Effects of a Healthy Vegan Versus Healthy Omnivorous

Diet on Cardiometabolic Health Markers

Ikshvak Tanay Ongolu¹

1. Amador Valley High School, Pleasanton, CA, 94566

Abstract

My research delved into the merits of a healthy vegan diet versus a healthy omnivorous diet on cardiometabolic health markers. While researching these diets and their effects on cardiometabolic health, I discovered a study where twins—one given a healthy omnivorous diet and one given a healthy vegan diet—were tested. Through further investigation, I found flaws in the test study, which may have skewed the results and caused the researchers to come to incorrect conclusions.

My research focused on the effects of a healthy vegan diet and a healthy omnivorous diet on cardiometabolic health markers by objectively observing the progression of the cardiometabolic markers before, and after the two different diets. I drew heavily on data from the twin study and evaluated it with a plethora of other research. I determined that the healthy vegan diet, despite lacking essential vitamins such as B12 and having lower HDL concentration, posed significantly better results for cardiometabolic health. The vegan diet led to a decrease in body weight, LDL cholesterol, insulin, blood sugar, and adipose tissue. The healthy vegan diet proved, in multiple cases, to help improve cardiometabolic health and, hence, the longevity of life.

Based on my findings, people who struggle with cardiovascular complications should implement the vegan diet or consume fewer animal products (characteristic of a vegan diet) into their lifestyles due to its repetitive success in reducing the likelihood of developing heart disease, as well as other cardiac-related conditions. Researching about different perspectives on diet, and various solutions to the cardiometabolic health crisis, was beneficial in outlining core principles of cardiac longevity and dietary effects on cardiometabolic health. **Research Question:** How does a healthy vegan diet compare to a healthy omnivorous diet for superior cardiometabolic health?

Introduction

For over a century, heart disease has been the leading cause of death in the US. Heart disease accounts for approximately 700,000 deaths, or around 20% of all deaths annually (Ahmad FB and Anderson RN, 2021). These staggering figures help explain why cardiometabolic health markers have long been held as a staple for the measurement of cardiac health and longevity. Scientists have long conducted studies into the effects of various diets on cardiometabolic health markers, but most have concluded that vegan diets have had a better effect on public health. Vegan diets consistently yield better results than their omnivorous counterparts in tests such as low-density lipoprotein (LDL) concentration, body weight, and insulin concentration (Landry et al., 2023).

Why does a vegan diet improve cardiometabolic health markers? To explain this, we must go over some major cardiometabolic health markers.

Cardiometabolic Health Markers

Cardiometabolic health markers are biological substances that provide information about an individual's cardiovascular and cardiometabolic health. The analysis of cardiometabolic health markers in a patient helps healthcare providers determine the patient's current cardiac health, as well as possible cardiovascular complications that may arise. Major cardiac health markers include:

- LDL Cholesterol (Low-Density lipoprotein) is a type of lipoprotein that carries cholesterol in the blood. Cholesterol is used in the making of cell membranes, hormone production, bile production, and Vitamin D synthesis. Despite the many benefits of cholesterol, too much LDL cholesterol can significantly impact cardiac health and increase the risk of serious cardiac complications (Cleveland Clinic, "LDL Cholesterol: What It Is & How to Lower It", 2022).
- HDL Cholesterol (High-Density lipoprotein) is a type of lipoprotein whose primary purpose is to rid the blood of other cholesterol (namely, LDL Cholesterol). A high concentration of HDL cholesterol has been associated with a far lower risk of cardiac disease (a 1% increase in HDL cholesterol decreased the chance of heart disease by 2%) (Mayo Clinic, "HDL Cholesterol: How to Boost Your "Good" Cholesterol", 2019).
- 3. Triglycerides are a lipid in the body that provide energy and preserve body heat. An excess of triglycerides in the blood can lead to the hardening or thickening of arterial walls and an increased risk of heart disease. Triglycerides are produced in condensation (OH on fatty acids and hydrogen on the glycerol molecule react together to form water) reactions between a molecule of glycerol and three fatty acids. The bond between the glycerol molecule and the fatty acid is known as an ester linkage ("B.3 Triglycerides (SL)", 2015).
- 4. Insulin concentration is a significant marker of cardiac health as it indicates a subject's insulin resistance (a condition where insulin receptors fail and the cell does not absorb glucose from the blood). Insulin resistance may lead to abnormally high levels of glucose in the blood which can cause Atherosclerotic plaque formation, abnormal lipid metabolism (increased triglycerides, and decreased HDL), and hypertension (high blood

pressure) (Cleveland Clinic, "Insulin Resistance: What It Is, Causes, Symptoms & Treatment", 2021).

5. Bodyweight, while not directly functioning as a cardiac health marker, provides insight into one's overall cardiac health. Body weight can indicate fat levels in the body such as visceral fat (fat around the organs), subcutaneous fat, etc. This is an important marker as lipid concentration is significant in the determination of cardiometabolic health ("Types of Body Fat: Benefits, Risks, Diet, Body Fat Percentage & More", 2019).

The Twin Study

The study, "Cardiometabolic Effects of Omnivorous vs Vegan Diets in Identical Twins," was conducted in affiliation with the Center for Human Microbiome Studies, Stanford University School of Medicine, and Principal investigator, Christopher D Garnder, PhD, to test the effects of a healthy vegan diet versus a healthy omnivorous diet, on cardiometabolic health markers. The use of twins in the study was to correct for age, sex, and genotype (factors that can disrupt the credibility of the results). After an 8-week intervention period, the researchers measured the twins for LDL cholesterol, HDL cholesterol, triglycerides, glucose, insulin, vitamin B₁₂, and weight. The results consistently yielded healthier results for the vegan diet when compared to the omnivorous diet as the vegan diet, on average, had lower LDL cholesterol levels, lower fasting insulin levels, lower calorie count, and lower body weight (Landry, Matthew J et al., "Cardiometabolic Effects of Omnivorous vs Vegan Diets in Identical Twins: A Randomized Clinical Trial", 2023).

The study concluded that the healthy vegan diet led to improved cardiometabolic outcomes compared with the healthy omnivorous diet. The lower LDL cholesterol values

signified a major dietary positive as LDL cholesterol is a principal-agent for heart disease. In high concentrations, LDL cholesterol can lead to heart disease as LDL cholesterol molecules have a tendency to stick to arterial walls and cause narrowing of the arteries. LDL particles penetrate the endothelium (inner lining of blood vessels) and become oxidized, leading to an inflammatory response by the body and the eventual development of plaque. The plaque can increase in size and eventually burst, leading to a blood clot formation (partially solidified clumping of red blood cells) and narrowing/blocking of the artery. This narrowing of the blood vessels leads to higher BP, and the blood clot formation can travel to the coronary/cerebral arteries and cause a heart attack/stroke (Toshniwal Paharia, Pooja, "What Causes High Blood Pressure", 2009). HDL cholesterol, on the other hand, is capable of reverse cholesterol transport as it contains apolipoprotein A-I, which attracts ATP-binding cassette transporters (transporters that transfer cholesterol and phospholipids from cell membranes to HDL) (Marit Westerterp et al., 2014).



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While the twin study accurately measured the effects of the diets on cardiac health markers, they had a major drawback—the calorie count of the foods consumed by the omnivorous vs vegan group was different. The omnivorous group generally consumed more

calories than the vegan group which introduced a confounding variable to the experiment and hence could be a possible explanation for the poor results on the omnivorous side.

Calorie Restriction

Calorie restriction has yielded statistically significant results on cardiometabolic health markers and is the most effective intervention for extending lifespan across many model organisms. A study conducted by Jasper Most highlights the benefits of Calorie restriction (CR) on cardiometabolic health. In the study titled "*Significant improvement in cardiometabolic health in healthy nonobese individuals during caloric restriction-induced weight loss and weight loss maintenance*"; CR has been shown to decrease body weight (-9 ± 0.5 kg), subcutaneous abdominal adipose (-1.9 ± 0.2 kg) and visceral tissue (-0.5 ± 0.01 kg), intramyocellular lipid content (-0.11 ± 0.05%), blood pressure (Systolic BP -8 ± 3 mmHg; Diastolic BP -6 ± 2 mmHg), total cholesterol (-13.6 ± 5.3 mg/d1, *P* = 0.001), LDL cholesterol (-12.9 ± 4.4 mg/d1, *P* = 0.005), and decrease the 10–yr risk of cardiovascular disease by 30% (Most, Jasper, et al., "Significant Improvement in Cardiometabolic Health in Healthy Nonobese Individuals during Caloric Restriction-Induced Weight Loss and Weight Loss Maintenance", 2018). As the data indicates, we can identify the significant effect lower calorie intake can have on cardiometabolic markers.

Food Groups in a Typical Healthy Vegan Diet and Their Significance

Whole grains (quinoa, whole wheat bread, brown rice) are complex carbs that provide a steady energy source (unlike simple carbs that are quickly digested and lead to rapid increases in blood sugar levels) (Cleveland Clinic, "Carbohydrates", 2021). Proteins, lentils, peas, and beans act as

the 'building blocks' of the body as they are essential for the growth, management, and replacement of various tissues. Fruits and veggies provide the essential nutrients and hydration (besides water) required for the body. Fruits and veggies contain Vitamin C (immune function, collagen synthesis), Vitamin A (vision, immune function, and integumentary health), Vitamin K (essential for blood coagulation and bone health), and various B vitamins, which are essential for metabolism, nervous function, and RBC production. Hemp, flax, and chia seeds contain Omega-3 Fatty Acids, a type of Omega-3 fatty acid, that is effective at maintaining good heart health and brain function, as well as reducing inflammation. Fiber-rich foods slow down digestion in the gut, as well as the rate at which sugars are absorbed into the bloodstream. This helps to reduce blood sugar spiking. Fiber adds 'bulk' to the diet, which takes longer to consume/digest, thus leading to slower sugar content in the blood, which reduces the chance of heart disease. In addition to 'bulking' digestion, fiber acts as a prebiotic (the nondigestible fiber that is consumed by symbiotic gut bacteria), which helps the beneficial gut bacteria thrive in the gut, hence helping us more efficiently digest food (Mayo Clinic, "Dietary Fiber: Essential for a Healthy Diet", 2022).

Image Credit: oopsvegan



Food Groups in a Typical Healthy Omnivorous Diet and Their Significance

A typical healthy omnivorous diet boasts high quantities of proteins, specifically, Lean meats (wild-caught salmon, mackerel, sardines), eggs, and legumes. Lean meats are an optimal source of Omega-3 fatty acids that have been shown to reduce inflammation in the body, lower Blood pressure, and improve endothelial health (omega-3 fatty acids promote the production of nitric oxide, a vasodilator, which relaxes blood vessels and allows for better blood vessel flow and hence a lower chance of clotting) (Mayo Clinic, "How Eating Fish Helps Your Heart", 2019). A typical healthy omnivorous diet also has the freedom to incorporate dairy foods such as unsweetened yogurt and cottage cheese. Yogurt and other such fermented dairy products contain probiotics (microorganisms in the gut that promote digestive health) which help us digest complex carbs and dietary fibers that our own digestive system cannot thoroughly digest. Probiotics also promote the production of mucin lining as well as a complete barrier of cells lining the intestines in order to prevent harmful substances from entering the bloodstream (Kaur et al., 2022). Dairy products are also an effective source of calcium, which is needed for bone health and strength as well as muscle movements (Calcium binds to troponin to allow for muscle movement) (Huth et al.2006).

Image Credit: europepmc.org



Vegan vs Omnivorous Diet

The data collected by the twin study shows significantly low LDL cholesterol values. This can be attributed to the types of foods consumed in the vegan diet. The vegan diet emphasizes a focus away from animal products such as meats and dairy products, which helps greatly decrease cholesterol intake compared to a healthy omnivorous diet. Lower cholesterol composition in the healthy vegan diet reduces insulin requirements and improves insulin sensitivity. A patient can turn to habits/venues to alleviate the effects of insulin resistance. A study revealed that decreasing triglyceride and LDL cholesterol levels, as well as raising HDL cholesterol levels, can treat insulin resistance. Another 12-week study found that the reduced-lipid vegan group reduced the amount of insulin that people with type 1 diabetes needed to take by 28% and increased insulin sensitivity by 127% compared to those following a portion-controlled diet with no rigorous restriction on lipid intake ("Low-Fat Vegan Diet Reduces Insulin Requirements and Improves Insulin Sensitivity for People with Type 1 Diabetes, Finds Groundbreaking New Study", 2024). Vegan diets typically lead to lower body weight due to factors such as a low-calorie density (foods provide fewer calories per pound compared to other foods), and high fiber content (High fiber leads to digestive 'bulking', giving the feeling of fullness, leading to reduced caloric intake).

Potential Flaws in Vegan Diet and Their Significance to Cardiometabolic Health

Vegan diets are deficient in certain nutrients that are commonly found in animal products. A significant flaw in the vegan diet is the lack of vitamin B12. In severe cases, this can impair RBC

synthesis and neurological function, leading to peripheral neuropathy, dementia, poor cognitive performance, and depression (Fernandez et al., 2024). The vegan diet also has the flaw of having a low HDL concentration (Landry et al., 2023). Despite the vegan diet having low amounts of LDL, having low amounts of HDL can be detrimental. Low HDL increases the risk of heart disease due to fewer agents picking up excess cholesterol in the blood. The lack of animal-based products in a vegan diet can lead to a deficiency in many growth-related nutrients (UCL, "Vegan Diets in Children May Bring Heart Benefits but Pose Growth Risks.", 2021)

Benefits of a Vegan Diet on Cardiometabolic Health

LDL cholesterols in the body negatively impact cardiac health, as they stick to the walls of vessels, and increase the chances of a blockage ("Cholesterol Animation | Heart Disease Risk Factors", 2015). Reducing the overall LDL levels will lead to a reduction in the risk of blockages, hence an increase in cardiac health. Low resting insulin levels indicate that the body is sensitive to insulin. Higher insulin sensitivity suggests that the cells in the body are better equipped to respond to insulin, which means that blood sugar levels are more stable ("Low-Fat Vegan Diet Reduces Insulin Requirements and Improves Insulin Sensitivity for People with Type 1 Diabetes, Finds Groundbreaking New Study", 2024). This reduction in blood sugar can reduce the excess production of insulin, which can decelerate the development of atherosclerosis (Stolar, 1988). High insulin levels can cause the walls of the blood vessels to become less stiff and elastic, leading to high BP. Lower body weight provided by a vegan diet improves cardiometabolic health. Excess body weight can lead to hypertension (high blood pressure), a major risk factor for heart disease (Zhao et al., 2018). Lower body weight can also reduce LDL cholesterol levels and improve HDL cholesterol levels, which can prevent plaque buildup in the

arteries (Most et al.). Obesity is also linked to insulin resistance as obesity leads to the expansion of adipose (fat) tissue, which can cause hypoxia (lack of oxygen) and lead to an inflammatory response that disrupts the normal cascade of insulin reception, making obese individuals insulin-resistant. Dietary cholesterol intake, specifically saturated fats, has been shown to increase total cholesterol concentrations in the blood (DiNicolantonio and O'Keefe, 2018). Since the vegan diet reduces the amount of total cholesterol consumed, LDL concentrations will be reduced.



Calorie Restriction Link to Cancer

Despite calorie restriction's significance in cardiometabolic health, it has also proved beneficial for cancer prevention. Cancer is a disease categorized by the mutation of cells caused by an abnormal cell cycle process. Cancer cells do not follow the checkpoints of the normal cell cycle process and end up multiplying uncontrollably leading to issues such as tumors (Cancerous growths that are unorderly and out of proportion) (National Cancer Institute, "What Is Cancer?", 2021). A study found calorie restriction to be one of the most potent and broadly acting dietary interventions for inhibiting tumor formation (Hursting et al., 2013). Calorie restriction leads to a reduction in tumor incidence through factors such as hormonal modulation and vascular limitation. CR reduces tumor incidence through hormonal modulation by inhibiting hormones such as Insulin and IGF-1, which promote excess cell growth and cancer progression. Lower expression of these hormones leads to decreased activation of cell signaling pathways that promote tumor growth. CR also inhibits tumor incidence by reducing net vascular malformation, and angiogenesis (development of new blood vessels). CR leads to lower levels of vascular endothelial growth factor (VEGF), which is a primary proponent of angiogenesis (Hursting et al., 2013). Calorie restriction can significantly inhibit tumor growth and cancer progression in addition to its productive influence on cardiometabolic health.



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Conclusion

Through extensive research into the effects of a healthy vegan and a healthy omnivorous diet on cardiometabolic health, the healthy vegan diet consistently proved to be superior for cardiometabolic health due to several effects on cardiometabolic health markers. The vegan diet led to a decrease in body weight, LDL cholesterol, insulin, blood sugar, and adipose tissue. Although the healthy omnivorous diet also led to the same reductions, it did not have as significant of an impact as the healthy vegan diet. Based on these results, the healthy omnivorous diet must not be overlooked

as a justifiable option for healthy cardiometabolic health. The vegan diet, apart from being significantly beneficial for cardiometabolic health, also had side effects that were significant in avenues such as cancer prevention. Overall, the healthy vegan diet proved to be the more efficient and effective option for cardiometabolic health.

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