

Where's the Beet: A Correlation between Vegan diet and the Reduction of Type 2 Diabetes

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### Abstract

This integrative literature review assessed the connection among various studies conducted on the relationship between participants on plant based diets and the recent effects on their health. Before medicine and technology, infectious diseases were the primary cause of death. As innovations in science and medicine progressed, the trend of diseases shifted from infectious to chronic. Currently, the foremost health issues in our society are almost all chronic and related to lifestyle choices. Despite copious amounts of money being poured into research and new drugs to improve our health, people are dying from chronic diseases now more than ever before. These chronic diseases include obesity, hypertension, stroke and diabetes. A renaissance in research transpired as studies took a different turn, focusing more on natural solutions to prevent these chronic diseases, such as plant based diets. An integrated literature review was used to analyze three different studies. Each study was about the relationship between diet and its effect on the body; however, each study had a different, narrower subtopic. After assessing and reviewing the literature, conclusions were then derived on the relationship of diabetes and plant based diets. Research has shown that low-fat vegan diets have been known not only prevent these chronic diseases but also revert the effects of the disease on the body. For the participants who followed a plant based regimen, there was a positive, significant change in health status, as BMIs were lowered to a healthier weight and A1C levels decreased in diabetic patients. In regards to the participant's diets that consisted of consumption of red and processed meats, these patient's health data indicated abnormal levels, indicating a greater risk for chronic diseases. There was a unanimous conclusion that an increased consumption of meat and animal products is consistently associated with chronic diseases, such as Type 2 Diabetes.

*Keywords:* Vegan, diet, Type 2 Diabetes, plant based

## Introduction

Diabetes Mellitus, also known as Type 2 Diabetes (T2D), is one of the major chronic as well as rapidly growing public health issues not only in the United States but throughout the world. An approximated 382 million adults worldwide had diabetes in 2013; this number is projected to rise to 592 million by 2035, (Kahleova et al, 2017) almost doubling the number of diagnoses in about 20 years. Decades ago, this disease was not as significant of a concern; however, currently, T2D has risen to the 7th leading cause of death in the United States in 2015 (Asif, 2014). The disease continues to represent itself as a more difficult health condition as news studies reveal the severity of the acute and chronic complications, as well as the increase in age range that the disease can affect, including children. The number of new cases of diabetes has greatly increased over recent years partly due to advances in technology and the ability to detect diabetes in its earlier stages, but also due to lifestyle choices, such as a poor diet, lack of physical activity and increase in sedentary lifestyle. The major factor in the prevalence of diabetes is poor diet, as suboptimal nutrition is a leading contributor to chronic disease and premature death in the United States and globally (Kahleova et al, 2017). According to recent analysis, certain dietary factors, specifically a high intake of processed meat products and high sodium intakes and low intakes of fruit and vegetables were associated with almost half of the deaths in United States that were cardio-metabolic related (Kahleova et al, 2017). T2D is a complex condition, as it is difficult to treat, expensive and complicated to manage and directly related to co-morbidities, such as obesity. It is estimated that two-thirds of Americans are currently overweight, half of whom are obese. Obesity is associated with an increased risk of serious health conditions, one of which is T2D (Xu et al, 2013). While there is belief that a cure for T2D does not exist, various studies demonstrate that a vegan or plant-based diet is successful

in managing complications of T2D through a reduction in Hemoglobin A1C (HbA1c), body mass index (BMI) and lipid index. The reduction of these factors as the outcome for these studies indicates that there is substantial and similar evidence indicate that a plant based diet can reduce and potentially prevent T2D.

### History of Communicable Diseases

For as long as there has been life on earth, diseases have existed. As science and technology advanced overtime, mankind has been able to identify, combat, treat and learn to prevent certain diseases. The majority of the diseases that were of primary concern in our history were communicable diseases otherwise known as infectious diseases. The bubonic plague and other infections like measles and smallpox were among the most devastating of the epidemic diseases. Before science and medicine advanced, infectious diseases took the lives of millions of people. The smallpox epidemics alone have killed millions of people. The most infamous epidemic was the smallpox epidemic in 1519 when Cortes and his European explorers introduced the diseases to the native population of the Aztec Empire. (“Deadly Diseases: Epidemics throughout History,” 2014). The epidemic ended up killing between 5-8 million people over the course of only two years (“Deadly Diseases: Epidemics throughout History,” 2014). Exactly a century ago, the United States was one of the numerous countries plagued by the flu epidemic of 1918 and 1919. (“Deadly Diseases: Epidemics throughout History,” 2014). This flu epidemic killed approximately between 30 million and 50 million worldwide and among those, over half a million were Americans (“Deadly Diseases: Epidemics throughout History,” 2014). Specifically, in the United States, the flu, smallpox, polio and HIV are the diseases that had the deadliest outcomes.

For centuries, communicable diseases were the most prevalent form of disease that affected the majority of the population. The demand for a way to combat the diseases and the epidemics stimulated advances in medicine and science. Through research, mankind has been able to successfully understand the mode of transmission and the path that the microorganism takes in the body as it progresses and the specific signs and symptoms that are distinguishable in certain diseases. Mankind has learned how the disease occurs, how to treat but most importantly, ways of prevention. The breakthrough in primary prevention in the form of vaccines and hand hygiene led to a massive and radical reduction in the number of new cases of communicable diseases including resultant deaths. During the 20th century, deaths due to infectious diseases declined drastically in the United States. This decline contributed to a sharp drop in infant and child mortality and a 29 year increase in life expectancy. At the beginning of the twentieth century,, the three leading causes of death were pneumonia, tuberculosis (TB) and infectious diarrhea, which were responsible for 30% of all childhood deaths who were aged less than 5 years old (“Deadly Diseases: Epidemics throughout History,” 2014). At the end of the 20th century, by 1997, that percentage dropped to only 1.4%. (“Deadly Diseases: Epidemics throughout History,” 2014). While there are still numerous areas of the world where these diseases still exist, the comparison of number of incidences and epidemics has dropped dramatically, giving way to a new trend in illness. The global burden of disease is transitioning from its original focus on infectious diseases to non-communicable conditions. Chronic diseases are ongoing and are generally incurable illnesses or conditions, such as heart disease, asthma, cancer, diabetes and obesity. In 2014, seven of the top ten causes of death listed were from complications of chronic diseases. Two chronic diseases, heart disease and cancer, together

accounted for nearly 46% of all deaths (“According to Chronic Disease Overview,” 2017). According to Turner-McGrievy, overweight and obesity are increasingly problematic in the United States, where two-thirds of the adults are overweight or obese and the prevalence of T2D among this population is 9.3%.

### Overview of Type 2 Diabetes

T2D is a significant chronic disease with an increasing prevalence rate worldwide. T2D results when the body does not produce enough or cannot properly use the insulin it produces (Asif, 2014). It is the leading cause of premature deaths and when improperly managed, it can lead to a number of health issues, including heart disease, stroke, kidney disease, leg and foot amputations, blindness, nerve damage and death (Asif, 2014). It is not only a dangerous condition when not properly controlled but also it presents many challenges, financially, since it is expensive to treat and manage. Obesity and other co-morbidities are strongly associated with a patient who also is diagnosed with T2D.

Diabetes branches off into various types. Type 1 Diabetes is also known as juvenile diabetes and insulin dependent diabetes, as it is typically diagnosed when a patient is still a child and the individual is dependent on an exogenous source of insulin for the remainder of his/her life. It is a chronic condition, specifically an autoimmune condition in which the pancreas produces very little to no insulin. (Asif, 2014). Type 1 Diabetes constitutes less than 5% of the total cases of diabetes (National Institute of Diabetes and Digestive and Kidney Diseases, 2016). T2D or adult-onset diabetes is different in comparison to Type 1 Diabetes, as the pancreas produces insulin but the body does not use the insulin properly. The most common type of diabetes, Type 2 usually begins when a person is in his or her mid-50s. T2D is heavily influenced by lifestyle factors as opposed to an autoimmune disease. While all types of this

illness are chronic, T2D is more preventable as it develops with co-morbidities and develops through environmental and lifestyle factors. Certain aspects in one's life can greatly increase the chances of getting this disease, with obesity and physical inactivity constituting the top reasons for the increasing burden that diabetes has in the developed world (Asif, 2014). Diabetes has become such a prevalent issue in our society. Despite availability of the wide range of pharmacological treatments and diabetes education from certified diabetic educators and other health care professionals, good control of diabetes and its comorbidities remains difficult (Trapp and Levin, 2012). The creation of the American Diabetic Association (ADA) diet and the use of synthetic insulin have proven to be helpful but not effective in managing the condition and preventing further damage. Attempts to comply with the "diabetic diet" tend to result in unnecessary restrictions of the wrong foods and overindulgence or monotonous consumption of certain food items (Asif, 2014). It is believed that this is due to the many misconceptions about what a diabetic can and should eat. A diet that has demonstrated effectiveness in managing diabetes, reducing BMI, lipid levels and the high blood sugar levels and therefore, the high A1C levels is the vegan diet.

### Veganism

Veganism is characterized as a lifestyle that excludes the consumption and use of all animal products. A vegan diet differs from the vegetarian diet, as vegetarians are defined as people who do not eat meat, poultry or fish, whereas dietary vegans refrain from consuming animal products, not only meat but also eggs, dairy products and other animal derived substances (Appleby & Key, 2015). This diet is also known as a plant-based diet as the foundation of the diet is based on a wide variety of whole plant foods: fruits, vegetables, whole grains, legumes, nuts and seeds. A healthy plant-based diet is one that aims to maximize consumption of nutrient-

dense plant foods while minimizing processed foods, oils, and animal foods, including dairy products and eggs (Hart, 2015). A vegan diet emphasizes unrefined carbohydrates and high-fiber foods, like fruits and vegetables and whole grains. It is indisputable that a diet centered around fruits and vegetables is healthy, and we have learned that vegan diets have resulted in improved glycemic control in T2D, lower serum cholesterol levels and no rise in serum triglycerides (Jenkins et al, 2003) but the goal for many studies was to discover the extent of just how beneficial a vegan diet can be.

#### Preventing Complications of T2D with a Vegan Diet

T2D is a very serious chronic disease, as its complications and effect on the body are systemic. Plant food components have a very significant impact on cardiovascular disease, which is one of the major complications of diabetes. Other diabetes-related complications include chronic kidney disease and diabetic angiopathy. Chronic kidney disease incidence also increases with age and is more common in diabetics than non-diabetic patients. A vegan diet is one of the most effective tactics in reducing the complications and reversing the effects of diabetes. This different dietary approach has been shown to be effective in the management of T2D through reducing A1c levels, BMI and lipid index. T2D is undeniably correlated with a high blood sugar level and eventually the cells of the body can become insulin resistant. In other words, the cells of the body do not respond correctly to the insulin that the body produces, therefore the insulin and glucose remain outside of the cell, and build up in the blood (Imatome-Yun, 2015). Going further, there is a scientific reason, explaining why the cells in the body become resistant to insulin.

### High-Fat Diet and T2D

Many people are knowledgeable that T2D is an acquired disease, a chronic condition caused by several factors, including lifestyles and genetics. Specifically, a particular lifestyle factor is diet, a high-fat diet. Many believe and argue that a high-carbohydrate diet is one of the causes of T2D since a carbohydrate is broken down into sugars for the body to use. However, a high-fat diet has a different effect on the body at a cellular level, and is the root cause of insulin resistant cells. What is not known to most people is that, as the amount of fat in the diet goes up, so does the blood sugar (Imatome-Yun, 2015). When a person eats, starches are broken down into glucose and it circulates as blood glucose or blood sugar (Imatome-Yun, 2015), where then the carbohydrates are taken up by the muscles to be stored and burned for energy. Blood sugar cannot go into the cell alone; it needs the help of insulin to move intracellularly. Imatome-Yun uses the analogy of a key and a door when describing how insulin works at the level of the cell. He states that insulin is like a key that unlocks the door to let sugar from our bloodstream into the cell. Without insulin, blood sugar will remain in the bloodstream without any way to get into the cell, so with nowhere to go, blood sugars will therefore, rise (2015). Specifically, for T2D, the insulin is produced and it is outside the cell, but it does not work properly as a facilitator of glucose transport as it should, therefore cells are deemed insulin resistant. Muscle cells can also become resistant to insulin. The fat inside the muscle cells is the reason why insulin is not as effective. The excess fat residing in the bloodstream can build up inside cell, thus causing toxic fatty break down and free radicals. As a result, these free radicals can and do block insulin. No matter how much insulin is in the blood, it will not work as effectively, therefore resulting in rising blood sugar levels in the blood (Imatome-Yun, 2015). The elevation of the fat in the blood or free fatty acid in the plasma can cause insulin resistance by its inhibition of glucose transport

into the muscles (Imatome-Yun, 2015). This inhibition can cause an elevation in blood sugar in as little as 3 hours. Many people assume that a diet high in carbohydrates will lead to acquiring diabetes. This is inaccurate, as we need sugar for our body to function. The sugar that is naturally found in food and the carbohydrates that we eat cannot be used when fat from a typical meat-based, animal-based diet is leading to an increase in the amount of fat in the blood. Ultimately, an increase in fat in the blood is a significant contributor to insulin resistance.

### Measurements of Weight

This discovery of the correlation between a high-fat diet and increase in blood sugar levels explains obesity as a comorbidity of T2D. A diagnosis of overweight or obese is the single best predictor of also developing T2D. A person who is overweight or obese has a higher fat content in his/her body as well as the diet, which increases the chances of developing T2D. The diagnosis of overweight or obesity is determined by calculating the BMI. A normal BMI ranges from 18.5- 24.9 for both men and women. Based on the BMI, a person would be overweight if he/she had a score of anywhere between 25- 29.9 and a person with a BMI of a score of 30 or more would be classified as obese. The BMI indicates that a person's weight is disproportional to his/her height, due to excess amount of fat and suggests that weight might increase the risk of health problems, such as heart disease, diabetes and cancer.

### BMI and T2D

Being obese has serious health consequences, as it is associated with an increased risk of T2D, cardiovascular disease, hypertension and certain cancers. Studies have shown that vegetarians and vegans have a generally lower BMI in comparison to omnivores as well as a lower prevalence of obesity and other chronic diseases. In one particular study, the objective was to determine whether a plant-based diet was a major contributing factor to a decrease in

BMI. The participants chosen all had a BMI of greater than or equal to 25. The control group, which also consisted of participants with a BMI of over 25, was instructed not to make any dietary or physical activity changes. Both groups had almost a similar amount of participants each, with 142 in the intervention group and 149 in the control group. As the control group, they were asked to remain constant in their diet and other lifestyle patterns. The participants in the intervention group were asked to follow a low-fat, vegan diet over the course of 18 weeks. Their diets were to compose of whole grains, vegetables, legumes and fruits only, avoiding animal products and to minimize added oils as much as possible. The participants in this group were educated on the healthy, vegan options in their workplace also on topics like the effect of diet on weight loss, diabetes, heart disease and cancer. Both groups were assessed physically at week 0 and week 18, the final week. Each participant's body weight, blood pressure and plasma cholesterol was measured. At the end of the 18 weeks, mean body weight decreased by 3kg in the intervention group and 0.06kg in the control group (Mishra et al, 2013). In terms of BMI, the mean BMI of the intervention group dropped by 1, whereas the mean BMI for the control group dropped by 0.01 (Mishra et al, 2013).

Participants in the intervention or vegan diet group also saw significant decreases in the total cholesterol, blood level and HbA1c levels. The study concluded that with a plant-based diet intervention, there was a significant weight loss. This randomized, controlled trial indicated that a vegan diet intervention yielded significant improvements in body weight and therefore, BMI, as evidenced by a greater weight loss demonstrated in the participants in the intervention group as opposed to the control group whose diets remained constant (Mishra et al, 2013). The study also concluded that as the only factor, a plant-based diet was still effective in weight loss, even in the absence of caloric restriction and exercise, thus demonstrating the efficacy of a plant-based

diet. In 18 weeks, on diet alone, participants were able to lose a significant amount of weight and decrease their BMI. One could argue that if the intervention group maintained the practice of a vegan diet, they would continue to steadily lose weight until they reached a healthy and normal BMI. Unfortunately, a limitation to this study is that participants were only observed for 18 weeks, so there is no data on whether the weight loss was sustained. A healthy BMI would thus lead to better management of T2D, as less serum fat in the body would make cells more sensitive to insulin.

### HbA1C level and T2D

One of the most significant factors in prevention and treatment of T2D is good glycemic control. Whether someone has good or poor glycemic control can be determined by the HbA1c level. Glycemic control is measured with the HbA1c test, which measures how much glucose in the blood binds to hemoglobin in the red blood cells. The test indicates to someone their average level of blood sugar over the past 3-4 months or the life of the red blood cell. For a person without diabetes, the normal range of the hemoglobin A1c level is between 4% and 5.6%. Generally, a level between 5.7% and 6.4% indicates that someone is at risk and has a higher chance of developing T2D, and a level at 6.5% or higher would be enough to diagnose someone with diabetes (Lee et al, 2016). In one particular study, the purpose of the research conducted was to compare the effect of a vegan diet and conventional diabetic diet on glycemic control in patients who were previously diagnosed with T2D. This randomized control trial consisted of 2 groups, the control group which followed the diabetic guidelines of the Korean Diabetic Association, and the experimental group in which participants were asked to follow a vegan diet consisting of whole grains, vegetables, fruits and legumes. They were also asked to follow instructions that were provided to these patients, which included rules such as, avoid all

animal food products and favor low-glycemic index foods (Lee et al, 2016). The instructions provided for the intervention group do in fact follow a standard vegan diet. Each group was randomly chosen and both groups were asked to maintain usual levels of exercise and physical activity, so that the major factor would be the diet. The objective was not to skew the outcomes. The study took place over a course of 12 weeks and at the end, the results showed that the HbA1c levels significantly decreased in both groups; however, the evidence indicated that there was twice as much a decrease in the vegan diet group in comparison with the control group (Lee et al, 2016). This was evident with a change in HbA1c level from baseline to the endpoint, which was greater in the vegan group. The participants in the vegan diet group, after only 12 weeks, were able to drop almost a whole percentage in A1c levels, which is significant as typically, A1c levels are usually consistent. To conclude, based on the evidence and the outcomes, the vegan diet seemed to be more effective for glycemic control among T2D patients (Lee et al, 2016). After about 3 months, a plant based diet had a major impact on a person's HbA1c level, and as that level decreases, so do the chances of further complications with the illness, and the disease becomes easier to manage.

### Lipid Levels and T2D

One of the major factors that contributes to insulin resistance is the increase of serum fat. The increase in lipids makes the cells become more resistant to insulin, thus resulting in a gradual build-up of serum glucose, raising the blood sugar levels in the body. There is a direct relationship between the increasing risk of developing chronic diseases with higher BMIs and higher percentages of body fat. Patients with T2D typically have an increased level of dyslipidemia. Cholesterol and lipid levels in vegans is primarily lower in comparison to non-

vegans. This difference is likely due to differences in fat intake and the quality of the fat, since processed and unprocessed meats have higher levels of trans fat and saturated fat. In contrast, fruits and vegetables have minimal unsaturated fat content. Another study was conducted to better understand if a dietary approach, specifically a vegan diet, would have an effect on abnormal lipid levels and improve glucose control in T2D patients (De Natale and Associates, 2009). The randomized crossover study was composed of 19 patients diagnosed with T2D, and each followed a diet that characterized a vegan diet, since it was high in carbohydrates and fiber and low in glycemic index. After a four week period, they followed a diet that was low in carbohydrates, low in fiber and high in glycemic index. Before the beginning of a new diet, the participant's fasting blood sample, LDL, HDL, cholesterol and triglycerides were measured and recorded (De Natale and Associates, 2009). At the end of each diet, the participants were each given a "test meal" that was similar to the diet that they were on for the past 4 weeks. After ingesting the meal, the plasma lipoproteins and blood glucose levels were measured. The results indicated that at the end of the vegan diet, which consisted of being rich in carbohydrates and fiber, there was a significant reduction of total cholesterol in comparison to the low carbohydrate and low fiber diet. Triglyceride levels were also 30% lower after four weeks on the vegan diet. In regards to the test meals, both triglycerides and cholesterol levels were lower after the test meal at the end of the high-carbohydrate and high-fiber diet.

The study concluded that a vegan diet that is rich in carbohydrates and dietary fiber induces a major reduction of lipoproteins in T2D patients. Even though the vegan diet that the participants were on was a high-carbohydrate diet, the blood glucose levels actually decreased due to the quality of the carbohydrate (De Natale and Associates, 2009). This study also

supports the belief that a high-fat diet has a greater negative effect on the body in terms of blood glucose levels than a high-carbohydrate diet.

### Conclusion

The results of these cited studies have clearly demonstrated that there is a strong correlation between a plant-based diet and the prevention and treatment of T2D. The data indicates that a diet low in fats, high in carbohydrates and fiber can lower BMI, lipid levels as well as HbA1c levels. By reducing these critical factors, T2D can be much more easily managed and its risk of developing greatly decreases. A long-term adoption of a plant-based diet will lead to a sustained lower BMI and lipid levels and glycemic index. The review of the data demonstrates that a move towards a more plant-based diet is necessary in treating T2D as well as reducing the risk of developing the disease. Each study resulted with a significant decrease in either BMI, HbA1c level or lipid level, which are all major contributing factors to the complications and further degradation of T2D. It can be concluded that if a participant were to follow the vegan diet further than the allotted time during the study, these levels would continue to decrease until the participant reached a healthy level. The same could be theorized regarding someone who is not yet diagnosed. If a healthy person began a vegan diet, then his/her lipid levels, HbA1c levels and BMI would not increase, thus decreasing his/her chance of developing a chronic disease. This strong evidence points to a plant-based diet having the ability to reverse the factors that worsen the chronic disease in someone who is already diagnosed with T2D. It is evident that a vegan diet is strong and effective in the management and also prevention of chronic diseases, like T2D.

### Impact of Meat Culture

Beginning during the 20<sup>th</sup> century, there has evidently been a massive and global shift towards an increase in consumption of meat and animal –based products (Graca, Calheiros, Oliveira, 2015). Within the western countries alone, meat has become a quintessential representation of the idea of food. Americans in particular are noted for their desire for the overconsumption of not only food in general but of such animal-based foods, like meat, eggs and dairy products (Templeton, 2014). In the US and other developed countries, meat has been and still continues to compose a significant portion of a typical diet. Specifically, in the United States, meat is so central to the typical American life. It has become a focal point, the centerpiece in holidays and special occasions. Whether it is a turkey during Thanksgiving, grilled hotdogs and hamburgers on the 4<sup>th</sup> of July, meat has a very special relationship in our nation’s culture. The United States remains the highest consumer of total meat, with the majority of Americans believing that the more protein, the better (Templeton, 2014).

A major misconception that is a commonly held belief among Americans is that one cannot achieve a diet of complete protein solely through eating a plant-based diet; however, what is not as well known is that all protein is initially made by plants. The protein that is obtained by eating animals is simply recycled plant protein. It is not necessary to eat animal tissue to get complete protein in your diet. Most Americans only get half the daily recommendation of fiber whereas more than half of the United States’ population is meeting or exceeding the daily total grains and protein recommendations. In addition, almost all Americans exceed the daily recommendations for added sugar, saturated fat and sodium. Through this diet, the population is also exceeding the caloric intake recommendation. Most often, their diet consists of these high-calorie foods that are less nutrient dense than fruits and vegetables. American’s excessive

consumptions of poor food choices harms their health and quality of life. With increasing rates of childhood obesity and T2D, it is projected that the average life span for younger generations is now shorter than in previous generations (Rogers, 2016). This is mostly due to dietary patterns but also paired with a significant lack of physical activity. American life expectancy is in decline for the first time since 1993, whereas in every other industrialized country, life expectancy is projected to increase. The overall death rate for the United States has also increased 1.2%. Rogers also states that 8 of the top 10 causes of death were responsible for an increase in the death rate, including those from heart disease, diabetes and kidney disease.

#### Effect of Diabetes in Healthcare

The trend of increasing diagnoses of chronic diseases, such as heart and kidney disease is becoming such a prevalent issue in our society that it is changing the healthcare field, as it constantly shifts to accommodate the rapidly increasing cases of chronic diseases. Advanced and more extreme surgeries are becoming more and more common. The incidences of heart disease and obesity have reached such high levels that surgeries like open heart surgery, coronary artery bypass grafting (CABG), stent placements gastric bypass and gastric sleeves must be performed to either prevent further complications or solve as a temporary solution to a pre-existing complication (National Heart, Lung and Blood Institute, 2014). Chronic diseases have such an incredible impact on the healthcare industry. It dictates the direction of the field in terms of innovating and introducing new surgical techniques and pharmacological interventions. The implementation of these interventions effect not only the healthcare industry but also the economy. Chronic diseases account for the vast majority of health spending. In the United States, total spending on public and private health care combined amounted to about \$2 trillion in

2005. Of the \$2 trillion spent, more than 75% went towards the treatment of chronic diseases, such as procedures (Rogers, 2016).

### Complications of T2D

Specifically, for T2D, there are numerous microvascular complications that can occur if the disease is not properly managed. A serious complication is called diabetic angiopathy, which affects almost 90% of diabetics (Schreiber et al, 2015). Diabetic angiopathy is a microvascular complication of diabetes that can potentially be debilitating (Stein, 2012). As it is a microvascular complication, it means that it can affect areas of the body where vessels are smaller in size. Diabetic angiopathy affects the vessels, leading to damage to capillaries in the kidneys as well as the nerves and the retina (Stein, 2012). This is termed diabetic triopathy; nephropathy, retinopathy and neuropathy. Diabetic angiopathy leads to neuropathy specifically, causing nerve damage principally in the lower extremities. Additionally, diabetic angiopathy is responsible for retinopathy causing blindness in a large percentage of T2D. Studies found that diabetic retinopathy was responsible in one of every 39 cases of blindness and one of every 52 cases of visual impairment (Tucker, 2016). These complications arise when a person has uncontrolled diabetes. Diabetic angiopathy also significantly affects the feet, which is why foot care is so critical for diabetic patients. Without the full function of the nerves, patients have difficulty with distinguishing sensations on their feet, which makes them much more susceptible to infections and ulcerations. Patients with diabetic neuropathy may not notice when there is an open wound on their feet, allowing for infection and sores to develop (Schreiber et al, 2015). An infection always has the potential to spread, and as a result, the only solution to prevent further systemic spreading of the infection is to amputate the affected toes and/or foot. While there have been advances in science, these surgeries have been developed out of necessity to alleviate the

complications that have already developed in patients with chronic illnesses. The trend that science and technology has been advancing throughout the past few decades reflects tertiary form of prevention, when the patient already has a disease that he/she will most likely permanently have. The medical field is mostly approaching the issues from a perspective that the patient already has a chronic illness or complications from a chronic illness. Either way, the surgeries previously mentions are not an effective treatment, as they not only present with serious risks, especially invasive procedures, like open heart surgery and kidney transplants, but also they are not effective in treating the actual root of the problem, which is the actual chronic disease itself. On the contrary, surgery only helps in managing the symptoms and reducing the complications, while the chronic illness is not being addressed.

#### Primary Prevention of T2D

For any caregiver, especially nurses, it is difficult to take care of a patient with a chronic illness for numerous reasons, the major reason being that the decision to change is all on the patient. A chronic illness arises mostly from lifestyle choices and personal factors, so treating the illness involves changing the lifestyle, which can only be done by the patient. A caregiver can do everything to manage the symptoms and the secondary issues to the chronic illness and educate the patient on the best lifestyle choices; however, it is ultimately up to the willingness of the patient to actually make a change. It is especially challenging for patients to make major lifestyle changes, when their habits are engrained and have stayed the same for years. For this sole reason, it is so imperative that prevention and education on positive lifestyle behaviors begins at an early age. The ultimate way to effectively prevent chronic illness is through education. Chronic diseases differ greatly from communicable diseases. With infectious illnesses, primary prevention includes vaccines and proper hygienic measures. Over the years,

research has shown how a communicable disease is spread and from then, the healthcare field has learned and developed ways to prevent these diseases from infecting others. Chronic diseases affect the body in a very different way, therefore the approach in terms of primary prevention must differ as well. Since chronic diseases arise from lifestyle choices, which are habits that are formed at a young age and influenced by society, then education about these chronic diseases must be taught at an early age, too. Education needs to be on these topics as well as the right choices to further increase the chances of disease prevention. Exercise and healthy diet choices are topics that must be emphasized, so that children and the younger generation know how to protect themselves from chronic, preventable diseases, just as we have learned that vaccines and washing our hands can protect us from communicable illnesses.

#### Secondary Prevention of T2D

In terms of secondary prevention, an increase in screenings is critical. Diagnosing patients with T2D has increased dramatically through advances in technology, as it has given us the capability to detect diabetes in its earlier stages, as well as those who are at a greater risk for developing T2D at a younger age. Not only do lifestyle factors play a major role in the development of T2D, but also genetics impacts the risk as well. Screenings and testing those who are genetically predisposed to develop T2D must be checked more regularly, so that the disease can be caught and detected at a much earlier stage. When diagnosed earlier, patients have the chance to start treatments and make changes to aim to reduce the impact of the disease and decreasing the chances of any complications. Through screening tests and regular exams, the goal is to detect any chronic disease as early as possible or notice any anomaly that makes someone more likely to develop any disease. Early diagnosis will give awareness to the individual and can prevent further damage from the disease.

### Tertiary prevention of T2D

Tertiary prevention is crucial and should be emphasized especially with those who have already been diagnosed to lessen the impact of the complications and challenges of the disease. For diabetics, this can be in the form of education regarding a change of lifestyle, particularly with diet and exercise and a maintenance and good control of a normal blood sugar level. Through the previously discussed studies, vegan diets are effective and can be applied to all three levels of prevention. The studies point to the evidence that a plant based diet is effective in managing specific levels in the body that can lead to complications of T2D. Properly managed blood sugar levels can be controlled when lipid levels are lowered, evidenced by various research indicating the possibility through a plant-based diet. A vegan diet can reduce the risk of developing T2D and for those who already have diabetes, a low-fat, plant-based approach has shown effectiveness for not only metabolic control and weight loss but also cardiovascular risk reduction (Trapp & Levn, 2012). With the substantial evidence concluding a noticeable reduction in BMI, HbA1c levels and blood lipid levels, it is indisputable that a vegan diet represents itself as one of the most effective means not only for the treatment of a chronic illness, like T2D but also for the prevention of them as well.

### Conclusion

At a time when chronic disease rates are at unprecedented incidences, it is crucial now more than ever for the public to be fully educated on various types of diets as well as the effects of meat and animal-based products on the body. Currently, the healthcare industry and society pushes for preventing chronic diseases before they begin to develop, but there is little evidence

that shows the industry pushing for primary prevention of these chronic illnesses. While primary prevention through diet and other various lifestyle choices can affect a person's chances of developing a chronic illness, there is still a heavy emphasis in the healthcare industry for physicians and specialists to treat patients when they are already sick and diagnosed with a disease. The interventions that are still mostly used today are machine heavy, in which radical surgical procedures and pharmaceutical involvement are suggested first rather than a change in diet. As our society has grown and developed with technology, so has our desire for instant gratification. If there is a problem, people want the fastest solution, which may not necessarily be the safest or most effective; however, because it offers a rapid resolution, people are more likely going to choose the surgery or choose the medication rather than taking control of their actions and changing their lifestyle. It has become such a popular notion that drugs are one of the ways to legitimately treat a disease. While this may not be necessarily true, it is easy for people to believe this, as they take a medication and the therapeutic effects take place within hours. Humans are habitual creatures and it can be very difficult to change ways when it is easy and comforting. It can be challenging to eliminate meat from a meal that is traditional to one's culture. It is undoubtedly difficult to break a habit as well as to accept a new way of thinking. It has been a general way of thinking that most if not all chronic diseases occur because of genetics and that the chances of developing a disease are much higher if there is a family history. Most people believe this and accept this potentially pre-determined fate because this is what research has found. Through the most current research, it has been found that we are in control of our health. Every individual, regardless of gender, race and family history has the ability to control what goes into his/her body and therefore, has the ability to control what happens after.

Ultimately, every individual has the choice to make the right dietary changes that can result in positive health outcomes.

All across the world, and in particular, the United States is in the midst of a chronic disease epidemic. It is projected that over the course of the next couple of decades that one third of Americans will be diagnosed with diabetes. This includes children and the younger generation, which will result in shorter lifespans. The link between an animal-based diet is undeniable. Eating sugar will not cause plaque to form in vessels, as excess sugar is stored as glycogen. It is the processed meats that are riddled with saturated fats that will result in plaque formation and an increase in cholesterol levels. The focus on sugar and the irrational belief that ingesting high amounts of sugar will lead to diabetes has taken the focus off of the real issue, which is the significant effects of meat and dairy on the body. The various studies reveal concrete evidence of the positive systemic effects that a plant-based diet possesses. There are various facets and components of a plant-based diet that definitively show positive effects on hyperglycemia and the improvement of T2D. The current approaches to combating this chronic disease epidemic are clearly not working and the trend of an increase in these chronic diseases will continue if the proper and most effective interventions are not emphasized and implemented. Chronic diseases, like T2D do not have to be the fate for Americans. The multiple peer-reviewed studies show that a low-fat plant-based, vegan diet is shown to be powerful and effective in controlling and even reversing multiple chronic diseases. The health of those following a vegan diet has been shown to be significantly enhanced than those who incorporate meat and animal-based products into their diet. The proof is in the plants; the studies show that society can not only survive on a purely vegan, plant-based diet, but also that we can thrive.

Addendum

Sample of Vegan Menu for One Week

**Monday:**

**Breakfast:** Steel-cut oatmeal, sliced bananas, walnuts, rice milk

**Lunch:** Whole grain pasta with veggie sausages, sun-dried tomatoes, broccoli; salad

**Dinner:** Seitan Parmesan with tomato sauce, green beans, mashed potatoes

**Tuesday:**

**Breakfast:** Bagel with Earth Balance butter

**Lunch:** Sandwich with vegan cold cuts, nondairy cheese, avocado, pickles; tomato soup

**Dinner:** Tacos with "meat" crumbles, nondairy cheese, guacamole; salad

**Wednesday:**

**Breakfast:** Bagel with almond or peanut butter

**Lunch:** Split pea soup with tempeh bacon, (nondairy) cheesy toast; salad

**Dinner:** Stuffed butternut or acorn squash with tofu; sautéed collard greens

**Thursday:**

**Breakfast:** Frozen waffles with Earth Balance butter, maple syrup

**Lunch:** Black bean and soy cheese quesadilla with guacamole; salad

**Dinner:** Pan-seared Gardein fillet with shiitake mushroom sauce; mashed potatoes and braised Brussels sprouts

**Friday:**

**Breakfast:** Brown rice (I make several days' worth at a time), chopped dates, almonds, nondairy milk poured over

**Lunch:** Cabbage, thyme and meatless ground beef soup; 7-grain garlic bread

**Dinner:** Coconut curry tofu with whole grain wild rice and green beans

**Saturday:**

**Breakfast:** Brown rice with blueberries and almonds; hemp milk

**Lunch:** Smoked paprika pinto beans with quinoa and sautéed kale

**Dinner:** Charred seitan skewers, wheat berries; chili broccoli

**Sunday:**

**Breakfast:** Whole grain pancakes and blueberries; tempeh bacon

**Lunch:** Chili with pinto beans, tomatoes, peppers and onions, soy sour cream; salad

**Dinner:** Seitan Parmesan (seitan fillets with melted nondairy cheese, tomato sauce), collard greens, mashed potatoes

## References

- Graca, J., Oliveira, A., & Catheiros, M.M. (2015). Meat, beyond the plate. Data-driven hypotheses for understanding consumer willingness to adopt a more plant-based diet. *Appetite*, 9080-90. Doi:10.1016/j.appey.2015.02.037
- Graca, J., Catheiros, M.M., & Oliveira, A. (2015). Attached to meat? (Un)Willingness and Intentions to adopt a More Plant-based Diet. *Appetite*, 95113-125. doi.10.1016/j.appet.2015.06.024
- De Natale, C., Annuzzi, G., Bozzetto, L., Mazzarella, R., Costabile, G., Ciano, O., & ... Rivellesse, A. A. (2009). Effects of a Plant-Based High-Carbohydrate/High-Fiber Diet Versus High-Monounsaturated Fat/Low-Carbohydrate Diet on Postprandial Lipids in Type 2 Diabetic Patients. *Diabetes Care*, 32(12), 2168-2173. doi:10.2337/dc09-0266
- Kahleova, H., Levin, S., & Barnard, N. (2017). Cardio-Metabolic Benefits of Plant-Based Diets. *Nutrients*, 9(8), 848. <http://doi.org/10.3390/nu9080848>
- McEvoy, C. T., Temple, N., & Woodside, J. V. (2012). Vegetarian diets, low-meat diets and health: A review. *Public Health Nutrition*, 15(12), 2287-94. doi:<http://dx.doi.org/10.1017/S1368980012000936>
- Trapp, Caroline, MSN, APRN,B.C.-A.D.M., C.D.E., & Levin, Susan,M.S., R.D. (2012). Preparing to prescribe plant-based diets for diabetes prevention and treatment.*Diabetes Spectrum*, 25(1), 38-44. Retrieved from

<http://library.ramapo.edu:2048/login?url=https://search.proquest.com/docview/926821056?accountid=13420>

Stein, J. (2012). Vegan diet benefits type 2 diabetics. *Renal & Urology News*, 11(9), 37.

Retrieved from

<http://library.ramapo.edu:2048/login?url=https://search.proquest.com/docview/1312429084?accountid=13420>

Templeton, David. (2014, June 30). The Vegan Community is Small but Active and Research Shows its Health Benefits. *The Pittsburgh Post-Gazette*. Retrieved from <http://www.post-gazette.com/news/health/2014/07/01/The-vegan-community-is-small-but-active-and-research-shows-its-health-benefits/stories/201407010015>

Wolfram, T., & Ismail-Beigi, F. (2011). Efficacy of high-fiber diets in the Management of of Type 2 Diabetes Mellitus. *Endocrine Practice*, 17(1), 132-142. Retrieved from <http://library.ramapo.edu:2048/login?url=https://search.proquest.com/docview/1700651511?accountid=13420>

Satija, A., Bhupathiraju, S. N., Rimm, E. B., Spiegelman, D., Chiuve, S. E., Borgi, L, Hu, F. B. (2016). Plant-based dietary patterns and incidence of type 2 diabetes in US men and women: Results from three prospective cohort studies. *PLoS Medicine*, 13(6)  
doi:<http://dx.doi.org/10.1371/journal.pmed.1002039>

Lee, Y., Kim, S., Lee, I., Kim, J., Park, K., Jeong, Lee, D. (2016). Effect of a brown rice based vegan diet and conventional diabetic diet on glycemic control of patients with type 2 diabetes: A 12-week randomized clinical trial. *PLoS One*, *11*(6)

doi:<http://dx.doi.org/10.1371/journal.pone.0155918>

Turner-McGrievy, G., Jenkins, D. J. A., Barnard, N. D., Cohen, J., Gloede, L., & Green, A. A.

(2011). Decreases in dietary glycemic index are related to weight loss among individuals following therapeutic diets for type 2 Diabetes1-4. *The Journal of Nutrition*, *141*(8), 1469-74. Retrieved from

<http://library.ramapo.edu:2048/login?url=https://search.proquest.com/docview/884811324?accountid=13420>

Harland, J., & Garton, L. (2016). An update of the evidence relating to plant-based diets and cardiovascular disease, type 2 diabetes and overweight. *Nutrition Bulletin*, *41*(4), 323-338. doi:10.1111/nbu.12235

Kim, S. J., deSouza, R. J., Choo, V. L., Ha, V., Cozma, A. I., Chiavaroli, L., Sievenpiper, J.

L. (2016). Effects of dietary pulse consumption on body weight: A systematic review and meta-analysis of randomized controlled trials. *The American Journal of Clinical Nutrition*, *103*(5), 1213. Retrieved from

<http://library.ramapo.edu:2048/login?url=https://search.proquest.com/docview/1790727475?accountid=13420>

Asif, M. (2014). The prevention and control the type-2 diabetes by changing lifestyle and dietary pattern. *Journal of Education and Health Promotion*, 3, 1.

doi:<http://dx.doi.org/10.4103/2277-9531.127541>

Dyett, P. A., Sabaté, J., Haddad, E., Rajaram, S., & Shavlik, D. (2013). Vegan lifestyle behaviors. An exploration of congruence with health-related beliefs and assessed health indices. *Appetite*, 67119-124. doi:10.1016/j.appet.2013.03.015

Barnard, N. D., Cohen, J., Jenkins, D. J. A., Turner-McGrievy, G., Gloede, L., Green, A., & Ferdowsian, H. (2009). A low-fat vegan diet and a conventional diabetes diet in the treatment of type 2 diabetes: A randomized, controlled, 74-wk clinical trial. *The American Journal of Clinical Nutrition*, 89(5) Retrieved from <http://library.ramapo.edu:2048/login?url=https://search.proquest.com/docview/231931752?accountid=13420>

Vegan diet may be right choice for managing type 2 diabetes. (2017). *Endocrine Today*, 15(7), 4-5. Retrieved from <http://library.ramapo.edu:2048/login?url=https://search.proquest.com/docview/1920027065?accountid=13420>

Katcher, H. I., Ferdowsian, H. R., Hoover, V. J., Cohen, J. L., & Barnard, N. D. (2010). A Worksite Vegan Nutrition Program Is Well-Accepted and Improves Health-Related

Quality of Life and Work Productivity. *Annals Of Nutrition & Metabolism*, 56(4), 245-252. Retrieved from doi:10.1159/000288281

Tucker, Miriam E., (2016 August 26). Blindness Due to Diabetic Retinopathy Surges Worldwide. *Diabetes Care*. 2016; 39: 1643-1649. Retrieved from <https://www.medscape.com/viewarticle/867987>

Ajala, Olubukola., English, Patrick., Pinkney Jonathan. Systematic review and meta-analysis of different dietary approaches to the management of type 2 diabetes. *The American Journal of Clinical Nutrition*, Volume 97, Issue 3, 1 March 2013, Pages 505–516, <https://doi.org/10.3945/ajcn.112.042457>

Le, L. T., & Sabaté, J. (2014). Beyond Meatless, the Health Effects of Vegan Diets: Findings from the Adventist Cohorts. *Nutrients*, 6(6), 2131–2147. <http://doi.org/10.3390/nu6062131>

Haider, Lisa M., Schwingshackl, Lukas, Hoffmann, Georg, Ekmekcioglu, Cem. (2016) The effect \_of vegetarian diets on iron status in adults: A systematic review and meta-\_\_\_\_\_analysis. *Critical Reviews in Food Science and Nutrition* 0:0, pages 1-16. <http://www.tandfonline.com/doi/abs/10.1080/10408398.2012.736093?journalCode=bfsn20>

Kahleova, H., Matoulek, M., Malinska, H., Oliyarnik, O., Kazdova, L., Neskudla, T., ...

Pelikanova, T. (2011). Vegetarian diet improves insulin resistance and oxidative stress markers more than conventional diet in subjects with Type 2 diabetes. *Diabetic*

*Medicine*, 28(5), 549–559. <http://doi.org/10.1111/j.1464-5491.2010.03209.x>

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3427880/>

Imatome-yun, Naomi. (2015, April 16). How does Fat Affect Insulin Resistance and Diabetes?

*Forks Over Knives*. Retrieved from [https://www.forksoverknives.com/fat-insulin-](https://www.forksoverknives.com/fat-insulin-resistance-blood-sugar/#gs.0S9Lmw8)

[resistance-blood-sugar/#gs.0S9Lmw8](https://www.forksoverknives.com/fat-insulin-resistance-blood-sugar/#gs.0S9Lmw8)

(2018). Deadly Diseases: Epidemics throughout History. *CNN*. Retrieved from

<http://www.cnn.com/interactive/2014/10/health/epidemics-through-history/>

Daniel, C. R., Cross, A. J., Koebnick, C., & Sinha, R. (2011). Trends in meat consumption in the United States. *Public Health Nutrition*, 14(4), 575–583.

<http://doi.org/10.1017/S1368980010002077>

(December 2015). *Dietary Guidelines for Americans: 2015-2020. 8<sup>th</sup> Edition*. Retrieved from

<https://health.gov/dietaryguidelines/2015/guidelines/>

Rogers, Katie. (2016, December 8). Life Expectancy in U.S. Declines Slightly, and Researchers are Puzzled. *The NY Times*, p. D5. Retrieved from

<https://www.nytimes.com/2016/12/08/health/life-expectancy-us-declines.html>