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Cheri Bell

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The Relationship Between Plant Based Diets and Cardiovascular Disease: A literature review. 1990 – 2015

By:

Cheri Bell

Master of Public Health

Prevention Science

Kathleen Miner, MPH, Ph.D.

Committee Chair

Melissa Alperin 7-23-16

Melissa (Moose) Alperin, MPH, MCHES

EMPH Chair

Jennifer Rooke MD, MPH

Jennifer Rooke, MD, MPH, FACOEM, FACPM

Thesis Field Advisor

The Relationship Between Plant-Based Diets and Cardiovascular Disease: A literature review. 1990 – 2015

By:

Cheri Bell

B.S.

Oglethorpe University, 2012

Committee Chair: Kathleen Miner, MPH, Ph.D.

An abstract of

A thesis submitted to the Faculty of the

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Master of Public Health in Prevention Science

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Abstract

The Relationship Between Plant-Based Diets and Cardiovascular Disease: A literature review. 1990 – 2015

By: Cheri Bell

Cardiovascular disease is a significant public health problem because it is the number one cause of preventable death worldwide (CDC, 2015; Mathieu, Pibarot & Despres, 2006). The most common outcomes of cardiovascular disease are heart attacks and strokes. The underlying cause of heart attacks and strokes is atherosclerosis, a disease characterized by the buildup of plaque within artery walls. Heart attacks and strokes occur when plaques rupture and block blood flow to the heart or the brain. Cardiovascular disease often goes undetected until one experiences a medical emergency such as a heart attack or stroke. Currently, in the United States, over 600,000 people die annually from cardiovascular disease.

Population studies and clinical trials strongly suggest that cardiovascular disease can be prevented and reversed by eating a plant-based diet. This literature review was conducted to examine the effects of dietary patterns on cardiovascular disease. It is hoped that results from this review provide an incentive to educate physicians and the general population about the health promoting benefits of plant-based nutrition.

The Relationship Between Plant-Based Diets and Cardiovascular Disease: A literature review. 1990 – 2015

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I would like to thank the Prevention Science faculty at Rollins School of Public Health. I have enjoyed my time here and the rigorous courses have thoroughly prepared me for a career in public health. I have gained valuable skills that will make me an asset to the health care community.

Lastly, I am eternally grateful to my family and my husband, Christopher. Without your love and support, I would not have made it this far. The support I receive from you all is the driving force that motivates me to do something great in this world. I want to be great for myself, but I also aim to be great to make you all proud.

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CHAPTER 1

INTRODUCTION

1.1 Introduction and Rationale

Cardiovascular disease (CVD) is the leading cause of preventable deaths worldwide (CDC, 2015; Mathieu, Pibarot & Despres, 2006). The Centers for Disease Control and Prevention (CDC) estimates that approximately 610,000 people die annually in the United States from CVD. CVD includes coronary heart disease, carotid artery disease and peripheral artery disease (CDC, 2015). It is one of the number one causes of mortality in the United States. Most people with CVD exhibit signs such as high blood pressure or chest pain. In others, no symptoms or signs may occur until arteries are seriously narrowed or completely blocked. The first sign of disease may be a fatal heart attack or stroke.

In addition to causing human suffering and death, CVD is very costly to treat. In America, the average cost for monthly treatment after diagnosis is $1,074 per person, which amounts to approximately $13,000 per year (Hoffman, 1996). The most effective way to lessen the adverse health impacts of CVD and decrease the cost of care is to address the underlying cause of disease. Population and clinical studies indicate the main cause of CVD may be a poor diet high in fats, cholesterol and animal protein.

As such, there is a need for preventive strategies. These strategies include, but are not limited to, the following: providing free health educational programs; promoting media and marketing policies that encourage heart-healthy food options and physical activity; and educating health care providers and the public about plant-based nutrition.

1.2 Problem Statement

Cardiovascular disease affects one out of every four people in the United States and accounts for 42% of all deaths each year. Approximately 735,000 Americans have a heart attack every year. In addition to heart attacks, CVD may decrease blood flow to vital organs. Decreased blood flow to the kidneys may result in high blood pressure and eventually progress to kidney failure. CVD is caused by the buildup of plaque in the arteries that supply oxygen to the body. This narrows and hardens arteries reducing the amount of oxygen available to vital organs.

A poor diet is one of the primary causes of CVD. The disease is prevalent in countries whose diets consist of a high intake of animal products, which includes fish, such as in the United States. It affects men, women, and all races and ethnic groups. In countries with low intake of animal products, CVD rates are low or non-existent. Population and clinical studies indicate plant-based diets may be protective against CVD. This review was conducted to investigate the relationship between plant-based diets and CVD. If there is a relationship, the information could be used to develop health education materials for health care providers and the general public.

1.3 Theoretical Framework

This study is based upon the Health Belief Model (HBM) which suggests an individual's beliefs and attitudes about health issues require action in order to change long- and short-term health behaviors. Individuals must first be convinced that cardiovascular disease is a preventable or reversible health issue. Then, they must take action to avoid the cause. The action begins when individuals actively change their eating habits, which is the starting point for building a healthier life.

The HBM suggests that a person's belief in their personal risk of getting a disease along with their belief in the effectiveness of a preventive behavior will predict whether or not they adopt the recommended preventive behavior. In this study, the preventive behavior is a plant-based diet.

1.4 Purpose Statement

The purpose of this literature review is to determine the effectiveness of plant-based diets in the prevention of cardiovascular disease. This study will review studies that have been conducted on individuals who live on a low cholesterol plant-based diet versus those who have diets high in cholesterol, fats, meats and dairy products in order to examine how CVD is affected by both diets. Questions to be addressed:

I. Why is cardiovascular disease a problem?

II. What is cardiovascular disease and how does it form?

III. Who is at risk for cardiovascular disease?

IV. What can be done to prevent or reverse cardiovascular disease?

V. What are the dietary effects on the development of cardiovascular disease and its remediation?

1.5 Significance Statement

Why are Americans dying and suffering from health issues such as cardiovascular disease? Is it due to uncertainty about the benefits of a plant-based diet? Is it because of the lack of health knowledge? Regardless of the reason, CVD is an issue that needs to be addressed and resolved because it kills thousands of Americans annually. These deaths could be prevented if health care providers and the public were better educated about effective CVD prevention strategies. Improved knowledge about the relationship between plant-based diets and CVD may benefit the public by possibly reducing the mortality and morbidity rates of this debilitating disease.

The results of this study can provide a guide to those looking for an intensive lifestyle change. In addition, this study can be a resource for health care providers who aim to supplement their traditional CVD treatments.

1.6 Terms and Abbreviations

This section lists terms which are commonly used to describe health issues associated with cardiovascular disease, as well as other topics relevant to the analysis of the disease.

Below are the major terms that are used throughout this thesis.

American Heart Association Diet: A diet consisting of the following items:

- a variety of fruits and vegetables
- whole grains
- low-fat dairy products
- skinless poultry and fish
- nuts and legumes
- non-tropical vegetable oils

Angina: A condition marked by severe pain in the chest, which usually spreads to the shoulders, arms, and neck and is caused by an inadequate blood supply to the heart.

Atherosclerosis (ath-er-o-skler-O-sis): A disease characterized by plaque build-up within the arteries which results in the narrowing of artery walls.

BMI: Body Mass Index

CAD: Coronary Artery Disease

Cardiovascular Disease (CVD): All diseases regarding the damaging of heart and blood vessels.

CDC: Centers for Disease Control and Prevention

Cholesterol: Fat that is found in the blood. Cholesterol is needed for the proper functioning of the brain, skin, and other organs. However, in excess, it creates plaque that can damage and block the arteries.

CHD: Coronary Heart Disease

Fatty streak: The first grossly visible lesion in the development of atherosclerosis.

HDL: High-density lipoprotein

IHD: Ischemic Heart Disease

LDL: Low-density lipoprotein

PAD: Peripheral Artery Disease

Plaque: Accumulation of fatty deposits (fat and cholesterol) within the wall of a blood vessel.

Serum Cholesterol: A combination of both HDL and LDL cholesterol.

Stenosis: The narrowing of aortic valves. As a result, the valve does not open properly causing the heart to work harder at pumping blood through the valve. Stenosis also causes a reduced supply of oxygen.

VEC: Vascular Endolethial Cell

WHO: World Health Organization

As previously stated, CVD is a preventable disease that accounts for 42% of deaths in the United States. Research has suggested that in areas of the world where diets do not include a high consumption of fats and animal protein, CVD deaths or related deaths have been extremely low or non-existent. The purpose of this research is to gain understanding on how a plant-based diet can affect CVD and examine any relationship between the reduction of CVD deaths and a plant-based diet.

CHAPTER 2

REVIEW OF THE LITERATURE

2.1 Introduction

A literature review is conducted to synthesize previous research on how low cholesterol plant-based diets can prevent or reverse cardiovascular disease. Sources include past and recent nationally conducted studies. Sources also include data retrieved from distinguished organizations and agencies such as the National Institute of Health, the Centers for Disease Control and Prevention (CDC) and the World Health Organization (WHO) which provide information on specific public health issues. This chapter will provide a summary of the research studies that were conducted, information from other literature reviews that were formed from the results of previous research and inclusion criteria for this overall review.

2.2 Literature Review

Information for this literature review was taken directly from renowned cardiologists who practice a plant-based lifestyle and have conducted research on the subject and its effect on health. In addition, EMBASE and PubMed databases were utilized through the *Woodruff Health Sciences Center Online Library* to search for journals and articles with a date range from 1990 to 2015. The objectives of this literature review were to 1) determine why cardiovascular disease is a problem, 2) define exactly what cardiovascular disease is and how it forms, 3) establish who is at risk for the disease, 4) determine what can be done to prevent or reverse the disease, and 5) determine the dietary effects on the development of cardiovascular disease and its remediation. The criteria in which information was selected from the databases was based upon the public health evaluation guidelines (See Table 2.1). In addition, a journal summary was composed to bring the most pertinent information together for this review (See Table 2.2).

Criterion	Description
Authority	Data for these studies was acquired from authoritative sources (experts in the field, physicians and their associates). Data was also gathered from well known published studies and journals that targeted different populations.
Accuracy	Accuracy of the information obtained was scrutinized to confirm the absence of information bias and ensure it came from reputable sources.
Relevance	Relevance of this research information is pertinent to the topic of plant-based diets and cardiovascular disease. Most research was conducted using a multi-ethnicity approach and various age ranges. All research information mentioned gives detailed results on the outcomes of this issue.
Currency	The information in this review contains research data from the last 25 years (1990 – 2015). All information is up to date and can be found in the reference section.

Table 2.1: Criteria for inclusion
Criteria for this literature review was based upon the guidelines for public health evaluation research.

Author & Publication Year	Sample Size	Setting/Location	Author's Results
Esselstyn C et al, 2014	198 patients	Cleveland Clinic	Of the 198 patients, 177 were adherent to the plant-based nutrition program. Exercise was encouraged but not mandatory. Most patients who were adherent experienced a low rate of cardiac events that were a result of atherosclerosis. Those who were not 100% compliant with the plant-based nutrition program experienced multiple adverse cardiac events associated with atherosclerosis.
Ornish, D et al, 1998	48 patients	Two tertiary care university medical centers	The study consisted of an experimental group and a control group. All patients had been previously diagnosed with CVD. In the experimental group, patients exhibited a regression of CVD after one year. The control group progressed in its negative symptoms of CVD and had twice as many adverse cardiac events than the experimental group.
Vogel, R et al, 1997	10 patients	University of Maryland School of Medicine	The study found that patients who ate a single meal high in fats experienced a reduction in endolethial flow. Conversely, patients who ate a low fat meal did not exhibit any adverse effects in endolethial function.
Insull, William, 2009	N/A	N/A	The study conducted a literature review of

			previous clinical trials. The author talks about the development of plaque in the arteries and how it occurs.
Lewis, Sandra, 2009	N/A	N/A	The study found that both sexes and all ethnic groups are at risk for the development of cardiovascular disease. It also determined that individuals on low fat diets exhibited lower LDL levels and were at less risk for adverse cardiovascular events. These individuals either did not develop CVD or their CVD was decreased.
Massera, D et al, 2015	1 patient	Montefiore Medical Center	The study found that a whole-food, plant-based diet improved vascular function, reduced body weight, and lowered blood pressure. It determined angina could be reversed without medications or invasive therapies.
Gadgil, M et al, 2015	892 patients	America	The study concluded that participants whose diets consisted of animal protein, fried snacks, sweets and dairy had higher cholesterol levels. Participants on a diet of fruits, vegetables, nuts and legumes exhibited lower cholesterol levels.
Kent, L et al, 2013	5,046 patients	Conducted in various locations throughout the United States. Avondale College of Higher Education's Human Research Ethics Committee gave the consent.	The results showed that a low fat, plant-based lifestyle decreased cholesterol levels, blood pressure, and BMI. Results also showed that participants who transitioned to a plant-based diet experienced

			reductions in cholesterol levels and improvements in cardiovascular function.
Ferdowsian, H & Barnard, N, 2009	N/A	Washington, District of Columbia, area and University of Toronto	Results showed that a plant-based diet decreased the LDL & HDL cholesterol concentrations for participants.
Bild, D et al, 2001	6,500 patients	N/A	The study stated that they hoped to find noninvasive measures to tackle this disease.
Barnard, N et al, 2005	64 patients	Washington, DC, area	The study examined the effect plant-based diets have on BMI, metabolism, etc.
Diez-Roux, A et al 1999	13,095 patients	Four United States communities (Washington County, MD; Suburban Minneapolis, MN; Forsyth County, NC; and Jackson, MS)	The study juxtaposes the diets of individuals in high-income and low-income neighborhoods. Results showed that patients in high-income neighborhoods consumed large amounts of fruits, vegetables, grains and limited meat. However, those in low-income neighborhoods consumed large amounts of meats and foods high in saturated fats.
Crowe et al, 2013	44,561 patients	England and Scotland: European Prospective Investigation into Cancer and Nutrition (EPIC) – Oxford study	The study concluded that patients on a vegetarian diet had a 32% lower risk of contracting IHD than their non-vegetarian counterparts.
Dehghan et al, 2012	31,546 patients	Health Research Institute, McMaster University and Hamilton Health Sciences (Hamilton, Canada); Oxford University (Oxford, UK); and University of Auckland (Auckland, New Zealand)	The study found a clear association between low rates of CVD and a healthy diet consisting mostly of vegetables, fruits, and whole grains.

Table 2.2: CVD Journal Summary

2.3 Summary of Current Problem and Study Relevance

In America, the leading cause of death is cardiovascular disease which is a disease derived directly from atherosclerosis. American physicians are not taught to treat cardiovascular disease with dietary or lifestyle changes. Instead, they are taught to use invasive medical procedures and drug therapy. This is costly and may result in new health problems from medication side effects and surgical complications.

The majority of studies that have been previously conducted support plant-based diets as an effective preventive method for CVD (Esselstyn, 2001; 2007). Research also supports plant-based diets as a means to stop the progression of CVD and also reverse CVD. Esselstyn and Golubic (2014) suggest that, if individuals are willing to make a substantial lifestyle transition to plant-based nutrition and maintain the lifestyle, the individuals can also prevent, halt or reverse their health issues caused by CVD. In their study, Esselstyn and Golubic recruited a total of 198 patients who had been diagnosed with cardiovascular disease. The authors reported that 89% of the patients they counseled in plant-based nutrition were adherent to the program. Of that population, 93% (104 total participants) experienced noteworthy improvement or a complete resolution of their angina symptoms after continuing a plant-based diet for a mean of 3.7 years (Esselstyn & Golubic, 2014). Lastly, Esselstyn and Golubic suggest that previous large cohort studies have placed emphasis on plant-based nutrition as a remediation to CVD because it is rich in antioxidants, high in fiber and protein, and low in saturated fats. This type of diet reduces the inflammation and cell proliferation that occurs from regular consumption of the typical Western diet which is high in animal protein, fats and cholesterol.

Crowe *et. al.* (2013) performed a study of 44,561 male and female participants who were enrolled in the European Prospective Investigation into Cancer and Nutrition. The purpose of the study was to follow vegetarians and non-vegetarians to see how nutrition would affect their cardiovascular health. Exercise was not considered as a mandatory factor. Of the participants, 34% (15,151) were vegetarians meaning they did not consume any form of meat or fish (Crowe, Appleby, Travis & Key, 2013). Both groups were followed for over a decade. At the 11-year follow-up, results showed that the vegetarians had a 32% lower risk of developing ischemic heart disease in comparison to the non-vegetarians (Crowe, Appleby, Travis & Key, 2013). The authors attributed this risk to the vast difference in non-HDL cholesterol levels and systolic blood pressure between the two groups.

The aforementioned studies propose nutrition as the solution to preventing or reversing cardiovascular disease and the diseases caused by it. However, differing opinions to this particular pedagogy do exist. Doctors John and Jan Portman of Emory University and Georgia Tech believe nutrition is not the sole method to remedying CVD. Since atherosclerosis is one of the main determinants of CVD, these researchers believe preventing atherosclerosis should be the primary objective. The investigators believe the appropriate treatment to be the micro RNA molecule (News.emory.edu, 2015). This treatment will supposedly impede the progression of atherosclerosis by reducing the inflammation that affects blood flow. While this treatment has yet to be tested on humans, it is still worth further investigation and experimentation. Ultimately, any medical alternative to nutrition that can prevent CVD and atherosclerosis should be explored. Having additional alternatives could potentially decrease the CVD mortality and morbidity rates and improve the health of Americans.

In the Lifestyle Heart Trial study, Ornish *et. al.* (1998) indicates that a Western diet containing large amounts of meats, salt, fat and cholesterol can lead to CVD and injury of the vascular endolethial cell (VEC) (Ornish, 1998). Ornish *et. al.* (1998) suggests that injury to the VEC is what leads to VEC dysfunction and causes cardiovascular disease. The study examined whether cardiovascular disease could be stopped or reversed without using drugs to lower lipid levels. Ornish *et. al.* (1998) questioned if an intensive lifestyle change regarding one's diet could reduce aortic stenosis and overall LDL levels. The Lifestyle Heart Trial study found that 82% of patients who followed the plant-based diet had a certified regression of cardiovascular issues, and 91% of patients experienced a substantial decrease in the incidence of angina episodes. The authors also found that participants in the control group, who adhered to the American Heart Association diet, experienced a progression of adverse cardiovascular events. This confirmed their hypothesis that plant-based diets have significant health benefits and serve as a preventative measure for diseases like CVD.

As previously stated in Chapter 1, diets high in fat have been suggested to be atherogenic which contributes to the development of cardiovascular issues. To test this hypothesis, Vogel *et. al.* (1997) took ten presumably healthy individuals who were physically active and said to have normal levels of cholesterol. The participants had an average age of 39 years (Vogel, Corretti & Plotnick, 1997). After a 12-hour fasting period, blood from the participants was drawn to determine LDL and HDL levels. The participants were then either given a high-fat meal or a low-fat meal. The high-fat meal (egg and sausage McMuffin, two hash browns and a decaffeinated beverage) consisted of 900 calories which included 50 grams of fat, 14 grams of saturated fat and 225 milligrams of total cholesterol. The low-fat meal (frosted flakes with skimmed milk and orange juice) consisted of zero grams of fat and 13 grams of cholesterol

(Vogel, Corretti & Plotnick, 1997). After eating these meals, patients were tested to measure the amount of serum triglyceride in the blood. This test occurred within a two-hour span. Participants who ate the high-fat meal exhibited serum levels ranging from 94 mg/dl to 147 mg/dl. However, those who ate the low-fat meal had serum levels within a range of 90 mg/dl to 91 mg/dl. The authors concluded that a single high-fat meal can reduce endolethial function, ultimately damaging arteries if the diet is continued long-term.

Even though these studies showed the benefits of a plant-based diet on cardiovascular disease, they did not address why this data is not promoted in places where people receive most of their medical or health related information. These places include schools, universities, and medical offices. Some of the studies had large sample sizes and included people from multiple ethnic backgrounds, ages and genders. The studies were able to show that dietary changes have more than a one-time positive effect on one's health. In fact, these changes can have long-term positive effects on an individual's health.

This literature review shows how a healthy individual on a plant-based diet can halt the progression of CVD. This review can inform those who wish to learn how the human body responds to plant-based diets. The studies examined in this literature review provide detailed and thorough information about how plant-based diets affect endolethial function. The authors found that individuals who followed a plant-based diet experienced a decrease in CVD symptoms while those who consumed a diet high in animal protein, fats and cholesterol experienced adverse CVD events. The research has been replicated numerous times and advocates switching to a plant-based diet in an effort to prevent or reduce CVD.

Taking into account the fact that plant-based nutrition is steadily on the rise, it will be necessary to continue conducting studies in this research field in order to demonstrate the affirmative and long-lasting results of a healthier diet. It should be noted there are contrasting studies which suggest other treatments to preventing CVD. Nonetheless, the use of nutrition as a prevention method is supported with strong evidence to have a health improving effect on cardiovascular disease. Thus, educating health care providers and the public on how to successfully make this lifestyle change would be beneficial to the overall health of the public.

CHAPTER 3

METHODOLOGY

3.1 Introduction

In order to gauge the life-threatening nature of cardiovascular disease and how it can be prevented, a literature review was conducted to synthesize information from different races, genders and ages to determine what effect a plant-based diet had on CVD. The literature review included data from patients who were presumed "healthy" individuals, patients who suffered from CVD, and patients with other related diseases. Regardless of the individual's health, all were studied to see how a plant-based diet affected their health. This chapter will provide a summary of the research design used, a description of the population who participated in the studies, the data analysis plan, and the limitations and delimitations for conducting this study.

3.2 Population and Sample

There were a total of 101,961 patients in the studies examined for this literature review. Patients ranged from the mean age of 24 to the mean age of 69. Participants were either strictly vegetarian, vegan or non-vegetarian. The sample size of men to women in these studies varied but were often times even in number. The majority of these studies were conducted in the United States with the exception of the largest study which took place in England and Scotland.

3.3 Research Study Design

The purpose of this study aimed to determine why cardiovascular disease is a problem and how it can be prevented or the progression of it ceased. Most studies chose to do a randomized control trial using a randomized invitational design. This research study design allows for changes to occur within the intervention without bias. This is necessary as any bias could change

the results of the study. Other studies chose to use case studies which enabled these authors to develop detailed analysis on how this particular diet affects the body.

3.4 Procedures

There were a few intervention strategies posed within this study. During the in-depth studies, physicians examined both individuals who were considered to be healthy and individuals who had known cardiovascular disease or related diseases. Some studies had a control and experimental group while others decided to focus on one sole group of people. Body mass index as well as LDL and HDL levels were measured at the beginning for every individual. They were then continuously measured while participants were on their assigned diet. This allowed for proper comparison of these factors in relation to diet. Physicians followed patients over an extended period of time. Patients were followed ranging from 1 to 11 years to ensure the studies provided robust data regarding the effects of plant-based diets on CVD and its symptoms.

3.5 Instruments

Electronic databases were utilized to collect information for this project. Those databases included EMBASE and PubMed which is available through the Woodruff Health Sciences Library website. Key words were used to retrieve journals and articles relevant to the topic. A questionnaire comparison tool was also created in order to assess the quality of information from each journal and to clarify each journal's usefulness. A list of key words used to search the electronic database and the data comparison tool can be found below.

EMBASE & PUBMED DATABASE SEARCHES

"Cardiovascular Disease" and "Plant-Based Diets"
"Cardiovascular Disease" and "Prevention"
"Meat and atherosclerosis"
"Cholesterol and Cardiovascular Disease"
"Multi-ethnic" and "Atherosclerosis"
"Atherosclerosis" and "Plant-Based Diets"
"Angina" and "Plant-Based Diets"
"Stages of Cardiovascular Disease/Atherosclerosis"

Table 3.5a Embase & Pubmed Database Searches

Journal Questionnaire Comparison Tool
1. Did this journal discuss what cardiovascular disease is and how it develops?
2. Did this journal discuss why cardiovascular disease poses a problem to the public?
3. Did this journal include a large participant or small participant group?
4. Did this journal discuss the diseases that are a manifestation of cardiovascular disease?
5. Did this journal do a literature review instead of conducting a study?
6. Did this journal discuss how to prevent or reverse cardiovascular disease? The best ways of reducing cardiovascular disease?
7. Did this journal publish recent information from the last 10 to 15 years?
8. Did this journal include anyone who is a nutritionist?
9. Did this journal convey what happens when exercise is combined with cardiovascular disease prevention and reversal?
10. Did this journal discuss the non – medical (diet) interventions that demonstrate the reduction of cardiovascular disease?
11. Did this journal include results from individuals of different age groups, gender and race?
12. What methodology did this journal use and what were their final findings?
13. Did this journal include participants from different races and age groups?

Table 3.5b Journal Questionnaire Comparison Tool

3.6 Data Analysis Plan

This study used comparative analysis to detect any trends in the results as they related to gender, race and age. A questionnaire tool was used to analyze the data for this project. A list of questions were compiled to evaluate the effectiveness of the studies and the relevance of the information to the topic. Each journal was carefully analyzed by using the criteria for inclusion table listed in Section 2.1. The journals were also analyzed based upon the number of subjects in each study and the amount of time taken to conduct each study. Conclusions were then drawn to determine if the results provided evidence supporting each question from the tool. After completing the questionnaire for each journal, a comparison was made to ensure all study questions had been answered.

3.7 Limitations and Delimitations

Limitations

There were a couple limitations based upon the different studies reviewed for this literature review. One observed limitation was that some of the studies did not have a control group. With no control group, it becomes more difficult to establish whether or not the patient's improvement is strictly due to the dietary lifestyle change. Another limitation was there were not many articles published within the last five years that provided in-depth research on the relationship between plant-based diets and cardiovascular disease.

Delimitations

This literature review was conducted using studies that had large cohorts of subjects, age ranges, races and genders. In an effort to keep conclusions consistent, articles that did not include various age groups, races and genders as subjects were excluded. This study focused on two

factors which were plant based diets and diets high in animal protein and fat. To ensure the data collected was manageable, the scope of the study was based off five distinct research questions.

The topic of whether a plant-based diet can positively affect cardiovascular disease is one that needs exploratory research and strong evidence. For this study, a research questionnaire comparison tool was created and an in-depth review of previous research was conducted to find information relevant to this subject. For review, it was mandatory to choose studies which had large cohorts of participants. Reviewing studies with large cohorts allowed for constructive analysis and for the five research questions to be answered. Finally, limitations and delimitations were derived from all of the studies to show what needs to be done for future research.

CHAPTER 4

RESULTS

4.1 Introduction

Information obtained from literature suggests a plant-based diet can prevent cardiovascular disease or stop the progression of CVD if continued for an extended period of time. However, many of the studies differ in their sample sizes, demographics and the methodologies used to conduct the research. Therefore, it would be beneficial to conduct additional studies using different methods and larger sample sizes to further demonstrate whether plant-based diets have positive effects on CVD. This chapter will associate the results of the literature review to the hypothesis proffered in Chapter 1.

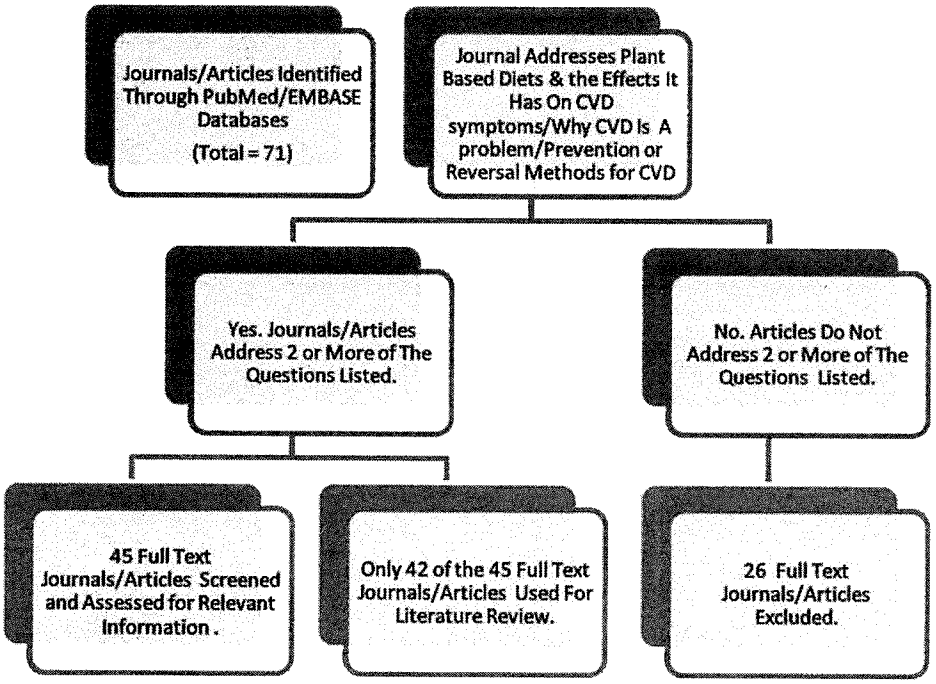

Figure 4.1a: Diagram for Plant Based Diet Journals/Articles on CVD

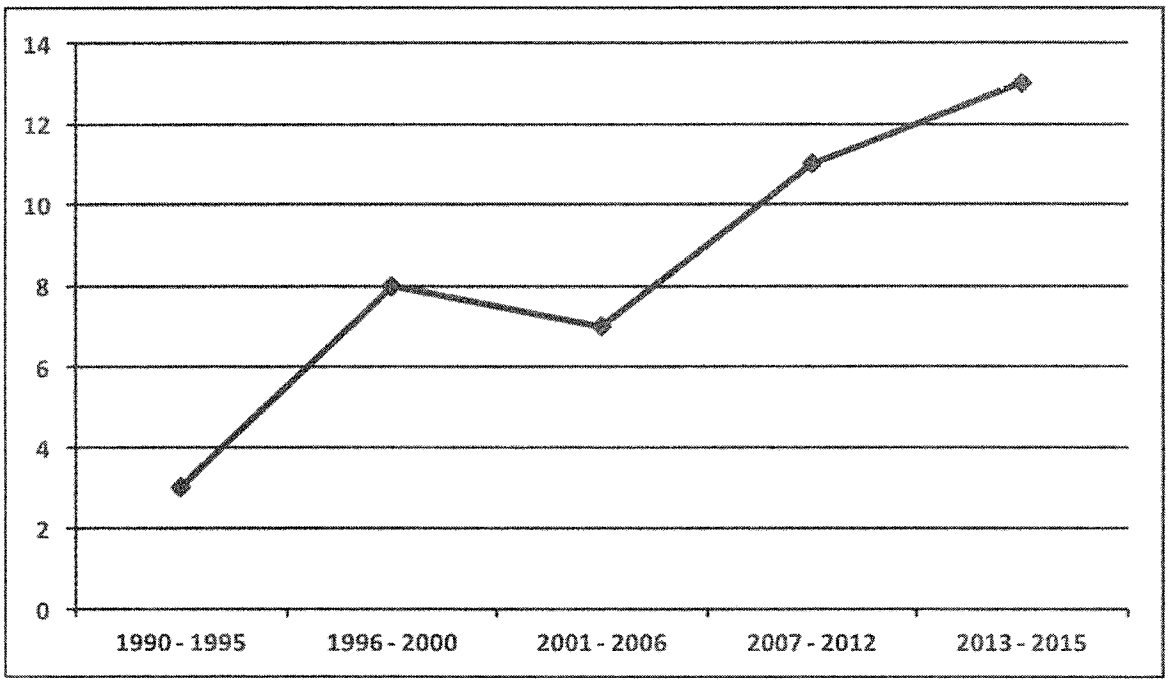

Figure 4.1b: Number of Journals/Articles By Publication Year

4.2 Findings

The data collection tool was comprised of five questions. Question 1 asked why cardiovascular disease is a problem. All the information found in the published journals gave a clear and concise rationale as to why CVD is a problem. The general consensus suggested CVD is a problem in the United States because it is the number one cause of preventable deaths. Question 2 asked what cardiovascular disease is and how it forms. Journals stated that it forms when arteries become blocked by the buildup of fatty deposits and cholesterol which places a strain on blood flow to the heart.

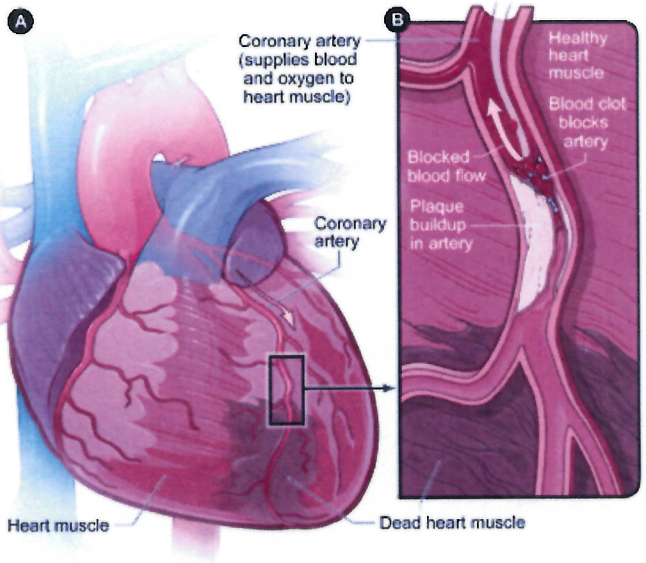

Figure 4.2a: How Cardiovascular Disease Forms
Courtesy of NIH: http://www.nhlbi.nih.gov/health/health-topics/topics/hdw

Part A of this figure shows where the damage to the heart occurs. **Part B** of this figure shows plaque buildup within the arteries which blocks blood flow and ruptures the artery.

Question 3 inquired about who is at risk for CVD. Research shows there is no particular race, ethnicity, gender or age group affected most by this disease. All people are equally at risk for CVD if they have the same unhealthy dietary habits. Question 4 asked what can be done to prevent or reverse cardiovascular disease. The literature review indicates that a dietary lifestyle change which excludes animal protein and foods high in fat, sodium and sugar will keep cholesterol levels low and prevent blockage of the blood vessels and arteries. Question 5 asked what were the dietary effects on the development of CVD. Results from this literature review show that healthy individuals who did not consume animal protein or foods high in fat, sugar or sodium did not experience CVD or CVD related symptoms. As previously stated in Chapter 2, results also showed that patients with CVD who made a lifestyle change to eat a plant-based diet experienced a 91% decrease in their angina episodes and an 82% decrease in CVD issues.

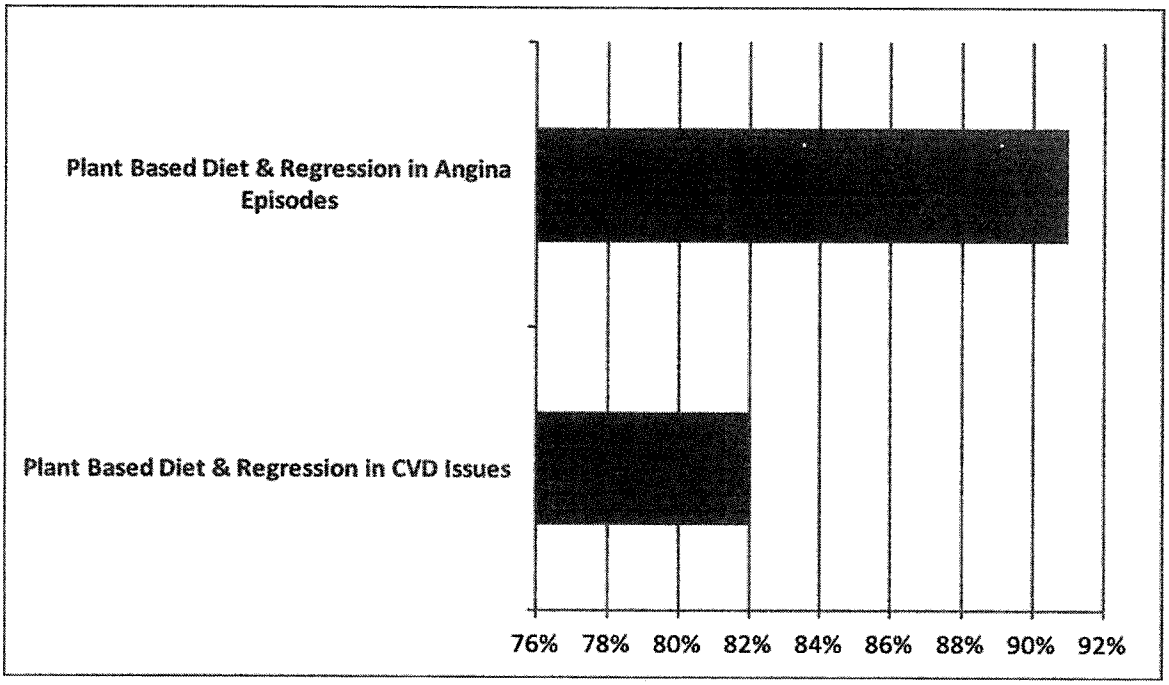

Figure 4.2b: Regression in Angina and CVD Issues

Research Questions Addressed According To Author	
Author	**Questions Addressed**
Barnard, N et al, 2006	Question I, IV & V
Campbell, T et al, 1998	Question I, II & III
CDC.gov, 2015	Question I, II & III
Craig, W, 2009	Question IV & V
Crowe, F et al, 2013	Question III, IV & V
Dehghan, M et al, 2012	Question III & IV
Després, J et al, 2000	Question II
Després, J, 2003	Question I & II
Diez-Roux, A et al, 1999	Question III & IV
Esselstyn, C et al, 1995	Question II, III, IV & V
Esselstyn, C, 2001	Question II, III, IV & V
Esselstyn, C, 2007	Question II, III, IV & V
Esselstyn, C., & Golubic, M, 2014	Question IV & V
Ferdowsian, H., & Barnard, N, 2009	Question II & V
Fraser, G et al, 2014	Question III, IV & V
Gadgil, M et al, 2015	Question III & IV
Hu, F, 2011	Question IV & V
Hoffman, C, 1996	Question I & III
Il, M et al., 1999	Question III, IV & V

Insull, W, 2009	Question II
Kappagoda, C et al, 2006	Question IV
Kent, L et al, 2013	Question IV & V
Libby, P, et al, 2011	Question I & II
Macknin, M et al, 2015	Question III & V
Massera, D et al, 2015	Question IV & V
Mathieu, P et al, 2006	Question I & II
Mishra, S et al, 2013	Question II, III, IV & V
News.emory.edu, 2015	Question IV
O'Connor, S et al, 2001	Question I & II
Ornish, D, 1998	Question IV & V
Ornish, D, 1998	Question IV & V
Roger, V et al, 2012	Question I
Ross, R, 1993	Question II
Singh, R et al., 2002	Question III, IV & V
Slyper, A, 1992	Question II
Trogdon, J et al, 2007	Question I
Tuso, P, 2013	Question V
Tuso, P, 2015	Question IV
Vogel, R, et al, 1997	Question II, IV & V
Who.int, 2015	Question I & II
Yang, S et al., 20011	Question III & V

Figure 4.2 Research Question Results

From the literature review conducted, research has classified cardiovascular disease as a problem because it is the number one cause of preventable deaths worldwide. One out of four people in the United States are directly affected by CVD, and 42% of deaths in the United States are caused by this debilitating disease. CVD is also considered a problem because it is costly to the patient and service providers.

As previously stated in Chapter 1, peer reviewed journals suggested that cardiovascular disease forms by the build up of plaque within the arteries which blocks the flow of oxygen to the body. This is also known as injury to the vascular endolethial cell (VEC) which causes VEC dysfunction and leads to CVD.

These studies have also implied that all genders and races can be equally affected by CVD if they consume a Western diet consisting of meats, salt, fats and cholesterol. Western diets are typically high in fats, which are atherogenic and contribute to the development of cardiovascular dysfunction.

Research conducted by the Lifestyle Heart Trial study and Vogel *et. al.* (1997) recommends using a plant-based diet to reverse or stop the progression of CVD. These studies, along with others, used two groups of subjects for testing. Those two groups often included one group who adhered to a strict plant-based diet and another group who consumed the American Heart Association (AHA) diet or a more typical Western diet. The control group that placed subjects on the AHA or Western diet suffered from additional CVD or angina symptoms. However, subjects who were compliant with the plant-based diet substantially lowered their amount of cardiovascular adverse events.

Chapter 2 outlined research displaying the effect diet has on the development of cardiovascular disease and its remediation. When patients followed a strict plant-based diet, 82% of them experienced a regression of cardiovascular issues, and 91% of the patients experienced a significant decrease in the incidence of angina episodes. On the other hand, patients who followed the AHA diet experienced a progression of adverse cardiovascular events. The conclusion drawn was plant-based diets have health benefits and could be utilized as a preventative measure for CVD.

4.3 Summary

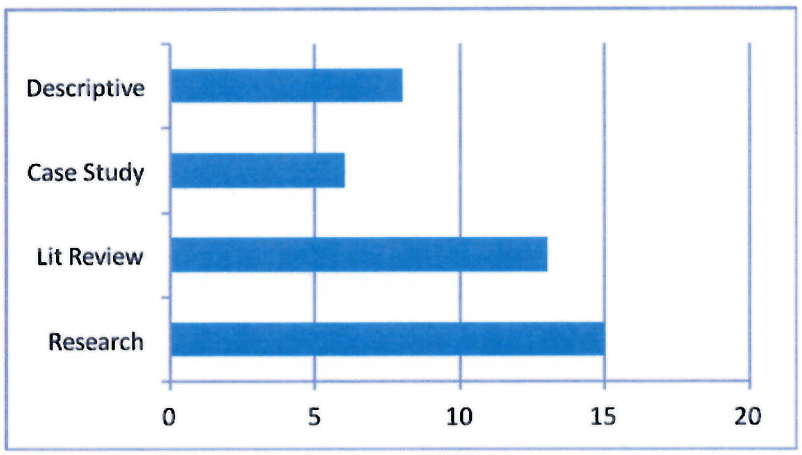

Figure 4.3a: Number of Studies By The Type of Research

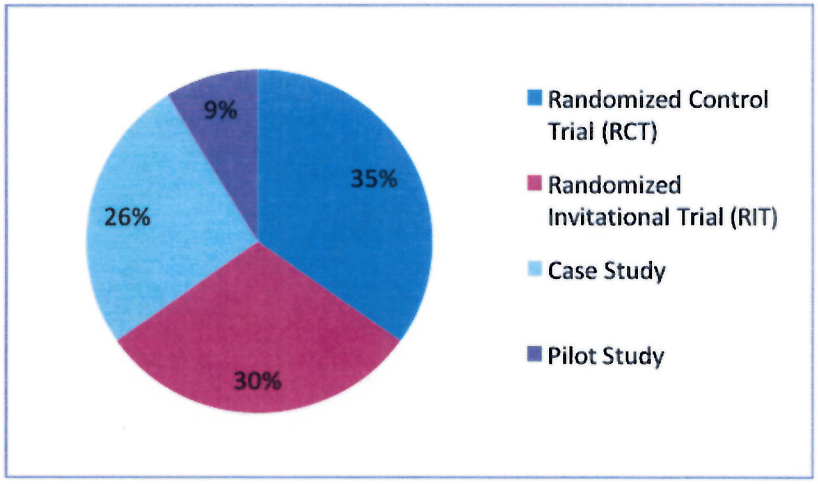

Figure 4.3b: Study Methodology Used In The Research Studies

All information was carefully analyzed gathered from credible sources. All five questions from the data collection tool were answered in the literature review based on the journals used for data collection. For the purpose of this literature review, the journals presented peer-reviewed information consistent which provided a framework for the study's hypothesis. However, more

in-depth analysis could be done to further confirm the importance of plant-based diets for the prevention of CVD and enhancing human health.

This literature review suggests converting dietary norms to be increasingly more plant-based. Based on the research of this review, this would have an impact in reducing the mortality and morbidity rates of CVD in the United States. However, for this information to become widespread, physicians and the public would need to be educated on the benefits of this diet. The results from this study could serve as a tool for physicians to learn about the effects of plant-based diets on CVD and could be used as a guide to conduct additional research.

CHAPTER 5

CONCLUSIONS, IMPLICATIONS AND RECOMMENDATIONS

5.1 Introduction

This literature review displayed alternative prevention methods for reducing cardiovascular disease and decreasing its mortality rate. It also served as a solution to improve the overall health of citizens. This chapter will provide a summary of the studies demonstrated throughout this literature review. It will also discuss the findings, conclusions and implications of this research and the effects it has on public health. Finally, the chapter will provide recommendations to assist with additional research in this field.

5.2 Summary of Study

Cardiovascular disease poses a significant threat due to being the number one preventable cause of death in the United States. By eating diets high in fats, meats, sugar and sodium, Americans are at a greater risk for developing CVD and other associated health risks. Research indicates that those whose diets contain plant-based foods and low cholesterol intake have a lower incidence of CVD, stroke and death from heart disease than those whose diets have higher levels of cholesterol (Craig, 2009). Making a lifestyle change to a plant-based diet has shown to be an effective way to prevent, reverse or halt the progression of CVD. Studies have also shown that making this lifestyle change can reduce the costs associated with the burden of this disease (Ornish, 1998).

5.3 Conclusions

Because studies included individuals from different age ranges, races, ethnicities and gender, this review was beneficial in determining how plant-based diets affect those from all walks of life. Many of the studies used healthy individuals and those who had known cardiovascular disease to see what health changes would occur. Having both types of subjects allowed investigators the opportunity to obtain detailed information on the association between plant-based diets and CVD. It also allowed investigators to accurately assess if the dietary change was the primary reason for health incline or health decline. Thus, the data collected from these studies was comprehensive and can be used to further demonstrate the positive effects of a plant-based diet. In conclusion, the review found that there is a relationship between plant-based diets and CVD and provided more clarity surrounding the review's hypothesis.

5.4 Implications

There is a considerable amount of evidence supporting the use of low cholesterol plant-based diets to prevent or reduce cardiovascular disease. The study has shown that subjects experienced a decrease in CVD symptoms when they made a lifestyle change to a plant-based diet (Esselstyn & Golubic, 2014). As such, it has important implications to assist in promoting this diet lifestyle among Americans. This lifestyle can be promoted through education of physicians and the general public. Increased awareness of plant-based diets can be achieved through comprehensive plant-based nutrition education in schools, educational courses offered by public health professionals or nutritionists, and the promotion of plant-based diets by physicians as a remediation for CVD. This could potentially address the underlying determinants of CVD, which continue to thrive due to a lack of knowledge in preventing this disease.

5.5 Recommendations

This study can be used as a guidance tool to conduct future supplementary research which suggests how a low cholesterol plant-based diet affects cardiovascular disease. Based upon previous research, it is recommended that plant-based nutrition be incorporated into educational programs and included in health care education programs. As a result, the public could improve the quality of their health through awareness and education. In an effort to strengthen and emphasize the conclusions of this study, it is also recommended that both retrospective and prospective research be conducted to further promote the idea of a plant-based diet being beneficial to the heart and body.

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