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Recipe Modification for Cardiovascular Health

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Recipe Modification for Cardiovascular Health

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Abstract

Cardiovascular disease (CVD) is the leading cause of death globally (WHO, 2021). CVDs affect the heart and blood vessels. The most prominent CVDs are coronary artery disease, cerebrovascular disease, rheumatic heart disease, and other conditions. Congestive heart failure is a condition coined by one or more CVDs leading to lowered cardiac output. More than four out of five CVD deaths are due to heart attacks and strokes (WHO, 2021).

The most important behavioral risk factors of heart disease and stroke are unhealthy diet and physical inactivity, but also include harmful abuse of tobacco and alcohol. These lifestyle factors display themselves as phenotypes like high blood pressure, high blood glucose and blood lipids, diabetes, and obesity. These risk factors, outside of genotype determinants, have been shown to indicate an increased risk of heart attack, stroke, heart failure, and other complications.

Dietary modifications to improve risk factors for CVD include the reduction of salt in the diet, eating more fruit and vegetables, increased plant-based and whole foods, and switching saturated, overly processed fats for plant oils. Dietary modifications have been shown to reduce cardiovascular events over time and are essential for improving heart health in future generations.

Introduction

Background and Need

The cardiovascular system is a complex component of the human body. The heart, and its accessory organs, communicate with all other systems in the body. Cardiovascular health is impacted by genetic and lifestyle factors. Nutrition and diet are the most essential modifiable risk factors for cardiovascular health (Tang, 2019). The foods we consume are directly connected to our heart health for the sole reason that nutrients are metabolized in the gut and synthesized into microbiota. The intestines, which absorb the nutrients, communicate with other organs via endocrine pathways using these microbiota. These pathways directly affect phenotypes related to cardiovascular health, like inflammation, obesity, and insulin resistance (Tang, 2019). The food we consume influences the reaction our body incites, which in most cases involves the heart.

In 2019, 85% of all deaths related to CVD were due to coronary artery disease, heart attack, and stroke (WHO, 2021). When we examine the global population for cardiovascular disease, those living on the shores of the Mediterranean Sea, in Greece, and southern Italy had a lower incidence of CAD (Ravera, 2016). Thus, the Mediterranean diet gained popularity. This diet consists of whole grains, fruit, vegetables, and low meat consumption, with the majority of fats deriving from olive oil and nuts. The diet as a whole, rather than each individual component, contributed to increased survival of 17% in a population elderly Greeks (Ravera, 2016). The Mediterranean diet is just one example of how dietary modifications can impact heart health. It is essential to study the diet and lifestyle of these populations to understand why their heart health is enormously greater than the rest of the world.

Plant-based foods are rich in fiber and phytonutrients. Increasing soluble fiber has been associated with a lower risk of coronary heart disease (Erkkilä, 2006). On a physiological level, soluble fiber decreases LDL-cholesterol concentrations, which in high levels can lead to a buildup of cholesterol in your arteries (Erkkilä, 2006). Examples of soluble fibers include oats, black beans, avocados, sweet potatoes, broccoli, figs, and sunflower seeds. Through the implementation of plant-based foods, we may see a severe decrease in risk factors for CVD.

Problem Statement

In America, heart disease has been the leading cause of death for decades. While genetic factors play a strong role in heart health, dietary modifications are an efficient way to prevent CVD. Following the Mediterranean diet is linked to increased heart health (Ravera, 2016). Soluble fiber intake, like oats and beans, is linked to decreased heart disease (Erkkilä, 2006). By increasing soluble fiber, fruits, vegetables, and plant-based oils, CVD can be prevented.

Purpose Statement

The first purpose of this creative project is to gather data supporting dietary modifications for CVD prevention. The second purpose is to create modified recipes promoting plant-based foods for heart health.

Research Objectives

The objectives of the study are to: (1) review and annotate research completed on CVD; (2) create three sections of educational materials on the types of cardiovascular diseases, dietary methods of prevention, and management of CVD and stroke; and (3) to formulate 10 modified recipes specific to CVD and Stroke.

Literature Review

Cardiovascular diseases (CVD) are the leading cause of death in almost all countries, taking nearly 17.9 million lives each year (WHO, 2021). The most important behavioral risk factors of heart disease and stroke are an unhealthy diet and physical inactivity. Studies have shown that a dietary-based approach resulted in effectively reducing cardiovascular risk worldwide (Ravera, 2016). It is important to identify those at risk for heart disease, based on genetic and lifestyle factors, and begin preventive measures to reduce the risk of premature death. Through dietary modification like salt and saturated fat reduction, including nutrient-rich foods like fruit and vegetables, and swapping for plant-based protein, the progression of CVD can be prevented.

Types of Cardiovascular Disease

Coronary Artery Disease

Coronary Artery Disease (CAD) is a build-up of plaque inside the coronary arteries. Coronary arteries supply the cardiac muscle tissue with oxygen-rich blood. Plaque narrows the arteries and reduces blood flow to your heart muscle. It primarily consists of fat, cholesterol, calcium, and other substances found in the blood. Hardening of the arteries is known as arteriosclerosis. Atherosclerosis occurs in the arteries that supply blood to your heart muscle, which can trigger angina or a heart attack. The primary symptom of CAD is angina. In cases of severe angina, nurses are recommended to prescribe pharmaceuticals like Nitroglycerin and Isordil (Sam, 2020). In postmenopausal patients with CAD, a higher intake of whole-grain products and cereal fiber was associated with less progression of coronary atherosclerosis. Further dietary modifications may alter the amount of plaque blocking arterial blood flow.

Congestive Heart Failure

Heart Failure (HF) occurs when the heart muscle cannot pump enough blood to meet the body's metabolic needs. When this happens, blood often backs up and fluid can build up in the lungs, causing impairment of ventricular function and shortness of breath. HF is a chronic condition rather than a disease, caused by various manifestations of cardiovascular disease such as chronic hypertension, coronary artery disease, and valvular disease (Wycliff, 2021). This condition also varies based upon which area of the heart is problematic. Studies show that micronutrient deficiencies are correlated with HF. Treatments for HF primarily include improving heart pump function through lifestyle and dietary modifications, however more severe cases may involve invasive surgery.

Cerebrovascular Accident

Cerebrovascular Accident (CVA), commonly known as stroke, is the sudden impairment of cerebral circulation in one or more blood vessels supplying the brain. When atherosclerosis occurs in arteries supplying blood to the brain, a blood clot can form and block the blood supply to the brain. This is known as thrombotic stroke. Atherosclerosis can also cause a blood clot to travel from the heart and lodge in the narrowed arteries. This is known as an embolic stroke. One specific risk factor for stroke includes high homocysteine concentrations in the blood (Spence, 2017). Other generalized risk factors for stroke include high blood pressure, diabetes, high blood cholesterol, and obesity.

Dietary Methods of Prevention

Nutritional Deficiency

Studies show that micronutrient deficiencies are correlated with CHF. In patients with HF, the reduced intake of CoQ10 is correlated with lower left ventricular ejection fraction (Sciati-

ti, 2016). CoQ10, a natural antioxidant, primarily functions in the synthesis of ATP and in healthy subjects is present in high concentrations in the heart muscle tissues (Sciatti, 2016). Vitamin D deficiency impacts bone mineralization; however, its preceptors are present in cardiomyocytes. In patients with HF, ionized calcium (Ca^{2+}) utilization is impaired and myocardial contractility is inhibited (Sciatti, 2016). Iron deficiency is the most common nutritional disorder, affecting 33% of the worldwide population. Iron deficiency contributes to cardiac and peripheral dysfunction and is associated with an increased risk of death in nearly 40% of HF patients (Sciatti, 2016). Thiamine, creatine, taurine, carnitine, carnosine, and arginine are also micronutrients that affect the cardiovascular metabolic pathways.

The Mediterranean Diet

This diet first gained attention in 1970, when an American biologist discovered that populations living on the shores of the Mediterranean Sea had a lower incidence of CAD and CVD (Ravera, 2016). In 1995, a study completed by Trichopoulou showed that adherence to a Mediterranean diet (MED) was strongly associated with overall survival in elderly Greeks (Ravera, 2016). Trichopoulou established eight years later that the components of the MED dietary pattern most important to cardiovascular health were moderate ethanol consumption, low consumption of meat products, high vegetable consumption, and high fruit and nut consumption (Ravera, 2016). The traditional MED diet, including plant-based protein and rich olive oil, provides a well-tested healthy dietary pattern to reduce CVD. Consumption of olive oil and other plant oils in a MED diet reduced CVD in two randomized controlled trials (Anand, 2015). More specifically, 50 grams of olive oil a day reduced CVD events by 30% over five years (Anand, 2015). When examining the difference between a MED diet rich in olive oil and nuts, after 4.8

years, the cardiovascular incidence was reduced drastically from the control study. Stroke was most significantly reduced with the MED diet (Ravera, 2016). Beyond olive oil and plant-based protein, the MED diet includes fruits, fish, vegetables, whole grains, legumes, and avoids red meat, high glycemic index refined grains, and foods with added sugars, including sugar-sweetened beverages (SSBs). Currently, the MED diet appears to be the primary dietary pattern for secondary prevention in patients with established coronary artery disease.

DASH Diet

DASH stands for Dietary Approaches to Stop Hypertension. The DASH diet includes foods that are rich in potassium, calcium, and magnesium. These nutrients help control blood pressure and prevent hypertension. The diet also limits foods that are high in sodium, saturated fat, and added sugars. A diet rich in sodium and saturated fat is linked to inflammation but in a prospective cohort of females, it is found that a high DASH adherence score was associated with less inflammation (Tang, 2019). Inflammation and heart disease go hand in hand due to the hardening of arteries. The DASH diet in a prospective cohort from the Women's Health Study observed a high DASH diet score with a relative risk reduction of HF mortality by 16% (Tang, 2019). While heart failure is not a disease, it is rather a condition of combined CVD which leads to malfunction of the left and right ventricles. A DASH dietary pattern was also associated with improvements in left ventricular diastolic function and arterial elastance (Tang, 2019). Overall, the DASH diet has a significant impact on CVD through the reduction of sodium and implementation of high-volume fruit and vegetable consumption.

Management of CVD and Stroke

Pharmaceuticals

Common drug treatments for CVD include statins, beta-blockers, angiotensin-converting enzyme (ACE) inhibitors, diuretics, calcium channel blockers, and aspirin (Hobbs, 2004). Statins are the most common primary prevention method, used to lower serum cholesterol concentration. Statins mode of action is via inhibition of HMG-CoA reductase, a process that biochemically inhibits the synthesis of LDL cholesterol (Ward, 2019). They have been widely proven to reduce atherosclerotic cardiovascular disease (CVD), however, there are concerns that statins can be toxic to certain muscular pathways.

Beta-blockers are a secondary method of prevention for people who also have had a myocardial infarction and help to prevent mortality (Hobbs, 2004). This class of drugs, known as antihypertensives, is also useful in managing angina. Beta-blockers mode of action is to block the effects of epinephrine. They have been shown to cause the heart to beat more slowly, with less force, lowering blood pressure (Mayo Clinic, 2021). These drugs reduce CVD because they widen the arteries, allowing more blood flow.

Angiotensin-converting enzyme (ACE) inhibitors are an additional prevention method for people with post-myocardial infarction who also had left ventricular dysfunction (Hobbs, 2004). ACE inhibitors block the body's production of angiotensin II, a hormone that constricts blood vessels (Sweitzer, 2003). This constriction can cause high blood pressure, and in the case of CVD, will cause the heart to overwork and lead to a heart attack in patients with heart failure. Diuretics work in the body to excrete urinary sodium, overall reducing blood pressure, plasma volume, and cardiac output. They are used frequently as the first-line treatment for mild to moderate hypertension because they can reduce both systolic and diastolic blood pressures (Shah,

2004). In a study on patients over 55 years of age with hypertension and at least one other risk factor, the diuretic chlorthalidone was shown to reduce cardiovascular events by as much as other clinically proven pharmaceuticals in patients with hypertension (Shah, 2004). Diuretics show more efficiency when combined with low sodium intake, like the DASH dietary pattern. Calcium channel blockers (CCBs) are another blood pressure-lowering medication. Their mode of action is to block calcium ions from entering the cardiac cells. This is because calcium forces the arteries to contract more strongly, whereas when the ions are prevented from entering, the blood vessels are relaxed and blood flows freely.

Aspirin is another secondary prevention for CVD and works to prevent blood clotting in the arteries. Daily low-dose aspirin tablets are encouraged for those over 40 and under 70 at high risk of developing cardiovascular disease and at low risk of bleeding (Peters, 2020). However, some studies do suggest the benefits of aspirin are outweighed by the risk of bleeding intracranially. Overall, drug therapy is a widespread treatment for CVD and there have been very few new heart medications being studied and produced. For acute CVD, there may be a need for invasive surgery like stents, angioplasty, bypass grafts, and heart valve replacements.

Supplementation

Certain vitamin and mineral deficiencies can worsen CVD. Coenzyme Q10 shows a 43% risk reduction in worsening heart failure, CVD death, machine assistance, or urgent cardiac transplants (Sciatti, 2016). Iron supplements show a 61% risk reduction for all-cause of death from CVD over 36 weeks (Sciatti, 2016). Low vitamin D levels were associated with an increase in plasmatic renin activity and C-reactive protein, which lead to ventricular damage (Sciatti, 2016). Multivitamins show no effect on CVD incidence. For the incidence of stroke, both

folic acid and B-vitamins showed benefits, while niacin showed a significant increase in mortality (Sunkara, 2019). Supplemental soluble fiber has been proven to have a positive effect on cholesterol levels. Three grams of soluble fiber decreases total and LDL cholesterol concentrations by 5 mg/dL, which would be predicted to reduce the incidence of coronary heart disease by about 4% (Erkkilä, 2006). The current studies support diets high in fiber on reducing CVD risk. Omega-3 fatty acids, from fatty fish, reduced multiple CVD risk factors, including vascular resistance, blood pressure, inflammation, serum lipids, and endothelial function (Anand, 2015). This trial was conducted for long-chain omega-3 polyunsaturated fatty acids. It is important to note that the MED diet does call for fatty fish as a protein source. The DASH diet notes sources of magnesium to be important in the prevention of hypertension. Studies have shown that higher magnesium intake can improve glucose and insulin metabolism, enhance vasodilation, and improve the lipid profile. These actions represent an anti-hypertensive and anti-inflammatory agent (Rosique-Esteban, 2018). Overall, dietary supplementation can improve cardiovascular health by strengthening the heart and its counterparts.

Conclusion

The most common cause of death worldwide is from cardiovascular diseases, more specifically coronary artery disease, heart failure, and stroke. Risk factors for CVD are most often genetic, however, lifestyle and diet are easily modifiable and can drastically improve the quality and function of the cardiovascular system. CVD can be properly reduced through nutritive modifications. Dietary patterns like the Mediterranean diet and DASH diet have been shown effective in reducing cardiovascular events. Nutritional deficiencies have been shown to increase CVD and can be counteracted by supplementation. An adequate dietary pattern that reduces

sodium and saturated fat intake, while increasing fruit, vegetable, and plant-based protein options have been shown to reduce CVD.

Development Plan

Worldwide, cardiovascular disease is the most fatal and leading cause of death. In the United States alone, CVD accounts for greater than 800,000 deaths a year. In 2020, deaths due to CVD were calculated at 25.3%, with cancer following at 17.8% and COVID-19 at 10.2% (HCP, 2021). Treatments for CVD are widespread and appreciated by heart doctors, yet more and more people are diagnosed with a form of CVD each year. Besides genetic factors, nutrition and lifestyle are the most effective alterations to treat CVD symptoms outside of pharmaceutical options. For my research, I intend to show how CVD can be prevented and certain symptoms can be treated through dietary modifications.

1. For this project, three topics of educational material will be created for the course *Recipe Modification* with Mrs. Nancy Buckley, along with modified recipes to provide instructional examples.
 - a. The topics include types of cardiovascular disease, dietary modifications for cardiovascular disease, and prevention for cardiovascular disease.
 - b. These materials will be reviewed and edited by Mrs. Buckley, then published onto an Open Educational Resource (OER) library that allows for free viewing. The efforts of my research include sources from six data libraries (Academic Search Complete, Ebook Central, JSTOR, MEDLINE, ProQuest Central, Web of Science) along with my own personal experience cooking and learning about recipe modification for disease states.

- c. The project also includes 10 modified recipes for cardiovascular health. I will primarily be modifying simple recipes from the American diet that can be applied to everyday cooking.
2. Canva was the primary method of educational content creation.
 - a. I began by creating a presentation format with slides that serve as the basis of my content materials.
 - b. The presentation slides were written in chronological order of my research beginning with types of cardiovascular disease, dietary modifications and patterns, and ending with prevention and treatment methods.
 - c. After including all of the written material from my research, I continued by adding correlating images from the suggested open image websites approved by OER.
3. I submitted the first draft to Dr. Elaine Thornton, the Open Education & Distance Learning liaison, along with Mrs. Buckley. The feedback I received is as follows;
 - a. You will need to include a slide with your sources (References).
 - b. You will need to remove U of A from the opening image. We like to keep these generic and unbranded so that anyone, anywhere can use the resource.
 - c. Each image will need to be attributed on a final slide or on the presentation slide.
 - d. We will also talk about what license you will apply to the presentation
 - e. It will of course be up to Prof Buckley to approve the content. For example, should CVD be spelled out on the title slide? Will readers automatically know what that is?

4. After receiving feedback from Dr. Thornton and Mrs. Buckley, I proceeded to edit the first draft and polish all details.
 - a. I decided to start over on a new template. I chose to create a google docs template.
 - b. I started by adding plain text to the document in a textbook-style fashion. I bolded headings and italicized subheadings to keep the document organized.
 - c. I included information on the significance of CVD, risk factors, types of CVD, dietary maintenance, nutritional recommendations, and recipe modifications.
 - d. I divided my findings into two categories: prevention of CVD and nutritional maintenance of CVD. I summarized these and made fact sheets in the same format.

5. I resubmitted the draft to Mrs. Buckley to receive her approval for the course content. I began to work on the modified recipes.
 - a. I chose 10 recipes from the typical American diet that could easily be modified.
 - b. These modified recipes are included in a separate document, with an introductory paragraph including general dietary modifications to the typical Western diet to reduce cardiovascular disease.
 - c. Important dietary modifications are based on the fact that increased intake of fish, nuts, fruits, vegetables, and legumes are also proven to reduce CVD risk factors (Anand, 2015). Also, overconsumption of sodium and saturated fat is linked to high blood pressure and CVD mortality (Anand, 2015).
 - d. The recipes I modified included sauces, dips, breakfast foods like waffles and bagels, burgers, pizza, and desserts like brownies and cookies.

- e. These modifications range from including plant-based protein options, whole grains, soluble fiber, and plenty of vitamin-and-nutrient-rich vegetables and fruits. Modifications also emphasized reducing saturated fat, sodium, processed sugar, and partially hydrogenated oils for frying.
 - f. Each recipe was included as is, then dissected into which portions could be modified for better heart health. The final modified recipe was included at the end with explanations of how the new components are beneficial to cardiovascular health.
6. Finally, the educational materials and modified recipes were complete.
- a. I submitted the documents to Mrs. Buckley for one last approval before sending them to Elaine Thornton for publication in the OER library.
 - b. The materials will run a test trial in Mrs. Buckley's *Recipe Modification* course for Fall 2022.

This creative project addresses cardiovascular health with a nutritional preventive approach. Through creating educational OER materials, evidence-based nutritional practices known to reduce and improve CVD will be organized into easily digestible text. The categories for the CVD section of the course include types of CVD, dietary methods of prevention, and common treatments for CVD. The final section, modified recipes to prevent CVD, will add a clear and concise example for students partaking in *Recipe Modification* with Mrs. Nancy Buckley.

Design Process and Creative Works

The result of this creative project includes tangible education materials on types of cardiovascular disease, dietary methods of prevention, and treatment of CVD. These materials are

presented digitally to complement the *Recipe Modification* course taught by Nancy Buckley, N.D.T.R., at the University of Arkansas. The materials are published on the Open Education Resource library including proper sourcing with the help of Dr. Elaine Thornton. Along with the educational content on Dietary Modifications for Cardiovascular Disease, there are 10 modified recipes to supplement the learning experience. These recipes show which modifications establish importance in heart health. These modifications range from reducing salt, swapping for plant-based protein options, and including fruits and vegetables when possible. In the Fall of 2022, these materials will run their first test trial by Mrs. Buckley. Future editions will depend on the successes and failures of the content during the course.

Discussion

The present creative project aims to collect data on nutrition-related evidence for the prevention and treatment of CVD and translate these findings into educational materials. While cardiovascular diseases are responsible for more deaths than any other disease worldwide, data from the American Heart Association suggests that diet may play an important role in heart health. Primarily this research recognizes that fat content and the total calories in the diet are important factors in the progression of atherosclerosis. Atherosclerosis is the main cause of coronary artery disease, heart failure, and stroke. Salt intake also plays a huge role in heart health, hence the DASH diet. In the Multi-Ethnic Study of Atherosclerosis (MESA), a 1-unit increase in DASH diet score was significantly associated with an increase in stroke volume, which is a sign of increased cardiac output, thus better heart health (Appel, 1997). Beyond salt and fat, dietary patterns with high volumes of fruits and vegetables, like the Mediterranean diet, have shown a reduction of cardiovascular events. The PREDIMED study found that CVD was reduced by 30%

over eight years when following a Mediterranean-like eating pattern (Estruch, 2013). These findings were combined to create content establishing a research-based approach to modifying recipes for the prevention of CVD.

During the creation of these educational materials, it became essential to narrow down what research exists. The main studies included in the materials are the PREDIMED study and the National Institute of Health clinical trials for the DASH diet. Simply creating educational material was not sufficient for the course. Other resources and referrals were necessary to communicate for those individuals that wanted a more in-depth experience. Additionally, when modifying recipes, it was important to select recipes that could easily be improved without deconstructing the entirety of the recipe. It also became necessary to include multiple modification options to be inclusive of the majority of dietary patterns, like Kosher and vegan. The materials and modified recipes alike were to be experienced digitally. This includes making the content user-friendly and properly licensing any images.

Conclusions

To create reasonable educational materials for the *Recipe Modification* course, it was essential to understand the purpose of this course. *Recipe Modification* serves to teach students how to customize any recipe to cater to someone with a disease or sensitivity. In the case of cardiovascular disease, this means primarily limiting sodium and saturated fat, while eating plenty of foods rich in phytonutrients. Using six databases (Academic Search Complete, Ebook Central, JSTOR, MEDLINE, ProQuest Central, Web of Science), I collected the proper statistics and segments from studies on nutrition-based approaches to CVD.

The result of this project included a combined resource of research-based dietary modifications for cardiovascular health. These materials combined were published in an OER library, including free access to students and other people interested in recipe modification. The final evaluation will occur in the Fall of 2022 after the educational materials are tested in the *Recipe Modification* course. Any editions made will be up to the instructor of the course, Mrs. Nancy Buckley. Given the widespread emergence of cardiovascular disease, understanding the role of food in our health is important. A better understanding of dietary methods of prevention for cardiovascular health may lead to improved heart health in the population.

Limitations and Future Research

Opportunities to explore the dietary modifications found in this study are abundant. This project allows for further development in terms of creating educational materials. The following recommendations are suggested for further phases of this study:

- Limitations include:
 - Few options for grocery stores in the local area. Future researchers could order different foods and have them shipped internationally to include dietary patterns in other countries.
 - Access to only free content creating applications. Future researchers could apply for funding to purchase more advanced content tools to enhance the learning experience for the students and the teaching experience for the instructor.
- Future research opportunities include:

- The expansion of dietary modifications could be further divided into the category of which disease is more impacted. For example, dietary modifications for stroke, dietary modifications for coronary artery disease, etc. depending on existing research.
- Additionally, additions to the original version to allow for a more immersive, interactive experience would benefit both the student and instructor.

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Appendix A: OER Materials

Introduction

Cardiovascular diseases are the leading cause of death globally. The cardiovascular system is a complex component of the human body. The heart, and its accessory organs, communicate with all other systems in the body. Cardiovascular health is impacted by genetic and lifestyle factors. Nutrition and diet are the most essential modifiable risk factors for cardiovascular health

Risk factors

It is important to identify those at risk for heart disease, based on genetic and lifestyle factors, and begin preventive measures to reduce their risk. High blood pressure, high blood cholesterol, and smoking are key risk factors for heart disease. About half of people in the United States have at least one of these three risk factors. Other conditions that put individuals at risk of developing heart disease are diabetes, obesity, unhealthy diet, sedentary lifestyle, and excessive use of alcohol. The most modifiable behavioral risk factors of heart disease and stroke are an unhealthy diet and physical inactivity.

Types of CVD

The most common type of heart disease in the United States is coronary artery disease, which affects the blood flow to the heart. This causes decreased blood flow and can lead to a stroke. A manifestation of multiple heart diseases is diagnosed as heart failure.

Coronary Artery Disease

Coronary artery disease (CAD) is a build-up of plaque inside the coronary arteries. Coronary arteries supply the cardiac muscle tissue with oxygen-rich blood. Plaque narrows the arteries and reduces blood flow to your heart muscle. Plaque primarily consists of fat, cholesterol, calcium, and other substances found in the blood. CAD is characterized by angina, a type of chest pain caused by reduced blood flow to the heart. Atherosclerosis is known as the hardening of the arteries. This can slowly narrow the arteries throughout your body. Atherosclerosis can affect the arteries that carry blood to the heart muscle, initiating coronary artery disease.

Cerebrovascular Accident

A cerebrovascular accident (CVA), commonly known as stroke, is the sudden impairment of cerebral circulation in one or more blood vessels supplying the brain. When atherosclerosis occurs in arteries carrying blood to the brain, a blood clot can form and block the blood supply to the brain. This is known as thrombotic stroke. Atherosclerosis can also cause a blood clot to travel from the heart and lodge in the narrowed arteries. This is known as an embolic stroke.

Heart Failure

Heart failure (HF) occurs when the heart muscle cannot pump enough blood to meet the body's metabolic needs. This is a chronic condition rather than a disease, caused by various manifestations of cardiovascular disease such as chronic hypertension and coronary artery disease.

Dietary Maintenance

Studies have shown that a nutritive approach resulted in effectively reducing cardiovascular risk worldwide.

The Mediterranean Diet

Following the Mediterranean diet is linked to increased heart health. This diet first gained attention in 1970, when an American biologist discovered that populations living on the shores of the Mediterranean Sea had a lower incidence of CAD and CVD in general. This diet promotes healthy changes in inflammation, blood sugar, and body mass index. The Mediterranean diet is based on seasonal and local vegetables, fruits, whole grains, legumes, nuts, and olive oil. This includes a moderate intake of low-fat dairy products, as well as eggs, fish, and chicken, but red meat is avoided. Small quantities of wine are encouraged with meals. The PREDIMED Study most prominently supports the emphasis of healthy fats in the Mediterranean diet. After four years, the risk of combined heart attack, stroke, and death from heart disease was lower by 31% in a group following the Mediterranean dietary pattern with a high olive oil component. The Mediterranean diet has been proven effective in reducing risk factors, like high blood sugar and cholesterol, in patients at risk for developing CVD.

The DASH diet

DASH stands for Dietary Approaches to Stop Hypertension. The DASH diet originated in 1992 when the National Institute of Health (NIH) started funding several research projects to see if dietary modifications were effective in treating hypertension. The DASH diet comprises vegetables, fruits, low-fat dairy products, whole grains, chicken, fish, and nuts. The DASH diet is low in fat, meat, sweets, and sodas. This diet provides more calcium, potassium, magnesium, and dietary fiber than the typical western diet while providing less fat, saturated fatty acids, cholesterol, and sodium. These nutrients help control blood pressure and prevent hypertension. The PREMIER Trial combined the DASH diet with a lifestyle program aimed at reducing obesity components. In patients with hypertension, systolic and diastolic blood pressures were reduced by 14.2 and 7.4 mmHg, respectively. The DASH diet has been proven effective in reducing risk factors, like hypertension, in patients at risk for developing CVD.

Nutritional Recommendations

In general, there are simple modifications to daily meal choices that can reduce the risk of developing cardiovascular disease. Most importantly, choose:

Healthy fats

Studies show that eating foods rich in unsaturated fat improve blood cholesterol levels, which can decrease your risk of heart attack and stroke. Monounsaturated fats can have a beneficial effect on your heart when used to replace saturated fat and trans fat in your diet. Good examples include extra virgin olive oil, avocados, and peanuts/ peanut butter. Polyunsaturated fats are essential to the diet, meaning our body cannot make them and **MUST** consume them. Good examples include walnuts, seeds like flax, sesame, pumpkin, and omega 3 fatty acids found in fatty fish like salmon.

Whole grains

To support heart health, replace 50% of the daily intake of carbohydrates with whole-grain options. Whole grains are loaded with dietary fiber, which in turn can lower blood cholesterol levels. Refined grains carry little to no fiber and should be avoided because they can spike blood sugar levels. Whole grains also provide micronutrients like B vitamins, iron, and magnesium. Common examples include whole wheat bread, tortillas, cereals, and crackers. Other good examples of whole grains are oats, barley, brown rice, wild rice, popcorn, and quinoa.

Variety of produce

Fruits and vegetables come in many colors, shapes, and sizes. It is important for our health to consume a variety of produce to obtain vitamins, minerals, fiber, and antioxidants. Fruits and vegetables are optimal when consumed fresh or frozen. When choosing produce, be sure to include a rainbow of colors and always choose low-sodium, water-packed canned goods. Different colored fruits and vegetables also have different health benefits.

- **Red** fruits and vegetables, such as tomatoes, beets, and strawberries, are packed with vitamin A and C, potassium, and antioxidants.
- **Yellow/ orange** fruits and vegetables include citrus fruits like oranges and lemons as well as carrots and squash. They are loaded with vitamin A and C and potassium. They also help boost immunity and vision.
- **Green** fruits and vegetables, like kale and spinach, are packed with potassium and vitamin K. These nutrients are essential for heart health. Vitamin K aids in clotting which can improve blood flow and heart function.
- **Blue/ purple** fruits and vegetables, such as blueberries, eggplants, and prunes, are loaded with antioxidants.
- **White** fruits and vegetables include mushrooms and onions. These are good for heart health because they improve blood cholesterol.

Lean protein

For heart health, it is essential to choose healthy sources of proteins, specifically from plant sources. Beans, nuts, and legumes are rich in protein. Plant-based proteins contain no saturated fat and are loaded with fiber. Regularly eating fish and seafood, a major component of the Mediterranean diet, has been linked to improving blood cholesterol. The omega-3 fatty acids found in salmon, tuna, mackerel, and anchovies can reduce the risk of heart disease. Always substitute nonfat and low-fat dairy products in place of full-fat versions. You can also look for unsweetened dairy products. When selecting poultry, opt for lean and unprocessed versions.

When eating for heart health, it is important to avoid:

Saturated fatty acids

Saturated fat raises LDL cholesterol in the bloodstream. High levels of bad cholesterol are linked to an increased risk of heart disease. Saturated fat is found in animal fat and is usually solid at room temperature. Examples of saturated fat that should be excluded from the diet are:

- Butter, margarine, and processed cheese
- Fatty, red meats like beef and pork
 - When preparing meat, trim off visible fat and skin before cooking.
- Fried foods
 - Use healthier cooking methods like baking, broiling, and roasting.
- Processed fats found in packaged foods

High sodium foods

Eating salty foods leads to high blood pressure which increases the risk of developing heart disease. Salt is found in almost everything and can be hard to avoid. Processed and packaged foods contain more sodium than fresh foods. Always read the label and remember that the DRI for sodium is 1,200 mg per day. Foods that contain high levels of sodium are:

- Seasoning blends
 - Use herbs and spices to add flavor to foods instead of adding salt
 - Choose low-sodium options
- Convenience foods like canned soups/ravioli, frozen pizza, lunch meat, jerky
 - Avoid packaged foods and look for reduced-sodium versions
 - Cook at home using fresh ingredients

Sweets

Added sugars in the diet contribute zero nutritional value and lead to increased body fat. Obesity and diabetes are the two main risk factors for developing cardiovascular disease. The major sources of added sugars are found in sugar-sweetened beverages like soda, coffee, and energy drinks. Added sugar is also found in candy, desserts, and sweet snacks. Sugar found naturally in foods, like fructose and glucose, are the safest options for consuming sugar. Always read the label to see how much sugar is added and avoid high fructose corn syrup and corn sweeteners.

- Instead of choosing a sweet dessert after dinner, opt for a bowl of fruit.
- Sweeten your coffee and tea with honey or date syrup instead of sugar and cream.
- Avoid processed, refined carbohydrates like white bread.

Recipe Modification

When cooking at home, there are very simple techniques that can transform the nutritional benefit of the meal. In general, there are 5 categories to analyze in a recipe.

1. Salt & sugar
 - a. Look to reduce the amount of added plain salt and sugar.
 - b. For added salt, substitute with herbs and spices. Choose low-sodium broths.
 - c. For added sugar, substitute with natural sweeteners like honey or mashed fruit.
2. Fat
 - a. Swap out butter for olive oil, nut butter, or avocado.
 - b. Trim the visible fat from less lean meats.
 - c. Choose low-fat or non-fat sources of dairy over full-fat.
 - d. Grill, bake, or roast instead of fry.
3. Carbohydrates
 - a. Replace 50% of the carbohydrates with whole grains.
 - b. Choose brown rice over white rice.
 - c. Use whole wheat flour over white flour.
4. Protein
 - a. Sprinkle nuts into dessert recipes.
 - b. Use less animal protein portions and add a serving of beans on the side.
 - c. Add quinoa on the side of any meal for a boost in plant-based protein.
5. Vegetables
 - a. Replace meat with vegetables in stocks.
 - b. Blend vegetables in smoothies and sauces for pasta.

Conclusion

The composition of one's diet is an important risk factor in the occurrence of CVD. Nutrition is easily modifiable. The Western diet is rich in sodium and sugar-sweetened beverages while being deficient in healthy fats, a variety of produce, nuts, plant-based oils, and whole grains. There are simple choices one can make to include more cardio-protective elements into their diet. Healthy blood pressure and cholesterol levels can prevent cardiovascular risk significantly. It is important to understand the impact our food has on these factors. Eating a heart-healthy diet is the best way to protect our hearts and improve our quality of life.

Appendix B: Modified Recipes

In general, there are simple modifications to daily meal choices that can reduce the risk of developing cardiovascular disease. Most importantly, choose healthy fats, lean meats, whole grains, plenty of colorful produce, and avoid high-sodium-and-sugar foods. Recipes can be modified easily at home to prevent cardiovascular disease. Pay attention to how much sugar and salt goes into the recipe. Look at how much fat is called for and avoid saturated fat. Here are some examples of recipes modified to support heart health.

Spaghetti Sauce

1 lb ground beef
15 oz tomato sauce
6 oz tomato pasta
1 tsp salt
½ tsp Italian seasoning
1 tsp garlic powder
1 tbsp Worcestershire sauce
1 tbsp white sugar
1 cup water

Here are some simple adjustments to significantly improve the nutritive value. First, swap the ground beef for a leaner cut of ground turkey. This reduces the amount of saturated fat. Also, swap out the regular tomato sauce, tomato paste, and Worcestershire sauce for reduced-sodium versions. Cut the additional table salt to ½ tsp. Instead of white sugar, use grated carrots. They are still sweet but offer natural sugar over the processed sugar. When making sauces, it is easy to sneak in vegetables. Add in a cup of blended broccoli as well for extra fiber. The new recipe will look like this:

Modified Spaghetti Sauce

1 lb ground turkey
15 oz reduced-sodium tomato sauce
6 oz reduced-sodium tomato pasta
½ tsp salt
½ tsp Italian seasoning
1 tsp garlic powder
1 tbsp reduced-sodium Worcestershire sauce
½ cup grated carrots
1 cup broccoli

1 cup water

Waffles

2 eggs

2 cups all-purpose flour

1 $\frac{3}{4}$ cup whole milk

$\frac{2}{3}$ cup butter

1 tbsp white sugar

4 tsp baking powder

$\frac{1}{4}$ tsp salt

$\frac{1}{2}$ tsp vanilla extract

First, swap 1 cup of the all-purpose flour out for 1 cup of whole-wheat flour. Whole grains should comprise 50% of the total carbohydrate intake. Use skim milk instead of whole fat milk. Use $\frac{1}{2}$ cup of extra virgin olive oil in place of butter to reduce saturated fat. Instead of using white sugar, substitute 1 mashed banana for natural sweetness. Substitute vanilla extract for a sugar-free version. The new recipe will look like this:

Modified Waffles

2 eggs

1 cup all-purpose flour

1 cup whole wheat flour

1 $\frac{3}{4}$ cup skim milk

$\frac{1}{2}$ cup extra virgin olive oil

1 mashed banana

4 tsp baking powder

$\frac{1}{4}$ tsp salt

$\frac{1}{2}$ tsp sugar-free vanilla extract

Burger

1 lb ground beef

1 egg

$\frac{1}{2}$ cup bread crumbs

½ tsp salt

½ tsp black pepper

This recipe is simple, but there are still some ways we can improve the nutritional value. Substitute ½ of the ground beef for ½ cup of portobello mushrooms and ½ cup finely chopped onions. These vegetables reduce the amount of saturated fat, as well as add fiber to the patty. Just squeeze them into the burger patty when preparing the meat for the grill. Also, instead of using refined bread crumbs, substitute them for crushed walnuts. Walnuts are a great source of omega-3 fatty acids and have a similar texture to breadcrumbs. Instead of using salt and pepper to season the meat, opt for herbs like parsley and spices like paprika or cayenne pepper. These herbs will offer great flavor without increasing blood pressure as sodium does. The new recipe will look like this:

Modified Burger

½ lb ground beef

½ cup portobello mushrooms

½ cup onion

1 egg

½ cup crushed walnut

½ tsp cayenne pepper or paprika

½ tsp garlic powder

½ tsp dried parsley leaves

Breakfast Bagel

2 eggs

¼ tsp salt

¼ tsp pepper

1 bagel

2 slices of cheese

3 slices of bacon

For this breakfast bagel, use only egg whites to reduce the overall fat content. Use only ⅛ tsp of salt. Some call this a “dash” of salt. Replace the white bagel with a whole-wheat option. Instead of cheese, use avocado spread for the healthy fats. Lastly, swap out bacon for leaner turkey bacon. The new recipe will look like this:

Modified Breakfast Bagel

2 egg whites
1/8 tsp salt
1/4 tsp pepper
1 whole-wheat bagel
½ avocado, mashed
3 slices of turkey bacon

Pizza Toast

4 slices of white bread, toasted
1 cup pizza sauce
1 cup grated mozzarella
½ cup pepperoni
1 tsp oregano

First, swap out the white bread for whole-wheat toast. Choose a reduced-sodium pizza sauce to avoid excess sodium. Use a non-fat version of mozzarella cheese to reduce the consumption of saturated fat. Instead of pepperoni, top the pizza toast with equal parts of your favorite veggies. The new recipe will look like this:

Modified Pizza Toast

4 slices of whole wheat bread, toasted
1 cup reduced-sodium pizza sauce
1 cup grated nonfat mozzarella
¼ cup black olives
¼ cup artichoke hearts
¼ cup roasted red peppers
¼ cup red onion
¼ cup mushrooms
1 tsp oregano

Brownies

10 tbsp salted butter, melted

1 cup white sugar
 2 large eggs
 2 tsp vanilla extract
 1/2 cup melted milk chocolate chips
 3/4 cup all-purpose flour
 1/4 cup unsweetened cocoa powder
 1/2 tsp salt
 1 cup milk chocolate chips

First, use unsalted butter and swap out half the amount of butter for extra virgin olive oil for healthy fats. Instead of using white sugar, add a mashed banana and honey for natural sweetness. Choose sugar-free vanilla extract. Swap out milk chocolate chips for dark chocolate for less processed sugar and more antioxidants. Add in crushed walnuts for protein and omega-3 fatty acids. The new recipe will look like this:

Modified Brownies

5 tbsp unsalted butter, melted
 3 tbsp extra virgin olive oil
 1 banana, mashed
 1 tbsp raw honey
 2 large eggs
 2 tsp sugar-free vanilla extract
 1/2 cup melted dark chocolate chips
 3/4 cup all-purpose flour
 1/4 cup unsweetened cocoa powder
 1/2 tsp salt
 1 cup dark chocolate chips
 1/2 cup walnuts

Tacos

1/2 lb lean (at least 80%) ground beef
 1/4 cup Thick 'n Chunky salsa
 2 taco shell
 1/4 head lettuce, shredded
 1/2 tomato, diced

¼ cup shredded cheddar cheese

First, substitute the ground beef for wild-caught salmon. Fatty fish is great for the cardiovascular system because it is loaded with omega-3 fatty acids. Fish tacos are a great way to consume more servings of fatty fish! Instead of lettuce, use cilantro to better pair with the fish. Add diced mango for antioxidants. Substitute avocado for cheddar cheese to reduce saturated fat. The new recipe will look like this:

Modified Tacos

1 salmon filet

¼ cup Thick 'n Chunky salsa

2 taco shells

¼ cup cilantro

½ tomato, diced

½ avocado, diced

½ mango, diced

Fried Rice

2 cups cooked white rice

2 tablespoons canola oil

1 small onion, finely chopped

2 medium cloves garlic, minced

1 teaspoon soy sauce

⅛ tsp kosher salt

1 large egg

First, replace the white rice with brown or wild rice to increase fiber and B vitamins. Replace canola oil with extra virgin olive oil for healthy fats. Opt for reduced-sodium soy sauce. Remove the added salt and substitute with herbs like coriander and paprika. Add frozen peas, carrots, broccoli, and cashews for fiber and protein. The new recipe will look like this:

Modified Fried Rice

2 cups cooked brown rice

2 tablespoons extra virgin olive oil

1 small onion, finely chopped

2 medium cloves garlic, minced
½ bag of frozen peas and carrots
1 cup of broccoli
¼ cup cashew halves
1 teaspoon reduced-sodium soy sauce
1 large egg
1 tsp coriander and paprika

Fruit and Veggie Dip

1 8-ounce package cream cheese, room temperature
½ cup powdered sugar
½ teaspoon vanilla extract
2 tablespoons maraschino cherry juice

Fruit and veggie dip is a great way to get kids to enjoy their produce. This one is on the sweet side. Substitute the cream cheese and vanilla extract for low-fat, low-sugar vanilla greek yogurt. This is a great source of protein and reduces the amount of sugar and saturated fat. Instead of topping with sugar and cherry juice, use honey for natural sweetness. Add orange or lemon zest on top for extra flavor and vitamin C. The new recipe will look like this:

Modified Fruit and Veggie Dip

1 cup low-fat, sugar-free vanilla greek yogurt
⅓ tsp honey
Zest of a citrus fruit

Chocolate Chip Cookies

1 cup salted butter, softened
1 cup white sugar
1 cup light brown sugar packed
2 tsp pure vanilla extract
2 large eggs
3 cups all-purpose flour
1 tsp baking soda

½ tsp baking powder
1 tsp sea salt
2 cups milk chocolate chips

To make these cookies heart-healthy, start by swapping the all-purpose flour for ground oatmeal flour. Oats are a good source of protein and fiber. Use unsalted butter. Replace the white sugar with honey. Use only ⅛ tsp of sea salt. Choose cacao nibs over the processed sugar in milk chocolate chips.

Modified Chocolate Chip Cookies

1 cup unsalted butter, softened
¾ cup honey
1 cup light brown sugar packed
2 tsp pure vanilla extract
2 large eggs
3 cups ground oatmeal flour
1 tsp baking soda
½ tsp baking powder
⅛ tsp sea salt
2 cups cacao nibs

Appendix C: Fact Sheet 1

Prevention of CVD

Cardiovascular diseases (CVDs) are the leading cause of death globally (1). An estimated 17.9 million people died from CVDs in 2019, representing 32% of all global deaths. Of these deaths, 85% were due to heart attack and stroke (1).

Types of CVD

Coronary artery disease is a disease of the blood vessels supplying the heart muscle characterized by a build-up of plaque inside the coronary arteries (2). A cerebrovascular accident is a disease of the blood vessels supplying the brain, commonly known as stroke (3). Peripheral arterial disease is a disease of the blood vessels supplying the arms and legs (3).

Risk Factors

The major risk factors for heart disease are diabetes, obesity, high blood pressure (BP), high cholesterol, smoking and drinking, poor diet, and inadequate physical activity. These are all modifiable with behavioral and lifestyle changes (4).

Prevention Methods

Most cardiovascular diseases can be prevented by addressing behavioral risk factors such as tobacco use, unhealthy diet, physical inactivity, and harmful use of alcohol (5-7). Below is a list of immediate behavioral changes that are proven to reduce the risk of cardiovascular diseases.

- Stop all use of tobacco (5-6).
- Get active. Aim for 30-60 minutes of physical activity daily (7).
 - This does not have to be a strenuous activity. If you're new to exercise try going for a walk, taking the stairs, or even housekeeping.
- Eat a cardio-protective diet to improve blood pressure and cholesterol levels (7).
 - Two examples of heart-healthy food plans include the Dietary Approaches to Stop Hypertension (DASH) eating plan and the Mediterranean diet (8).
- Maintain a healthy weight. A larger waist circumference is linked to greater risk (9).
- Get good quality sleep. An average adult needs 7 hours per night (10-11).
- Reduce and manage stress (8).
 - Many adults tend to cope with stress in unhealthy ways. Look to practice mindful techniques like meditation and yoga for relaxation.
- Attend regular health screenings (1).

- Know your family history and work with professionals to regularly monitor blood pressure, cholesterol, and any known risk factors for diabetes like obesity.

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Appendix D: Fact Sheet 2

Nutritional Maintenance of CVD

The composition of one's diet is an important risk factor in the occurrence of CVD because nutrition is easily modifiable. The Western diet is rich in sodium and sugar-sweetened beverages while being deficient in healthy fats, a variety of produce, nuts, plant-based oils, and whole grains (1). This results in a greater risk of heart attack, stroke, and type 2 diabetes (1). Alternatively, there are two primary diets that aid in the prevention of CVD: the Mediterranean diet and the DASH diet (2-7).

The Mediterranean Diet

This diet promotes healthy changes in inflammation, blood sugar, and body mass index (2). The Mediterranean diet is based on seasonal and local **vegetables, fruits, whole grains, legumes, nuts, and olive oil** (3). This includes **moderate intake of low-fat dairy products, as well as eggs, fish, and chicken**, but red meat is avoided. Small quantities of wine are encouraged with meals (3).

- The **PREDIMED Study** most prominently supports the emphasis of healthy fats in the Mediterranean diet (4).
- After four years, the risk of combined heart attack, stroke, and death from heart disease **was lower by 31%** in a group following the Mediterranean dietary pattern with a high olive oil component (4).
- The Mediterranean diet has been proven effective in reducing risk factors, like high blood sugar and cholesterol, in patients at risk for developing CVD (5).

The DASH Diet

The DASH diet is recommended to prevent hypertension and lower blood pressure (6). The DASH diet comprises **vegetables, fruits, low-fat dairy products, whole grains, chicken, fish, and nuts**. The DASH diet is low in fat, meat, sweets, and sodas (6). This diet provides more **calcium, potassium, magnesium, and dietary fiber** than the typical western diet, while providing less fat, saturated fatty acids, cholesterol, and sodium (6).

- The **PREMIER Trial** combined the DASH diet with a lifestyle program aimed at reducing obesity components (7).

- In patients with hypertension, systolic and diastolic blood pressures were reduced by **14.2 and 7.4 mmHg**, respectively (7).
- The DASH diet has been proven effective in reducing risk factors, like hypertension, in patients at risk for developing CVD (6).

Dietary Modifications for CVD

In general, there are simple modifications to daily meal choices that can reduce the risk of developing cardiovascular disease. Most importantly, choose;

- **Healthy fats** over saturated fats (2-5)
 - Include **extra virgin olive oil**, avocados, and nut butters
 - Avoid butter, shortening, animal fat, and processed foods
- **Lean meats** as the preferred animal protein (2-7)
 - Include **fatty fish** like wild-caught salmon
 - Avoid red meat like beef and pork
- **Whole grains** over processed, refined, white flour (8)
- Plenty of **colorful produce** (9)
 - Look for **seasonal & local** fruits and vegetables
 - **Fresh or frozen** are equally nutritious
 - Opt for **lower-sodium**, water-packed canned goods
- **Lower-sodium** options (6-7)
 - Season foods with herbs and spices
 - No-salt seasoning blends
- **Water** over sugar sweetened beverages (2-7)

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