[3] (WHO, 2018) and obesity has been shown to be responsible for the deaths of more than 3.4 million adults worldwide each year[4] (WHO, 2018). The term optimal is described as being the 'best or most favourable[5] (Oxford dictionaries), this is important to mention because in the context of this project, an optimal diet is one that is the best for the majority of people in both short and long-term weight loss. This project will discuss the prominent debate of what diet is the most optimal for weight loss in the form of fat-loss. Due to the substantial popularity of radical diets to produce significant weight loss and fat-loss success, we will delve into the research to find out if there is really an optimal diet, this is important because often individuals who are desperate for results are drawn into a diet that is simply unsustainable and results in no progress and often even regression. Additionally, this review will provide an insight as to why people should focus on fat-loss rather than simply weight-loss and the methods which can be used in order to do so. Also, it is clear that there is still a considerable quantity of misconception within the realm of nutrition and dieting, so this project will aim to cover aspects of these misconceptions and answer them. Furthermore, this dissertation will highlight the importance of adherence and sustainability of diets for the prevention of weight regain. Based on the current magnitude of scientific literature, it is clear that calories are the primary determinant for changes in body composition, however; despite this, it has been claimed that certain diets have the ability to enable fat-loss from outside the energy balance theory (Hall et al. 2012)[6]. Within this project there will be a review of the

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[3] "Obesity and overweight - World Health Organization." 16 Feb. 2018, http://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight. Accessed 1 Nov. 2018.
This source is definitely reliable as it is from the World Health Organisation, which is a very reputable source.

[4] "Obesity and overweight in Western Pacific - World Health Organization." http://www.who.int/westernpacific/health-topics/obesity. Accessed 1 Nov. 2018.
This source is definitely reliable as it is from the World Health Organisation, which is a very reputable source.

[5] "optimal | Definition of optimal in English by Oxford Dictionaries." https://en.oxforddictionaries.com/definition/optimal. Accessed 1 Nov. 2018.
This source is clearly reliable as it is from a reputable name and is likely not going to contain any sort of bias due to the nature of the quoted material.

[6] "Energy Balance and Obesity - NCBI - NIH." 3 Jul. 2012, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3401553/. Accessed 9 Sep. 2018.
This is a peer-reviewed paper that has been cited over 464 times so the reliability of this paper is clear.

brief history of dieting, a look into the current literature and then a discussion between the effectiveness of modern diets, I will then discuss the possible components that could be incorporated into a diet to make it more optimal (preserving muscle mass), easier for an individual to adhere to and that contribute to an improvement in health and not just body composition.

Literature Review

History

In order to understand current beliefs and standpoints about 'dieting', it is necessary to see how people have approached it over time. We will begin with a review of the history of dieting. George Cheyne was an English doctor and labelled as the first dietician. Cheyne was very overweight and was known to indulge excessive amounts of food and drink. To try and overcome his weight issues, Cheyne embarked on a meatless diet, consuming only milk and vegetables, and consequently improved his health. In 1724, Cheyne wrote 'An Essay of Health' and Long Life, within this publication, he encouraged people to involve themselves in exercise and fresh air as well as avoiding luxury foods. Another figure known for his unorthodox views on nutrition was the Scottish military surgeon, John Rollo, who in 1797 published a book labelled 'Notes of a Diabetic Case'. The book outlined the benefits diet rich with meat for those who were diagnosed with diabetes,. These views stemmed from the recommendations of Matthew Dobson, the discoverer of glycosuria in diabetes mellitus. More relevant to this project, the original popular diet was "Banting", labelled after the English undertaker William Banting. Banting published a book in 1863 titled a 'Letter on Corpulence', the book was addressed to the people, which included the framework in which he followed that lead to his successful weight loss. In this, his diet was reported to have been composed of four meals per day, largely made up of meat, greens, fruits, and dry wine. The book also prioritises the avoidance of sugar, sweet foods, starch, beer, milk and butter. The booklet, produced by Banting was a big hit in the public sphere for years to follow, and would also be used as a foundation for many of the current modern diets. [7] (Wikipedia)

[7] "Dieting - Wikipedia." https://en.wikipedia.org/wiki/Dieting. Accessed 18 June. 2018.
This is source that has questionable reliability because is open to anonymous and collaborative editing, however it has been shown by studies conducted by IBM researchers in 2003 that vandalism and false information submitted is repaired extremely quickly and that most users would never its effects.

How the body eliminates fat

When an individual is in a negative energy balance i.e, they are expending more energy (calories) than there is entering the body, (ingesting) then the body looks to alternative methods for fuelling the body. The body's cells thus depend on internally stored energy stores, for example stored, complex carbohydrates (glycogen, a complex carbohydrate, 65% of which is stored as energy in skeletal muscles and also in the liver, adding up to approximately 2,000 kcal in the whole of the human body) and fat from fat cells (adipocytes and adipose tissue). Glycogen is primarily created from the excess of ingested macronutrients, mainly carbohydrates. Once the human body's glycogen is nearly depleted, the body initiates mechanisms that begin the process of lipolysis, which is the mobilization and catabolism of fat stores for energy. In this process, fats, obtained from adipose tissue, or fat cells (adipocytes) , are broken down into glycerol and fatty acids, which then can be utilised to generate energy. The resultant primary by-products of metabolism are carbon dioxide and water; carbon dioxide is removed through the respiratory system.

What are the benefits to losing fat?

Most people refer to losing fat as weight loss but ultimately weight loss and fat mass are fundamentally different, weight loss simply describes the reduction in ones body weight and often is made up of a number of different components as well as fat. By focusing on primarily weight loss individuals may not be effectively targeting what they want to be lost in the process. For example during any dieting phase individuals will lose water, lean body mass (LBM, muscles, bones, ligaments tendons and internal organs) and fat free mass (FFM). LBM and FFM differ as LBM includes some essential fat in the marrow of your bones and internal organs. Reducing the amount of LBM lost during a dieting phase is more often than not the best approach in terms of aesthetically and from a health perspective which has been outlined in the literature quite extensively. Low muscle strength has been associated with all cause mortality (Li et al. 2018)[8], furthermore both cardiac and cancer are associated with rapid loss of muscle strength, muscle mass and metabolic function (cachexia) (Wolfe 2012)[9]. Once establishing the importance of fat loss as

[8] "Associations of Muscle Mass and Strength with All-Cause ... - NCBI - NIH." https://www.ncbi.nlm.nih.gov/pubmed/28991040. Accessed 22 Feb. 2019.
This source is a peer-reviewed study with a significant sample size of 4449 participants and thus can be seen as reliable.

[9] "underappreciated role of muscle in health and disease | The American ...." https://academic.oup.com/ajcn/article/84/3/475/4648841. Accessed 22 Feb. 2019.

opposed to weight loss, individuals can incorporate a number of components in their diet to minimise the loss of LBM which including higher protein intakes and a less rapid rate of fat loss. Furthermore, it should be outlined what the key benefits to losing fat are, other than aesthetics, these include; increased longevity (Chenham et al. 2017)[10], decreased risk for cardiovascular disease (CVD) (Brown et al. 2015)[11], decreased risk of cancer (Luo et al. 2017)[12], reduced risk of type II diabetes (Wilding et al. 2014)[13], improved quality of life and also the advantageous psychological impact (Rippe et al. 2012) [14].

Energy Balance and its role in fat-loss

Overall, the current scientific research on energy balance and weight is extensive and the current literature now shows that ultimately it is energy balance that determines whether an individual loses or gains body mass. Research has shown that bodyweight can only change when energy intake (in the form of calories) is not equal to energy expenditure. Therefore, when the body is in an energy balance and body energy is thus 'stable', the individual will theoretically neither gain or lose weight. However, when an individual who takes in more energy (in the form of calories), than they expend (in the form of calories), causes the individual to be in a positive energy-balance and subsequently gain body mass. This weight gain is

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This is a peer-reviewed paper that is reviewing the current literature and thus is a trustworthy source as it simply is analysing the research that has been conducted on a specific topic.

[10] "Effects of weight loss interventions for adults who are ... - NCBI - NIH." 15 Nov. 2017, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5682593/. Accessed 22 Oct. 2018.
This source is particularly dependable in the context of being evidence because of several factors, firstly, it is a peer-reviewed publication, and secondly, it is a systematic review and meta-analysis, often seen as the 'gold standard' of scientific publications.

[11] "Effects on cardiovascular risk factors of weight losses ... - NCBI - NIH." 4 Nov. 2015, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4987606/. Accessed 22 Oct. 2018.
This source is dependable because is a peer-reviewed study conducted by well educated researchers, furthermore, this study can be seen as particularly reliable because of the the large sample size of 604 participants wich is significant and thus been seen as more reliable.

[12] "Intentional weight loss and cancer risk - NCBI - NIH." 6 Sep. 2017, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5669836/. Accessed 22 Oct. 2018.
This source is a peer-reviewed paper and so this evidence can be seen as reliable.

[13] "The importance of weight management in type 2 diabetes ... - NCBI - NIH." 18 Feb. 2014, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4238418/. Accessed 22 Oct. 2018.
This source is another peer-reviewed paper and thus can been seen as reliable as it has been evaluated by other researchers.

[14] "Improved Psychological Well-Being, Quality of ... - Wiley Online Library." 6 Sep. 2012, https://onlinelibrary.wiley.com/doi/abs/10.1002/j.1550-8528.1998.tb00339.x. Accessed 22 Oct. 2018.
This source is another scientific publication that has been peer-reviewed indicating that the reliability of the source is quite high.

usually 60-80% made up of body fat. Conversely, an individual who consumes less energy than they expend (in the form of calories), then the individual will lose body mass (Hall et al. 2012)[15]. The composition of different micronutrients within a diet has shown to be of little importance in comparison to focusing on the caloric intake of an individual.

The longevity component of weight loss

The component of longevity within a fat-loss is fundamental because as shown by the current data if an individual cannot see themselves sticking to the diet that they are currently involved with, then the individual should probably rethink their strategy. Due to this factor, weight-regain has become an ever-greater issue. Current statistics show that within one year of weight loss nearly 80% of people will have relapsed to heavier than their pre-diet weight (MacLean et al. 2011)[16]. Furthermore, after 2 years that figure is 85% and within 3 years over 95% of people will have relapsed to their pre-diet weight (Ayyad et al. 2000)[17] (Langeveld et al. 2013)[18] (Fat Loss Forever, 2019)[19]. What's almost more concerning is that the people who return to their previous weight, ⅓ to ⅔ will regain even more weight than they had before they started (Dullo et al. 2012)[20]. This evidence clearly suggests the importance of

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[15] "Energy Balance and Obesity - NCBI - NIH." 3 Jul. 2012, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3401553/. Accessed 12 Sep. 2018.
This is a peer-reviewed paper that has been cited over 464 times so the reliability of this paper is clear and therefore unlikely to be biased.

[16] "Biology's response to dieting: the impetus for weight regain. - NCBI - NIH." 15 Jun. 2011, https://www.ncbi.nlm.nih.gov/pubmed/21677272. Accessed 22 Oct. 2018.
This source is respectable in terms of its reliability because it firstly a peer-reviewed scientific review of the current evidence and also it has been cited over 267 times and thus can be seen as trusted.

[17] "Long-term efficacy of dietary treatment of obesity: a systematic ... - NCBI." https://www.ncbi.nlm.nih.gov/pubmed/12119984. Accessed 22 Oct. 2018.
This source is another peer-reviewed and systematic review of other studies and so the source can been seen as reliable.

[18] "[The mediocre results of dieting]. - NCBI." https://www.ncbi.nlm.nih.gov/pubmed/23859104. Accessed 22 Oct. 2018.
This source is reliable because it is another peer-reviewed paper evaluated by other scientific researchers and thus the reliability can be confirmed.

[19] "Fat Loss Forever | How to Lose Fat and Keep it Off - Biolayne." https://www.biolayne.com/fat-loss-forever/. Accessed 24 Feb. 2019.
This source, is a book written by Layne Norton who has a PhD in nutritional sciences and has published a number of papers on the subject of nutritional science, in this book he outlines all the literature on weight regain as well as metabolic adaptations to dieting and so is reliable.

[20] "How dieting makes some fatter: from a perspective of human ... - NCBI." 5 Apr. 2018, https://www.ncbi.nlm.nih.gov/pubmed/22475574. Accessed 22 Oct. 2018.
This source is also reliable because it is peer-reviewed paper that covers already pre-existing scientific evidence and thus can be seen as reliable.

selecting a sustainable diet that an individual can adhere to. Though fad diets such as low-carb, low-fat and low-sugar can all be used as tool to create a calorie deficit and aid an individual to adhere to their diet, these diets are undeniably generic and thus lack the crucial element of individualisation that is key to obtaining a successful fat-loss phase, without the deadly and overshadowed weight-regain. A period dedicated to fat-loss should have a diet incorporated that is tailored to the specific food choices as well as eating preferences to encourage sustainable eating habits.

The body's defense mechanisms

The human body's DNA is clearly behind the advancements in technology and developments in all industries, in particular the food market. When an individual diets down the body transitions into an anti-famine mode in which it activates a number of mechanisms to try and reduce damage or even death to the person. This prehistoric idea is very much present in modern day society and explains one common problem that arises during dieting such as weight-loss plateaus. When a person is in a prolonged energy deficit the body overreacts to the process by slowing down their overall total daily energy expenditure (TDEE), most commonly referred to as someone's 'metabolic rate.' This process occurs because certain mechanisms try to prevent the body from losing any more stored energy (body fat) and thus causes the energy deficit to eventually become an energy balance (calories consumed equal those that are expended) and thus weight loss stops unless further energy restriction is imposed. These metabolic adaptations also include; adaptations that cause a decrease in a person's basal metabolic rate (BMR), a rather substantial reduction in a person's non-exercise activity thermogenesis (NEAT), alterations to a person's hormones, including leptin, ghrelin, thyroid hormone, as well as others that contribute to decreased in metabolic rate and increased hunger (MacLean et al. 2011)[21]. Furthermore, linking on from the aforementioned section which details the importance of a diet being long-term structured because the body's defense system doesn't stop once the fat-loss period has stopped. During the diet the body is preparing the person for the fat regain process, the body does this by activating systems in the body that improve the efficiency of energy storage which directs the increased energy (calories) a person takes in during the post-diet phase and puts it towards preferential fat gain. Additionally, not only is the person more able to store more fat they are more hungry due to lower levels of leptin, insulin, neuropeptide Y, as well as an increased

[21] "Biology's response to dieting: the impetus for weight regain - NCBI - NIH." 15 Jun. 2011, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3174765/. Accessed 23 Oct. 2018.
This source is respectable in terms of its reliability because it firstly a peer-reviewed scientific review of the current evidence and also it has been cited over 267 times and thus can be seen as trusted.

selection of the hormone ghrelin which is often referred to as the body's hunger hormone (Johannsen et al. 2012)[22].

Underestimating caloric intake and expenditure

People may understand that calories are ultimately the most substantial factor of weight control, however, it is shown frequently that many individuals underestimate the caloric value of the food products they consume (Lichtman et al. 1992)[23]. This is particularly common in individuals who are attempting to eat 'clean', in other words, they are trying to eat whole (minimally processed) foods. Despite the fact that individuals are eating 'healthy foods' they are still unable to stay in a caloric deficit. Individuals are shown to not fully understand that even though they are eating nutritious foods, those foods do still contain calories. As a result, of not seeing progress some may therefore turn to diet plans that segregate or eliminate certain foods.

Furthermore, a further common misconception held by many individuals with the aim to lose fat and thus become leaner is that eating "clean" foods this will automatically allow them to achieve their goal. Despite eating "clean" minimally processed nutrient-dense foods, many individuals struggle to lose weight because they continue to consume an excess of calories thus creating a positive energy balance causing them to gain weight. People often do not have the knowledge of the basic calorie value of foods and thus heavily underestimate their calorie intake.

[22] "Metabolic Slowing with Massive Weight Loss despite ... - NCBI - NIH." 24 Apr. 2012, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3387402/. Accessed 23 Oct. 2018.
This source is peer-reviewed and so the reliability of the study is high, also it was co-authored by Dr Kevin Hall, a very well respected researcher on obesity.

[23] "Discrepancy between self-reported and actual caloric ... - NCBI - NIH." 31 Dec. 1992, https://www.ncbi.nlm.nih.gov/pubmed/1454084. Accessed 12 Sep. 2018.
This study is peer-reviewed and has been cited over 1350 times and therefore is likely to be a reliable source, however due to the date it was published there may have been some changes in the current literature, but from current research the findings of the source are similar to what was found in this one.

Low-Carb diets

Low-Carb diets have been popular for decades, such variations include the Atkins diet, Ketogenic diet which have all developed a strong following in recent years. The ketogenic which is arguably the most popular in recent years is a diet that is high in fat, has adequate-protein but most importantly it is low in carbohydrates. It has been used in medicine most often to treat difficult-to-control epilepsy in children. The diet forces the body to utilise fats rather than carbohydrates. The Ketogenic diet is shown to have associated health benefits, including some improvements in some cardiovascular risk factors, such as obesity, type 2 diabetes and high density lipoprotein (HDL) cholesterol levels, however, these 'effects are usually limited by time'. Also, Ketogenic diets are inherently high in fats to compensate for the reduced carbohydrates and therefore some negative effects could be caused. Some studies, mainly in rodents, found the diet to cause the developments of NAFLD (Non-alcoholic fatty-liver disease) and insulin resistance, conversely, some studies have shown improvements in insulin sensitivity. Widely speaking, the Ketogenic diet may ultimately aid obese individuals in achieving moderate weight loss which could be *"metabolically beneficial for them"* (Kosinski et al. 2017)[24].

Furthermore, the diet has also shown to be beneficial in achieving fat-loss as, there has also been research on the effects of a high-protein ketogenic diet on hunger, appetite, and weight loss in obese men feeding ad libitum (at one's pleasure). The results show that in the short term, a higher protein, lower carbohydrate ketogenic diet "*reduces hunger and (subsequently) lowers the food intake significantly more than a high-protein, medium-carbohydrate non-ketogenic diet."* Some authors propose this could be due to decreasing ghrelin (hunger hormone) production in the body (Johnstone et al.2008)[25].

However, the possibility that despite the positive effects of the diet, this may have been due to the increased intake of protein as opposed to the reduction in carbohydrates. This is because, in a low-carb

[24] "Effects of Ketogenic Diets on Cardiovascular Risk Factors ... - NCBI - NIH." 19 May. 2017, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5452247/. Accessed 19 Sep. 2018.
This is a review publication so it looked at multiple human and animal studies and compared the results of the Ketogenic diet on the subjects, because of this it can be argued that it is reliable as it takes the results of more than a single study.
[25] "Effects of a high-protein ketogenic diet on hunger ... - Oxford Journals." https://academic.oup.com/ajcn/article/87/1/44/4633256. Accessed 19 Sep. 2018.
This source is a randomized crossover design study, as a result the likelihood for bias is limited, however the study only had 17 obese men which is a relatively small sample size and they were non randomly selected, so the relevant reliability of this study is questionable.

diet such as the Ketogenic diet, carbohydrate (CHO) is replaced partly with an increase in dietary protein (PRO), being shown (Halton et al. 2004) to be one of the most satiety macronutrients as well as thermogenic, consequently aiding in creating a calorie deficit for the individual (Halton et al.2004)[26]. Furthermore, many individuals will gain a false sense of accomplishment when seeing large decreases in weight after a few days, thinking that the exclusion of carbohydrates has greatly helped. However, this large drop in weight will more than likely be a loss of retained water within the stored glycogen as well as a loss of glycogen that was stored in the muscles.

Low-fat diets

Low-fat diets have also been adopted by many in the health and fitness industry as a method of fat-loss. This is firstly easy to understand for the average person given that 1 gram of fat is 9 calories, whereas 1 gram of carbohydrate is more than half at 4 calories. As a result, it is clear that by restricting fat intake, an individual will find it far easier to sustain a calorie deficit and thus achieve fat-loss. To add on to, the diet has also gained support due to its other perceived benefits. Firstly, a low-fat diet is seen to be preferable when talking about metabolic reasons as fat intake does not significantly stimulate fat oxidation and therefore dietary fat above requirements is stored in adipose tissue. Also, as mentioned above, diets high in fat or are energy dense have a poor level of satiation (being full or beyond satisfied) and thus promote passive overconsumption of energy relative to need, subsequently hindering an individual's' aims to lose fat by being in a calorie deficit. "*Also low-fat diets are advocated to lower the risk of coronary heart disease and certain forms of cancer,"* (Jequier et al.2002)[27]. However, despite the media hysteria surrounding the macronutrient, that is fat, it is shown to be fundamental in the maintenance of individuals health. Current recommendations from the World Health Organization recommend a total fat intake between 20 and 35% of total calories. This minimum of 20% is to ensure adequate consumption of total energy, essential fatty acids, and fat-soluble vitamins and prevent atherogenic dyslipidemia, which occurs

[26] "The effects of high protein diets on thermogenesis, satiety ... - NCBI - NIH." https://www.ncbi.nlm.nih.gov/pubmed/15466943. Accessed 28 Sep. 2018.
This source is reliable firstly because it is a systematic review, this means that it is a collection of all the current research, including randomised controlled trials (RCTs), which are a often seen to provide some of the most reliable evidence, this is because RCTs minimise the risk of confounding factors influencing the results. Another reason why the paper is reliable is that it has been cited over 898 times highlighting the importance of the paper.
[27] "Low-fat diets are preferred. - NCBI." https://www.ncbi.nlm.nih.gov/pubmed/12566138. Accessed 8 Feb. 2019.
This study is peer-reviewed, reviewing the literature on low-fat diets and so is reliable.

with low-fat, high carbohydrate diets and increases the risk of coronary heart disease. Furthermore, diets high in monounsaturated fat have been related to a lower rate of coronary heart disease. To add on to, it is well known that this dietary model reduces LDL-cholesterol plasma levels when replacing a saturated fat-enriched diet. As a result, a diet high in monounsaturated fat is now being encouraged to individuals to prevent cardiovascular disease, particularly in Mediterranean countries (Jiménezet et al. 2002)[28].

Low-fat vs low-carb? (Based on published study in February 2018)

The more currently argued debate in the health and fitness industry revolves around whether a low-carb or low-fat diet is optimal for fat-loss. This recent study is of importance as it shows no notable difference between the two diets. The study conducted by Gardner and colleagues in 2018 has gained much attention, the study is particularly noteworthy due to several components including, its large sample size, long duration (12 months), as well as the inclusion of careful dietary monitoring. Furthermore, it was somewhat funded by NuSI, an organization co-founded by a well-known low-carb advocate, Gary Taubes. The trial randomly assigned 609 participants to one of two diets, the options were either a healthy low-fat diet or a healthy low-carb diet, in which they had to stick to for 12 months. Over those 12 months, all participants were also instructed to attend 22 dietary counselling sessions with a dietitian. During these sessions, the dietitian showed them how to stick to a high-quality whole-food eating plan on their designated diet. Researchers of the study also examined to see if genotype or insulin production could predict weight loss on either a low-fat or a low-carb diet, in other words, they wanted to decipher whether people were predisposed with a gene that would indicate which of the two diets would be better for the person. Other health outcomes measured during the study included weight change, body fat (DXA), cholesterol, blood pressure, and fasting glucose. The study concluded that there were no significant weight-loss differences between the low-fat and low-carb diet groups, furthermore, they found, in this study that neither genetics nor insulin production could predict weight-loss success on either diet (Gardner et al. 2018) [29].

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[28] "Protective effect of dietary monounsaturated fat on ... - NCBI." https://www.ncbi.nlm.nih.gov/pubmed/12052487. Accessed 29 Oct. 2018.
This source is reliable as it is a publication that has been peer-reviewed by other reputable researches and also has been cited over 188 times.

[29] "Effect of Low-Fat vs Low-Carbohydrate Diet on ... - The JAMA Network." 20 Feb. 2018, https://jamanetwork.com/journals/jama/fullarticle/2673150. Accessed 26 Sep. 2018.

Higher protein diets

The reason why protein is of significance to this discussion is that, despite fitness stereotypes, the actual scientific literature does show the overarching benefits of a higher protein diet; and this is the reason why a higher protein intake that is incorporated into most diets with the aim to lose fat is a good method. Furthermore, the ineffectiveness to take up and store fuel, and to also shift from fat to glucose as the primary source of fuel during a time of caloric abundance (high insulin) or scarcity (low insulin) has been termed metabolic inflexibility which contributes to a whole body dysregulation and potential cardiovascular risk. Having established that musculature is key for the ability for an individual to remain in a healthy state, there is a magnitude of studies that have highlighted the importance of protein in muscle preservation. Higher protein diets have been shown to be rather more beneficial for the maintenance of lean body mass. A study (Mettler 2011), found that approximately 2.3g/kg (of body mass) or approximately 35% protein was undoubtedly superior to roughly 1.0/kg or approximately 15% energy protein, for maintenance of lean body mass in young healthy athletes during short-term hypoenergetic (typically low calorie, energy intake is less than energy expenditure) weight loss (Mettler et al. 2010)[30].

Skeletal muscle has been shown to constitute as the greatest insulin-sensitive tissue in the human body and is the main site for insulin-stimulated glucose utilization. Skeletal muscle resistance to insulin is fundamental to the metabolic impairment that is associated with obesity and physical inactivity and subsequently contributes to the development of the metabolic syndrome (MS) (Stump et al. 2006)[31].

This source is a recent 2017 study, in which had a sample size of 632 participants which is a rather significant number and thus indicates its authenticity. Another reason for this his source in particular to be seen as reliable is that it was conducted by Dr Christopher Gardner, the National Institute of Health and the Nutrition Science Initiative (NuSI). This is important to mention because NuSI was co-founded by Gary Taubes, a well-known advocate of the low-carb diet and the results do contradict his view that low-carb diets are superior.

[30] "Increased protein intake reduces lean body mass loss during ... - NCBI." https://www.ncbi.nlm.nih.gov/pubmed/19927027. Accessed 11 Sep. 2018.

This source is a study in which 20 young healthy resistance-trained athletes, so this is a relatively niche and small sample size and so the reliability could be an issue. However the author is an experienced researcher who has carried out a number of studies in the same field of research so may result in the reliability of this source to be improved.

[31] "The metabolic syndrome: role of skeletal muscle ... - NCBI - NIH." https://www.ncbi.nlm.nih.gov/pubmed/17008303. Accessed 11 Sep. 2018.

This paper reviews the role of skeletal muscle metabolism and its relevance with metabolic syndrome, this source is fairly reliable due to the fact that it has been cited over 203 times. Furthermore, this source was written by a number of well educated researchers including Craig S Stump (2,926 citations) and Erik J Henriksen (6,693). Also the paper was peer-reviewed so it can be drawn that the source is reliable.

Higher protein diets have been commended for being a contributor to weight loss in the form of fat in individuals. Firstly because protein has been frequently found to be one of the most satiating macronutrients [32] (Boelsma et al. 2010) and thus play a role in decreasing appetite, thus helping an individual to reduce the amount of food they consume, consequently allowing them to stay in a calorie deficit and achieve fat-loss by being in a negative energy balance. Also, protein is found to be one of the most thermogenic macronutrient meaning the digestive system uses the most energy to digest the micronutrients and causing the individual to expend more energy and further aiding the person to achieve a calorie deficit. Furthermore, studies have shown that not only does protein have a positive effect on body composition and satiety (being full or beyond satisfied) for an individual but protein has also shown to other health benefits (Paddon-Jones et al. 2008)[33]. Protein has been demonstrated to have positive effects on blood lipids as well as glucose homeostasis.

The importance of having fruit and vegetables in the diet

Fruit and vegetables are universally promoted and seen to be as healthy, partly because of the 'natural' factor that plays a key role in their consumption but also it is widely known amongst the majority of the population that fruit and vegetables include a varied group of plant foods that vary greatly in energy and nutrients. Furthermore, fruit and vegetables are a common source of dietary fibre that is consumed in people's diets. Epidemiological studies support the view that dietary fibre is linked to less cardiovascular disease and perhaps has a key part to play in obesity prevention. Studies have shown that generally, whole foods that naturally contain fibre are satiating and results showed that eating an apple reduced lunch energy intake by 15% compared with control (Food-Obbagy et al. 2009)[34]. Added (non-natural) fibre,

[32] "Measures of postprandial wellness after single intake of two ... - NCBI." 9 Jan. 2010, https://www.ncbi.nlm.nih.gov/pubmed/20060863. Accessed 11 Sep. 2018.
Like the aforementioned sources this paper was published by a number of well documented and educated researchers who have all been cited widley. The paper is also peer-reviewed so it can be concluded that the paper is reliable. One thing to highlight however, the sample size was small as it consisted of twenty-one healthy men with mean age of 33 + or - 14 years.
[33] "Protein, weight management, and satiety | The American Journal of ...." 1 May. 2008, https://academic.oup.com/ajcn/article/87/5/1558S/4650426. Accessed 11 Sep. 2018.
This source, was also a peer-reviewed paper and was published by a number of reputable researchers. This source was a review of the literature to summarise it all and thus has an added reliability to it as all the sources that itself cited would have also been peer-reviewed.
[34] "The effect of fruit in different forms on energy intake and ... - NCBI - NIH." 6 Dec. 2008, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2664987/. Accessed 19 Sep. 2018.

however, such as pectin fibre has been shown to not alter satiety when consumed as part of apple juice. Highlighting the importance for individuals to consume fruits and vegetables to reap the benefits as opposed to looking to more processed food products to fill in their fibre requirements. In addition to the advantageous effects that fruit and vegetables provide in the form of fibre, fruit and vegetables have also been shown to provide a number of other health benefits. Fruits and vegetables have been shown to provide perks in terms of the wide variety of micronutrients they provide. Micronutrients play a central part in the metabolism and maintenance of tissue function. Nearly 30 vitamins and minerals that your body cannot manufacture in sufficient quantities are called 'essential micronutrients', as a result, it is key that individuals consume a variety of fruit and vegetables to prevent the deficiency of them (Shenkin et al. 2006)[35].

Factors causing short term weight fluctuations

Often individuals aren't educated about how the scales can distort progress and seemingly show regression, and how weight fluctuations are caused by an array of factors. Weight fluctuations can cause stalls in individuals fat-loss progress, this can in some cases result in physiological damage to the individual and cause them to possibly lose motivation to achieve their goal of losing weight in the form of fat. As a consequence, the individual may metaphorically 'fall' of their fat-loss diet and resort to their previous unsustainable and progress-hindering eating habits. These factors show that an apparent gain in weight highlighted by the use of scales does not automatically mean that the individual has gained fat. The majority of the factors that have currently be researched and found to be contributors to weight fluctuations involve the influence of water retention within the body, this retention of fluid is shown to be caused by a number of components.

This source was a peer-reviewed study which had a reasonable sample size of 58 adults and a study length of 5 weeks which indicates it's reliability. Furthermore, this study has been cited by over 234 times which shows its significance.

[35] "Micronutrients in health and disease - NCBI - NIH." https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2585731/. Accessed 19 Sep. 2018.
This is another peer-reviewed review and has been widely cited (119) and therefore can be seen as reliable.

1. Carbohydrate intake

Carbohydrates increase muscle glycogen storage substantially, as a consequence of increased glycogen comes a surge in water retention. This is because of 1 gram of extra glycogen carrying with it 3-4 grams of water. As muscle has a capacity to store 500 grams of glycogen, subsequently there will be fluctuations on the scales the next day which has the potential to be anything from 0-4 lbs (0-1.8kg), all of which is intramuscular water and not fat (Olsson & Saltin 1970)[36].

2. Varying Salt intakes

Sodium found to play a key role in the regulation of water in the body with the volume of extracellular fluid highly determined by its sodium content (Fregley 1984). As a result, variations in sodium balance significantly impact fluid balance and therefore having differing sodium intakes will result in an increase of body mass via it's 'water gaining' effects, thus adding weight to the scales for the individual.

3. Stress

Elevated cortisol is shown to cause an increase in aldosterone, a major hormone involved in fluid regulation subsequently, high stress levels can draw in more water which will result in an accurate add of body weight seen on the scales. This body weight is merely water rather than perceived fat to many individuals (Freel & Connell 2005)[37].

4. Menstrual Cycle

The level of oestrogen, progesterone Follicle-stimulating hormone and Luteinizing hormone in the body alter how much water the body retains and thus alters how much women might weigh at different stages of the month. Weight (which is mostly water) often peaks during the late-follicular and late-luteal phase, thus showing that menstruation can have an accuse effect on weight fluctuations.

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[36] "Variation in Total Body Water with Muscle ... - Wiley Online Library." https://onlinelibrary.wiley.com/doi/full/10.1111/j.1748-1716.1970.tb04764.x. Accessed 10 Oct. 2018.
This source is another study which is published on Wiley Online Library which is a high quality which is peer reviewed, however it is important to mention that this paper was published in 1970 so the reliability of the data may be somewhat weak as science has developed in the period up to now and new research may have been published.

[37] "Mechanisms of Hypertension: The Expanding Role of ... - NCBI - NIH." https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1283142/. Accessed 10 Oct. 2018.
This source is a peer-reviewed study paper, cited by over 114 and therefore, it can be seen as a reasonable reliable source.

Discussion

It is clear by the research that a diet that creates a calorie deficit and thus enables the individual to lose fat is the fundamental component of fat-loss. The way a person achieves this does not matter and as long as the method they use is one that they can see themselves sticking to and thus be sustainable. The scientific literature that has been published shows clearly that calories are the most important factor when aiming for weight loss (and weight gain), as a result, the multitude of diets that are attempted by many are simply methods of creating a calorie deficit but do not offer any superior metabolic adaptation. Once understanding this, a diet that firstly, can be adhered to (Alhassan et al. 2008)[38] [39] (Dasinger et al. 2005), by the individual, can provide adequate protein and has plenty of fruits and vegetables is most optimal. Specific diets such as a low carbohydrate diet or low-fat diet are proven to achieve fat-loss, however, these are simple techniques to create a calorie deficit for an individual and thus cause them to lose fat. Not one macronutrient is responsible for fat gain or fat-loss and is simply the energy balance in which an individual is in that will determine whether they lose or gain fat.

Overall, the scientific literature shows clearly as a result of extensive research, that calories within an energy balance context are the most fundamental component in an individual's' effort to lose weight (Hall et al. 2012)[40]. The individual simply has to be in a negative energy balance meaning that they are in a calorie deficit. An individual can do this in by consuming less energy in the form of calories than they expend. This can be achieved either by simply reducing the calorie intake of a person or by increasing the amount of energy the individual expends either in the form of NEAT (non-exercise activity thermogenesis) or EAT (exercise activity thermogenesis). Either way, an individual can lose weight which is approximately 60-80% contributed to by body-fat by achieving a calorie deficit. Losing weight

[38] "Dietary adherence and weight loss success among ... - NCBI - NIH." 12 Feb. 2008, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4005268/. Accessed 21 Sep. 2018.
This source is a peer-reviewed study that had a rather large study size of 181 participants, also it was done over a 1 year randomized controlled trial and so the reliability is high.
This is a peer-reviewed paper that has been cited over 154 and is published by well educated researchers.

[39] "Comparison of the Atkins, Ornish, Weight ... - The JAMA Network." 5 Jan. 2005, https://jamanetwork.com/journals/jama/fullarticle/200094. Accessed 5 Oct. 2018.
In a similar trial to the one above, this source is peer-reviewed and has over 160 participants who take part in a 1 year randomized trial, however it was published in 2005 so the data could have changed. But due to the fact that it has been cited over 1861 times highlighting that it is trusted and thus the source can be classed as reliable,

[40] "Energy Balance and Obesity - NCBI - NIH." https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3401553/. Accessed 21 May. 2018.
This source is a peer reviewed paper by a very well respected researcher who specialises in obesity and weight loss and who has been cited over 36,000 times and has published many other high quality pieces of work, so is reliable.

can be achieved via either reducing total caloric intake and/or increasing physical activity, but as research has shown frequently to have many beneficial effects on individuals. Resistance training in particular, has been shown to have cardiovascular disease inhibiting effects,"resistance training must be considered in addition to aerobic exercise in the prevention and treatment of CVD, since both muscle strength and cardiorespiratory fitness may provide unique benefits" (Artero et al. 2013)[41]. Overall, it has been shown in the literature that exercise training, regardless of weight loss, provides a number of health benefits especially for overweight and obese individuals at risk for cardiovascular diseases (CVD) or with current cardiovascular conditions. Physical activity will also enable an individual to achieve a calorie deficit far easier rather than just restricting their energy intake. From understanding that calories are the most important determinant of weight control, it can be said that the macronutrient (carbohydrates, fats and protein) composition of an individual's diet has little importance and thus a diet that maximises adherence is one that is most likely to be successful in the long-run.

Diets that are believed to be optimal for fat-loss

Stemming on from this, low calorie diets (LCDs) and very low calorie diets (VLCDs) have been employed by both general populations as well as in a clinical setting and the results are obviously significant. One study prescribing a total of 2093 obese patients, 583 pre-diabetic and 367 patients with type 2 diabetes-mellitus (T2DM), both LCDs (800-1200 cal per day) and VLCDs (500-800 cal per day). The result was that all patients lost weight as significantly on VLCDs as LCDs over 12 months (Li et al. 2014)[42]. Furthermore, the efficacy of VLCDs has also been demonstrated in several papers including one that showed results of an average weekly weight loss of approximately 2.0kg during the first 4 to 6 weeks, which the decreases to a rate of 0.8kg over 6 months. However, the authors concluded that very low calorie diets and low calorie diets with an average intake between 400 and 80 calories do not result in different weight loss outcomes, but due to the greater initial weight loss with the VLCDs, they were

[41] "Effects of Muscular Strength on Cardiovascular Risk Factors and ...."
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3496010/. Accessed 9 Sep. 2018.
This source is another peer-reviewed paper written by a number of well respected researchers and has been cited over 219 times, so the source can been seen as reliable.
[42] "Clinical efficacy of a medically supervised outpatient high ... - NCBI - NIH." 10 Feb. 2014,
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3940825/. Accessed 20 Feb. 2019.
This source is a peer-reviewed study with a sizeable sample size of over 2000 individuals, subsequently, the paper can be deemed as reliable.

proposed an effective method (Saris et al. 2001)[43]. Another paper by Ricci and a colleagues' comparing rapid weight loss via a VLCD to a gradual weight loss program found that using VLCDs, participants saw greater weight loss compared to the gradual approach, however, individuals who lost 12.5% or greater body weight, the speed in which they regained weight was not significantly different. (Ricci & Jay 2015) [44] However, for the general population VLCDs and LCDs may not be a suitable approach for the reason that it will result in greater LBM loses. It has been established in a number of studies that more moderate rates of weight loss will preserve greater amounts of LBM (Lombardo et al. 2017)[45], (Ashtary-Larky et al. 2017)[46], (Weiss et al. 2017)[47], (Cava et al. 2017)[48] By preserving more LBM including muscle mass, individuals will more than likely enjoy the benefit aesthetically but also in terms of health which has also been established in a broad body of literature. Some of the benefits include, reduced risk of mortality from CVD (Srikanthan et al. 2016)[49], higher levels of muscle strength are shown to protect hypertensive men against all-cause mortality (Artero et al. 2011)[50]. By just outlining some of the benefits, it is clear that a

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[43] "Very-Low-Calorie Diets and Sustained Weight ... - Wiley Online Library." 17 Sep. 2012, https://onlinelibrary.wiley.com/doi/full/10.1038/oby.2001.134. Accessed 23 Feb. 2019.
This source is peer-reviewed and is a review of the literature on the topic so unlikely to be unreliable and invalid.
[44] "Fast and Furious: Rapid Weight Loss Via a Very Low Calorie Diet May ...." https://www.mdedge.com/jcomjournal/article/146512/obesity/fast-and-furious-rapid-weight-loss-very-low-calorie-diet-may-lead. Accessed 21 Feb. 2019.
This source is another peer-reviewed paper and there was a total of 200 participants constituted as a decent sample size and thus the reliability is moderately high.
[45] "ideal reduction of calories for greatest reduction of body fat and ...." http://www.jarcp.com/3290-ideal-reduction-of-calories-for-greatest-reduction-of-body-fat-and-maintenance-of-lean-body-mass.html. Accessed 22 Feb. 2019.
This source is peer-reviewed and form the Journal of Ageing and Clinical Practice and so likely reliable.
[46] "Rapid Weight Loss vs. Slow Weight Loss: Which is More ... - NCBI - NIH." https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5702468/. Accessed 22 Feb. 2019.
This source is a another peer-reviewed making it a reliable source however, it is important to mention that it had a small sample size of 42 obese and overweight participants as well as the fact that it was conducted over 15 weeks so the results may not be reliable.
[47] "Effects of Weight Loss on Lean Mass, Strength, Bone ... - NCBI - NIH." https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5161655/. Accessed 22 Feb. 2019.
This source is also peer-reviewed but also had 52 sedentary women and men so reliability of results could be questioned but the source is from reliable from a provenance standpoint.
[48] "Preserving Healthy Muscle during Weight Loss - NCBI - NIH." 5 May. 2017, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5421125/. Accessed 22 Feb. 2019.
This source is reliable due to the fact that it is a review of the literature and unlikely to have biases from the researchers.
[49] "Relation of Muscle Mass and Fat Mass to ... - Science Direct." 15 Apr. 2016, https://www.sciencedirect.com/science/article/pii/S0002914916301552. Accessed 22 Feb. 2019.
This is a peer-reviewed paper from The American Journal of Cardiology, however, it should be mentioned that it was an associative study looking at two variables.
[50] "A prospective study of muscular strength and all-cause mortality in ...." 3 May. 2011, https://www.ncbi.nlm.nih.gov/pubmed/21527158. Accessed 22 Feb. 2019.
This source is also peer-reviewed study that covered over 18 years and so the reliability of the study is high.

more gradual calorie deficit is effective at maintaining muscle mass and have further health benefits. Furthermore, it goes without saying that reducing calories so significantly is unsustainable and as a result unrealistic for long-term success, leading to eventual weight regain. As mentioned, an individual should create a diet that they can adhere to and enjoy, one that doesn't feel like a diet and that once the dieting phase has been completed, they can carry on to consume the same foods but as part of an overall greater energy intake.

Perhaps the most frequently argued case is the low-carb diet. Low-carb diets however, come in a number of forms, according to Examine.com, one option of the low carb diet would be for an individual to consume less than 50 grams of carbohydrates a day [51] (Bueno et al. 2013), this specific variation of the diet is classified by most studies as a Very Low Carbohydrate Ketogenic Diet (VLCKD). The second option would be for an individual to consume less than 150 grams of carbohydrate, this is to deplete the 150 grams of stored carbohydrate in the form of glycogen that is stored in the liver (Rothman et al. 1991) [52]. Option 3, of which is when an individual would consume less than 250 grams of carbohydrate, is not classified by any as low-carb, but it's lower than the average consumption of carbohydrates and is also easily sustainable for most. There has been extensive research on whether low carb diets are more effective for weight loss, the benefits of the diet can be seen as it was effective for weight loss with participants losing a mean average of 3.5kg of fat mass over 12 months and the reduction of cardiovascular risk than a low-fat diet which was shown by the ratio change of total-high-density lipoprotein (HDL) cholesterol with a mean change of -0.44; as well as greater increases in HDL cholesterol level than those on a low carb diet (Bazzano et al. 2014)[53]. One of the most prominent points low-carb advocates use to promote a diet low in carbohydrates is because of insulin. Insulin is a hormone, that acts as a regulator, controlling the level of sugar in an individual's blood. When someone consumes a meal, the carbohydrate in the meal is broken down into glucose (a type of sugar used as energy by your

[51] "Very-low-carbohydrate ketogenic diet v. low-fat diet for long ... - NCBI." 7 May. 2013, https://www.ncbi.nlm.nih.gov/pubmed/23651522. Accessed 21 May. 2018.
This source is a peer-reviewed paper that is also a meta-analysis of randomized controlled trials. This is notable as a meta-analysis is a study of studies and thus is less bias, furthermore the paper looked at 13 randomized controlled trials, which are often regarded as one of the strongest trial designs, therefore the reliability is clearly shown.
[52] "Quantitation of hepatic glycogenolysis and ... - NCBI - NIH." https://www.ncbi.nlm.nih.gov/pubmed/1948033. Accessed 23 Feb. 2019.
This source is a peer-reviewed study cited by over 485 other researchers and so can be viewed as a reliable source.
[53] "Effects of low-carbohydrate and low-fat diets: a randomized trial.." 2 Sep. 2014, https://www.ncbi.nlm.nih.gov/pubmed/25178568. Accessed 21 May. 2018.
The reliability of this source presented is obvious as it is a randomized controlled trial with a large sample size of 148 men and women and is therefore the probability for bias is not high.

cells). The glucose then enters your pancreas, then senses the rising glucose and releases insulin. Insulin allows the glucose to enter your liver, muscle and fat cells. After your blood glucose starts to decrease, insulin levels come back down too. This cycle happens regularly throughout the day; however, it is important to mention that insulin does not just have the job of regulating blood sugar. It also has effects on the body including, stimulating muscles to build new protein (a process called muscle protein synthesis)[54] (Timmerman et al. 2010). It also inhibits lipolysis (the breakdown of fat) and stimulates lipogenesis (the creation of fat) (Kersten et al. 2001) [55]. Due to this very point, people have been led to believe that diets high in carbohydrates led to chronically high insulin levels. This is because it is believed because of high carbohydrate intake, this will lead to high insulin levels, meaning an individual will gain fat because lipogenesis will constantly exceed lipolysis (because you can only gain if the rate of lipogenesis exceeds the rate of lipolysis). On the contrary, in healthy people, insulin only elevates in response to meals, when comparing against people with diabetes. This means that lipogenesis will only exceed lipolysis during the hours following a meal (known as the postprandial period). Also, it is worth adding, that when someone is fasting (such as extended times between meals, or when you are asleep), lipolysis (breakdown of fat) will exceed lipogenesis (meaning the body is burning fat). Over a day, it will all balance out (making the assumption that the individual is not consuming more calories than they are expanding), meaning they do not gain weight. Another, misconception about insulin is that it can have an effect on stimulating hunger, despite these claims there have dozens of studies suggesting otherwise (Pliquett et al. 2006) [56]. To add on to, carbohydrates continue to be attacked upon low-carb zealots because of the macronutrients' (carbohydrates) effect on insulin and thus the consequences. However, it has been shown that protein can be just as potent of a stimulus for insulin as carbohydrate (Boelsma et al. 2010)[57]. Within the study, it was shown that despite the fact that the blood sugar response was much

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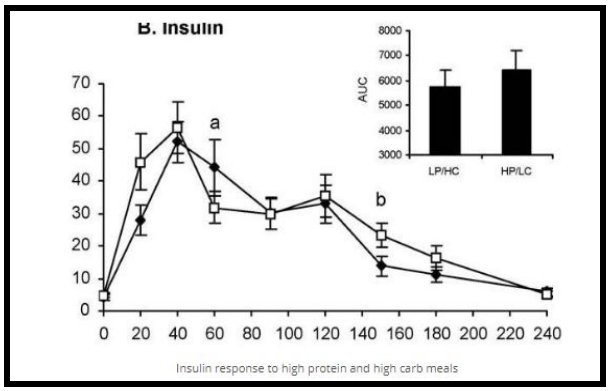
[54] "Insulin stimulates human skeletal muscle protein ... - NCBI - NIH." 19 May. 2010, https://www.ncbi.nlm.nih.gov/pubmed/20484484. Accessed 1 Sep. 2018.
This 2010 source is a peer-reviewed study which has been cited over 118 times and was published by several reputable authors.

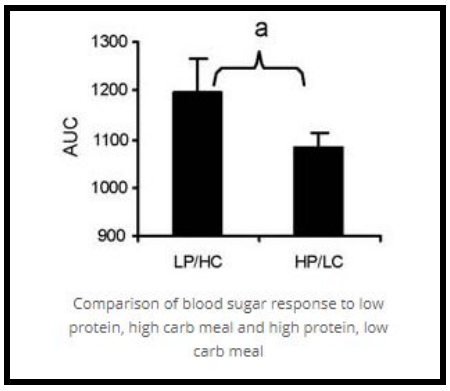
[55] "Mechanisms of nutritional and hormonal regulation of lipogenesis." https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1083868/. Accessed 1 Sep. 2018.
This source is a report on a subject, which is peer-reviewed and the reliability is shown as it is clearly a reliable source by the fact that it has been cited over 577 times by other researchers.

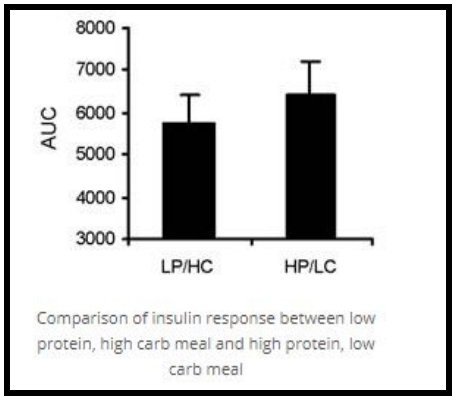
[56] "The effects of insulin on the central nervous system--focus on ... - NCBI." https://www.ncbi.nlm.nih.gov/pubmed/16933179. Accessed 1 Sep. 2018.
This source is a peer-reviewed paper which looks at the current literature and so it is likely to be reliable.

[57] "Measures of postprandial wellness after single intake of two ... - NCBI." 9 Jan. 2010, https://www.ncbi.nlm.nih.gov/pubmed/20060863. Accessed 1 Sep. 2018.
This source is again a peer-reviewed exploratory study which had a randomized cross-over, double blind design, consequently making the source reliable.

higher in the meal with more carbohydrate, the insulin response was not higher. In fact, the insulin response was actually higher after the high protein meal.







Additionally, the chart (above), shows there was a trend for insulin to spike faster with the high protein feeding, with an average response of 45 uU/mL at 20 minutes following the meal conversely, for the high carbohydrate meal which saw a response of around 30 uU/mL. As a result, this was associated with a result of more appetite suppression and the participants showed a trend towards less hunger and more satiety after the meal that was high in protein. (Boelsma et al. 2010) The Ketogenic diet (KD), alternatively, has been shown to be effective in reducing caloric intake via its effect on appetite and thus result in weight loss (Johnstone et al. 2008)[58]. The view is that there a number of different factors that can influence, firstly, protein has been shown to be the most satiating macronutrient with an abundance of research to support it [59] (Leidy et al. 2012), generally, people who are on a KD typically eat more protein than they would normally do. Furthermore, regardless of the protein content within the KD, it has also been shown that the diet's effect on producing ketones (ketone bodies [60] (Wikipedia) are three water-soluble molecules (acetoacetate, beta-hydroxybutyrate, and their spontaneous breakdown product, acetone) containing the ketone group that are produced by the liver from fatty acids during periods of low

[58] "Effects of a high-protein ketogenic diet on hunger ... - Oxford Journals." https://academic.oup.com/ajcn/article/87/1/44/4633256. Accessed 12 Sep. 2018.
This is another peer-reviewed study which has been cited over 287, however, it's sample size was fairly small with only 17 obese men and was done over a short period of 4 weeks. So the results of the study should be taken with caution.
[59] "The effects of consuming frequent, higher protein meals ... - NCBI - NIH." 16 Sep. 2010, https://www.ncbi.nlm.nih.gov/pubmed/20847729. Accessed 12 Sep. 2018.
This source is a peer-reviewed study, however like the aforementioned source it has a relatively small sample size of 27 obese men and was done over a period of 12 weeks so the source is probably not biased but the results should be viewed as not completely reliable in its results but can be seen as a trusted source.
[60] "Ketone bodies - Wikipedia." https://en.wikipedia.org/wiki/Ketone_bodies. Accessed 12 Sep. 2018.
This is source that has questionable reliability because is open to anonymous and collaborative editing, however it has been shown by studies conducted by IBM researchers in 2003 that vandalism and false information submitted is repaired extremely quickly and that most users would never its effects.

food intake (fasting), carbohydrate-restricted diets, starvation, prolonged intense exercise[61] (Koeslag et al. 1980) has an impact on an individual's appetite (Sumithran et al. 2013)[62] (Gibson et al. 2014)[63].

However, one point that is important to discuss is whether the initial short term drop in weight of an individual is perhaps a reason to why many believe that it is the best diet. A paper by Olsson et al showed that when consumed, carbohydrates increase muscle glycogen storage substantially, as a consequence of increased glycogen; there comes a surge in water retention. This is because, with one gram of extra glycogen, 3-4 grams of water is retained. As muscle has a capacity to store 500 grams of glycogen, subsequently there will be fluctuations on the scales the next day which has the potential to be anything from 0-4 lbs (0-1.8kg), all of which is intramuscular water and not fat (Olson & Saltin, 1970)[64]. Therefore, because a low-carb diet is inherently, low in carbohydrates, individuals will be consuming far fewer carbohydrates and thus be retaining less water. After establishing this, it is clear that many individuals who adopt this diet with the aim of fat-loss may be believing that they have made fast results after switching from a regular calorie restricted diet to a low carb diet when in truth their bodies more than likely have just stopped retaining as much water. More importantly, the ketogenic diet, in particular, has become quite trendy and popular as of late along with the idea that eating more dietary fat helps you to burn more fat as fuel. However, this is not quite how the human body works, though it is true that when you transition to a ketogenic diet, you shift your body's fuel usage more towards burning fat, but since you are also consuming more fat, it doesn't necessarily result in greater fat-loss (Hall et al. 2015)[65]. To add on to, as an indirect impact on fat-loss, the ketogenic diet can also be suboptimal because going too

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[61] "Post-exercise ketosis. - NCBI - NIH." https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1279383/. Accessed 12 Sep. 2018.
This source is another peer-reviewed paper so it is therefore a reliable source as it has been examined by other researchers.

[62] "Ketosis and appetite-mediating nutrients and hormones after ... - Nature." https://www.nature.com/articles/ejcn201390. Accessed 12 Sep. 2018.
This source is a peer-reviewed study that had a larger sample size of 50 non-diabetic, overweight or obese subjects who began the study but 39 completed the 8-week period. Therefore the study can be classed as reliable.

[63] "Do ketogenic diets really suppress appetite? A systematic ... - NCBI." 17 Nov. 2014, https://www.ncbi.nlm.nih.gov/pubmed/25402637. Accessed 12 Sep. 2018.
This piece of work is a peer-reviewed meta-analysis so the reliability of this research is most likely reliable.

[64] "Variation in Total Body Water with Muscle ... - Wiley Online Library." https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1748-1716.1970.tb04764.x. Accessed 23 Feb. 2019.
This source is another study which is published on Wiley Online Library which is a high quality which is peer reviewed, however it is important to mention that this paper was published in 1970 so the reliability of the data may be somewhat weak as science has developed in the period up to now and new research may have been published.

[65] "Calorie for Calorie, Dietary Fat Restriction Results in More Body Fat ...." 13 Aug. 2017, https://www.ncbi.nlm.nih.gov/pubmed/26278052. Accessed 14 Aug. 2018.
Despite the small sample size and short trial duration, this source is reliable because it is peer-reviewed and it was conducted by Dr Kevin Hall is a renowned researcher in obesity and thus unlikely to be bias.

low in carbohydrate can potentially degrade performance in exercise and recovery. While ketogenic diets have been shown to be of benefit to endurance athletes who use more fat for fuel, for other sports such as lifting, they are reliant on anaerobic metabolism and muscle glycogen, studies have consistently shown an impairment in performance from this diet (Havemann et al. 2006[66], Stellingwerff et al. 2006[67] and Burke et al. 2017[68]). As a result of this impact, this could potentially result in an individual being unable to maintain a hypoenergetic diet (weight loss), due to the fact they may not be able to perform as well and therefore their expenditure may be reduced. Overall, the use of a low-carb diet has been shown to have high efficacy when pursuing a target of fat-loss as it is a useful tool to implement a calorie deficit. However, it is instantly clear that cutting out one macronutrient (carbohydrates), may not be a viable solution for all. As a result, the incorporation of a much more wholistic structure to one's diet is probably a more sustainable approach with the inclusion of protein, carbohydrates and fats, but also prioritising fibrous fruits and vegetables.

One of the most prominent debates within the health and fitness industry is the discussion of whether low-carb or low-fat diets are better than one another. There has been extensive research on this debate with hundreds of papers each highlighting different points. One randomized controlled trial of low-carb and low-fat/high fibre diets for weight loss published in 1986 that looked at the difference between the diets in 135 overweight subjects found that participants allocated the low carbohydrate/low fiber dietary advice tended to lose more weight than those given a higher carbohydrate/higher fibre plan (5.0 vs 3.7 kg on average at three months). It is worth noting also that there were no differences between the groups in the proportion complaining of hunger but, in general, participants who were part of the low-carb group complained of more problems in dieting (Baron et al. 1986)[69]. Another paper, this time a meta-analysis of

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[66] "Fat adaptation followed by carbohydrate loading compromises ... - NCBI." https://www.ncbi.nlm.nih.gov/pubmed/16141377. Accessed 19 Aug. 2018.
Much like the other sources within this project this is a peer-reviewed study and so is mostly reliable, however, the study was only for 8 days so the reliability of the results may be questionable and a longer study duration should be done to show more dependable results.

[67] "Nutritional strategies to optimize training and racing in middle ... - NCBI." https://www.ncbi.nlm.nih.gov/pubmed/18049980. Accessed 19 Aug. 2018.
This source is another paper that looks at nutritional strategies for training and like the others mentioned it is peer-reviewed as so is going to relatively solid is reliability.

[68] "Low carbohydrate, high fat diet impairs exercise economy ... - NCBI - NIH." 14 Feb. 2017, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5407976/. Accessed 19 Aug. 2018.
The source outlined in this part of the project is a peer-reviewed study therefore it can be presumed as being reliable, however it is worth to note that the results of this particular study may not be converted to normal everyday activity as the study was done on race-walkers.

[69] "A randomized controlled trial of low carbohydrate and low ... - NCBI - NIH." https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1646726/. Accessed 28 Oct. 2018.

randomized controlled trials, conducted by Nordmann and colleagues found that low-carbohydrate, non-energy-restricted diets were at least as successful as low-fat, energy-restricted diets including weight loss for up to 1 year (Nordmann et al. 2006)[70]. In 2012, another large meta-analysis of randomized controlled trials was published. The paper, compiled of 23 trials from multiple different countries, with a total of 2,788 participants, found that both diets lowered weight (weighted man changes in outcomes were -6.1 versus -5.0kg for body weight)and improved metabolic risk factors (Hu et al. 2012)[71].

Before discussing the most recent and widely publicised study comparing low-carbohydrate diets and low-fat diets, it is noteworthy reviewing a released in 2017 by Dr Kevin Hall, one of the most reputable figures in the research field for obesity. This review, which was a meta-analysis, looking at over 32 controlled feeding studies with comparing isocaloric (equal calorie) diets composed of either mostly fat or carbohydrates as well as constant dietary protein, for both energy expenditure (thermic effect of food, non-resting energy-expenditure and resting energy-expenditure), as well as fat-loss. The authors found 32 studies representing 563 subjects matching our inclusion benchmark with dietary carbohydrate ranging from 1%-83% and dietary fat ranging from 4%-84% of total calories. As the two figures displayed below highlight, the pool weighted difference in energy expenditure was 26 kcal per day greater with lower fat diets. Furthermore, as illustrated, the rate of body fat change between the two diets had a pool weighted mean difference of 16 g per day more in favour of the lower fat diets. Despite concluding that the size of difference was so small that they would have generated physiological meaningless" results between the two, it does contradict the view held by some, that to be able to lose substantial amounts of fat, an individual has to adhere to a low-carb diet. [72] (Hal & Guo 2017)

This source is reliable because it is a peer-reviewed scientific paper and also it is a randomized controlled trial which is high quality according to the hierarchy of study designs.

[70] "Effects of Low-Carbohydrate vs Low-Fat Diets on ... - The JAMA Network." https://jamanetwork.com/journals/jamainternalmedicine/fullarticle/409791. Accessed 28 Oct. 2018.

This source is another peer-reviewed publication that is also a meta-analysis of randomized controlled trials so the reliability of this source is very high.

[71] "Effects of Low-Carbohydrate Diets Versus Low-Fat Diets - NCBI - NIH." https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3530364/. Accessed 28 Oct. 2018.

This source is also a meta-analysis of randomized controlled trials that has been peer-reviewed and thus the scientific evidence is strong and the reliability confirmed.

[72] "Obesity Energetics: Body Weight Regulation and the ... - NCBI - NIH." 11 Feb. 2017, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5568065/. Accessed 28 Nov. 2018.

This is another peer-reviewed paper conducted by the world-renowned Dr Kevin Hall, who specializes in the area of obesity, also it is a meta-analysis, a study of studies which are often seen as producing the highest quality of evidence.

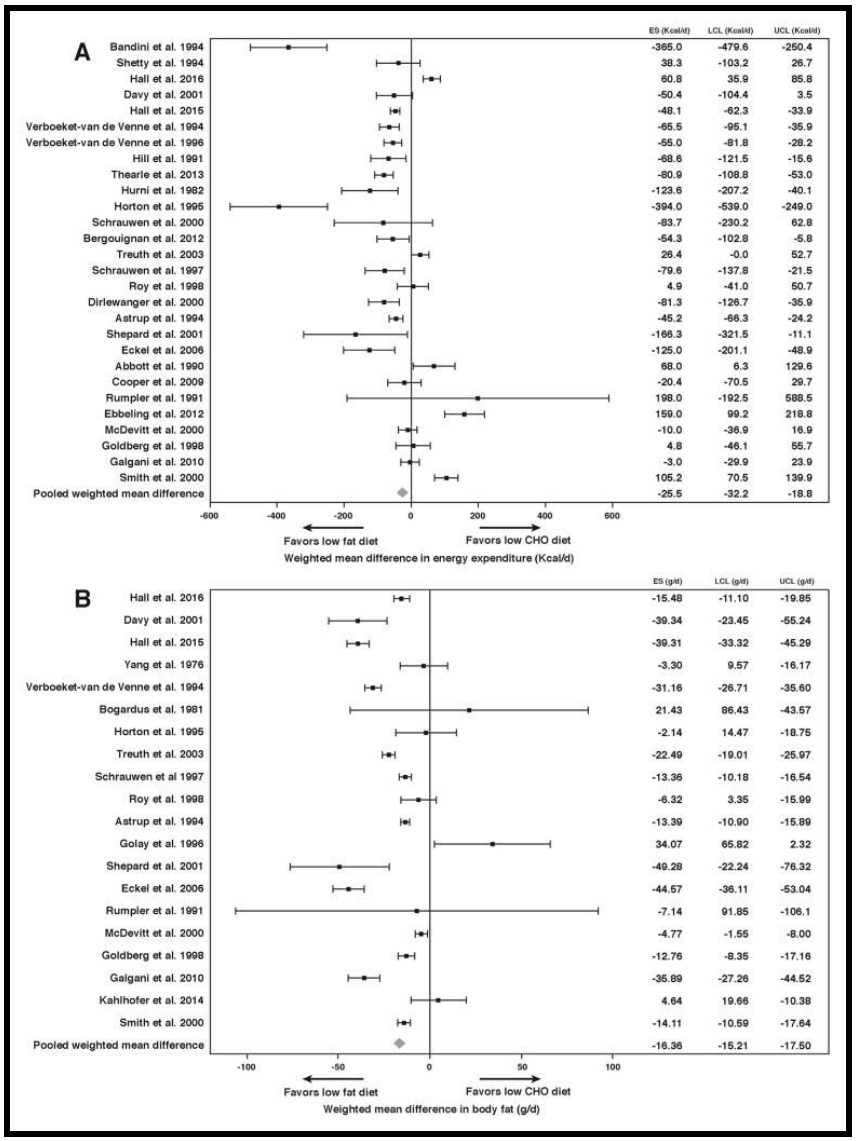


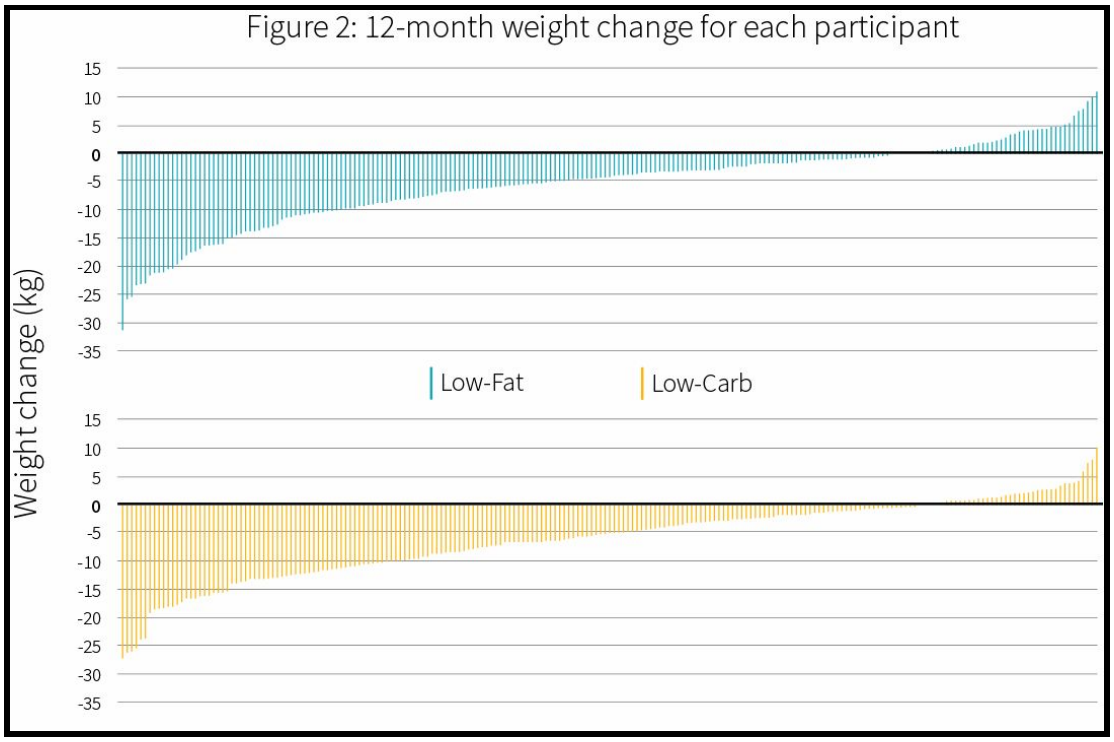
Figure A & B:

These figures, from the meta analysis of controlled, isocaloric (having similar caloric values) study that maintained constant dietary protein and differing ratios of carbohydrate to fat. In these figures, the studies included are ordered from top to bottom corresponding to the largest difference in carbohydrate between the compositions of the prescribed diets. *'Effect size (ES), upper and lower 95% confidence limits (UCL and LCL, respectively) are indicated for the differences in **daily energy expenditure (A)** and rate of **body fat change (B)**. The pooled weighted mean difference across studies demonstrated small differences in daily energy expenditure (**26 kcal/d**, P <.0001) and body fat change (16 g/d, P <.0001) favoring lower fat diets'* (Hall et al, 2018)

A recent randomised clinical trial (RCT), this study is seen as notable due to its large sample size (number of participants), long duration (12 months), and careful dietary monitoring [73] (Gardner et al. 2018). In addition, the study was partially funded by NuSI, which is an organisation founded by low-carb advocates. The trial randomly assigned 609 individuals to either a healthy low-fat diet or a healthy low-carb diet for 12 months. During those 12 months, everyone was encouraged to attend 22 dietary counselling sessions with a dietitian. The dietitian illustrated to them how to maintain a high quality, whole-food eating plan on their designated diet. To add on to, before the study began researchers looked to see if genotype or insulin production could predict weight loss on either a low-fat or a low-carb diet. Other health results measured included weight change, body fat (DXA), cholesterol, blood pressure, and fasting glucose. From the start of the study, all participants were instructed to consume either ≤20g of fat (if in the low-fat group) or ≤20g of carbs (if in the low carb group) for the first 12 months, it is worth highlighting that these are incredibly restricted amounts and thus probably unsustainable for the majority of people. The participants were then told to slowly add back fats or carbs until they reached a level they felt could be maintained for life. By the end of the study, the majority had increased their intake of either fat or carb with an average family fat intake of 57g for the low-fat group and an average daily carb intake of 132g for the low carb group. In addition, both groups were given the instruction to consume as many vegetables as possible, choose high-quality, nutritious whole foods and restrict the quantity of processed products, prepare food themselves at home and avoid trans-fats, added sugars as well as refined carbohydrates such as flour. Overall, in this 12-month weight loss diet study, there was shown to be no significant difference in weight change between a healthy low-fat diet vs a healthy low-carbohydrate diet (figure 2), furthermore neither genotype pattern nor baseline insulin secretion was linked with the dietary effects on weight loss, and there was also no notable differences between the groups for most other health markers tested. The conclusion from this study are that both diets were labelled as healthy, and they were because the researchers encouraged participants to eat high-quality, nutritious whole foods, have mostly plants (fruits and vegetables) and avoid flours, sugars, avoid trans fats and processed foods. The investigators also presented participants with basic behavioural counselling aimed at reducing emotional eating. These components to the study are what make it a great one, the lessons and eating habits gained were fundamental and important to note because the principals not only would help most with their

[73] "Effect of Low-Fat vs Low-Carbohydrate Diet on ... - The JAMA Network." 20 Feb. 2018, https://jamanetwork.com/journals/jama/fullarticle/2673150. Accessed 28 Oct. 2018.
This source is a recent 2017 study, in which had a sample size of 632 participants which is a rather significant number and thus indicates its authenticity. Another reason for this his source in particular to be seen as reliable is that it was conducted by Dr Christopher Gardner, the National Institute of Health and the Nutrition Science Initiative (NuSI). This is important to mention because NuSI was co-founded by Gary Taubes, a well-known advocate of the low-carb diet and the results do contradict his view that low-carb diets are superior.

fat-loss endeavours, but also improve the health of most individuals.[74] (Examine.com) These publications highlight the lack of relevance of macronutrient composition when it comes to basic fat-loss, neither diets rich in carbohydrate or fat will prove to better, instead the composition of carbohydrates and fats should be altered based on the preferences of the individual and whatever combination that best allows them to adhere to their diet. The recent 2018 study is an important point to take away as the authors of the study were less interested in differences between the two diets, but the eating habits that they implemented. The prioritisation of eating high-quality, nutritious whole foods and increasing the consumption of fruit and vegetables is one that should be highlighted and learnt.



[74] "Low-fat vs low-carb? Major study concludes: it doesn't ... - Examine.com." 20 Feb. 2018, https://examine.com/nutrition/low-fat-vs-low-carb-for-weight-loss/. Accessed 18 June. 2018.
This source is definitely honest because it is from Examine.com, which is, in my opinion one of the most reliable and unbiased websites for nutritional and supplement surrounding advice.

Other popular eating/dieting strategies

Another form of diet that has gained wide popularity amongst the fitness community and many others looking to weight, is intermittent fasting. Intermittent fasting is an umbrella term for various diets that cycle between a period of fasting and non-fasting during a defined period. Intermittent fasting can also be used with calorie restriction for weight loss. Intermittent fasting has been shown to work, however, to varying degrees in different studies, one study (Tinsley et al. 2015)[75], showed that alternate-day fasting trials of 3-12 weeks were effective at decreasing body weight (≈3%-7%), body-fat (≈3-5.5 kg), total cholesterol (≈10%-21%), and triglycerides (≈14%-42%) in normal-weight, overweight, and obese humans. Furthermore, whole-day fasting trials lasting 12 to 24 weeks were also shown to reduce body weight (≈3%-9%) and body-fat, and positively improve blood lipids (≈5%-20% reduction in total cholesterol and ≈17%-50% reduction in triglycerides). However, a study by Betts et al. 2014, showed that physical activity thermogenesis was higher with individuals who had breakfast rather than those who were fasting, as well as body mass and adiposity not differing between (Betts et al. 2014)[76]. The overall consensus that can be formulated is that IF is effective in weight loss as individuals will push their eating window later in the day so that they consume the bulk of their energy (calories), in a short time frame. As a result, these individuals will be less likely to exceed their necessary target to remain in a caloric deficit as they will feel more full and satisfied. To conclude, IF has been shown (Seimon et al. 2015)[77], that it does not appear to reduce other adaptive responses to energy restriction or improve weight loss effects and thus is not superior to traditional continuous energy restriction. Therefore, IF can be an optional tool for individuals who want to ensure that they remain in a negative energy balance, but does not offer any other weight loss advantages and thus could be incorporated to increase adherence to a calorie deficit but the principles of eating a high quality, unprocessed diet with plenty of fruits and vegetables should instead be prioritised.

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[75] "Effects of intermittent fasting on body composition and clinical ... - NCBI." 15 Sep. 2015, https://www.ncbi.nlm.nih.gov/pubmed/26374764. Accessed 9 Sep. 2018.
This source is a review of studies conducted on the subject of intermittent fasting and is also peer-reviewed so can be observed as reliable.

[76] "The causal role of breakfast in energy balance and health - NCBI - NIH." https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4095658/. Accessed 9 Sep. 2018.
This source is another reliable piece of research because it is a peer-reviewed paper and is also a randomized controlled trial and so it is very strong is scientific reliability.

[77] "Do intermittent diets provide physiological benefits over ... - NCBI." 16 Sep. 2015, https://www.ncbi.nlm.nih.gov/pubmed/26384657. Accessed 9 Sep. 2018.
This source is a peer-reviewed paper that is also a systematic review of studies and so the reliability is definitely strong because of the added layer of unbiased reviewing by other researchers on the studies included.

Other popular diets

Other popular and trending diets that have grown in popularity over the years include, the Dukan diet, Paleo diet, Atkins diet, Alkaline diet, Carnivore diet, Sugar-free diet. One of the most prominent diets is the Sugar-free diet, over the decades, sugar has increasingly gained a bad reputation as a result of its association with the obesity epidemic that is growing ever more important. Sugar has been associated with this worldwide health issue primarily due to the fact that those hyper-palatable foods that obese individuals would usually consume, tend to contain large amounts of sugar and therefore the link between the macronutrient and weight gain was established. The literature on sugar's effect on weight gain has been mixed, a systematic review and meta-analysis of prospective cohort studies and RCTs (randomised controlled trial) by Malik et al. 2013, showed that SSB (sugar-sweetened beverages) consumption promotes weight gain in children and adults (Malik et al. 2013)[78]. However, the literature shows with a multitude of research that with caloric consumption controlled the consumption of sugar will not affect body composition. This has been supported by a recent paper (Surwit et al. 2017) that studied the comparative effects of high- and low-sucrose, low-fat, hypoenergetic diets . The results were clear, a high sucrose content in a hypoenergetic, low-fat diet did not adversely affect weight loss, metabolism, plasma lipids, or emotional effect.[79] Furthermore, a paper by Ha et al. 2015, highlighted that sugary beverages are one of the many tributaries that can result in overconsumption and therefore overall attention needs to be pinned down on reducing overconsumption of all caloric foods associated with obesity, not directly sugar (Ha et al. 2015)[80]. To add on to a review by Rippe and colleagues (Rippe et al. 2015) illustrated that several studies in both adults and children showed inconsistent results and typically did not adjust for total energy intake, thus demonstrating that there is no unique relationship between sugar and obesity (Rippe et al. 2015)[81]. To sum up, despite the current controversy of sugar and its effect on both health but more

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[78] "Sugar-sweetened beverages and weight gain in children ... - NCBI - NIH." 21 Aug. 2013, https://www.ncbi.nlm.nih.gov/pubmed/23966427. Accessed 23 Feb. 2019.
This source is a peer-reviewed systematic review and meta-analysis and so because of this can be classed as a reliable source.

[79] "Metabolic and behavioral effects of a high-sucrose diet during weight ...." 1 Apr. 1997, https://academic.oup.com/ajcn/article/65/4/908/4655511. Accessed 16 Aug. 2018.
This source is a peer-reviewed study that was done over a 6 week period and the source can be classed as reliable.

[80] "Do Fructose-Containing Sugars Lead to Adverse Health ... - NCBI - NIH." 7 Jul. 2015, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4496733/. Accessed 23 Feb. 2019.
This source is also reliable as it is a peer-reviewed paper that is also a meta-analysis and thus the quality of the results can be seen as high.

[81] "Sugars, obesity, and cardiovascular disease: results from ... - NCBI - NIH." 14 Jul. 2016, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5174142/. Accessed 23 Feb. 2019.
This source is reliable as it is a peer-reviewed paper that is also a review of randomized controlled trials, often regarded as producing the highest quality of results due to the fact that they are the most rigorous methods of determining whether a variable is caused by another.

importantly weight loss, in this case, is that there is not strong evidence to suggest that sugar consumption has an explicit influence on obesity and weight gain. It is instead the extrapolated correlation between increased in obesity rates and coincidental increase in sugar-sweetened products that has led people to believe that sugar is responsible for the epidemic. The current data shows that the quantity of sugar within a diet does not matter when calories are controlled, however, it terms of health and ensuring adherence it is probably prudent to steer away from the ultra-processed, refined sugar filled foods and instead look to a diet that is whole, nutrient dense foods as well as plenty of fibrous fruits and vegetables.

The Paleolithic diet

Another diet that has become increasingly popular in recent years is The Paleo diet, also referred to as the caveman or Stone-Age diet, includes lean meats, fish, fruits, vegetables, nuts, and seeds. Proponents of the diet emphasize choosing low-glycemic fruits and vegetable.[82] (Harvard Education, The Nutrition Source) The research on this diet has been promising with some randomized controlled trials showing the Paleo diet to produce greater short-term benefits than diets based on national nutrition guidelines, including greater weight loss, reduced waist circumference, reduced blood pressure, increased insulin sensitivity and improved cholesterol (Manheimer et al. 2015)[83] (Masharani et al. 2015) [84] (Obert et al. 2017)[85]. However, despite these results, these studies were short duration ranging from 6 months or less and with less than 40 participants which are relatively small. On the contrary, one larger randomized controlled trial (RCT) with 70 postmenopausal Swedish women for two years, who were placed either on a Paleo diet or a Nordic Nutrition Recommendations (NNR) diet. The Paleo diet within this RCT consisted of 30% protein from total calories, 40% fat (mostly from monounsaturated and polyunsaturated

[82] "Diet Review: Paleo Diet for Weight Loss | The Nutrition Source ...." https://www.hsph.harvard.edu/nutritionsource/healthy-weight/diet-reviews/paleo-diet/. Accessed 9 Sep. 2018.
This source is from Harvard - School of Public health and thus can be seen as reliable as it has been published and reviewed from well respected individuals.
[83] "Paleolithic nutrition for metabolic syndrome: systematic review and ...." 12 Aug. 2015, https://academic.oup.com/ajcn/article/102/4/922/4564680. Accessed 9 Sep. 2018.
This source is a systematic review of randomized controlled trials which is worth noting because of the reliability and unbiased nature of these study designs and thus makes the source reliable.
[84] "Metabolic and physiologic effects from consuming a hunter ... - Nature." https://www.nature.com/articles/ejcn201539. Accessed 9 Sep. 2018.
This source is a peer-reviewed study and so is reliable, however it had a small sample size of 14 participants and so the results could be unreliable.
[85] "Popular Weight Loss Strategies: a Review of Four ... - Springer Link." https://link.springer.com/article/10.1007/s11894-017-0603-8. Accessed 9 Sep. 2018.
This is another peer-reviewed review so it is relatively reliable, however the paper itself does reference how the studies included were quite limited.

fats) and 30% carbohydrates. On the other hand, the NNR diet supplied less protein and fat, but a greater proportion of carbohydrate with 15% protein, 25-30% fat, and 55-60% carbohydrates. The results were that both groups significantly reduced fat-mass as well as waist circumference at both 6 and 24 months. However, it was shown that the Paleo diet produced greater fat-loss at 6 months but not at 24 months. To summarise, the Paleo diet enables individuals to consume nutrient-dense whole fresh food and encourages participants to avoid highly processed foods containing added salt, sugar and unhealthy fats and will therefore, contribute to reducing one's caloric intake and subsequently make weight loss easier to achieve. However, it should obviously be mentioned that, despite the success for the individuals who were part of this trial, the results can be replicated by others using a simple calorie restricted diet that has a sustained calorie deficit.

What are the components of an optimal diet?

Aside from calories being the most important factor in fat-loss, the ability to adhere to a diet is a commonly underrated factor and can have a significant impact on the success of one's diet. In fact, dietary adherence has been shown to be key in fat-loss by a study (Alhassan et al.2008) that showed regardless of the assigned diet type (Atkins, Ornish and Zone), weight change was greater in the most adherent compared to the least adherent (Alhassan et al. 2008)[86]. To further add on to the point that dietary adherence is of great importance, issues start to show with drastic diets such as the ketogenic diet. The Keto diet which is as stated in the aforementioned, consuming high fat, moderate protein, but below 50g of carbohydrates has become increasingly popular. However, for an individual trying to lose considerable amounts of weight the diet has been shown to be unsustainable and difficult to adhere to (Ye et al. 2015)[87] . The elimination of essentially a whole macronutrient from one's diet is extremely confining in terms of flexibility and will more than likely cause the individual to experience physiological stress as a consequence of not being able to comply with their diet. To further address this point, diets such as Keto are unlikely to be a suitable option for most individuals because if they are unable to adhere to or struggle to this will cause added stress to one's life. Due to the increase in stress caused by the rigid dietary

[86] "Dietary adherence and weight loss success among overweight ...." 12 Feb. 2008, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4005268/. Accessed 15 Aug. 2018.
This source is a study that conducted secondary analysis on 181 free-living overweight/obese women. This therefore suggests that it is reliable due to the large sample size and the fact that the source is peer-reviewed.
[87] "Efficacy of and Patient Compliance with a Ketogenic Diet ... - NCBI - NIH." 2 Jan. 2015, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4302176/. Accessed 19 Aug. 2018.
This source is a peer-reviewed study and also a meta-analysis which can also mean that there is a higher chance for the source to be reliable.

constraints, it will often result in elevated cortisol which has been shown to cause an increase in aldosterone, a major hormone involved in fluid regulation (Freel & Connell 2005)[88] subsequently, high stress levels can draw in more water which will result in an accurate add of body weight seen on the scales. This body weight is merely water rather than perceived fat to many individuals and thus cause the individual to think that their efforts have resulted in no progress. As already stated, the composition of fat, carbohydrates and protein are shown to meaningless as long as the diet itself is hypocaloric (hypocaloric diet is simply one in which you eat fewer calories than you burn). One study divided 811 overweight adults to one of four targeted percentages of energy derived from *'fat, protein, and carbohydrates in the four diets were 20, 15, and 65%; 20, 25, and 55%; 40, 15, and 45%; and 40, 25, and 35%.'* The results were that 80% of subjects who completed the trial, the average weight loss was 4 kg; 14 to 15% of the participants had a reduction of at least 10% of their initial body weight. The relevant effect on satiety, hunger, satisfaction with the diet, and attendance at group sessions was similar for all diets; attendance was strongly associated with weight loss. It can therefore, be concluded that the reduced-calorie diets resulted in clinically valid weight loss regardless of the macronutrient composition. However, despite not showing that the overall composition of determining and altering body composition is energy balance, protein has long been seen as an important micronutrient in both health and an individual's goal of losing weight. Protein has often been perceived as a stereotypical bodybuilder necessity (Sacks et al. 2009)[89]. However, what people fail to acknowledge is the importance of dietary protein for both health benefits and aiding an individual to achieve their weight loss goals. Protein is first shown to be fundamental in the maintenance of muscle preservation, and having more muscle for the majority of the population will be very beneficial.

The importance of longevity within diets

In conjunction with the factor of adherence with a diet comes the fundamental component of the longevity of the diet itself. The current data clearly indicates that if an individual cannot see themselves sticking to the diet that they are currently involved with, then the individual should probably rethink their strategy because of the possible adverse implications that may occur as a consequence. The most prevalent

[88] "Mechanisms of Hypertension: The Expanding Role of ... - NCBI - NIH." https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1283142/. Accessed 14 Feb. 2019.
This source is a peer-reviewed study paper, cited by over 114 and therefore, it can be seen as a reasonable reliable source.

[89] "Comparison of Weight-Loss Diets with Different ... - NCBI - NIH." https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2763382/. Accessed 19 Oct. 2018.
This source is another peer-reviewed study that had a large sample size of 811 with 645 completing and was a long duration of 2 years this source is clearly reliable and is actually a great study.

implication being weight regain, which has become an even greater issue. Current statistics show that within one year of weight loss nearly 80% of people will have relapsed to heavier pre-diet weight (Maclean et al. 2011)[90]. Furthermore, 2 years that number is 85% and within 3 years over 95% of people will have relapsed to their pre-diet weight (Ayyad & Andersen 2000)[91] (Langeveld & de Vries 2013)[92] (Fat Loss Forever, 2019)[93]. What's even worse is that the people who relapse to their previous weight, ⅓ to ⅔ will regain even more weight than they had before they started (Dulloo et al. 2012)[94]. From the data outlined, it is pretty clear that the structure of the diet is just as important for the short-term, initial weight loss as the long-term plan for an individual and thus they should find what works to them and confirm to themselves that they are not being overly restrictive but not so 'loose' with their diet and thus prevent the possibility for the 'post-diet' binge. Although the thought of completely destroying your results from your diet sounds like a far-fetched idea, the problem is very much real and can be caused by a number of factors including; over-restrictive diet structure and other external factors that indirectly cause a person to look to food. Another important factor should be discussed, when an individual enters a hypocaloric diet and essentially restricts the body of energy (calorie deficit), the body implements a number of mechanisms to hold on to as much energy from fat stores, to prevent starvation. When a person is in a prolonged energy deficit the body overreacts to the process by slowing down their overall total daily energy expenditure (TDEE), commonly referred to as someone's 'metabolic rate.' This process occurs because the body tries to prevent the body from losing any more stored energy (body fat) and thus causes the energy deficit to eventually become an energy balance (calories consumed equal those that are

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[90] "Biology's response to dieting: the impetus for weight regain. - NCBI - NIH." 15 Jun. 2011, https://www.ncbi.nlm.nih.gov/pubmed/21677272. Accessed 22 Oct. 2018.
This source is respectable in terms of its reliability because it firstly a peer-reviewed scientific review of the current evidence and also it has been cited over 267 times and thus can be seen as trusted.

[91] "Long-term efficacy of dietary treatment of obesity: a systematic ... - NCBI." https://www.ncbi.nlm.nih.gov/pubmed/12119984. Accessed 22 Oct. 2018.
This source is another peer-reviewed and systematic review of other studies and so the source can been seen as reliable.

[92] "[The mediocre results of dieting]. - NCBI." https://www.ncbi.nlm.nih.gov/pubmed/23859104. Accessed 22 Oct. 2018.
This source is reliable because it is another peer-reviewed paper evaluated by other scientific researchers and thus the reliability can be confirmed.

[93] "Fat Loss Forever | How to Lose Fat and Keep it Off - Biolayne." https://www.biolayne.com/fat-loss-forever/. Accessed 24 Feb. 2019.
This source, is a book written by Layne Norton who has a PhD in nutritional sciences and has published a number of papers on the subject of nutritional science, in this book he outlines all the literature on weight regain as well as metabolic adaptations to dieting and so is reliable.

[94] "How dieting makes some fatter: from a perspective of human ... - NCBI." 5 Apr. 2018, https://www.ncbi.nlm.ih.gov/pubmed/22475574. Accessed 22 Oct. 2018.
This source is also reliable because it is peer-reviewed paper that covers already pre-existing scientific evidence and the the possibility of the paper being bias is slim.

expended) and thus weight loss stops unless further energy restriction is imposed. These metabolic adaptations also include; adaptations that cause a decrease in a person's basal-metabolic-rate (BMR), this also includes the reduction in lean body mass such as the metabolically active muscle mass that is also used as energy for the body, a rather substantial reduction in a person's non-exercise activity thermogenesis (NEAT), changes to a person's hormones including, leptin, ghrelin, thyroid hormone, as well as others that contribute to decreased in metabolic rate and increased hunger (MacLean et al. 2011)[95]. Furthermore, linking on from the aforementioned section on the importance of a diet being long-term structured because the body's defense system doesn't stop once the fat-loss period has stopped. During the diet the body is preparing the person for the fat regain process, the body does this by activating systems in the body that improve the efficiency of energy storage which directs the increased energy (calories) a person takes in during the post-diet phase and puts it towards preferential fat gain. Furthermore, not only is the person more able to store more fat they are more hungry due to lower levels of leptin, insulin, neuropeptide Y, as well as an increased selection of the hormone ghrelin which is often referred to as the body's hunger hormone (Johannsen et al. 2012)[96]. Due to these mechanisms, it is clear that an individual should set up a diet that they know they can stick to, even when it gets difficult because they will have to at some point, reduce calories further to stimulate further fat-loss.

Strategies as part of a diet can be proved to be a useful method for individuals looking to lose fat, despite the view that continuous calorie restriction is superior to intermittent calorie restriction (alternating calorie restriction with a period of maintenance (eating an amount of energy that will result in no weight gain or loss). However, the data shows overwise, alternating 2 weeks of 33% calorie restriction with 3 weeks of maintenance resulted in better fat-loss than continuous restriction for 16 straight weeks (-14.1 intermittent versus -9.2 in the continuous group). The researchers came to the conclusion that the mechanism responsible for the difference was more likely to be the increased dietary adherence, as nearly a 1000 calorie deficit is easier to comply with for 2 weeks at a time, compared to 16 continuous weeks (Byrne et al. 2017)[97]. This study clearly highlights the importance of dietary adherence and the fact that it can quite

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[95] "Biology's response to dieting: the impetus for weight regain - NCBI - NIH." 15 Jun. 2011, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3174765/. Accessed 23 Oct. 2018.
This source is respectable in terms of its reliability because it firstly a peer-reviewed scientific review of the current evidence and also it has been cited over 267 times and thus can be seen as trusted.
[96] "Metabolic Slowing with Massive Weight Loss despite ... - NCBI - NIH." 24 Apr. 2012, https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3387402/. Accessed 23 Oct. 2018.
This source is peer-reviewed and so the reliability of the study is high, also it was co-authored by Dr Kevin Hall, a very well respected researcher on obesity.
[97] "Intermittent energy restriction improves weight loss efficiency ... - Nature." https://www.nature.com/articles/ijo2017206. Accessed 23 Oct. 2018.

clearly result in greater weight loss. The results of this study are interesting as they provide a method that can be practically applied to structuring individuals fat-loss diets if it encourages long-term compliance.

Protein within a diet

Higher protein diets have been shown to be significantly more beneficial for the maintenance of lean body mass. A study by Mettler (2011) , found that approximately 2.3g/kg (of body mass) or approximately 35% protein was undoubtedly preferable to roughly 1.0/kg or approximately 15% energy protein, for maintenance of lean body mass in young healthy athletes during short-term hypoenergetic (a diet in which fewer calories are consumed that are necessary to maintain weight) weight loss (Mettler et al. 2010)[98]. An increase in dietary protein is firstly beneficial within a fat-loss diet because of its influence of maintaining and increasing muscle mass. Due to the research that has shown muscle mass to be more metabolically active than then an individual's basal-metabolic-rate (BMR), will be higher than an individual with a less muscle or fat free-mass (Zurlo et al. 1990)[99]. This can be explained because protein has been frequently found to be one of the most satiating macronutrients and thus play a role in decreasing appetite, thus helping an individual to reduce the amount of food they consume, consequently allowing them to stay in a calorie deficit and achieve fat-loss by being in a negative energy balance. This is illustrated by the evidence that high-protein diets involve increased secretion of satiety hormones (GIP, GLP-1), reduced orexigenic (appetite-stimulant) hormone secretion (ghrelin) the 'hunger hormone'. Additionally, higher protein diets are also highlighted to be an aid in a fat-loss diet. This is due to the nature of the macronutrient and its effect on diet-induced thermogenesis (DIT), which is a metabolic response to food. This DIT, is due to various steps of nutrient processing, for example, the digestion, absorption, transport, metabolism and storage of nutrients. The diet-induced thermogenesis is mostly indicated as percentage increase in energy expenditure over the basal metabolic rate (BMR). Consequently, higher protein diets are thus more beneficial for an individual who is trying to lose fat because protein is shown to have one of the highest DIT value (~15-30%), with carbohydrates shortly behind (~5-10%) and fat (~0-3%). As

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This source can be seen as dependable because of it firstly being a peer-reviewed study, furthermore, the study had a sample size of 50 obese men and so the the results are more likely to be reliable.

[98] "Increased protein intake reduces lean body mass loss during weight ...." https://www.ncbi.nlm.nih.gov/pubmed/19927027. Accessed 15 Aug. 2018.
This source is reliable firstly because it is a peer-reviewed study and secondly, it has been cited over 283 times indicating that the source is dependable, however it is worth mentioning that the sample size in the study was small with only 20 resistance strained men and thus there will likely be a larger margin for error.

[99] "Skeletal muscle metabolism is a major determinant of resting energy ...." https://www.ncbi.nlm.nih.gov/pmc/articles/PMC296885/. Accessed 21 May. 2018.
This source is a paper that has been peer-reviewed and therefore can be viewed as reliable.

shown by numerous studies, protein has a high DIT, for example, one study shows that if a subject consumed an 8368 kJ/d (2000 cal) diet with 30% energy from protein, then the thermic effects of food will be 58kJ/d higher than if protein contributes only 20% (Pesta & Samuel, 2014)[100]. Due to the fact that the protein has a higher DIT than other macronutrients, if an individual ingested more protein their body would subsequently expend for energy during the processes of digestion, absorption, transport and metabolism. To summarize, higher protein diets are clearly shown to be beneficial in an individual's' objective of weight loss because of protein's positive effect on satiety, maintenance and growth of muscle mass and the advantages of doing so and lastly protein's influence on diet-induced thermogenesis (Paddon-Jones 2008)[101].

Fibre within a diet

Another key integral part of an optimal diet for fat-loss, is one that is rich in fibre, especially from fibrous fruit and vegetables. Fibre has been shown to be beneficial when trying to reduce body weight highlighted by Heaton (1973), fibre is shown to act as an obstacle to energy intake for three primary reasons. Firstly, fibre displaces available calories and nutrients for methods diets; fibre increases chewing which limits intake by promoting the secretion of saliva and gastric juice, resulting in the expansion of the stomach and increased satiety; and fibre reduces the efficiency of the small intestine (Heaton, 1973)[102]. A review by Slavin and Green illustrated the benefits of a higher fibre diet for tackling obesity and weight loss. Primarily, high-fibre foods have much lower energy density compared to high-fat foods, therefore, high-fibre foods can displace energy (calories). Furthermore, the 'bulking and viscosity', properties of fibre have a fundamental responsibility of satiation (satisfaction of appetite that develops during the course eating and eventually resulting in the discontinuance of eating) and satiety. This is due to the fact that fibre rich foods are usually accompanied by increased efforts and/or time of mastication, which results in increased satiety through a reduction in the rate of ingestion (Salvin & Green, 2007). In addition to this, a study by Slavin 2005 found that inherent, hormonal and colonic effects of dietary fibre, decreased food

[100] "A high-protein diet for reducing body fat: mechanisms and possible ...." https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4258944/. Accessed 21 May. 2018.
This source is also a peer-reviewed paper that was published by a number of reputable researchers such as Dominik H Pesta - PHD.
[101] "Protein, weight management, and satiety | The American Journal of ...." 1 May. 2008, https://academic.oup.com/ajcn/article/87/5/1558S/4650426. Accessed 11 Sep. 2018.
This source is a review and has been peer-reviewed to confirm the validity and competence of the work produced, it has also been cited by over 508 other researchers.
[102] "FOOD FIBRE AS AN OBSTACLE TO ENERGY INTAKE - The Lancet." https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(73)92806-7/fulltext. Accessed 14 Feb. 2019.
This is another peer-reviewed paper reviewing the literature on fibre, it can therefore be deemed as a reliable source.

intake by encouraging satiation and/or satiety (Slavin & Green, 2007)[103] Dietary fibre also has a reducing influence on gastric emptying and slows energy and nutrient absorption, thus leading to decreased postprandial (after a meal) glucose and levels; further adding in another paper that 'addition of functional fibre to weight-loss diets should also be considered as a tool to improve success' (Slavin, 2005)[104]. These noted effects of dietary fibre on hunger, satiety and energy intake resulting in changes in body weight have been illustrated. During the studies, energy intake was controlled and reported an increase in post-meal satiety and a reduction in subsequent hunger with the increased fibre intake. Across all studies, it was shown that an additional 14 grams of fibre per day resulted in a 10% reduction in energy intake and a subsequent weight loss of over 1.9 kg through approximately 3.8 months of intervention. Results from studies that included obese individuals were even more significant form increasing dietary fibre intake from their current average of 15 grams to around 25-30 grams per day (Howarth et al. 2001)[105]. Overall, fibre's influence on digestion has event a beneficial impact for someone who is trying to lose weight primarily because an increase of dietary fibre will increase satiation, satiety and decrease hunger which will therefore, reduce the likelihood of an individual to overeat, thus enabling them to remain in a calorie deficit.

As mentioned throughout this discussion, the quality of diet, in terms of prioritising minimally processed, nutrient dense foods as opposed to processed foods. The research also supports this, one study examined whether specific food sources were habitually more or less likely to result in weight gain. The researchers had the aim to analyse whether "a calorie is a calorie", or if eating a better quality diet would lead to maintenance or even weight loss (Mozaffarian et al. 2011)[106]. The study involved 120,000 healthy men

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[103] "Dietary fibre and satiety - Slavin - 2007 ... - Wiley Online Library." 7 Mar. 2007, https://onlinelibrary.wiley.com/doi/full/10.1111/j.1467-3010.2007.00603.X. Accessed 14 Oct. 2018.
This source is another reliable cited piece of research because it is a peer-reviewed paper that has been cited a number of times and has been published by a number of reputable of scientific researchers.

[104] "Dietary fiber and body weight. - NCBI." https://www.ncbi.nlm.nih.gov/pubmed/15797686. Accessed 14 Oct. 2018.
This is another source by the researcher Slavin who is renowned for his research surrounding fibre/fiber. furthermore , this review is peer-reviewed so it can be viewed as reliable.

[105] "Dietary fiber and weight regulation. - NCBI - NIH." https://www.ncbi.nlm.nih.gov/pubmed/11396693. Accessed 14 Oct. 2018.
This source is another peer-reviewed review that summarises the published studies on the effects of dietary fiber on hunger, satiety, energy intake, and body composition in healthy individuals. It can therefore be said that the source is likely to be reliable.

[106] "Changes in Diet and Lifestyle and Long-Term Weight ... - NCBI - NIH." https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3151731/. Accessed 15 Feb. 2019.
The fact that this source is a peer-reviewed study with over 120,000 participants spaninging 20 years makes this publication fairly reliable despite the fact that it was based on associations between two variables.

and women across a 20 year period, investigators found that weight change was rigidly associated with the ingestion of potato chips, potatoes, sugar sweetened beverages, as well as both processed and unprocessed red meats. Furthermore, the researcher's came to the conclusion that the intake of processed foods higher in refined grains, fats, starches and sugars can cause an increase in weight gain. To add on to, it was found that whole grains, vegetables, fruits and nuts were foods shown to be associated with weight loss. It is important to note that the researchers acknowledged the importance of calories, explaining how the selection of high-quality foods is an efficient method in helping individuals to reduce their caloric intake and enable greater adherence to a calorie deficit. The importance of diet quality for both health and sustainability has also been shown to be important as shown by the results of a new study led by the prominent researcher Kevin Hall. The investigation looked at whether ultra-processed foods would affect the energy intake in 20 weight-stable adults (Hall et al. 2019)[107]. The subjects were confined to the NIH (National Institute of Health) Center and randomized either the ultraporcessed diet or unprocessed diet for a period of two weeks, then switching to the alternate diet for another two weeks. The meals were isocaloric (same calories) for both diets as well as equal macronutrients, sodium, sugar, fibre and the participants were instructed to consume ad libitum (as much/little as desired). The results of the study were somewhat unsurprising with the energy intake greater in the ultra-processed diet (508±106kcal/d), as well as increased carbohydrate and fat but not protein consumption. Subsequently, weight changes were significantly correlated with energy intake and led to subjects gaining 0.8±0.3kg when on the ultra-processed diet. Conversely, subjects lost 1.1±0.3kg on the unprocessed diet . The conclusions drawn from this study were that limiting the intake of ultra-processed foods could be a beneficial strategy for obesity prevention and treatment. Overall, it is clear that consumption of whole, nutrient dense unprocessed foods with the inclusion of fibrous fruits and vegetables as well as foods high in protein could be an effective method for individuals to lose weight primarily in the form of fat.

[107] "NutriXiv Preprints | Ultra-processed diets cause excess calorie ... - OSF." 12 Feb. 2019, https://osf.io/preprints/nutrixiv/w3zh2. Accessed 16 Feb. 2019.
This source is also peer-reviewed but because it was published by the accredited Dr Kevin Hall, who specialises in obesity, this study is reliable.

Conclusion

To conclude, it is clear from the current research, that there is no optimal diet that will work for everyone. In conjunction to this, it has been shown that within a calorie controlled diet an individual can consume any combination of foods with all the macronutrients present and still see progress as long as they have secured a stable and accurately calculated calorie deficit. Though certain diets such as a low-carbohydrate diet have been shown to yield equal results to a low-fat diet, it is important to mention that these diets can be used as a tool to implement a calorie deficit (by cutting out a wide range of foods available) and sustain one based on the individual's preferences. For example, an individual who has an eating behaviour that causes them to overeat on foods generally high in carbohydrates, it could be beneficial for them to start on diet low on carbohydrates to enable them to create a calorie deficit and make progress initially, but could adopt a more sustainable approach later on. However, it is by no means recommended to revert to such radical eating habits that may lead to unwanted stress because of the confinement of these diets. On the contrary, it is clear within the the scientific literature that a diet high in protein will likely be beneficial to most, due to protein's effect on appetite and satiety, as well as its mechanism of preserving lean body mass in the form of muscle that will also have an indirect benefit to an individual's fat-loss efforts. In conjunction with this, a diet that has plenty of fibrous fruit and vegetables will also provide benefits both in terms of health and weight loss. This will most likely be because of fibre's ability to reduce appetite and increase satiation but also may provide a mild improvement to fat-loss. Lastly, as shown by the staggering data on the topic, weight regain has become an ever-growing problem and as a result, the importance of creating a diet structure that can be stuck to in the long-run has risen in importance. Therefore as shown by the current evidence strategies such as 'diet breaks' could be implemented to sustain compliance if it fits with the individuals' preferences. It should also be mentioned that the dietary practices implemented in the recent DIETFITS randomised controlled trial are of use and more than likely aid individuals' in losing weight, become healthier and obtain better eating habits that will lead to increased chance of them sticking to their diets. In the trial, the participants were encouraged to eat as many vegetables, choose high-quality, nutritious whole foods and limit anything processed, prepare food themselves at home and avoid trans fats, added sugars as well as refined carbohydrates such as flour. All of these components each have a large body of evidence highlighting their usefulness and the practices taught are undeniably effective in achieving weight loss and improving the health of people. Based on my personal view and knowledge of fat-loss, I think that it a person's diet should not come with a name but be based on their preferences and that will allow for adherence and sustainability.

Evaluation

Throughout the research process, I have been able to access many journal articles and published investigations which have enabled me to develop a broader array of evidence to support my opinions. During the course of the project, I found my title formulate into a more clear question based on researching what I already had knowledge around. I have also learned the breadth of conflicting evidence within the scientific literature and how studies often vary in quality which can certainly impact the studies importance within the discussion. I have also cultivated a great understanding of how significant the quantity of research there is on this topic due to the ever-growing importance of fat-loss both in terms of tackling the obesity crisis as well as an array of sports competitions. Throughout this project there has been a clear limitation, in that within the parameters of this proposal, the volume of evidence is difficult to tackle as well as the constant stream of new research. To add on to, it is difficult to analyse the studies to find out which ones are significant on which ones are not due to the frequent conflicting evidence. Furthermore, there have been limitations for myself in creating a more concise review as it is important that I do not miss important pieces of evidence. Additionally, during the course of developing my project, I found myself mentioning the effects of diets in terms of health rather than explicitly body composition. In hindsight, I would have tried to formulate my title faster and with more precision, this would then have allowed me to create a complete plan that laid out a more direct and calculated course for me to take when completing the project to avoid stalling when not knowing what area I need to cover next. Throughout the process of writing my dissertation I have cultivated a better understanding of how to look at research more critically in terms of analysing the quality of a study, which will more than be helpful in future. Furthermore, during the process I have learnt the importance to look at both sides of the argument when looking at a topic to ensure that the answer given is well formulated and takes into consideration the possible counter arguments.

If I was able to extend my project, I would further delve into more research about the mechanisms behind certain diets and whether these had notable effects on weight-loss, or whether changes were due to other variables. This would give a clearer understanding to people about where the claims come from about a diet being optimal. Furthermore, if I were able to extend this project I would more than likely look to cover research on veganism and the claims that it is great for weight loss. To add on to, if I were given the opportunity to further research my question and talk more about my chosen subject, I would have enjoyed talking more in-depth about ‘yo-yo’ dieting and also the mechanisms behind the body’s ‘self-defence

system' as I am sure it would have provided some useful context to the discussion. Additionally, if I were to cover other areas in more detail, one of those areas would be to further explain the misconceptions behind insulin when consuming diets rich in carbohydrates, as it is an interesting topic in my opinion. To summarise, I was pleased to find more studies that supported my views and knowledge on the topic and was also appreciative to learn new information that was far more complex and that lead to giving me more understanding on the area of scientific research.

Bibliography

1. “Weight Management.” *Boston Medical Center*, 7 Sept. 2017, www.bmc.org/nutrition-and-weight-management/weight-management.
2. “Obesity and Overweight.” *World Health Organization*, World Health Organization, www.who.int/news-room/fact-sheets/detail/obesity-and-overweight.
3. *World Health Organization*, World Health Organization, www.who.int/westernpacific/health-topics/obesity.
4. “Optimal | Definition of Optimal in English by Oxford Dictionaries.” *Oxford Dictionaries | English*, Oxford Dictionaries, en.oxforddictionaries.com/definition/optimal.
5. Hill, James O., Holly R. Wyatt, and John C. Peters. “Energy Balance and Obesity.” Circulation 126.1 (2012): 126–132. PMC. Web. 18 Oct. 2018.
6. “Dieting.” Wikipedia, Wikimedia Foundation, 4 Oct. 2018, en.wikipedia.org/wiki/Dieting.
7. Li, Ran, et al. "Associations of muscle mass and strength with all-cause mortality among US older adults." *Medicine and science in sports and exercise* 50.3 (2018): 458-467.
8. Wolfe, Robert R. "The underappreciated role of muscle in health and disease." The American journal of clinical nutrition 84.3 (2006): 475-482.
9. Kravitz, Len, and Vivian H. Heyward. "Getting a grip on body composition." IDEA today 10 (1992): 34-41.
10. Rippe, James M., et al. "Improved psychological well-being, quality of life, and health practices in moderately overweight women participating in a 12-week structured weight loss program." Obesity Research 6.3 (1998): 208-218
11. Wilding, J. P. H. "The importance of weight management in type 2 diabetes mellitus." International journal of clinical practice 68.6 (2014): 682-691.
12. Luo, Juhua, Michael Hendryx, and Rowan T. Chlebowski. "Intentional weight loss and cancer risk." Oncotarget 8.47 (2017): 81719.
13. Ma, Chenhan, et al. "Effects of weight loss interventions for adults who are obese on mortality, cardiovascular disease, and cancer: systematic review and meta-analysis." bmj 359 (2017): j4849.
14. MacLean, Paul S., et al. "Biology's response to dieting: the impetus for weight regain." American Journal of Physiology-Regulatory, Integrative and Comparative Physiology 301.3 (2011): R581-R600.

15. Ayyad, C., and T. Andersen. "Long-term efficacy of dietary treatment of obesity: a systematic review of studies published between 1931 and 1999." Obesity reviews 1.2 (2000): 113-119.
16. Langeveld, M. "The mediocre results of dieting." *Nederlands tijdschrift voor geneeskunde* 157.29 (2013): A6017-A6017.
17. Fat Loss Forever | How to Lose Fat and Keep It Off." *Biolayne*, Layne Norton, 2019, www.biolayne.com/fat-loss-forever/.
18. Dulloo, Abdul G., Jean Jacquet, and Jean-Pierre Montani. "How dieting makes some fatter: from a perspective of human body composition autoregulation." *Proceedings of the Nutrition Society* 71.3 (2012): 379-389.
19. Hill, James O., Holly R. Wyatt, and John C. Peters. "Energy Balance and Obesity." Circulation 126.1 (2012): 126–132. PMC. Web. 18 Oct. 2018.
20. Johannsen, Darcy L., et al. "Metabolic slowing with massive weight loss despite preservation of fat-free mass." *The Journal of Clinical Endocrinology & Metabolism* 97.7 (2012): 2489-2496.
21. Lichtman, Steven W., et al. "Discrepancy between self-reported and actual caloric intake and exercise in obese subjects." New England Journal of Medicine 327.27 (1992): 1893-1898.
22. Kosinski, Christophe, and François R. Jornayvaz. "Effects of Ketogenic Diets on Cardiovascular Risk Factors: Evidence from Animal and Human Studies." Nutrients 9.5 (2017): 517. PMC. Web. 18 Oct. 2018.
23. Alexandra M Johnstone, Graham W Horgan, Sandra D Murison, David M Bremner, Gerald E Lobley; Effects of a high-protein ketogenic diet on hunger, appetite, and weight loss in obese men feeding ad libitum, The American Journal of Clinical Nutrition, Volume 87, Issue 1, 1 January 2008, Pages 44–55, https://doi.org/10.1093/ajcn/87.1.44
24. Johnstone, et al. "Effects of a High-Protein Ketogenic Diet on Hunger, Appetite, and Weight Loss in Obese Men Feeding Ad Libitum | The American Journal of Clinical Nutrition | Oxford Academic." OUP Academic, Oxford University Press, 1 Jan. 2008, academic.oup.com/ajcn/article/87/1/44/4633256.
25. Pérez-Jiménez, Francisco, José López-Miranda, and Pedro Mata. "Protective effect of dietary monounsaturated fat on arteriosclerosis: beyond cholesterol." *Atherosclerosis* 163.2 (2002): 385-398.
26. Gardner, Christopher D., et al. "Effect of low-fat vs low-carbohydrate diet on 12-month weight loss in overweight adults and the association with genotype pattern or insulin secretion: the DIETFITS randomized clinical trial." *Jama* 319.7 (2018): 667-679.

27. Baron, John A., et al. "A randomized controlled trial of low carbohydrate and low-fat/high fiber diets for weight loss." *American journal of public health 76*.11 (1986): 1293-1296.
28. Nordmann, Alain J., et al. "Effects of low-carbohydrate vs low-fat diets on weight loss and cardiovascular risk factors: a meta-analysis of randomized controlled trials." Archives of internal medicine 166.3 (2006): 285-293.
29. Jéquier, Eric, and George A. Bray. "Low-fat diets are preferred." *The American journal of medicine*113.9 (2002): 41-46.
30. Hu, Tian, et al. "Effects of low-carbohydrate diets versus low-fat diets on metabolic risk factors: a meta-analysis of randomized controlled clinical trials." *American journal of epidemiology 176*.suppl_7 (2012): S44-S54.
31. Mettler, Samuel, Nigel Mitchell, and Kevin D. Tipton. "Increased protein intake reduces lean body mass loss during weight loss in athletes." *Medicine & Science in Sports & Exercise* 42.2 (2010): 326-337.
32. Stump, Craig S., et al. "The metabolic syndrome: role of skeletal muscle metabolism." *Annals of medicine* 38.6 (2006): 389-402.
33. Boelsma, Esther, et al. "Measures of postprandial wellness after single intake of two protein–carbohydrate meals." *Appetite* 54.3 (2010): 456-464.
34. Paddon-Jones, Douglas, et al. "Protein, weight management, and satiety–." *The American journal of clinical nutrition* 87.5 (2008): 1558S-1561S.
35. Flood-Obbagy, Julie E., and Barbara J. Rolls. "The Effect of Fruit in Different Forms on Energy Intake and Satiety at a Meal." *Appetite* 52.2 (2009): 416–422. *PMC*. Web. 18 Oct. 2018.
36. Shenkin, A. "Micronutrients in Health and Disease." *Postgraduate Medical Journal* 82.971 (2006): 559–567. *PMC*. Web. 18 Oct. 2018.
37. Olsson, Karl-Erik, and Bengt Saltin. "Variation in total body water with muscle glycogen changes in man." *Acta Physiologica Scandinavica* 80.1 (1970): 11-18.
38. FREEL, E. MARIE, and JOHN M.C. CONNELL. "Mechanisms of Hypertension: The Expanding Role of Aldosterone." *Journal of the American Society of Nephrology : JASN* 15.8 (2004): 1993–2001. *PMC*. Web. 18 Oct. 2018.
39. Alhassan, S et al. "Dietary Adherence and Weight Loss Success among Overweight Women: Results from the A TO Z Weight Loss Study." *International journal of obesity (2005)* 32.6 (2008): 985–991. *PMC*. Web. 18 Oct. 2018.

40. Dansinger, Michael L., et al. "Comparison of the Atkins, Ornish, Weight Watchers, and Zone diets for weight loss and heart disease risk reduction: a randomized trial." *Jama* 293.1 (2005): 43-53.
41. Artero, Enrique G. et al. “Effects of Muscular Strength on Cardiovascular Risk Factors and Prognosis.” *Journal of cardiopulmonary rehabilitation and prevention* 32.6 (2012): 351–358. *PMC*. Web. 18 Oct. 2018.
42. Bueno, Nassib Bezerra, et al. "Very-low-carbohydrate ketogenic diet v. low-fat diet for long-term weight loss: a meta-analysis of randomised controlled trials." *British Journal of Nutrition* 110.7 (2013): 1178-1187.
43. Saris, Wim HM. "Very‐low‐calorie diets and sustained weight loss." *Obesity research* 9.S11 (2001): 295S-301S.
44. Li, Z et al. “Clinical efficacy of a medically supervised outpatient high-protein, low-calorie diet program is equivalent in prediabetic, diabetic and normoglycemic obese patients” Nutrition & diabetes vol. 4,2 e105. 10 Feb. 2014, doi:10.1038/nutd.2014.1
45. Lombardo, M., et al. "Ideal reduction of calories for greatest reduction of body fat and maintenance of lean body mass." The Journal of Aging Research and Clinical Practice (2017).
46. Ashtary-Larky, Damoon, et al. "Rapid weight loss vs. slow weight loss: which is more effective on body composition and metabolic risk factors?." International journal of endocrinology and metabolism 15.3 (2017).
47. Weiss, Edward P., et al. "Effects of weight loss on lean mass, strength, bone, and aerobic capacity." Medicine and science in sports and exercise 49.1 (2017): 206.
48. Cava, Edda, Nai Chien Yeat, and Bettina Mittendorfer. "Preserving healthy muscle during weight loss." Advances in nutrition 8.3 (2017): 511-519.
49. Srikanthan, Preethi, Tamara B. Horwich, and Chi Hong Tseng. "Relation of muscle mass and fat mass to cardiovascular disease mortality." *The American journal of cardiology* 117.8 (2016): 1355-1360.
50. Artero, Enrique G., et al. "A prospective study of muscular strength and all-cause mortality in men with hypertension." *Journal of the American College of Cardiology* 57.18 (2011): 1831-1837.
51. Bazzano, Lydia A., et al. "Effects of low-carbohydrate and low-fat diets: a randomized trial." *Annals of internal medicine* 161.5 (2014): 309-318.
52. Rothman, Douglas L., et al. "Quantitation of hepatic glycogenolysis and gluconeogenesis in fasting humans with 13C NMR." *Science* 254.5031 (1991): 573-576.

53. Timmerman, Kyle L., et al. "Insulin stimulates human skeletal muscle protein synthesis via an indirect mechanism involving endothelial-dependent vasodilation and mammalian target of rapamycin complex 1 signaling." *The Journal of Clinical Endocrinology & Metabolism* 95.8 (2010): 3848-3857.
54. Kersten, Sander. “Mechanisms of Nutritional and Hormonal Regulation of Lipogenesis.” *EMBO Reports* 2.4 (2001): 282–286. *PMC*. Web. 18 Oct. 2018.
55. Pliquett, R. U., et al. "The effects of insulin on the central nervous system-focus on appetite regulation." *Hormone and metabolic Research 38*.07 (2006): 442-446.
56. Boelsma, Esther, et al. "Measures of postprandial wellness after single intake of two protein–carbohydrate meals." *Appetite* 54.3 (2010): 456-464.
57. Leidy, Heather J., et al. "The effects of consuming frequent, higher protein meals on appetite and satiety during weight loss in overweight/obese men." *Obesity* 19.4 (2011): 818-824.
58. “Ketone Bodies.” *Wikipedia*, Wikimedia Foundation, 30 Sept. 2018, en.wikipedia.org/wiki/Ketone_bodies.
59. Koeslag, J H, T D Noakes, and A W Sloan. “Post-Exercise Ketosis.” *The Journal of Physiology* 301 (1980): 79–90. Print.
60. Sumithran, P., et al. "Ketosis and appetite-mediating nutrients and hormones after weight loss." *European journal of clinical nutrition* 67.7 (2013): 759.
61. Gibson, Alice A., et al. "Do ketogenic diets really suppress appetite? A systematic review and meta‐analysis." *Obesity Reviews* 16.1 (2015): 64-76.
62. Hall, Kevin D., et al. "Calorie for calorie, dietary fat restriction results in more body fat-loss than carbohydrate restriction in people with obesity." *Cell metabolism* 22.3 (2015): 427-436.
63. Havemann, L., et al. "Fat adaptation followed by carbohydrate loading compromises high-intensity sprint performance." *Journal of Applied Physiology*100.1 (2006): 194-202.
64. Sacks, Frank M. et al. “Comparison of Weight-Loss Diets with Different Compositions of Fat, Protein, and Carbohydrates.” *The New England journal of medicine* 360.9 (2009): 859–873. *PMC*. Web. 19 Oct. 2018.
65. Stellingwerff, Trent, and Mike K. Boit. "Nutritional strategies to optimize training and racing in middle-distance athletes." *Journal of Sports Sciences*25.S1 (2007): S17-S28.
66. Burke, Louise M. et al. “Low Carbohydrate, High Fat Diet Impairs Exercise Economy and Negates the Performance Benefit from Intensified Training in Elite Race Walkers.” *The Journal of Physiology* 595.9 (2017): 2785–2807. *PMC*. Web. 18 Oct. 2018.

67. Examine.com. “Low-Fat vs Low-Carb? Major Study Concludes: It Doesn't Matter for Weight Loss.” *Examine.com*, Examine.com, 21 Feb. 2018, examine.com/nutrition/low-fat-vs-low-carb-for-weight-loss/.
68. Tinsley, Grant M., and Paul M. La Bounty. "Effects of intermittent fasting on body composition and clinical health markers in humans." *Nutrition reviews* 73.10 (2015): 661-674.
69. Betts, James A et al. “The Causal Role of Breakfast in Energy Balance and Health: A Randomized Controlled Trial in Lean Adults.” *The American Journal of Clinical Nutrition* 100.2 (2014): 539–547. *PMC*. Web. 18 Oct. 2018.
70. Seimon, Radhika V., et al. "Do intermittent diets provide physiological benefits over continuous diets for weight loss? A systematic review of clinical trials." *Molecular and cellular endocrinology 418* (2015): 153-172.
71. Surwit, Richard S., et al. "Metabolic and behavioral effects of a high-sucrose diet during weight loss." *The American journal of clinical nutrition* 65.4 (1997): 908-915.
72. “Diet Review: Paleo Diet for Weight Loss.” *The Nutrition Source*, 24 July 2018, www.hsph.harvard.edu/nutritionsource/healthy-weight/diet-reviews/paleo-diet/.
73. Manheimer, Eric W., et al. "Paleolithic nutrition for metabolic syndrome: systematic review and meta-analysis, 2." *The American journal of clinical nutrition* 102.4 (2015): 922-932.
74. Masharani, Umesh, et al. "Metabolic and physiologic effects from consuming a hunter-gatherer (Paleolithic)-type diet in type 2 diabetes." *European journal of clinical nutrition* 69.8 (2015): 944.
75. Obert, Jonathan, et al. "Popular weight loss strategies: a review of four weight loss techniques." *Current gastroenterology reports*19.12 (2017): 61.
76. Ye, Fang et al. “Efficacy of and Patient Compliance with a Ketogenic Diet in Adults with Intractable Epilepsy: A Meta-Analysis.” *Journal of Clinical Neurology (Seoul, Korea)* 11.1 (2015): 26–31. *PMC*. Web. 18 Oct. 2018.
77. Heaton, K. W. "Food fibre as an obstacle to energy intake." The Lancet 302.7843 (1973): 1418-1421.
78. Slavin, Joanne L. "Dietary fiber and body weight." *Nutrition* 21.3 (2005): 411-418.
79. Malik, Vasanti S., et al. "Sugar-sweetened beverages and weight gain in children and adults: a systematic review and meta-analysis." *The American journal of clinical nutrition* 98.4 (2013): 1084-1102.
80. Slavin, J., and H. Green. "Dietary fibre and satiety." Nutrition Bulletin 32 (2007): 32-42.
81. Ha, Vanessa, et al. "Do fructose-containing sugars lead to adverse health consequences? Results of recent systematic reviews and meta-analyses." *Advances in Nutrition* 6.4 (2015): 504S-511S.

82. Rippe, James M., and Theodore J. Angelopoulos. "Sugars, obesity, and cardiovascular disease: results from recent randomized control trials." *European journal of nutrition* 55.2 (2016): 45-53.
83. Howarth, Nancy C., Edward Saltzman, and Susan B. Roberts. "Dietary fiber and weight regulation." *Nutrition reviews* 59.5 (2001): 129-139.
84. Mozaffarian, Dariush et al. “Changes in diet and lifestyle and long-term weight gain in women and men” New England journal of medicine vol. 364,25 (2011): 2392-404.
85. Hall, Kevin D. “Ultra-processed Diets Cause Excess Calorie Intake and Weight Gain: A One-month Inpatient Randomized Controlled Trial of Ad Libitum Food Intake.” NutriXiv, 11 Feb. 2019. Web.