

Comparison Between Healthy Plant-Based Diets and Unhealthy Plant-Based Diets and Their Health Impacts

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Abstract. A plant-based diet (PBD), also known as a vegetarian diet, has become a popular topic in recent years. Numerous research studies have investigated the advantageous aspects of adhering to a healthful PBD. Compared to the typical omnivorous diet, a healthful PBD, consisting of whole grains, fruits, and vegetables, can help protect individuals from Type II Diabetes (T2D), cardiovascular diseases (CVD), cancer, and high blood pressure. This is primarily because PBD are rich in dietary fiber, micronutrients, polyphenols, and low in harmful saturated fatty acids. One of the key features of metabolic syndrome is insulin resistance, which leads to an increase in blood glucose levels. Insulin resistance can potentially trigger the development of CVD and T2D. Transitioning to a healthful PBD can reduce the risk of insulin resistance. Additionally, the risk of CVD can be reduced by replacing animal fats (saturated fatty acids) with vegetable fats (monounsaturated fatty acids), as MUFAs help lower low-density lipoprotein levels in cells. Dietary fibers play a significant role in promoting healthier body indexes. They slow down food movement in the intestine and facilitate the excretion process. Fiber can also reduce the risk of obesity by maintaining a better body mass index. However, it's important to note that not all PBD are healthy, and an irrational PBD can worsen one's physical condition.

Keywords: Plant-based diet, PDI, hPDI, uPDI.

1. Introduction

As people's material lives becoming increasingly better, the idea of plant-based diet (PBD) gradually receives more attentions than before. Insisting on consuming a PBD can change one's health condition, vitality, mental health etc. PBD encourages the intake of plant-orientated foods, which contains more dietary fibers, micronutrients, polyphenols and less calories, unhealthy saturated fats and heme iron compared to other foods made, such as poultry and fully processed meat. Diet rich in fibers generally decreases the possibilities of having MetS because of replacing the animal-origin protein with plant-origin protein stimulate more dietary fiber intake.

People generally recognized that the PBD is sometimes beneficial to physical health and environment in a great variety of ways. However, some PBD studies showed that not all of them are necessarily to make positive changes to most of biomarkers, which includes Type II Diabetes (T2D), cardiovascular diseases (CVD), blood pressure (BP), BMI or obesity. PBD can be classified into healthy PBD and unhealthy PBD based on the PDI (plant-based diet index). A prospective research cohort study on T2D, published in 2016 Satija et al. creates PDI, hPDI(healthy PDI) and uPDI(unhealthy PDI) to record the healthfulness of the dietary pattern. The paper emphasizes the significance of having a healthful diet on reducing the health risks [1]. Additionally, there are a large number of completed studies have shown that having a comprehensive and nutrient-rich plant diet can effectively reduce the risks of suffering from lots of chronic diseases and metabolic syndromes in the most circumstances.

Consuming more healthful plant-based food represents an increasing in the intake of whole grains (dietary fibers), tea and coffee, nuts and legumes(protein), which corresponds to a higher hPDI number. On the contrary, a higher uPDI number correspond to an unhealthier eating habit, such as sugar-sweetened drinks, refined grains products, potatoes(chips) and sweet desserts [2]. Instead, they have adverse effects on the body.

Generally speaking, it is reasonable to conclude that maintaining a balanced healthy PBD with plentiful necessary nutrients could be really helpful and beneficial to people's health. It reduces the risk of having detrimental health problems to a great extent.

2. Plant-Based Diet

Main plant-based dietary pattern can be divided into three distinctive categories --- Vegan Diet, Lacto-Ovo Vegetarian Diet and Fish-Vegetarian Diet based on their dairy product, egg and fish (seafood) consumption. Vegan Diet includes no animal related product. Lacto-Ovo Diet includes plant products and dairy products (milk). Fish-Vegetarian Diet includes plant products and fish or other seafood. Nutrient deficiencies in protein and vitamins are pretty common in people adherence to vegan diet for a long time because they lack food resources to obtain necessary proteins and vitamin B12 especially. Proteins can only be obtained from nuts and legumes for vegans, and vitamin B12 mostly presents in meat, fish, cheeses and milk.

3. Benefits of PBD

PBD are more advantageous than omnivorous diet in a wide range of aspects especially in maintaining a healthier body weight/waist circumference, lowering the blood pressure, reducing the risks of metabolic syndrome and CVD. Nowadays, lots of studies also suggest that plant-based foods are much less harmful to living environment than animal-based foods because it requires fewer natural resources than food with meat.

Polyphenols are commonly found in plants to protect plants away from UV lights and pathogens. Recent epidemiological studies shows that polyphenols can also positively affect human health as a biological antioxidant. To be more specific, based on the current understanding, polyphenols offer helps in preventing cancer, hypertension, CVD, aging, diabetes etc [3].

3.1. T2D and Obesity

Metabolic syndrome, also known as MetS, is a series of health situations that finally can lead to a higher risk of having CVD, T2D, hypertension and other health-related problems. From an MetS definition article, MetS is a combination of several interrelated risk factors shared many similar signaling pathways and mechanisms. Insulin resistance and visceral obesity are two of the most important features. Generally speaking, insulin facilitates the glucose absorption, and insulin resistance makes the overall circulating blood glucose concentration remain in a high range. Visceral obesity is affected by different adipokines. Adiponectin is an insulin sensitivity protective hormone, which is deficient in obesity and Type 2 Diabetes [4]. Pancreatic beta-cell will significantly affect the blood glucose level, and as it impairs, beta-cells lose its function, which causes insulin resistance [5]. A clinical trial study suggests the possibility of making beta-cell back to function by dietary changing. A low-fat PBD has potentials to diminish the risks of T2D and obesity. Apart from this, there is a meta-analysis on the glycemic control and diabetes by Yokoyama et al. concludes that consuming more dietary fibers enhances the insulin sensitivity. It lowers the T2D rate by reducing the glucose absorption, which makes the glycemic index for carbohydrates lower [6]. Fortunately, PBD is very rich in dietary fibers, which can never be found in animal-based food. Dietary fibers, water-soluble and insoluble fibers, cannot be fully digested in human intestine because they will not be hydrolyzed by digestive enzyme. Water-soluble fibers will form a viscous gel when combining with water. They can positively benefit health in a number of ways, such as slowing food transit, reducing the macronutrients absorption and increasing fecal excretion [7]. Actually, a PBD, like cereals and whole grains, are essential in keeping a healthy blood glucose level, since magnesium and dietary fibers are rich in cereals, and magnesium plays an important role in stimulating the insulin signaling pathway. A deficiency in magnesium impairs the pathway and thus increase the risk of T2D [8].

Another prospective cohort study suggests that people with higher dietary fiber intake normally have lower body weight and reduced risks of obesity than those with lower fiber intake by approximately 30% [7].

3.2. CVD and Heart Diseases

Lots of risk factors will contribute to the CVD, including elevating blood pressure, T2D, dyslipidemia and some other harmful living habits. Dyslipidemia is one of the important factor to cause CVD, and it will be affected by dietary fatty acids composition. Animal fats, such as butter, fatty meat and coconut oil, are rich in saturated fatty acid (SFA). On the contrary, plant-based fats, such as soybean oil, are derived from seeds of the ripen plant. As fig. 1 shown below, keeping a good vegan diet without animal meats, the cardiovascular systems are protected in eight different ways, including lowering the LDL-C and dietary fats level. Plant-based fats typically are monounsaturated fatty acids (MUFA). Saturated fatty acid will raise the low-density lipoprotein, which is a threatening factor for CVD. Thus, It has been widely emphasized that the importance of consuming more monounsaturated fatty acids than saturated fatty acids to lower the level of low-density lipoprotein in serum. So as to further lessen the probabilities of getting CVD, including more MUFA in diet instead of SFA in diet by replacing animal meat with plant-based food can be very effective and significant. In a prospective study, the author concludes that there are a 24% decrease the ischemic heart disease mortality rate for vegetarians than non-vegetarians, after adjusting the lifestyles, ages and other environmental factors [9].

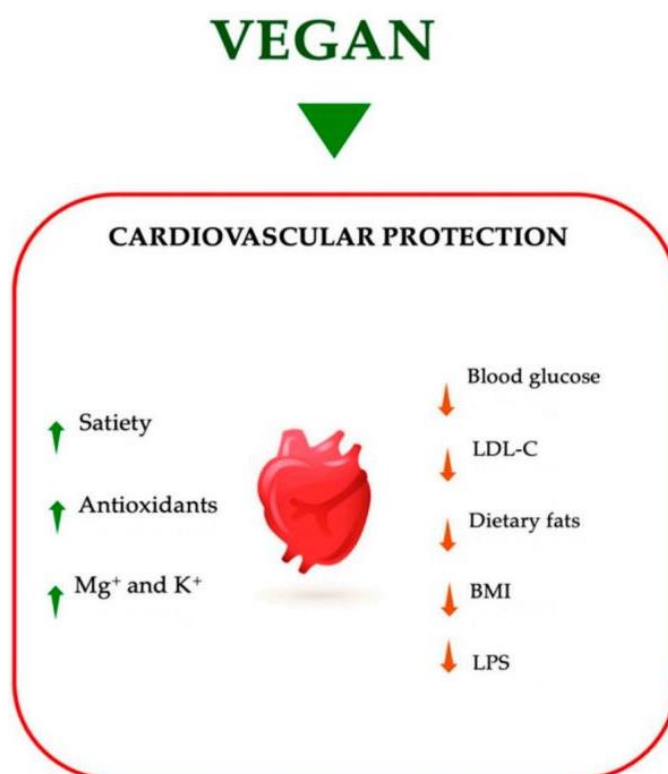


Figure 1. Cardiovascular protections from a healthful vegan diet [3].

4. The hPDI and uPDI Can Be Used to Evaluate Whether the PDB is Healthy

However, PBD are not always good for people's body. In order to investigate deeper on the relationship between the quality of the plant-based food and risks of having different health issues and diseases, this paper focuses on those investigators who use the dietary quality indexes PDI, hPDI and uPDI created by Satiji et al to measure and record the data. The quality of the PBD is classified into healthful diet and unhealthful diet by using two indices: hPDI and uPDI based on their impacts

on people's health diseases [1]. First, they distribute 18 food groups into different quintiles, which are assigned with a number between 1 and 5 respectively. Each food group will receive a score through 1 to 5, and a more positive score represents the more consumption in this particular kind of food group. Vice versa. Receiving a more positive score on hPDI indicates the more consumption on beneficial plant-based food; any consumption on unhealthy PBD and animal-based food will make the score lower, while uPDI is measured in a similar but opposite way. Receiving a higher score when having more harmful PBD, and a lower score when taking healthy PBD food.

To be more specific, there are existing evidence to support that different amounts of consumption on this food will affect people's body health differently. Cereals, fruits, vegetables, nuts, vegetable oils, tea and coffee as well as low-fat dairy products are several examples of the healthful plant-based food. On the other hand, unhealthy PBD contains refined grains, sweetened beverages, desserts as well as high-fat dairy products. Authors point out that high PDI/hPDI decile represents a higher intake of fiber, Vitamin C and folate [2]. A high uPDI decile means the decreasing consumption of beneficial micronutrients, dietary fibers etc. and an increasing consumption of added sugars, sodium and saturated fatty acids, which will finally lead to additional cardiovascular risks. A higher intake of sodium is one of the potential factors responds to the higher blood pressure based on research by S.L. Jackson focusing on the association between urinary sodium and blood pressure. Importantly, for people who only eat plant-based food, it is so important to avoid being nutrient deficiency through taking special supplements. Otherwise, it should be regarded as an unhealthy PBD because of lacking vital nutrients, which can ultimately lead to very serious health problems.

Higher PDI and hPDI, lower uPDI quintiles means healthier diet, and lower PDI and hPDI, higher uPDI means less healthful diet. Thus, it is indicating that increasing the consumption of whole grains (breakfast cereals, oatmeal, brown rice), fruits (grapes, prunes, oranges...), vegetables (tomatoes, broccoli, cabbage...), nuts (peanuts...), unsweetened tea and decaffeinated coffee will make diet much healthier.

5. The Application of hPDI and uPDI on Health Problems

5.1. T2D and Obesity

One large cohort study investigated on the correlation between the T2D and the plant-based dietary pattern, points out the inverse linear correlation between the hPDI score and the rate of T2D, and a direct correlation between the uPDI score and the rate of T2D. There are about 200,000 health professionals participated in the study for 20 years with their background information being collected. The study result shows a 20% decrease in T2D rate as replacing most of the food made from animal components with plant components. A 34% further reduced in T2D rate when emphasizing on the healthy PBD [1].

A prospective cohort study started adopted the similar measurement so as to record the healthfulness of distinctive PBD through PDI, hPDI and uPDI. They study focuses on the Korean Asian population. 7363 middle-aged Koreans without any T2D and other chronic diseases medical history participated in the study. After 14 years, the results clearly shows that the risk of T2D lowers 14%, when the hPDI index score becomes 10 points higher. Additionally, people with a family history of T2D demonstrate a much stronger inverse association [2].

5.2. Cancers and CVD

Two prospective cohort studies were conducted to investigate the quality of PBD affects the risks of colorectal cancer (CRC) by using PDI indexes. There are 123000 participants from Nurse Health Study and health Professionals in these two studies, and the data were obtained from repeated food frequency questionnaires. The results demonstrates that people with higher hPDI scores are less likely to develop CRC. In contrast, higher uPDI scores is directly correlated with higher CRC risks with 95% confidence interval. The KRAS tumor marker is more strongly related to the food quality than other tumoral statuses [10].

Additionally, understanding the association between the adherence to healthy PBD and the risks of CVD with the consideration of genetic susceptibility is the target of another 5 years cohort study. A total of 156148 healthy adults participated in the research. After adjusting some external factors, such as age, lifestyles, demographics etc., PDI index and the risk of CVD are collected from participants. Unsurprisingly, the result shows that as hPDI goes higher, the risk of developing CVD is lower. Thus, different PBD could make changes to one's body health and the risk of CVD, and plenty of studies show that constantly having a healthy PBD plays a really significant role on body health. Unhealthy PBD could increase the risk of having a large number of health problems, being detrimental to people's health [11].

Unhealthy PBD usually contains higher added sugar concentrations, which is reported to have adverse impact on health in different aspects. Many researchers conclude that higher intake of added sugar could increase the blood pressure and thus potentially increase the risks of CVD. An INTERMAP cross-sectional study dedicated to figure out what's the interacted relation between sugar intake and hypertension. The study focused on the 2696 USA and UK participants. Each participant will provide their dietary data to interviewers by multi-pass 24 hours recall method during every visit and their two 24-hour urine collections. The urine collections were used to verify their dietary intake of chemical elements, including sodium, potassium and so on. The final result shows that the relationship between added sugar and blood pressure is stronger when people consume higher sodium [12].

6. Conclusion

In general, numerous studies have consistently shown that a PBD offers numerous potential health benefits when compared to a typical omnivorous diet. A well-balanced PBD rich in dietary fibers can effectively reduce the risks of T2D, CVD, and high blood pressure, among others. Additionally, recent research has suggested that polyphenols, commonly found in plant-based foods, possess immunomodulatory and anti-inflammatory properties. However, it's crucial to note that an unhealthy PBD can have adverse effects on people's health due to increased consumption of added sugars and saturated fats, coupled with a decrease in dietary fiber intake. For individuals following a vegetarian diet, it is of utmost importance to diversify their food choices to prevent nutrient deficiencies, which are common among this group and can lead to additional health concerns. Finally, while the positive impacts of a PBD may not always result in dramatic improvements in health, a substantial body of research supports the notion that adopting a healthy PBD can significantly reduce the risks of many serious health conditions. Therefore, promoting this dietary approach on a global scale is a beneficial endeavor.

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