

# A Look at Plant-Based Diets

by Julia Clem, MD & Brandon Barthel, MD



**A well-planned diet of plant-based whole foods incorporating a variety of vegetables, whole grains, nuts, and legumes can be one tool to help physicians and patients address the chronic lifestyle diseases with which many struggle.**



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## Introduction

A high sugar, high fat, processed food-laden diet has contributed significantly to the burden of obesity and chronic disease in America. Not only do Americans consume fewer than the recommended daily servings of fruit and vegetables, but the average American eats approximately 200 pounds of red meat and poultry each year.<sup>1</sup> This volume is higher than needed to meet the average daily calorie and protein requirements of a healthy diet. According to recent data published by the Centers for Disease Control (CDC), just over 42% of Americans are obese.<sup>2</sup> Rates of obesity-related diseases such as cardiovascular disease, hypertension, and type 2 diabetes mellitus are at an all-time high. These common chronic diseases are known to be heavily impacted by diet and lifestyle. As a result, many people are looking to modify their diets for weight loss and improve their overall health.

Many Americans will go to extreme lengths to lose weight, as is evident from the proliferation of fad diets like the South Beach diet and the cabbage soup diet. Many physicians recommend plans such as the Mediterranean diet to help patients manage chronic comorbidities and pursue their health goals. Though perhaps less often recommended by physicians, a whole food, plant-based diet is another evidence-based option

which can promote weight loss and ameliorate many so-called lifestyle diseases. Physicians need to understand the benefits and possible risks of alternative diets in order to effectively counsel patients on their adoption.

## Plant-Based Diets Through the Ages

Throughout human history, different groups have adhered to plant-based diets. In ancient Greece, the philosopher Pythagoras extolled the health benefits of a vegetarian diet and taught that animal slaughter was immoral. This tenet was based on his belief that the immortal soul was reincarnated after death of the body. He and his disciples ate a simple diet of bread, honey, and vegetables. Thus, until the 1800s, a plant-based diet was known widely as the Pythagorean Diet. Many religions feature a long tradition of adhering to a vegetarian diet, including both Buddhism and Jainism. Much like Pythagoras's followers, these religions approach the plant-based diet through the lens of nonviolence. In contrast, in the mid-1800s, the newly formed Seventh-Day Adventist Church advocated a vegetarian diet for its adherents, although its aim was to promote personal health and longevity rather than adhere to an ethical framework.

Today, plant-based eating continues to be popular. The number of Americans who follow a vegan diet decreased 600% from



2014 to 2018.<sup>3</sup> Interest in plant-based diets is driven by a number of factors. Many choose a plant-based diet in the pursuit of health, out of concern for animal welfare, or as a way to reduce their environmental footprint. Some have also been driven in part by celebrity endorsement, media attention, and popular documentaries. Regardless of the reasons for their change, more Americans than ever are seeking to incorporate more plant-based foods into their diet.

As interest in plant-based diets has grown, so too has the market. Many restaurants are incorporating meat alternatives into their options, with some crafting and marketing dedicated plant-based menus. Items like the Beyond Burger® are popular among vegans and meat-eaters alike. In grocery stores, plant-based egg, cheese, and milk alternatives have driven sales. The interest in plant-based alternatives is evident; the plant-based foods market has increased 29% in the U.S. between 2017 and 2019.<sup>4</sup>

### Obesity

There are many benefits to consuming a diet high in fresh fruits and vegetables, one being better weight control. Multiple studies have linked plant-based diets to a lower BMI, and experimental data has shown that switching to a plant-based diet can help with weight loss. One example is a 16-week randomized control clinical analysis published in 2018.<sup>5</sup> This study assessed whether a diet void of animal protein and rich in plants would affect one's body fat percentage, body mass index (BMI), and degree of insulin resistance. Participants were counseled not to change their physical activity level, and those in the control group continued their previous omnivorous diets. The findings demonstrated an association between eating plant-based protein and decreased BMI, lower visceral fat, and improved insulin resistance.<sup>5</sup> A systematic review published in January 2020 analyzing 40 diet- and weight-related case studies or cohort studies reported that those following a vegan diet were less likely than those following any other diet to be overweight and had lower BMIs.<sup>6</sup>

### Cardiac Health

In addition to helping improve insulin sensitivity and decrease BMI, a vegan diet may reduce risk of cardiovascular disease and improve cardiac function. This is of particular importance given that the CDC ranked heart disease as the leading cause of death in the United States in 2020.<sup>7</sup> There have been many

studies that researched how a plant-based diet affects cardiovascular outcomes.

The Lifestyle Heart Trial examined the relationship between atherosclerosis and diet. In this study, patients with cardiac disease were switched from their standard omnivorous diets to either a plant-based diet or the American Heart Association Diet, which is the current standard of care dietary intervention. The study found that 34% more patients on the plant-based diet had reduction of atherosclerosis than those on the diet recommended by the American Heart Association.<sup>8</sup>

A meta-analysis featuring seven prospective cohort studies reviewed heart health in vegetarians vs. omnivores. The analysis concluded that those who do not consume meat have significantly lower rates of both ischemic heart disease and all-cause mortality.<sup>9</sup>

In a combined evaluation of five prospective analyses comparing omnivore vs. vegetarian rates of death from ischemic coronary disease, vegetarians were found to have 24% lower rates of death from ischemic heart disease than those who ate meat after controlling for factors such as smoking status, age, and gender.<sup>10</sup>

A recent experimental study swapped amateur athletes' omnivorous diets to a vegan diet and studied the athletes' cardiac structure via echocardiogram prior to and following the diet. This study suggested that actual structural remodeling of the heart can occur when switching from an omnivorous diet to a plant-based diet.<sup>11</sup> This structural remodeling of the heart, albeit noted in healthy athletes, may play a role in the documented improvement of health in those with cardiovascular disease who adapt a plant-based diet.

### Type II Diabetes Mellitus

Evidence suggests that a plant-based diet can help patients with type II diabetes achieve weight loss and improve glycemic control. The American Diabetes Association (ADA) Standards of Medical Care in Diabetes recognizes a plant-based diet as a viable option for patients with type II diabetes.<sup>12</sup> Multiple studies have shown an inverse relationship between a vegan diet and type II diabetes.<sup>13</sup> Research published in the *Journal of Nutritional Medicine* in 1994 studied 21 patients with type II diabetes who simultaneously changed to a diet free of animal products and began an exercise regimen.<sup>14</sup> Notable improvements included a decrease in triglycerides, total cholesterol, fasting blood glucose, and insulin resistance. Within two weeks, participants' fasting blood glucose dropped an average

# The Many Variations of a Plant-Based Diet



**Vegetarian:** Also known as ovo-lactovegetarian, this diet includes all plant-based foods, as well as allowing eggs and dairy.

**Vegan:** This is a diet that consists of plant-based foods only and excludes meat, dairy, eggs, and often honey. Many who follow this lifestyle do so for ethical or environmental reasons, and other lifestyle modifications are typically included in addition to the dietary changes.

**Pescatarian:** This is a largely vegetarian diet that also includes seafood.

**Whole-foods, plant-based (WFPB):** Extremely similar to a vegan diet, this diet eschews the ethical baggage and focuses on the health aspect. High in fruit, vegetables and whole grains while typically low in fat.

**Flexitarian:** This is a broad term used by those who primarily follow a vegetarian or plant-based diet, but allow for some meat, dairy, and seafood on occasion.

of 35%, and five participants improved so much that they no longer required glucose-lowering medications. During long-term follow-up for four years, 17 out of the 21 patients had remained on the vegan diet and continued with an exercise program. These patients continued to have improved glycemic control.

Whereas meat consumption has been linked to an increased risk of developing diabetes, higher intake of fruits and vegetables has been shown to reduce the risk by as much as 50%. A prospective 10-year-long case-cohort study of over 300,000 individuals found an inverse relationship between the amount of fruits and vegetable servings eaten per day and risk of developing type II diabetes mellitus.<sup>15</sup> This research, published in *BMJ* in July 2020, found that increased produce intake was linked to higher levels of plasma vitamin C and carotenoids, markers of vegetable and fruit consumption, which was associated with decreased development of diabetes. Participants who developed diabetes over the course of the study had markedly lower biomarkers of fruit and vegetable intake than those who did not develop diabetes. Following a whole food plant-based diet, or simply increasing daily fruit and vegetable consumption, is one step individuals can take to reduce their risk of type II diabetes.

## Hypertension

A meta-analysis and systematic review of 24 studies published between the years 1984 and 2019 was conducted to analyze the effect that dietary changes had on blood pressure in patients with type II diabetes.<sup>16</sup> The vegan diet was reviewed alongside other popular diets including the Dietary Approaches to Stop Hypertension (DASH) diet and the Mediterranean diet. All dietary changes were analyzed against a control, defined as patients making no dietary changes. The vegan diet, along with several others, was found to significantly lower both systolic and diastolic blood pressure.

A similar systematic review published in 2020 found that a vegan diet is associated with a significant decrease in blood pressure in those with hypertension (WMD = -3.118, 95% CI = -4.540, -1.696).<sup>17</sup> Those that followed either a vegetarian diet or a vegan diet reported decreases in blood pressure, although the decrease was more significant in those that followed a fully vegan diet. High blood pressure contributes to many other health complications and can compound the risks that those with diabetes already have. Hypertension is an independent risk factor for both heart disease and stroke; however, those with both



diabetes and hypertension have the highest risk of fatal stroke. With more emphasis on dietary change, patients could see a substantial decrease in blood pressure while decreasing polypharmacy and the side effects that anti-hypertensive medications can provoke.

### **Dyslipidemia**

Consumption of dietary cholesterol found in meat and dairy products contributes to atherosclerosis and heart disease. Since humans are capable of synthesizing all needed cholesterol, further dietary intake is not required for optimal function. A study published in May 2020 analyzed the correlation between meat consumption and low-density lipoprotein (LDL) levels in patients diagnosed with coronary artery disease.<sup>18</sup> The mean LDL level in the omnivorous group was found to be 34.75 points higher than the mean of the vegetarian group. Similarly, a large review of vegetarian diets and health outcomes, published in 2020, found there to be a clinically significant decrease in both total and LDL cholesterol levels in those who do not consume meat or fish products.<sup>13</sup> High levels of LDL are known to increase both the risk and severity of coronary artery disease including heart disease, angina, and myocardial infarction. Therefore, reducing dietary cholesterol by eliminating meat and dairy from one's diet may represent one option to reduce risk of coronary disease.

### **Cancer**

Although many studies have been inconclusive as to whether or not vegetarian diets reduce risk of various specific cancers, some studies have suggested that eating processed meats such as ham, bacon, and salami pose an increased risk of developing cancer. In fact, the World Health Organization (WHO) classified processed meats as a Group 1 carcinogen and red meats as a Group 2 carcinogen.<sup>19</sup> Examination has also identified heme iron, the iron obtained by eating animal tissue, to be a risk factor for colorectal cancer.<sup>20</sup> Further recent research has suggested a dose-related effect between the amount of heme iron consumed and overall colorectal cancer risk due to heme-mediated DNA damage. A cohort study in 2006 of French women concluded that women whose diets were rich in meats had a greater likelihood of developing colorectal cancer than those who did not consume large amounts of red meat.<sup>21</sup>

These studies suggest that plant-based diets may decrease modifiable risk factors for certain cancers.

### **Nutrient Content of a Plant-Based Diet**

A plant-based diet is not always healthful. As the interest in plant-based eating has risen, so have the options for plant-based “junk food” such as donuts and cinnamon rolls. Imitation meat, milk, egg, and cheese products are typically lower in fat and calories than their animal product counterparts, but they are not necessarily nutritious. Attention must be paid to both the macro- and micro-nutrient content of any diet. A person could eat a diet that is plant-based yet high in sugar, saturated fats, and highly processed food products, thus negating some of the health benefits of a plant-based diet. A healthful plant-based diet is one composed of high-quality whole foods like grains, fruits, vegetables, legumes, nuts, and seeds.

### **Fiber**

A startling 95% of Americans are deficient in fiber, which is likely related to ingesting high amount of processed foods, yet little fruit, vegetables, legumes or whole grains.<sup>22</sup> A plant-based diet is by nature high in fiber, whereas animal products are devoid of fiber. All dietary sources high in fiber, such as beans, broccoli, berries, avocados, and apples, are plant-derived. Sufficient fiber intake is protective against insulin resistance, hypertension, cancer, gastrointestinal disease, obesity, heart failure and digestion-related disorders.<sup>23</sup> The small proportion of Americans who have adequate fiber intake are nearly all vegetarian or vegan, and incorporation of more plant foods into the standard American diet could help provide some mitigation against common chronic diseases.

### **Protein**

While a plant-based diet is rich in many micronutrients that are missing from the standard American's diet, care should be taken with any diet to ensure adequate intake of all vital nutrients. When considering a plant-based diet, the first component many people think about is protein. While most people equate protein with meat, dairy, and eggs, many plant foods contain high amounts of protein as well. Brown rice, quinoa, beans, and legumes can be added as part of a plant-based diet to ensure adequate intake of all essential amino acids. Americans tend to prioritize protein, but according to the Institute of Medicine,

only 10% to 35% of daily of calorie intake needs to be from protein.<sup>24</sup> Most people have no issue meeting this goal. If protein is a concern, a plant-based diet can be augmented with increased content of high-protein plant foods. For those with high protein goals such as athletes, plant-based protein supplements are widely available.

### Micronutrients

One micronutrient that often raises concern in a plant-based diet is vitamin B12. Some studies have shown that those on a plant-based diet are found to have lower plasma vitamin B12 levels and higher levels of vitamin B12 deficiency than those who consume animal products.<sup>6</sup> Vitamin B12 is an important cofactor in DNA synthesis, and deficiency can lead to anemia and severe neurological dysfunction. It is especially critical that pregnant persons ensure adequate Vitamin B12 levels, as a deficiency can lead not only to neural tube defects, but long-term consequences in weight management and brain development affecting the unborn child past delivery into its adulthood.<sup>25</sup>

Vitamin B12 is created by bacteria in the soil. Due to current food processing procedures removing this bacteria, vitamin B12 is primarily obtained by consuming meat products. Fortunately, many modern foods, like breakfast cereals and nondairy milks, are fortified with vitamin B12. In addition, vitamin B12 supplements are widely available and commonly found at health food stores and pharmacies. Some evidence suggests that vegans are also at risk for deficiencies of other micronutrients, including selenium, zinc, niacin, vitamin B2, vitamin B6, and calcium.<sup>6</sup> Supplementation of vitamin B12 and other micronutrients is one way to ensure adequate intake and reduce the risk for developing deficiency while on a plant-based diet. However, a German study published in 2020 compared serum levels of micronutrients of 36 omnivores and 36 vegans and found that there was no significant difference in vitamin B12 levels between the two groups. This suggests that eating a variety of fortified foods and taking a supplement is sufficient for obtaining normal vitamin B12 levels.<sup>26</sup>

### Unresolved Issues

Recently published research has identified other potential risks of a plant-based diet which deserve further study. Whereas older studies have shown that persons following a plant-based diet have lower bone

mineral density (BMD) than those who eat meat, evidence published in late 2020 suggests that fracture risk may be higher as well.<sup>27</sup> Some, but not all of this increased risk was accounted for by differences in BMI, as obesity may be protective against fracture at certain sites. However other recent research, including a recent meta-analysis, failed to show an association between increased dairy intake and prevention of fractures.<sup>28</sup>

Therefore, it is unclear whether a plant-based diet – devoid of dairy – would increase fracture risk. Regardless, it is prudent for those on a plant-based diet to ensure sufficient intake of calcium- and vitamin D-containing foods. Careful attention to intake of fortified foods, such as plant-based milks, may be helpful.

According to another recent study published in the British Medical Journal, hemorrhagic stroke was cited as a risk for vegetarians and vegans.<sup>29</sup> This study compared the rates of stroke between meat eaters, pescatarians, and vegetarians, and found a statistically significant increase in hemorrhagic stroke in vegetarians compared to meat eaters. Their research found that vegetarians had “three more cases of total stroke (95% confidence interval 0.8 to 5.4 more) per 1,000 population over 10 years.” However, it was found that risk of mortality from stroke was not significantly higher or lower in vegetarians compared to meat eaters. This study also did not differentiate results between those eating dairy and eggs and those following purely plant-based diets due to the small number of vegans enrolled. It is postulated that a low level of LDL, which is found primarily in animal products, may lead to increased risk of hemorrhagic stroke.<sup>30</sup> Although the study was informative, these results of increased stroke risk have not been corroborated by further studies. This same study found that vegetarians, including vegans, had lower rates of myocardial infarction, ischemic heart disease, obesity, high cholesterol, hypertension, and diabetes.

### Conclusion

As millions of Americans continue to struggle with obesity, diabetes, and cardiovascular disease, many continue to seek healthier alternatives to the typical American diet. According to an expansive review published in 2020, plant-based diets “were associated with a significantly reduced risk of negative health outcomes with a pooled ES of 0.886 (95% CI: 0.848 to 0.926; P < 0.001) without significant heterogeneity

( $I^2 = 43.16\%$ ; 95% CI: 3.55 to 66.51;  $P = 0.02$ ).<sup>11,13</sup> Given that so many health conditions and adverse outcomes can be mitigated by a plant-based diet, and that there is rapidly-growing public interest in this diet, physicians need to be educated and ready to counsel their patients on the benefits and risks of a plant-based diet. A well-planned diet of plant-based whole foods incorporating a variety of vegetables, whole grains, nuts, and legumes can be one tool to help physicians and patients address the chronic lifestyle diseases with which many struggle.

Patients with chronic health conditions who adhere to this diet may expect to see weight loss, improvement in blood pressure and cholesterol, and reduced risk of heart disease. Care should be taken to include a variety of fruits, vegetables, seeds, nuts, and legumes to ensure adequate consumption of protein. Vitamin B12 and calcium can be found in fortified foods or added via supplementation to ensure adequate intake. Organizations like the American Heart Association and Academy of Nutrition and Dietetics now recognize that a well-planned plant-based diet is healthy and safe for most adults. Physicians should feel confident recommending such a diet to their patients and supporting this choice when a patient expresses interest.

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## Disclosure

None reported.

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