Evaluating the Influence of the Mediterranean Diet on Reducing Cardiovascular Disease Risk Factors in Obese Individuals

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ABSTRACT

Purpose

Obesity affects a significant proportion of the United States adult population. With the condition of obesity comes an increased risk of developing cardiovascular diseases (CVD) such as atherosclerosis and myocardial infarction, among others. Adherence to healthy diets is recommended by healthcare providers to reduce weight loss and CVD risk through the consumption of essential nutrients. The Mediterranean Diet and reduced caloric intake of the Standard American Diet (SAD) are often followed by those who are overweight or obese to reduce weight and promote health. Since there is an association between diet and CVD risk, this review aims to investigate whether the Mediterranean Diet is better than simple caloric reduction in SAD in reducing the likelihood of CVD onset in obese individuals. In particular, this review will be looking at how adherence to special diets plays a role in clinical factors of CVD.

Summary

Primary research and systematic reviews related to the two aforementioned diets in obese patients were included and those that did not analyze any clinical outcome of cardiovascular risk were excluded from the study. After a critical appraisal of all potential studies using the Joanna-Briggs Critical Appraisal Tools, 1 systematic review and 4 primary research articles were included. This review found that there seemed to be no significant difference between reduction of CVD risk due to the Mediterranean Diet and due to calorie restriction in SAD. Both methods seemed to reduce low-density lipoprotein cholesterol and triglyceride levels in the blood but quantitatively, the reduction of such levels was low. Adherence to the Mediterranean Diet was found to be inversely associated with CVD risk factor occurrence. Further clinical research needs

to be conducted with larger sample sizes and effectively evaluating whether obese patients originally consuming SAD are better off with adhering in higher level to the Mediterranean Diet or reducing caloric intake in their existing diet.

Keywords

Standard American Diet, Western Diet, Mediterranean Diet, Obesity, Cardiovascular Disease Risk, Diet Adherence, Reduced Caloric Intake, Randomized Controlled Trial, Meta-Analysis, Systematic Review

INTRODUCTION

Background

Obesity is a significant public health concern, affecting over 41.9% of American adults and which increases the risk of developing cardiovascular disease, also known as CVD.[1] Excess weight leads to a buildup of fatty material in the major blood vessels of the human body, particularly the arteries. If the arteries leading to the heart are clogged with fatty plaques, the individual could undergo a myocardial infarction (heart attack). The heart muscle can die due to the lack of oxygen being brought to it from the blood, thus leading to damaging cardiovascular consequences. Aside from myocardial infarction, one study found that metabolically healthy obese patients had a 28% increased risk of heart disease compared with people of normal weight who were metabolically healthy.[2]

The Standard American Diet (SAD) is thought to contribute to the high levels of obesity and CVD in America. SAD consists of excess calories, ultra-processed foods, fatty meats, added fats, and much lower consumption of fresh fruits and vegetables.[3] Prior studies investigated how

reduced caloric intake in sweetened beverages part of the Standard American Diet could lead to small improvements in weight and cardiometabolic risk.[4] On the other hand, a controlled and specialized diet is normally a method of weight loss for obese patients. A study by the American Heart Association says that the Mediterranean diet decreases major adverse cardiovascular events (MACEs) in patients with a higher risk for CVD.[5] A Mediterranean Diet is a primarily plant-based diet that includes a daily intake of olive oil, fruits, legumes, whole grains, nuts, herbs, and spices. Animal proteins are consumed in lesser amounts.

However, few studies show how much adherence to the Mediterranean diet is needed to help reduce CVD risk in obese patients. [5] Few studies also show a distinct reduction of CVD with weight loss. With the epidemic of obesity and CVD in America, it is essential to understand how changes in nutrition and diet can help reduce the incidence of such adverse health outcomes in the population of obese individuals.

Research Question

In obese adult patients, how effective is the Mediterranean diet and adherence to it compared to reduced caloric intake with the Standard American Diet in reducing the risk of cardiovascular disease?

Under the PICO model, the population of obese adult patients is being examined. Obesity is defined as having a Body Mass Index (BMI) greater than 30 whereas the BMI for a healthy weight ranges from 18.5 to less than 25. BMI is calculated by considering the age, sex, and weight of individuals and is used as a clinical diagnostic factor in determining obesity. The intervention will be the use and adherence to the Mediterranean diet, defined in the background section. This literature review will evaluate clinical evidence of reduced cardiovascular disease

risk due to the diet. In particular, this review will look at whether there are reduced fatty deposits in the blood and adipose (fat) tissue as a result of the chosen diet. The comparison point will be the Standard American Diet, also defined in the background. Since SAD has been found by multiple studies to lead to the prominent levels of obesity and cardiovascular disease observed in the United States today, comparing patients who are on the Mediterranean diet to those on SAD can prove to be a valuable analysis. Lastly, the outcome is to determine if the specified diet leads to lowered cardiovascular disease risk in obese patients. Again, this review will look for concrete clinical evidence for lowered risk and will analyze quantitative data regarding physical risk factors.

METHODS

Databases and Search Terms

PubMed and Scopus were the primary databases used to search for the research studies and articles in this literature review. PubMed is a highly reliable and authoritative source, funded by the National Institutes of Health, and includes research and papers from multiple peer-reviewed journals in the broader field of health and healthcare. Scopus is similar to PubMed but also includes linked references for each study, which enables easier access to snowball sampling to find relevant studies to the research question. Scopus also includes an additional 10,000 or so journals that PubMed does not. Search terms that were originally used include “Mediterranean Diet,” “Obesity,” “Cardiovascular Risk,” and “Standard American Diet.” However, given the large number of studies related to either one of the four terms, the research question was modified to focus on the “adherence” to the specified diets to narrow the focus of the review.

Inclusion and Exclusion Criteria and Critical Appraisal Process

Most studies that were reviewed or used in background research are within the past ten years, with the exception of certain key studies that may have been conducted before then and provide valuable insight into my research question. Only primary research with measurable clinical outcomes of reduced cardiovascular risk were included in the final review. Only randomized controlled trials, cohort studies, and meta-analyses were included in this literature review as these studies offer reasonably strong evidence that can undergo statistical analysis. Single-blind studies were preferred due to the reduction of bias and the effect of factors not related to the treatments in the study. In the initial search for systematic reviews, only those that underwent a rigorous critical appraisal process with multiple reviewers were considered for this literature review.

Primary research articles must have included the grouping of study participants, randomly or not, to follow the Mediterranean Diet or a "standard" control diet that was similar to a Western or Standard American Diet. If the research included a comparison to the caloric restriction of SAD, it was included in this review. Further, participants had to be obese and/or have low-moderate cardiovascular risk. Studies with participants who had cardiovascular disease were less preferred, partly due to the effects of the reverse causation bias on the results of the study. Although, such studies offered insights into diet in reducing cardiovascular disease outcomes, which is a topic parallel to this review's focus on risk.

The Joanna-Briggs Critical Appraisal Tools were used to objectively evaluate the studies being considered for inclusion. This methodology of literature search and appraisal yielded one systematic review and four primary research studies that were analyzed in this review.

RESULTS

Diet and Cholesterol Levels

The Standard American Diet is well known by the general population and researchers alike to be detrimental to individual health. With an excess consumption of calories, fats, and processed foods, the Standard American Diet, also called the Western Diet, is believed to be linked to the high prevalence of heart disease in the United States. [6]

The Mediterranean Diet is one that has grown in popularity around the world due to claims of it reducing the risk for heart disease. The Mediterranean Diet has been associated with an increase in high density lipoprotein (HDL) cholesterol, which is good for reducing blood cholesterol levels, whereas the Standard American Diet was associated with an increase in low density lipoprotein (LDL) cholesterol, which can lead to plaque buildup in blood vessels. [7] Participants in the highest tertile of adherence to the Standard American Diet were significantly worse in terms of weight, HDL cholesterol, and blood triglyceride levels. This shows that increased consumption of a Western Diet can increase the CVD risk of individuals. A rigorous systematic review and meta-analysis on 121 randomized controlled trials by Ge et. al found that the Mediterranean Diet is the most effective in reducing LDL cholesterol in obese or overweight patients and is the most effective out of all popular diets in America (i.e., Atkins, Paleolithic, etc.) in doing so.[8]

Caloric Restriction of Standard American Diet

To contrast the effects of full consumption and adherence to the Mediterranean Diet, this review investigated how caloric reduction/restriction of the Standard American Diet can play a role in

cardiovascular health in obese individuals. In Trepanowski et al.'s randomized clinical trial investigating alternate day fasting versus daily caloric restriction in obese patients [9], the researchers recruited participants without a past medical history of endocrine or cardiovascular disease. After random assignment of individuals into the alternate day fasting group, daily caloric reduction group, and a control group, the researchers evaluated patients' clinical outcomes of disease at the 1-month baseline phase, 6-month weight-loss phase, and 6-month weight maintenance phase. The results of this study found that there was no statistically significant difference in blood pressure, triglyceride levels, and cholesterol between the two diet regimes. Although this study does not compare such caloric restriction to the Mediterranean Diet, it can be inferred that caloric restriction may not have any significant benefit to reducing CVD risk in obese individuals. When comparing the clinical indicator measures of this study to those including the Mediterranean Diet, the latter diet leads to more acceptable levels in patients, indicating that it may be a better option for reducing risk.

A parallel study investigated the effects of caloric restriction in heart failure patients. Kitzman et. al conducted a randomized, single-blind, attention-controlled study on how diet, alone and with aerobic exercise, leads to better exercise capacity and cardiac function, among other things. [10] Participants included in this trial were 60 years of age or older, had a BMI > 30, and signs and symptoms of heart failure. Exclusion criteria included other specific diseases that could lead to heart failure symptoms. Participants were assigned to one of four groups: diet only, exercise only, diet and exercise, and a control group. Participants in either exercise group were receiving a hypocaloric western diet that they chose on their own. The study found that a hypocaloric western diet, but not exercise, caused a significant improvement in the Kansas City Cardiomyopathy Questionnaire (KCCQ) score, which is a heart-failure specific measure. The

study also found that body weight decreased significantly with both diet and exercise. The major finding of the study is that caloric restriction in older obese patients with chronic heart failure was feasible and improved exercise capacity. The study found that with the western diet restrictions, the wall thickness of the heart decreases, which is a negative outcome, but there were no improvements in resting cardiac function. This study demonstrates how caloric restriction may not improve cardiac function in situations of rest or exercise for patients with heart failure. Rather, it tended to improve heart-failure specific health status of patients.

Diet and Cardiovascular Risk in Obese Individuals

Obesity is known to increase the risk for cardiovascular disease, blood pressure, diabetes, and high cholesterol. [7] Diet plays a significant role in the reduction of weight and thus disease risk. The Mediterranean Diet is the only popular diet to lead to sustained weight loss and cardiovascular risk factor improvements after 12 months when compared to other popular diets. [8] High blood pressure is also a leading indicator of heart disease and the Mediterranean diet is inferior to the most effective diet, Paleolithic, but is much better than the least effective diets evaluated in Ge et. al's systematic review. [8] However, this systematic review states that although LDL reduction from the Mediterranean diet existed, improvements in cardiovascular risk factors largely diminished after the 12-month participant follow-up. This result indicates that the Mediterranean Diet may not be all that better than other dietary programs in reducing cardiovascular risk in obese individuals in the long run.

Trepanowski et al. investigated different methods of caloric restriction in obese patients, particularly alternative day-fasting versus daily caloric restriction. [9] Obese participants without a

history of CVD were randomized equally into an alternate day fasting group, daily calorie restriction group, or no intervention control group. The researchers conducted stratified random sampling by participant sex, age, and BMI. The active clinical trial lasted for 1 year and consisted of a 1-month baseline phase, a 6-month weight loss phase, and a 6-month weight-maintenance phase. In the baseline phase, participants consumed their normal diet and followed their normal daily routine to maintain their current body weight. In the weight loss phase, specific meals in accordance with the American Heart Association were provided to the two experimental groups. In the weight-maintenance phase, participants were again asked to maintain their body weight. The control group was instructed to maintain their body weight and normal food and lifestyle habits throughout the course of the study. Among other results, the study found that there was no significant difference in blood pressure between the intervention groups relative to the control group at 6 months and 12 months into the study. The heart rate also had no statistically significant differences between the intervention groups. Cholesterol and triglyceride levels also did not differ. The results were that the alternate-day fasting did not produce any improvement in weight loss or in risk for cardiovascular disease as compared to the daily calorie restriction in obese patients.

Adherence to Diet

Adherence to diet is a topic that has relatively little research. A single-blind randomized controlled trial by Sánchez-Taínta et al. found that a higher adherence to the Mediterranean Diet is inversely and strongly associated with the prevalence of hypertension, diabetes, and obesity. [11] A total of 3,214 patients were a part of this study, which was randomized and single-blind. All participants were between 60 and 80 years of age and were identified by their primary care

physician as having at least three cardiovascular disease (CVD) risk factors. To determine adherence to the Mediterranean Diet, a dietician conducted a 14-item adherence questionnaire and a 137- food item frequency questionnaire. This inverse association persisted when comparing groups of risk factors and between women and men. In particular, there was a reduction in likelihood of developing diabetes, hyperlipidemia, obesity, and hypertension in at-risk asymptomatic patients. The inverse association was even stronger when two or more risk factors were considered together in the statistical analysis of the data.

This study was a controlled clinical trial and cohort analysis that had statistically significant findings in that increased adherence to the Mediterranean Diet was leading to reduced cardiovascular risk. It can be linked to the review by Ge et. al [8] to correlate diet adherence to the effects of the diet itself.

DISCUSSION

Strengths and Limitations

The primary strength of this review is its synthesis of various primary research studies relevant to the research question, in particular, studies directly comparing the two diets of interest as well as studies that independently evaluated the effects of the Mediterranean Diet or reduced intake in the Standard American Diet. Furthermore, a comprehensive systematic review comparing the clinical factors of CVD (blood pressure, triglyceride levels, cholesterol levels, etc.) was included, which provided for the synthesis of dietary effects information collected from over 100 studies. Additionally, only randomized controlled-trials, cohort analyses, meta-analyses, clinical/dietary

trials, and systematic reviews were included, as these sources are more likely to result in data that has a higher reliability.

The limitations of the study also include that most primary research articles were randomized-controlled trials. Although this type of research is beneficial in that researchers can better evaluate cause-effect relationship between diet and risk factors, more cohort studies would prove to be beneficial to this review, since researchers are observing individuals in their natural environment and dietary patterns, and simply collecting data on obese individuals who already follow the Mediterranean diet and those who already reduce their calories from the Standard American/Western Diet. Since the individuals are not forced to follow a specific diet, there is a less of a chance of individuals leaving the study due to lack of adherence to a diet.

Future Research

Due to the limited amount of primary research directly comparing the Mediterranean Diet and reduced caloric intake of the Standard American Diet in obese individuals, further controlled trials/primary research needs to occur to determine the answer to the research question. To influence evidence-based healthcare practices in reducing CVD risk in obese patients, significant clinical research with large population sizes and a diversity of overweight/obese BMI values needs to occur. Further, studies need to compare the Mediterranean diet and the SAD caloric intake in patients who have already been consuming solely SAD/Western diets prior to the start of the study. This would help give more weight to the significance of the study's results since we are directly comparing the two diets.

CONCLUSION

Implications and Results

There may be a slight benefit to consuming the Mediterranean Diet for obese individuals. Many studies tend to conflict as to the extent of this diet's benefits in CVD risk. Although the Mediterranean Diet has been shown to be the most effective in reducing LDL cholesterol levels, this reduction is minimal than what was expected. Furthermore, the reduction of caloric intake in the Standard American Diet proved to greatly reduce CVD risk in obese patients who were already consuming the Standard American diet as part of their dietary regime in the past.

Taking all studies and reviews into account, the result is that there is no significant benefit in consuming the Mediterranean Diet. Caloric reduction of SAD does the same job in reducing overall CVD risk. Although the American Heart Association indicates that the Mediterranean Diet may be beneficial in reducing MACEs, as mentioned in the background of this review, it also mentioned that further studies with larger sample sizes and extensive controlled trials need to occur before clinical recommendations can be made.

Conflicts of Interest Statement

The author of this review certifies that they have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

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