SHANNON LANDRY

UD78372NU87584

DIET IN THE PREVENTION OF CHRONIC ILLNESS

Nutrition in the Prevention of

Cardiovascular Disease and Type II Diabetes

ATLANTIC INTERNATIONAL UNIVERSITY
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Table of Contents

Introduction

In a society where nearly 75% of adults are overweight or obese (Fryer et al, 2020), there has been an increased public interest in diets and nutrition, primarily for the purposes of losing weight. From a public health perspective, however, the interest in nutrition has grown as a means of preventing and treating chronic illness, which has become a global epidemic and huge economic burden. Over the past few decades, individuals have seen a significant increase in weight gain due largely to changes in eating habits and decreased physical activity. These changes have led to increased incidences of cardiovascular diseases and Type II Diabetes (Ley et al, 2014). Dietary choices play a crucial role in public health, with an unhealthy diet ranked as the most prevalent cause of death in the United States (Wang et al, 2022); therefore, it is essential to investigate the potential interventions that can be used to improve upon these major health concerns. Eating healthily helps prevent, delay, and manage heart disease, type II diabetes, and other chronic diseases. A balanced, nutritious diet includes a variety of fruits, vegetables, whole grains, lean protein, and low-fat dairy products and limits added sugars, saturated fats, and sodium (CDC, 2022). Specifically, the DASH diet and Mediterranean diet have been shown to be particularly effective.

High quality dietary fats and carbohydrates included in or in addition to the food items listed above, have been shown to reduce risk for developing diabetes and improve glycemic control and blood lipids in patients with pre-existing diagnoses (Ley et al, 2014). Limiting excess caloric intake from any source is also recommended. In addition to eating healthily and losing weight, larger scale changes are required at a systemic level in order to prevent chronic illness. These include providing education to children and families about nutrition, reducing sodium in prepackaged foods, ensuring physicians receive education regarding nutrition, and improving food labelling. With the implementation of these changes, we may see a major shift in our current #1 health crisis.

What the Research Shows:

In the Western world, most people have access to the internet and understand the fact that they should consume nutritious foods in order to maintain good health. With a world of information at our fingertips, why then are we experiencing more chronic illness than ever? A simple Google search reveals an almost universal message about the importance of eating a healthy diet. For example:

The Center for Disease Control and Prevention (CDC) states: "*Eating healthy helps prevent, delay, and manage heart disease, type 2 diabetes, and other chronic diseases. A balanced, healthy dietary pattern includes a variety of fruits, vegetables, whole grains, lean protein, and low-fat dairy products and limits added sugars, saturated fats, and sodium*" (CDC, 2022).

The FDA states: *"We recommend that consumers eat more fruits, vegetables, low-fat dairy products, whole grains, and healthy oils. They also should consume less sodium, saturated fat and added sugars* (FDA, 2022).

Health Canada States: *"Healthy eating can reduce the risk for chronic disease and contribute to overall wellbeing. When you consume foods and drinks that are high in calories, fat, sugar and salt, you're increasing your risk of heart disease -- not to mention Type 2 diabetes and colorectal cancer. Eating fruits and vegetables, whole grains and plant-based proteins reduces your risk for heart disease… and makes your heart happy"* (Health Canada, 2018).

Though the wording varies slightly, the message is clear: eat healthily to maintain good health and prevent disease. Unfortunately, we do not seem to be following public health advice. In the United States, 74% of adults aged 20 and over are overweight or obese (Fryer et al, 2020). According to Fryar et al (2020), body mass index (also known as BMI) is expressed as weight in kilograms divided by height in meters squared (kg/m^2), and is a commonly used tool to classify overweight (BMI 25.0–29.9), obesity (BMI at or above 30.0), and severe obesity (BMI at or above 40.0). Obesity, in particular, has seen a significant increase since the 1960s, as shown in the graph below.
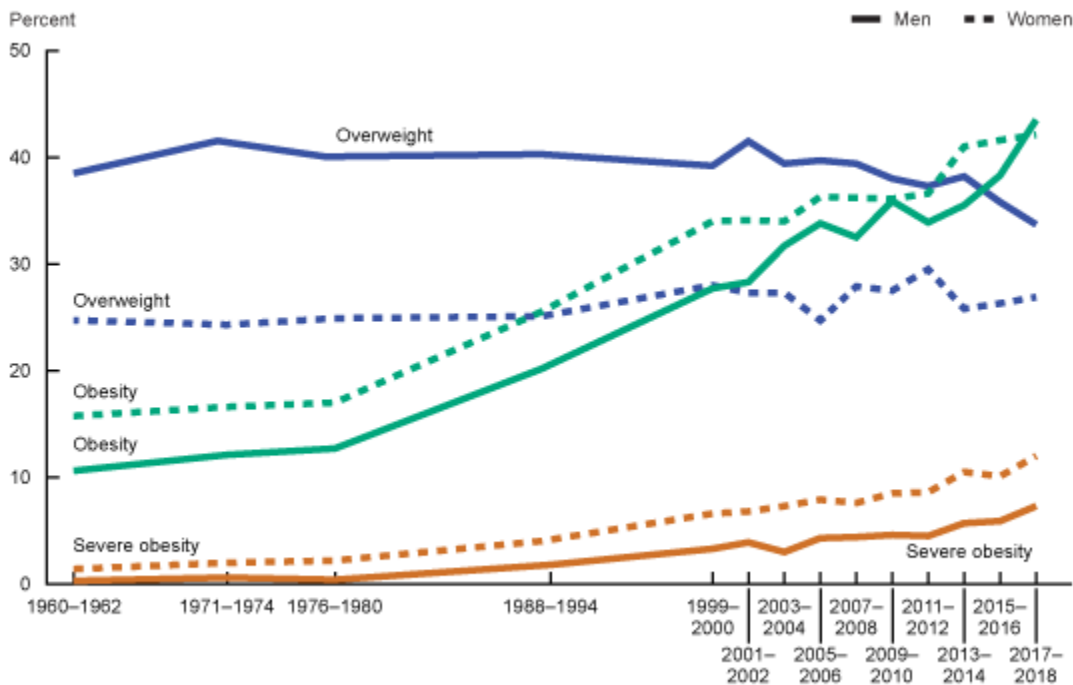
Overweight is body mass index (BMI) of 25.0–29.9 kg/m2. Obesity is BMI at or above 30.0 kg/m2. Severe obesity is BMI at or above 40.0 kg/m2. Pregnant women are excluded from the analysis.

SOURCES: National Center for Health Statistics, National Health Examination Survey and National Health and Nutrition Examination Surveys (in Fryar et al, 2020).

Although not the only contributing factor, we know that obesity is a precursor to heart disease and Type II Diabetes (Yu et al, 2018). There have been many studies on the specific dietary and lifestyle determinants of chronic illnesses and the general consensus has been that reducing dietary and lifestyle risk factors could prevent most incidences of cardiovascular disease, diabetes, and many cancers among high-income populations (Willett, 2002). The importance of these results cannot be overstated as they show us that these chronic illnesses are not simply unavoidable consequences of existing in a modern society, which means we have the choice and the power to change our habits to reduce the risk of these diseases. It also means that low rates of these chronic illnesses are possible without intervention from expensive drugs or medical treatments and that a proactive, preventive approach is possible. In order to promote and facilitate prevention, changes in our behaviors associated with our health (nutrition

and physical activity, etc), will need to occur, as well as investments in education, and changes in food policies (Willett et al, 2006).

Cardiovascular Disease:

Cardiovascular disease, sometimes referred to as heart disease, is an umbrella term for conditions affecting the heart or blood vessels. It is typically related to a build-up of fatty deposits inside the arteries and an increased risk of blood clots (NHS, 2022). Forms of cardiovascular disease include heart attack, stroke, angina, and arrhythmias.

Cardiovascular disease is the world's leading cause of death. It is estimated that nearly 18 million people died from heart disease in 2019, which represents a whopping 32% of all global deaths. CVD is also the leading cause of premature death under the age of 70, and in 2019, 38% of the 17 million premature deaths were caused by cardiovascular disease (World Health Organization, 2021). This is an astonishing fact given that most cardiovascular diseases can be prevented by addressing risk factors such as nutrition and physical inactivity. Even a reduction in excess calories and improvement in food choices we make may prevent a substantial amount of primary and secondary cardiovascular events (Yu et al, 2018).

The factors associated with risk of heart disease include medical conditions and lifestyle choices, and include:

Medical:	**Lifestyle:**
High blood pressure	Unhealthy diet
High cholesterol	Physical inactivity
Diabetes	Overweight/obesity
Sleep apnea	Too much alcohol

It's important to note the interrelation between the items in those lists. They typically do not exist in isolation from one another, and most can be attributed, at least in part, to

nutrition. For example, poor nutrition and consuming an excess number of calories leads to weight gain, which leads to becoming overweight or obese, which is a contributing factor to high cholesterol, sleep apnea, etc., which then increases risk of cardiovascular disease.

According to the CDC, consuming a diet high in saturated fats, trans fat, and cholesterol has been associated with increased incidences of heart disease and related conditions. Excess sodium, in the diet can raise blood pressure (2019). Some foods that fall under these categories include baked goods, processed deli meats, soda, white bread, rice and pasta, fried foods, and canned soups. These items have one thing in common: they're typically ultra-processed.

Though the debate over the impact of our sodium intake on blood pressure has been a contentious one among nutrition and healthcare professionals, leading health organizations continue to support a reduction in dietary sodium to 2,300 mg per day. Currently, Americans are consuming an average of 3,400 mg per day (Thompson et al, 2011). I believe that the information about sodium being a concern has been misinterpreted by the general population and resulted in a "salt is bad" mentality. Ironically, sodium is important for many of our body's functions, and we cannot survive with it. The message should be clarified to indicate that the recommendation isn't a low-sodium diet; rather, it's a reduction in the *excess* amount of sodium that American's consume in their ultra-processed food.

One diet that has shown positive effects on blood pressure is the **DASH** diet plan (DASH stands for Dietary Approaches to Stop Hypertension), which resulted from a largescale study funded by the National Institutes of Health (Thompson et al, 2011). The DASH plan emphasizes foods that are low in fat and high in fiber, as well as foods that are rich in micronutrients such as potassium, calcium, and magnesium. It recommends fruits and vegetables, whole grains, and low-fat dairy products. It includes a sodium content of about 3000mg.

Research has consistently shown that the DASH diet has a positive impact on blood pressure, and researchers theorize that incidences of heart disease and strokes would be reduced by 15% and 27% respectively if all American's followed this diet.
It has also been shown to be particularly beneficial for African Americans with hypertension and for reducing the risk or heart disease and stroke among women. (Thompson et al, 2011). The table below shows the daily recommendations with the DASH plan, according to a 2000 calorie per day diet.

Food Group	Daily Servings	Serving Size
Grains and grain products	7–8	1 slice bread 1 cup ready-to-eat cereal* 1/2 cup cooked rice, pasta, or cereal
Vegetables	4–5	1 cup raw leafy vegetables 1/2 cup cooked vegetable 6 fl. oz vegetable juice
Fruits	4–5	1 medium fruit 1/4 cup dried fruit 1/2 cup fresh, frozen, or canned fruit 6 fl. oz fruit juice
Low-fat or fat-free dairy foods	2–3	8 fl. oz milk 1 cup yogurt $1\frac{1}{2}$ oz cheese
Lean meats, poultry, and fish	2 or less	3 oz cooked lean meats, skinless poultry, or fish
Nuts, seeds, and dry beans	4–5 per week	1/3 cup or $1\frac{1}{2}$ oz nuts 1 tbsp. or 1/2 oz seeds 1/2 cup cooked dry beans
Fats and oils[†]	2–3	1 tsp. soft margarine 1 tbsp. low-fat mayonnaise 2 tbsp. light salad dressing 1 tsp. vegetable oil
Sweets	5 per week	1 tbsp. sugar 1 tbsp. jelly or jam 1/2 oz jelly beans 8 fl. oz lemonade

Note: The plan is based on 2,000 kcal per day. The number of servings in a food group may differ from the number listed, depending on your own energy needs.

*Serving sizes vary between 1/2 and $1\frac{1}{4}$ cups. Check the product's nutrition label.

†Fat content changes serving counts for fats and oils: for example, 1 tablespoon of regular salad dressing equals 1 serving; 1 tablespoon of a low-fat dressing equals 1/2 serving; 1 tablespoon of a fat-free dressing equals 0 servings.

Data from: National Institutes of Health. Healthier Eating with DASH. Available at www.nhlbi.nih.gov/health/public/heart/hbp/dash/new_dash.pdf.

Source: Thompson, Janice, et al. *Science of Nutrition*. Benjamin Cummings. 2nd edition, 2011.

Another diet that has been shown to be effective for reducing the risk of cardiovascular disease is the Mediterranean diet. In the 1950s, it was noted that incidences of heart disease were lower in in Mediterranean countries than in the US, which sparked interest in the diet. Since then, many studies have concluded that the Mediterranean diet does help prevent cardiovascular disease (Mayo Clinic, 2021).

Plant-based foods, such as fruits and vegetables, whole grains, nuts and seeds, as well as herbs and spices are the foundation of the Mediterranean diet. The main source of added fat is olive oil. These healthy fat source (monounsaturated fat) lower LDL (low-density lipoprotein) cholesterol as well as total cholesterol. Poultry, fish, dairy, and seafood are eaten in moderation, while red meat and desserts/sweets are included only occasionally. They polyunsaturated fats they consume through fatty fish such as mackerel and salmon are rich in Omega-3, which helps fight inflammation, decrease triglycerides, reduce blood clotting, and reduces the risk of cardiovascular disease (Mayo Clinic, 2021).

Type II Diabetes:

Like cardiovascular diseases, Type II diabetes mellitus is a major public health crisis. Type II diabetes is a flaw in the way the body controls and uses sugar (glucose) as a fuel. Long-term, this results in too much sugar circulating in the bloodstream, which can lead to other serious health problems such as cardiovascular disease and kidney disease (CDC, 2022).

A 2014 study by Ley at al. showed that 382 million adults globally were living with diabetes, and that number was expected to rise to 592 million by 2035. A more recent study done in 2020 showed that by that time, only 6 years later, the number of people diagnosed with diabetes globally was 425 million, with a predicated increase to 629 million by 2045 (Toi et al, 2020). Type II Diabetes is also a significant risk factor of developing cardiovascular disease, which we know is the leading cause of death worldwide. The disease has become a major cause of death in individuals aged 60 and under (International Diabetes Foundation, 2013). Although Type II Diabetes usually

develops in people over age 45, unfortunately it is becoming more and more prevalent in children, teens, and young adults (CDC, 2022).

The economic burden on the healthcare system is astronomical. In 2013, 147 billion (USD) was spent on healthcare for diabetes in Europe. In the same year, 263 billion was spent in North America (Ley et al, 2014). This economic burden contributes to an estimated 12% of global health expenditure (Toi et al, 2020)!

An unhealthful diet has been known to be a main contributor to the development of diabetes for many years, but only within the last two decades have studies begun to investigate nutrition in the prevention of the disease (Ley et al, 2014). Due to these unhealthy diets and decreased physical activity, people around the world have been gaining weight in recent decades. Excess body fat (high BMI) is the strongest risk factor for developing diabetes (Ley et al, 2014).

Specific racial and ethnic minority groups as well as those with a lower socioeconomic status are at an increased risk of nutrition-related chronic illness. For example, according to the FDA, more than 40% of American adults have high blood pressure, but that number increases to approximately 60% for non-Hispanic Black adults. American Indians and Alaska Natives are also disproportionally affected and are diagnosed with diabetes at higher rates than other racial/ethnicity groups (Payne, 2002).

As previously mentioned, type II diabetes affects several major organs, including the heart, blood vessels, eyes, kidneys and nerves. Importantly, risk factors for developing diabetes are also risk factors for other chronic diseases, such as cardiovascular disease. This means that risks, potential complications, and comorbidities oven overlap. Again, these rarely exist in isolation and many of the risk factors could be mitigated by changes in diet.

Some of the complications/comorbidities include:

- Cardiovascular disease
- High blood pressure
- Nerve damage (neuropathy) to the limbs, heart, & digestive system.

- Kidney disease

- Eye damage, potentially leading to blindness

- Skin infections

- Poor ability to heal from cuts and blisters.

- Hearing impairment

- Sleep apnea

- Dementia

(Mayo Clinic, 2021)

Over the past two decades, evidence from clinical trials and observational studies have demonstrated the importance of specific nutrients/foods in the prevention of Type II Diabetes. Most people think of eating healthily as not eating an excess of calories, when in reality, the *quality* of dietary fats and carbohydrates in a person's diet is more important than the *quantity* of these macronutrients. A common phrase in the health and fitness field is "a calorie is a calorie", and while that might be true to a certain extent, we need to consider the nutrient the calorie provides and how it affects our body. Diets that are rich in whole grains, fruits & vegetables, legumes, nuts and seeds, have been shown to reduce the risk for diabetes. It also improves glycemic regulation and blood lipids in patients who already have diabetes (Ley et al, 2014). These healthy diets were moderate in the consumption of alcohol, and low in refined grains, processed meats, red meat, and sugar sweetened drinks.

A large study published in 2022 found that adherence to a type II diabetes–prevention diet resulted in lower risks of death from all causes, as well as from cardiovascular disease and cancer (Wang et al, 2022). An overview of the research on specific diet plans for the prevention and management of diabetes is shown below.

Table 2: Summary of research on dietary patterns for the prevention and management of diabetes.

	Main components	Diabetes prevention	Diabetes management
Mediterranean diet	high consumption of whole plant-based foods; olive oil as the main source of fat; low-to-moderate consumption of dairy products, fish, and poultry; low consumption of red meat; and low-to-moderate consumption of wine with meals	Mediterranean dietary patterns were associated with lower risk of type 2 diabetes	Mediterranean diets for diabetes management improved glycemic control and insulin sensitivity, and reduced risk of CVD
Dietary Approaches to Stop Hypertension (DASH)	rich in vegetables, fruits, and low-fat dairy products, including whole grains, poultry, fish, and nuts; lower in saturated fat, red meat, sweets, and sugar containing beverages; and often reduced in sodium	DASH diet was associated with lower risk of diabetes.	The DASH diet with 2 400mg/d sodium restriction had beneficial effects
Vegetarian and vegan	vegan, vegetarian diets, including lacto- ovo (consuming dairy and/or eggs), pesco (consuming fish, eggs, and/or dairy), semi (consuming all but no red meat and poultry)	Vegan, lacto-ovo and semi-vegetarian diets were associated with lower risk of type 2 diabetes	Improved risk was not consistently reported and the effect of vegetarian diets was difficult to isolate because calorie-restriction was often implemented.
Dietary guidelines - Alternative Healthy Eating Index (AHEI)	including greater intake of vegetables and fruits, whole grains, nuts and legumes, omega-3 fatty acids, PUFAs; lower	AHEI diet was strongly associated with lower risk of diabetes	NA

	Main components	Diabetes prevention	Diabetes management
	intake of sugar-sweetened beverages red/processed meat, trans fat, sodium; and moderate alcohol consumption		

Source: Ley et al, 2014

How to Improve Outcomes:

We have vast amounts of evidence supporting a healthful diet in the prevention of chronic illness, yet incidences of these diseases continue to rise. In order to battle this global epidemic which has led to so many premature deaths, we need to invest in effective prevention and management strategies with a focus on nutrition. Some of these strategies will need to be at the individual level, but others will need to be at the manufacturer and legislative levels. These could include:

1) Eat whole foods

As with the Mediterranean and DASH diets, individuals should choose whole foods whenever possible. One strategy for this is to shop the perimeter of the grocery store first, as this is where the fresh produce, meat, and dairy are typically located. Individuals should avoid pre-packaged food whenever possible, as it often contains many additives such as sugar, unhealthy fats, and high levels of sodium.

Some more specific suggestions include:

▪ Choose unsaturated fats, including sources of omega-3 fatty acid, instead of trans and saturated fats. Replacing saturated fats with unsaturated fats will reduce the risk of CAD (Willett, 2002) by reducing serum low-density lipoprotein (LDL) cholesterol. Also, omega 3 fatty acids can prevent ventricular arrhythmias, thereby reducing fatal cardiovascular disease.

- Eat a lot of fruits and vegetables. Research indicates that generous intakes of fruits and vegetables will reduce the risk of cardiovascular disease (Conlin, 1999)

- Consume grain/cereal products in a whole-grain, high-fiber form (as opposed to refined grains). Consumption of fiber from cereal products has been linked with a reduced risk of both cardiovascular disease and type II diabetes. High fiber also helps facilitate weight control. Conversely, high consumption of refined grains is associated with increased incidences of CAD and Type II Diabetes (Willett, 2002).

- Reduce sugar and sweetened drinks. Sugar, which has no nutritional value beyond calories, contributes to the dietary glycemic load, which is associated with the risk of cardiovascular disease and diabetes (Willett, 2002).

- Limit excessive caloric intake overall. Given the significance of in the causation of many chronic illnesses, and the proportion of the population who are overweight or obese, controlling caloric intake and not eating in a caloric surplus is of fundamental importance.

- Limit sodium intake. Again, the main reason for limiting sodium is the fact that most people consume far too much, and for some people, sodium causes an increase in blood pressure, which is a major risk factor for cardiovascular disease (Thompson et al, 2011).

2) Lose weight

We know that excessive weight can lead to many health problems, including cardiovascular disease and diabetes, and that losing weight will help prevent disease and/or manage pre-existing conditions. Effective and sustainable weight loss programs should be encouraged, low cost or free, and accessible.

3) Reduce sodium in prepackaged foods

Manufacturers should be encouraged or mandated to provide lower sodium pre-packaged food. In 2021, the FDA established voluntary short-term sodium reduction targets for manufacturers of commercially processed and pre-packaged foods. This plan

was in recognition of the fact that American's consume unhealthy levels of sodium, which is directly associated with cardiovascular disease. Since most of the sodium in the average US diet comes from processed and pre-packaged food, the hope was that encouraging a reduction in sodium in the food supply will assist in lowering individuals' sodium levels (Payne, 2022).

4) Education for and interventions by health care providers

As part of their medical training, physicians receive little to know training with respect to nutrition. Considering that two of the world's largest causes of death are usually preventable with nutrition and lifestyle changes, it is astonishing that physicians are not well versed in nutrition. In many cases, nutrition should be discussed before medication, but that is almost never the case.

5) Education for children and youth

Providing education to younger populations is critical because healthy dietary patterns in childhood can influence the eating habits later in life (Payne, 2022). Food advertising is also geared larger to children, appealing to them with fun characters, bright colours, fun shapes (and added sugar and unhealthy fats). Legislation regarding advertising to children should be considered.

6) Food labelling

Appropriate and thorough food labelling will assist in creating a healthier food supply by empowering individuals with information they can use to make good food choices. For example, after the FDA required trans fat to be indicated on nutrition labels, there was an 80% reduction in trans fat in the food supply. It has been suggested by experts that this likely led to the prevention of tens of thousands of incidences of cardiovascular disease. Changing the requirement for food labels (declaring added sugars, for example) may also encourage manufacturers to reformulate existing products and/or create healthier new ones (Payne, 2022).

Conclusion:

Increased incidences of cardiovascular disease and type II diabetes have led to a global health crisis. Hundreds of millions of people worldwide are suffering from these conditions despite the fact that they are largely preventable. As such, there is an urgent need to reduce the worldwide health and economic burden caused by these disorders.

Nutrition, as we've learned, plays a major role in the prevention and management of these chronic illnesses. Indeed, diet is a critical lifestyle factor that affects cardiovascular disease risk through body weight and many other pathways such as the development of comorbid or compounding disorders. Research is abundant avoiding excess caloric intake and focusing on a larger consumption of fruits and vegetables, whole grains, fish, nuts and seeds, and legumes will assist in preventing chronic illness. It is also important to moderate alcohol consumption, and reduce consumption of processed meats, red meats, refined grains, sodium and sugary beverages (Yu et al, 2018). This information has been widely available for decades, yet the incidences of chronic illness continue to rise. As such, greater emphasis must be placed on interventions aimed at prevention. These Interventions should be at the individual and societal level and aimed at changing diet and lifestyle factors. Methods can include educating children and families, modifying/moderating the amount of unhealthy ingredients in pre-packaged foods, educating health care professionals, and improving food labelling.

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