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Health Benefits of a Plant-based Diet

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Health Benefits of a Plant-based Diet

The rise and spread of Western culture brought about tremendous change in the way people live. With it came remarkable advances in medicine, communication, and technology, yet contrarily it also brought about an expanse of chronic diseases and ailments that never once existed. Certain aspects of this cultural shift are playing a detrimental role on society—specifically those involving the Western diet. The Western diet has been characterized as one with a focus on meat, dairy, and refined grains, contrasting the typical Eastern or Oriental diet which contains greater quantities of fruits, vegetables, fish, and whole grains. Practicing such a diet has been linked to coronary heart disease, obesity, hypertension, type-2 diabetes, cancers, autoimmune diseases, and osteoporosis, all of which are virtually non-existent in non-westernized populations (Carrera-Bastos et al., 2011). With diet-related chronic illnesses being the single largest cause of morbidity and mortality in the United States (Cordain et al., 2005), it is imperative that this dietary shift be analyzed and severely reformed to promote health and wellness in individuals.

1. Western Diet Health Effects

There is no single element to blame for the prevalence of these diseases, for they all are due to a variety of complex interactions within the body. When evaluating what is creating these epidemics, it is essential to look into all facets of this dietary change and how they may intertwine with one another. When dissecting the popular food components of the Western diet (red meats, dairy, refined grains and sugars, etc.) and comparing the nutritional content to that of the Eastern diet, there are clear differences that in combination will promote disease in population. A study led by Cordain et al. (2005) assesses a variety of these key differences, specifically increased glycemic load, fatty acid composition, macronutrient composition,

micronutrient density, skewed acid-base balance, inverted sodium-potassium ratio, and decreased fiber content. All of these factors have adverse effects on systems of the body, effects that are exacerbated when combined with one another.

a. Glycemic Index

Glycemic index is used to evaluate how a food will affect an individual's blood glucose levels. Foods with high glycemic indexes are quickly absorbed and metabolized, rapidly elevating blood glucose levels and, resultantly, elevating insulin levels (Glycemic Index Foundation, 2013). Insulin is a hormone released by the pancreas used to uptake glucose from the blood into the cells. This process, however, sets the body up to store the excess glucose as fat. Additionally, chronically high insulin levels can result in insulin resistance, a condition in which there is decreased response to insulin and greater amounts must be produced for proper functioning. This may result in diabetes or heart disease (Stoppler, 2016).

Foods with low glycemic loads do not have such effects (Glycemic Index Foundation, 2013). Long-term consumption of highly glycemic foods has significantly adverse effects on metabolism, causing chronic hyperglycemia and hyperinsulinemia, which, in turn, promote insulin resistance and are key factors in developing metabolic syndrome. Diseases regarding developed insulin resistance are nearly nonexistent in non-westernized cultures and can be solely attributed to dietary habits (Cordain et al., 2005). In the United States, sugars with high glycemic loads (high fructose corn syrup, sucrose, glucose, honey, and syrup) supply 18.6% of total energy and refined grains supply 20.4% of energy (Cordain et al., 2005). Refined grains, in contrast to whole grains, are products that have been significantly altered from their natural composition, stripping them of nutritional value (Whole Grains Council). These refined grains constitute 85% of grains consumed in the United States yet contain 400% less fiber than whole

grains and are nearly devoid of nutritional value (Ungar, 2004). Replacing whole grains with these highly glycemic foods is not only detrimental to one's health, but also prevents the individual from gaining the necessary nutrients to promote health.

b. Fatty Acid Composition

Fatty acids are categorized into three overarching groups, saturated, monounsaturated, and polyunsaturated. There is also a subgroup of *trans* fatty acids which do not occur naturally, but are developed through the process of hydrogenation. Hydrogenation is the process of solidifying vegetable oils. While fats are stigmatized and often avoided, evidence shows that is not the amount of fat that matters but the *type* of fat. Monounsaturated and polyunsaturated fats have positive effects on health and disease prevention and they include the essential omega-3 and omega-6 fatty acids that the body needs to thrive. It is saturated fatty acids and *trans* fatty acids that can have negative effects and should not be consumed in excess (Institute of Medicine of the National Academies, 2002). The Western diet includes excessive amounts of saturated and *trans* fatty acids through consumption of fatty meats, cheeses, milk and butter. This resultantly elevates total and LDL cholesterol, which contributes to the formation of artery clogging plaques and the development of atherosclerosis. If the development of such plaques is not controlled, blood flow will be inhibited and heart attack or stroke may occur (American Heart Association, 2014).

c. Micronutrient Density

Because so much of the Western diet is focuses on refined and processed foods, which contain little nutritional value, much of the population is lacking in regards to vitamins and minerals. Over half of the population in the United States fails to meet the recommended amount of calcium (65.1%), magnesium (61.6%), vitamin A (56.2%), vitamin B6 (53.6%) and zinc

(73.3%) and over one-third of the population is lacking in iron (39.1%), vitamin C (37.5%), and folate (33.2%) (Cordain et al., 2005). These vitamins and minerals are imperative to maintaining good health and aid in disease prevention. Fruits and vegetables provide a large quantity and diversity of micronutrients; however, the Western diet does not promote large consumption of these food groups.

d. Acid-Base Balance

After being metabolized, most foods release acid or base into the body. Generally, fish, meats, eggs, cheese, milk, grains, and salt are net acid producing while fruits, vegetables, and nuts are net base producing. The human body is optimum when acid-base levels are balanced. Because the Western diet tends to favor acid producing foods, those who practice this diet tend to carry a net acidic load of 50mEq per day, which is detrimental to the body. This load is especially damaging to the kidneys due to the increased acidic load on nephrons working to stabilize blood pH (Lemann, 1999). This may promote bone and muscle loss in individuals and contribute to carcinogenesis when combined with other dietary factors. Evidence shows that alkali supplementation through fruit and vegetable consumption can work to neutralize the excess hydrogen produced by these net-acidic foods (Scialla & Anderson, 2013), however because so many individuals are replacing these alkaline foods with acidic ones there is often not enough consumption to balance the diet (Robey, 2012).

e. Sodium Intake

On average, Americans consume over 3500mg of sodium per day, which is significantly greater than the 2300mg recommended by the 2015-2020 Dietary Guidelines for Americans (Centers for Disease Control and Prevention, 2016). The body only needs a small amount of sodium for proper functioning and what is consumed in excess causes the body to retain water,

placing stress on the heart and blood vessels. This can result in increased blood pressure and risk for heart disease and stroke. Additionally, 90% of the sodium consumed is manufactured from sodium chloride and only about 330mg of American sodium intake is naturally occurring (Cordain et al, 2005). Potassium has been shown to counter some of the negative effects sodium has on the body, decreasing risk of cardiovascular disease, kidney disease, and stroke rates (Aaron & Sanders, 2013). However, the typical Western diet is severely lacking this nutrient due to the shift in focus from fruits and vegetables, which are potassium rich, to refined sugars, which are essentially devoid of potassium.

f. Fiber Intake

Fiber is an essential component of the diet and can be divided into two groups, soluble fiber and insoluble fiber. Insoluble fiber does not dissolve in water and resultantly moves through the gut without being broken down. This increases fecal bulk, which helps other foods to move through the digestive system quickly. This, in turn, helps to maintain bowel regularity and prevent constipation (Lattimer & Haub, 2010). Conversely, soluble fiber is able to dissolve in water but it is equally as important, for it decreases blood glucose and blood cholesterol levels and slows gastric emptying, making an individual feel fuller faster and for longer (Cordain et al., 2005). Fibers cleansing effects also aid in cleaning bacteria and buildup from the intestines, reducing the risk of colon cancer (Lattimer & Haub, 2010).

The book *Evolution of the Human Diet: The Known, the Unknown, and the Unknowable* assesses dietary change in humans over time. It states that the average American consumes about 15 grams of fiber per day, which is significantly lower than the recommended values of 25-30 grams. This is largely due to the typical Western diet that most Americans follow. While whole grains are a good source of fiber, fiber-depleted, refined grains constitute 85% of the grains

consumed in the United States, containing 400% less fiber. Fruits and vegetables are even greater sources of fiber, containing four and eight times more fiber than whole grains, respectively. Diets devoid of grains, dairy, and processed foods have been shown to have significantly more fiber than even the recommended fiber values, consuming approximately 42.5 grams per day. This difference can be attributed to novel nutrient-depleted foods that the Western diet introduced, replacing the natural, fiber-rich foods that were once consumed in its place (Ungar, 2007).

2. Plant-based Diet and the Body

The changes that accompany this significant dietary shift result in impaired functioning of our body's systems, ultimately leading to disease. A variety of research has been conducted to assess what specifically is being compromised and what can be done to repair damage.

Transitioning to a more plant-based diet has been shown to result in a tremendous amount of health benefits in respect to all systems in the body.

a. Cardiovascular System

The cardiovascular system works to transport oxygen, nutrients, hormones, and waste products throughout the body. The system consists of the heart, blood vessels, and blood. The heart is the powerhouse behind this system, transporting oxygenated blood throughout the body through the arteries and deoxygenated blood is then returned through the veins. These two vessels are connected through smaller, thinner vessels called capillaries. Arteries are forced to face high levels of blood pressure in order to generate adequate force to distribute oxygenated blood to the rest of the body. Because to this, arterial walls are thicker and more elastic than the other vessels (Gaze, 2012).

According to the American Heart Association (2017), cardiovascular disease (CVD), commonly referred to as heart disease, is the cause of one in every four deaths in the United States making it the leading cause of death for both men and women. CVD include a wide range of conditions, most of which can be attributed to atherosclerosis. Atherosclerosis is a condition that develops due to the stiffening and buildup of plaque on arterial walls, interfering with blood flow to organs and tissue. If blood flow becomes completely blocked, heart attack or stroke may occur (WebMD). When looking at other cultures that rely primarily on plant-based and whole foods, this epidemic is nonexistent due to healthier lifestyle choices.

Saturated and trans fats are the greatest cause of plaque buildup, significantly contributing to LDL cholesterol. Saturated fats are most commonly found in animal products such as fatty and processed meats, cheese, whole milk, and cream while trans fats are manufactured by hydrogenated oils and often found in processed foods. Dietary cholesterol, found only in animal products such as meats, eggs, and cheese, also significantly promotes plaque buildup and should be limited to under 200mg per day (Garippo, 2015).

Consumption of animal foods can result in vascular damage through other mechanisms, as well. Humans carry intestinal microbial that metabolize carnitine, a compound found in high amount in red meats and eggs, into trimethylamine N-oxide (TMAO), a species that has been shown to promote the formation of plaques in the blood vessels and also reduce the body's ability to remove cholesterol. Increased plasma levels of TMAO resulted in a 2.5-fold increased risk of cardiovascular event occurring. It was found, however, that those who consume exclusively plant-based foods produce very little TMAO. Even after being given red meat or other foods that lead to its formation, little to no TMAO was produced because the intestinal bacteria become incapable of forming it (Koeth et al., 2013).

Additionally, these foods result in decreased arterial production of nitric oxide, a gas that works to relax blood vessels and thus increase the flow of blood and oxygen. The enzyme dimethyl arginine dimethyl amino hydrolase (DDAH) is key to enhancing nitric oxide production, however this enzyme is inhibited by high cholesterol, high triglycerides, insulin resistance, diabetes, and smoking. Aside from smoking, these conditions are often the result of diet high in meats and dairy, and would improve through transitioning to a plant-based diet. Fruits and vegetable consumption has been shown to have beneficial effects on nitric oxide production (Lai & Ghebremariam, 2016).

In a study done by Lin et al. (2001) comparing vegetarians to non-vegetarians, a substantial positive correlation was found between years on a vegetarian diet and vasodilation. In both, flow-mediated and drug-induced vasodilation, vasodilation was four times higher among the vegetarian participants. Vasodilation is essential to managing blood pressure and permitting the flow of oxygen and nutrients, meaning a vegetarian diet may be effective in lowering cardiovascular risks.

A study lead by Esselstyn et al. (2014) followed 198 patients recently diagnosed with cardiovascular disease. Patients were encouraged to switch to a plant-based diet eliminating fish, dairy, and meats and implementing healthy oils. Those who adhered to the diet restored blood flow after only three weeks, and of those adherent patients 89% showed evidence of disease reversal through radiographing and stress testing results. This shows how significantly diet influences and benefits cardiovascular health, even after diagnosis. It has also been shown that individuals following a vegan diet have significantly lower lipid profiles, including cholesterol, LDL, non-HDL, phospholipids, and apolipoprotein B, resulting in decreased risk of atherosclerosis and other cardiovascular disease. (Caridol, 2016).

b. Digestive System

The digestive system works to break down foods and to extract and absorb nutrients for the body. The gastrointestinal tract consists of the esophagus, stomach, small intestine, large intestine, and rectum, which work together to digest food and excrete waste. Digestive health is directly influenced by an individual's diet and lifestyle. The gastrointestinal tract gut flora houses thousands of different bacteria, more than any other part of the body. Diet can significantly alter the microbial composition and function, which can result in a variety of gastrointestinal diseases (Quigley, 2013).

Digestive health is upheld through staying hydrated, exercising regularly, managing stress and by avoiding smoking, excessive caffeine, and alcohol, which have been shown to interfere with digestive functioning (Live Science, 2015). Additionally, the key element in digestive health is through adequate fiber consumption. Diets high in fiber have been shown to prevent or treat a variety of digestive conditions such as diverticulosis, hemorrhoids, and irritable bowel syndrome. Fiber is most prevalently found in, vegetables, fruits, whole grains, and legumes and aid in keeping the digestive tract in motion. (Live Science, 2015)

Inflammatory bowel disease (IBD) is one of the most common digestive conditions in the United States, effecting 10-15% of the population (Orenstein, 2015). This is due to the chronic inflammation of all or part of the digestive tract, creating severe pain, constipation, diarrhea, bloating, weight loss, and fatigue, which can become life-threatening conditions if not properly treated (MayoClinic). The common form of treatment is to restrict trigger foods and increase fiber consumption. A 10.4-year study led by Jantchou et al. (2010) assessed the pathogenesis of IBD and its relationship with diet by tracking food intake in women. It was found that high total protein intake, specifically animal protein, was significantly associated with increased risk of

IBD development. Additionally, it has been shown that diet plays a role in development of ulcerative colitis, a specific type of IBD causing ulcers in the intestinal and rectal linings.

Consumption of meat products, particularly red meats, increased the likelihood of relapse after treatment by a 3:2 ratio (Jowett et al., 2004).

Diverticular disease, also referred to as diverticulosis, is also extremely common in aging adults, affecting about 50% of individuals over the age of 60. This disease involves the development of numerous small sacs, diverticula, on the intestinal walls. If not cared for, diverticulosis may result in rectal bleeding or diverticulitis, in which one or more of these sacs becomes infected (WebMD). An EPIC-Oxford study examined effects of vegetarian diet and fiber intake had on diverticular disease compared to non-vegetarians. It was found that vegetarians had a 31% decreased risk of diverticular disease compared to non-vegetarians. Further, those participants who followed a vegan diet had a 72% decreased risk. Participants in the highest fifth of fiber intake had a 41% lower risk of diverticular disease. The consumption of meat may result in increased risk by altering bacteria in the colon and thus weakening the colon wall. This would result in a higher risk of diverticular disease and other colon-related diseases (Crowe et al., 2011).

Diet also plays an important role in the development of cancers in the digestive system. Colorectal cancer is the second leading cause of cancer death in the United States, most often arising in adenoma polyps. Diet and lifestyle contribute to 25-35% of colon adenoma risk. It has been found that higher frequency consumption of cooked green vegetables, dried fruits, legumes, and brown rice were associated with significantly decreased risk of colorectal polyps. Specifically, consuming legumes at least three times a week and brown rice at least once a week

displayed a decreased risk of colon polyps by 33% and 40% respectively (Tantamango et al., 2011).

In recent years, there has also been a rapidly increasing prevalence of esophageal and gastric adenocarcinomas. A study lead by Novarro et al. (2008) examined different food group intakes as risk factors for subtypes of esophageal and gastric cancers. Total meat intake was associated with increased risk of esophageal adenocarcinoma, gastric cardia adenocarcinoma, and non-cardia gastric adenocarcinoma. High-fat dairy was also associated with increased risk of esophageal and gastric cardia adenocarcinoma. Contrarily, total vegetable intake was associated with a decreased risk of esophageal adenocarcinoma.

c. Urinary System

The urinary system, also referred to as the renal system, produces, stores, and eliminates waste in the form of urine. The urinary system consists of the kidneys, ureters, urinary bladder, and the urethra. The kidney is made up of millions of functional units called nephrons. Nephrons have blood delivered to the glomerulus, where it is filtered so that only water, waste products, and excess ions are left to be excreted. Urine produced by the kidneys is then sent through the ureter tubes to the bladder, where is stored and expelled (Taylor).

The urinary system is directly impacted by an individual's diet, for it is the kidneys that work to remove the wastes and toxins from the body. The typical Western diet, which is high in acid and sodium, plays a detrimental role on renal health. A Nurse's Health Study assessed how different dietary patterns affected the kidneys and found that the Western-style dietary pattern directly correlates with a rapid decline in glomerular function as well as microalbuminuria (MA), which is chronic high levels of albumin in the kidneys, indicating damage or disease. The diet was shown to impair renal vascular function, promote inflammation and microalbuminuria, and

decrease overall kidney functioning. Those participants who practiced a DASH diet, a diet low in sodium and high in fruits, vegetables, and grains, displayed a decreased risk for glomerular filtration decline and may have protective benefits (Lin et al., 2012). Further emphasizing these results, additional studies have shown that diets low in animal protein, animal fat, and cholesterol may have protective effects against MA and two or more servings of red or processed meat increased odds of MA by 50% (Lin et al, 2010).

Research published by the National Kidney Foundation (2015) also found that the mortality rates of individuals diagnosed with chronic kidney disease (defined as a glomerular filtration rate under 60) is inversely related to the consumption of plant protein, stating that every 33% increase in the ratio of plant protein to total consumed protein resulted in a 23% decreased risk of death. This may be due to the amount of sulfate containing amino acids found abundantly in animal proteins, which result in increased acid load and promote inflammation in the kidneys. In turn, transitioning to plant-based proteins may reduce acid load and improve serum bicarbonate levels (Scialla et al., 2012). This transition is also beneficial to those diagnosed with Berger's disease, also known as IgA nephropathy, which occurs when the immunoglobulin A antibody lodges into the kidney, creating significant inflammation that interferes with kidney filtration (MayoClinic). The IGA Nephropathy Support Network states that substituting animal proteins with plant proteins helps to reduce strain on the kidney as well as reduce damaging inflammatory response (Entwistle, 2013).

d. Endocrine System

The endocrine system consists of glands that produce the hormones to regulate our body and maintain homeostasis. This includes the pituitary gland, thyroid gland, parathyroid glands, adrenal glands, pancreas, and ovaries and testicles (Zimmerman, 2016). Dietary intake plays a

significant role in the activities of a many of hormones, such as insulin, glucagon, and cortisol (Boyers, 2016). Maintaining proper hormonal balance is imperative to body functioning, and an unhealthy diet can result in disease-causing defects.

According to the American Diabetes Association (2017), there are over 29 million people currently diagnosed with diabetes and an additional 86 million who are pre-diabetic, meaning they are on the path of diagnosis. Type-2 diabetes occurs either when the body becomes resistant to the hormone insulin or the pancreas stops producing enough insulin, interfering with the body's ability to digest sugar. While genetics does play a role in contracting this disease, diet, excess weight, and inactivity are large contributors (MayoClinic).

Because diabetes hinders the metabolism of sugars and keeps blood glucose levels high, it is a well-conceived notion that the key to controlling diabetes is avoiding carbohydrates. This results in a diet high in proteins and fats. However, when looking at older Eastern countries that rely heavily on carbohydrates, such as Japan and China rely heavily on noodles and rice, there is very little prevalence of this disease. However, as the Western diet began to spread and invade Asia, rates of diabetes began to drastically elevate (Edelman, 2015).

The consumption of red and processed meats been associated with increased risk of type-2 diabetes. Additionally, the overconsumption of the heme-iron found in these meats may lead to pancreatic beta cell damage, interfere with insulin production and secretion, and interfere with glucose metabolism (Aune et al., 2009). Individuals diagnosed with type-2 diabetes who eliminate animal products and instead replace it with a plant-based diet find improvements in weight, blood sugar control, lipid levels, and blood pressure soon after (Edelman, 2015). When comparing a low-fat vegan diet to the conventional diabetes diet recommendations, it was found that while both diets resulted in weight reduction and decreased plasma lipid concentrations, the

vegan diet had better results regarding glycemic and plasma lipid levels (Barnard et al., 2009). When comparing a vegetarian diet to an omnivorous diet, vegetarians showed significantly lower levels of fasting insulin and plasma glucose, as well as higher insulin sensitivity (Hung et al., 2006). Additionally, on average transitioning to a plant-based diet resulted in a 1.2% decrease in blood glucose absolute percentage points, which is a significant decrease (Edelman, 2015).

In addition to diabetes, plant-based diets have been shown to have a positive effect on thyroid functioning. Studies have found that prevalence of hyperthyroidism is twice as high in those practicing an omnivorous diet compared to those practicing a vegan diet. Prevalence in lacto-ovo- and pesco-vegetarians fell intermediate, suggesting that meat intake may increase risk of hyperthyroidism (Tonstad et al., 2015). Vegan diets have also been found to have protective effects on hypothyroidism. (Tonstad et al., 2013)

e. Respiratory System

The respiratory system is responsible for bringing oxygen into the body and expelling carbon dioxide through a process known as ventilation, or breathing. This system consists of the lungs, which carry out the exchange of gases, and the airway, which carries air to and from the body and its exterior. While the relationship between respiration and diet is not an obvious one, healthy eating affects the system in a variety of ways (Zimmerman, 2016).

Multiple studies have found that fruit and vegetable intake has been shown to have a protective impact on children with asthma, resulting in decreased asthma incidence and airway hyperresponsiveness (Ellwood et al., 2012) (Protudjer et al., 2012). Additionally, when adult asthma patients were asked to reduce or withdraw from medication substitute it with a vegan diet for one year, 71% of patients reported improvements in their condition after only four months and 92% reported improvements within one year. Significant improvement was found in vital

capacity, forced expiratory volume, and physical working capacity (Lindahl et al., 1985).

Contrarily, the Western dietary pattern has been shown to increase risk of asthma in children and increase frequency of asthma exacerbation in adults (Bronwyn & Wood, 2015).

Increased fruit and vegetable intake has also been shown to improve prognosis in individuals with chronic obstructive pulmonary disease (COPD), resulting in improved fractional expiratory volumes and overall disease prognosis (Keranis et al., 2010). Additionally, a positive correlation has been found between soy consumption and observed lung function measures, resulting in a decreased risk for COPD (Hirayama et al., 2009). Cured meat, however, has been shown to increase risk of COPD diagnosis due to the excessive nitrates used in the curation process (Varraso et al., 2007) (Jiang et al., 2008).

f. Nervous System

The nervous system is responsible for communication and overall control of the body. It is divided into the central nervous system, consisting of the brain and spinal cord, and the peripheral nervous system, consisting of nerves. The central nervous system processes information and makes decisions, and the peripheral nervous system relays information to and from the rest of the body (Innerbody).

Upon examining the diet of individuals, a direct link was found between diet and age-related macular degeneration (AMD). Those practicing a typical Western diet were much more likely to be diagnosed with AMD than those practicing a traditional Oriental diet. Diets high in fruits and vegetables have been shown to most strongly prevent AMD, especially by consumption of dark, leafy greens, which provide especially protective effects to the macula and prevent onset of degeneration. (Chiu et al., 2015) Additionally, it has been found that for every

three servings of fruits and vegetables consumed per day, there is a 22% decreased risk of all forms of stroke and transient ischemic attack (Gillman et al., 1995).

g. Musculoskeletal System

The musculoskeletal system provides the body with ability for movement and stability. It consists of bone, muscles, tendons, ligaments, joints, and additional binding connective tissue. Bones provide support for the body and movement is accomplished through the contractile actions of muscles. There are a variety of diseases that can interfere with stability and movement in individuals (Boundless, 2016).

While it is a common belief that cow's milk is the answer for strong bone, the Nurse's Health study followed over 72,000 women over an eighteen-year period and found no decreased risk of fracture in those who drank three or more glasses of milk per day compared to those who drank little to no milk (Feskanich et al., 2003). Additionally, it has been shown that elderly women consuming high amounts of animal protein have a 2.7 times increased risk of hip fracture compared to those consuming high amounts of vegetable protein, as well as an increased rate of femoral neck bone density loss (Sellmeyer et al., 2001).

When looking at musculoskeletal disease, fibromyalgia syndrome is the second most common, characterized by severe muscle and joint pain, resulting in various secondary symptoms such as fatigue, depression, and headache (WebMD). When implementing a raw vegetarian diet intervention on fibromyalgia patients, 63% of participants responded favorably with FIQ scores increasing 46% on average within seven months (Donaldson et al., 2001). Additionally, multiple studies have shown that transitioning to a vegetarian diet has

positive effects on those suffering from rheumatoid arthritis, significantly decreasing symptoms (Kjeldsen-Kragh, 1999) (Hafstrom et al., 2001).

3. Contraindications

While transitioning to a plant-based diet provides tremendous benefits to an individual's health and body, there are some substances more readily found and metabolized from animal products. Because of this, special precautions must be taken when practicing a strictly plant-based diet and some supplementation may be necessary to ensure optimum health.

a. Iron

Iron is an essential factor of an individual's diet, used to make up the hemoglobin and myoglobin that work to transport oxygen throughout our bodies (Abbaspour et al., 2014). There are two different types of dietary iron—heme and non-heme iron. Heme iron is found primarily in animal products and is more readily absorbed than the non-heme iron found primarily in plant-based foods (Lynch & Cook, 1980). This is due to inhibitory compounds found in plants, such as phytic acid, polyphenols (Abbaspour et al., 2014). Because of this, it is a common misbelief that individuals who follow a strictly plant-based diet are unable to obtain adequate amounts of iron.

A study led by Saunders et al. (2012) looked into a variety of studies assessing iron levels in vegetarians and found that vegetarians who eat a varied, well-balanced diet are at no greater risk of anemia than non-vegetarians. The vegetarian and vegan diets generally consumed as much, if not more, iron than diets containing meat. Even with the difference in bioavailability, there was not significant difference in iron status. Those consuming appropriate amounts of iron-rich foods such as whole grains, legumes, nuts, fruits, cereals, and green leafy vegetables are able to receive adequate iron intake. Additionally, consumption of vitamin C can enhance iron

absorption up to six-fold in those with low iron stores, surpassing most inhibitory factors. Those practicing a plant-based diet should consume vitamin C with meals to decrease risk of low iron levels.

b. Vitamin B12

Vitamin B12 is imperative to many body functions, such as the production of amino acids, neurotransmitters, and red blood cells. It is only synthesized by microorganisms, however, and cannot be obtained through plant-based foods. (Pawlak et al., 2013) According to the National Institutes of Health Office of Dietary Supplements (2011), the average adult should consume 2.4 micrograms per day. While some cereals and yeasts may be a source of vitamin B12, it is not naturally found in plant-based foods and those practicing a strictly plant-based diet should supplement.

c. Protein Intake

Protein is used for many functional and structural components of the body, such as building muscle and tissue as well as producing enzymes and hormones. Proteins must be metabolized into amino acids in order to be used. There are 20 amino acids necessary for proper human functioning, the majority of which can be produced by the body and are termed *non-essential* amino acids. The remaining amino acids cannot be produced by the body, however, and must be consumed in our diets, termed *essential* amino acids (Hoffman & Falvo, 2004).

A study done by Hoffman & Falvo (2004) assessed a wide variety of protein sources and evaluated the results of each one. It was found that while animal sources provide the highest quality of proteins, there is a health concern when used as the primary protein source. The proteins from animal products come with a variety of cardiovascular risks due to the high

amounts of saturated fat and cholesterol as well as detriments to bone health due to the sulfur-containing amino acids. Vegetable proteins were found to be an excellent source of protein when properly combined to include all of the essential amino acids, resulting in decreased saturated fats and cholesterol. Additionally, soy was found to be an adequate protein source and can be found in a variety of forms to easily implement into the diet.

4. Conclusion

The rise of the Western diet has resulted in a significant detriment in overall health due to the decrease in nutrients consumed and increase in amounts of fats, cholesterol, and sodium. In order to reverse the effects of such a dietary change, it is essential to begin to transition back to plant-based roots. Such a transition would provide individuals with the nutrients they are now lacking in, as well as significantly diminish the dietary risk factors of the epidemics currently plaguing society.

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