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Exploring the Efficacy of Vegetarian Diet in Diverse Pathologies

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Abstract:

Introduction and Purpose: Human health is influenced by a variety of factors, such as genetics, environment, lifestyle, and accessibility to healthcare. While some of these factors are beyond the control of the patient, lifestyle, which is considered the primary determinant of a healthy life, strongly relies on individual choices. In this paper, we aim to demonstrate the benefits of adopting a vegetarian diet as a cornerstone for maintaining good health and as a supplementary approach to treating common diseases.

State of Knowledge: The vegetarian diet is primarily based on plants and includes products from animals, such as eggs and dairy. However, it excludes all types of meat and any products that require the death of animals. This diet is adopted for various reasons, including religious, socio-economic, or ethical considerations. It is recognized globally and has become a subject of scientific research for numerous scholars. Many studies investigate its influence on human health, and the results are generally positive. The diet is frequently used as a treatment, often in combination with specific pharmaceutical drugs. This approach leads to weight reduction, decreases the risk of cardiovascular diseases, and can have positive therapeutic effects on conditions like gout or chronic kidney disease. Given that some of these diseases have become increasingly problematic for public health systems, a vegetarian diet can help decrease the number of people affected by them.

Conclusion: Given that cardiovascular diseases and incidents are the leading causes of death worldwide, adopting a vegetarian diet can assist patients in avoiding them by reducing their LDL levels and decreasing blood pressure. This diet demonstrates a positive therapeutic effect on patients dealing with chronic kidney disease and gout. It aids in weight reduction and helps prevent the development of metabolic syndrome, which has a variety of beneficial effects.

Key words: diet, vegetarian diet, cardiovascular, gout, chronic kidney disease, obesity

1. History of vegetarianism

Diets that purposefully exclude consuming animal meat date back to 3200 BC. Many civilizations, including Egypt, Greece, and India, had communities that adhered to this nutritional pattern. Such actions were typically motivated by religious principles [1]. These instances were sporadic, though, and throughout the majority of recorded human history, people consumed animal flesh when it was available. Leonardo da Vinci, regarded as a man ahead of his time, was a strong promoter of vegetarianism in the 15th century. He claimed that killing humans and animals is the same thing. However, there were few supporters of such an approach. Charles Darwin's mid-19th-century theory of evolution influenced a change in the perception of consuming animals by highlighting a previously unacknowledged kinship between humans and animals. This theory revealed a closer connection between humans and animals than had previously been recognized. The first known Western vegetarian organization was founded in 1847 and still operates today under the name "Vegetarian Society of the United Kingdom." Since then, a wide range of other organizations have appeared to promote a meat-free diet [2]. It is estimated that 5-10% of the population in affluent countries currently follows a vegetarian diet. A number of additional reasons for avoiding eating meat have also arisen [3]. Recent study suggests that, among many others, the three most popular causes for vegetarians in developed Western nations are concerns about animals, health, and the environment. A vegetarian diet is also being considered as a solution to delay climate change, as it reduces the production of greenhouse gasses, mostly by decreasing livestock. In this study, we will focus on the health aspects associated with a vegetarian diet [4].

2. Cardiovascular diseases

Cardiovascular Diseases (CVD) encompass a spectrum of disorders affecting the heart and circulatory system. These conditions represent a diverse group of ailments, often stemming from the development of atherosclerosis as the primary underlying cause. CVDs are characterized by their chronic nature, gradually progressing over a lifetime, frequently remaining asymptomatic for extended periods. Typically, symptoms only manifest in the advanced stages of the disease, with sudden death being a potential initial indicator. For a significant duration, these conditions have held their position as the leading contributors to

premature mortality worldwide. Projections estimate that by the year 2030, approximately 23.6 million individuals will die from CVD annually. Notably, there exists a modest trend of declining mortality and CVD incidence in regions of northwestern and southern Europe [5].

Throughout the 20th century, a range of risk factors associated with the onset of cardiovascular diseases were elucidated, encompassing diverse blood lipid profiles. A well-documented and widely accepted verity posits an inverse correlation between HDL concentrations and the incidence of coronary heart disease, in contrast to a positive correlation observed between LDL concentrations and coronary heart disease incidence. Obesity, hypertension, and elevated blood glucose levels constitute additional empirically established risk factors for these conditions. These risk factors can be linked to food habits to some degree [6].

Long term intake of a plant-centered, high quality diet that also includes subsets of animal products was linked with a 52% decreased risk of incident CVD in a 32-year prospective cohort trial that tracked participants since young adulthood. Furthermore, an improvement in plant-centered diet quality over 13 years was linked to a 61% decreased risk of incident CVD over the next 12 years [7]. In an organized examination and combined analysis of 8 prospective investigations conducted on Seventh-day Adventists, it was observed that adhering to vegetarian diets correlated with a 40% lower likelihood of experiencing coronary heart disease incidents and a 29% decrease in occurrences of cerebral vascular disease, in comparison to individuals following non-vegetarian dietary patterns [8].

An important distinction between plant and animal diets is the prevalence of polyunsaturated fats in plant-based diets, whereas saturated fats are more common in animal diets. Substituting these fats in the diet led to outcomes akin to those achieved through statin therapy [9]. Ingesting saturated fat escalates blood LDL-C levels, with an average LDL-C increase of 2% for each 1% rise in energy sourced from saturated fat intake. Similarly, dietary cholesterol, exclusive to animal products, heightens both total cholesterol and LDL-C [10].

A meta-analysis analysis of 7 randomized controlled trials and 32 observational studies unveiled that adopting vegetarian diets corresponds to reduced blood pressure, encompassing both systolic and diastolic measurements, in comparison to omnivorous diets. In observational studies, those on vegetarian diets showed significant average reductions of 6.9 mm Hg for systolic and 4.7 mm Hg for diastolic blood pressure. In randomized controlled trials, vegetarian diets led to reductions of 4.8 mm Hg in systolic and 2.2 mm Hg in diastolic

blood pressure. The estimated 5 mm Hg systolic blood pressure decrease translates to a remarkable 7% reduction in overall mortality, a 9% decrease in coronary heart disease-related mortality, and a substantial 14% drop in mortality attributed to strokes. This can be attributed to the higher fiber and potassium content and lower fat levels typically found in vegetarian diets compared to omnivorous diets [11,12].

Platelet aggregation is another important risk factor in the development of CVD, particularly coronary heart disease, and its complications. Platelets become activated when they come into contact with endothelial receptors exposed by damage, and their interaction is critical in the pathogenesis of atherosclerosis. Plant-based foods have been shown to reduce platelet aggregation, lowering the risk of CVD. Plant meals rich in polyphenols and flavonoids have been revealed to protect against the development of CHD by enhancing platelet function. Whole plant foods are particularly effective at reducing platelet aggregation. [10].

A notable example of vegetarian approach in CVD treatment is portfolio diet. It was formulated around four cholesterol-lowering foods: nuts, plant protein, soluble fiber, and plant sterols. An advanced variant swaps carbohydrates for MUFA. Combining this with the NCEP Step II diet notably reduced primary outcome LDL-C by about 17%. Additionally, improvements were observed in non-high-density lipoprotein cholesterol, apolipoprotein B, total cholesterol, triglycerides, blood pressure, C-reactive protein, and estimated 10-year coronary heart disease risk when contrasted with the NCEP Step 2 diet alone [13].

3. Chronic kidney disease

Chronic kidney disease (CKD) is a syndrome characterized by changes in kidney function and structure that can lead to end-stage renal disease (ESRD). CKD is diagnosed when kidney damage persists for more than three months and the glomerular filtration rate (GFR) is less than 60 ml/min/1.73 m2 or GFR greater than 60 ml/min/1.73 m2, but signs of structural kidney damage are observed [14].

It’s estimated that 37 million American adults have CKD and millions more are at increased risk. Another fact is that 9 out of 10 adults with CKD are unaware of the disease, which may be due to the lack of initial symptoms [15]. With this in mind, CKD as a major global public health issue has become the target of many studies aimed at improving

diagnosis, treatment, and detection of the disease at earlier stages. The aim of such action would be to improve the prognosis and quality of life as well as lower the cost of treatment [16].

CKD can occur as a result of abnormal renal development or injury, an inflammatory process, or toxins. These factors disturb the structure of the organ, leading to hyperfiltration and hypertrophy of undamaged nephrons, thus deepening the process [17].

The causes of CKD are different depending on nationality, ethnicity, or race, as well as socioeconomic status. Diabetes and hypertension are two main factors in the development of CKD in high- and middle-income countries. Other prevalent risk factors are obesity, age, and glomerulonephritis. In Asia and Africa, the use of herbal medications is more prevalent and can lead to renal damage because of their nephrotoxic effects. In some geographical areas, the incidence of CKD is reported to be higher due to pesticide use and heavy metal pollution of the water [18], [19], [20].

Treatment largely depends on the cause of organ damage. However, there are many recommendations for all CKD patients. Cessation of smoking cigarettes, moderate physical activity of about 30 minutes a day, or limiting alcohol consumption are just some of them. Dietary recommendations include eating plenty of fiber. Patients with CKD should monitor their sodium, potassium, phosphorus, and protein intakes. A low-protein diet (0.6g/kg/day) as determined by a nutritionist should be considered with a GFR of 29 ml/min/1.73 m2 and less [21].

Due to the progressive nature of the disease, without effective treatment, it can lead to ESRD. At this stage, replacement therapy, dialysis, or kidney donation are necessary. ESRD remains universally deadly [22].

The most commonly suggested diet among CKD patients is a protein-restricted diet. This is due to their structure, excretion in the form of uric acid and urea, hydrogen ions, and phosphates. Limiting their intake allows you to slow down the progression of kidney failure by reducing hyperfiltration. Lower urinary protein levels were observed among vegetarians as a result of the diet [23], [24]. However, not sufficient research was conducted among vegetarian populations suffering from CKD [25].

In comparison to omnivores, those who follow a plant-based diet are less likely to experience hypertension, diabetes, and obesity, which are known risk factors for CKD [26]. Other advantages of plant-based diets include slowing the disease's course by eliminating factors that make CKD more likely to occur [27].

The concept of a vegetarian diet is quite broad, and many people understand it in different ways. Using this diet, you can limit the consumption of meat only, as well as eggs and all animal products. For this reason, an unambiguous determination of the effectiveness of a vegetarian diet requires clarification [23].

Hao-Wen Liu et al. indicate greater prevention of proteinuria in patients following a vegan diet. Also pointing to the lower percentage of CKD in the vegan subjects than other groups such as omnivores [28].

Pescetarianism is another term for a vegetarian diet that also includes eating fish meat. In young individuals with type 1 diabetes, this diet was linked to a preventive effect against the development of microalbuminuria [29].

In their study, Zhou Jing et al. brought up the topic of soy proteins' potential for preventing CKD. They highlight the positive impacts in human models, including the ability to lower renin-angiotensin incorrect expression and the effects of soy isoflavones on lowering oxidative stress and their anti-inflammatory qualities. Although it is not certain, the effect of soy isoflavones may delay the development of renal impairment [30].

4. Gout

Gout is a form of inflammatory arthritis characterized by the deposition of uric acid crystals within joint structures [31]. Uric acid, a byproduct of purine metabolism, is ordinarily dissolved in the bloodstream and excreted through renal mechanisms [32]. The origins of gout commonly entail a variety of elements, including genetic susceptibilities, coexisting health issues, diet and usage of specific drugs. Regardless of the underlying reason, the outcome is an increase in uric acid levels in the blood, leading to the development of clinical gout [33]. The elevated urate levels lead to the formation of crystals known as monosodium urate (MSU) crystals [34]. This crystalline deposition incites an immune-mediated response, inducing marked inflammation, intense pain, and localized edema within the afflicted joint(s). Predominantly observed in the metatarsophalangeal joint of the great toe, gout can also manifest in other articulations, including the ankles, knees, fingers, and wrists [34].

Gout's onset is often abrupt, characterized by acute and excruciating paroxysms of pain. The affected joint becomes erythematous, distended, and exquisitely sensitive to palpation. If not vigilantly managed, gout can evolve into a chronic ailment, marked by

recurrent and increasingly debilitating flare-ups, potentially leading to progressive joint degeneration [35] [36].

Nowadays, gout has firmly established itself as a significant worldwide health concern, attracting focus due to its rising frequency, various associated metabolic conditions, and elevated premature mortality [37]. It is found in 1-4% of the overall population. The global occurrence of gout is on a gradual rise, primarily attributed to unhealthy dietary patterns, insufficient physical activity, and the heightened prevalence of obesity [38][39].

Extensive clinical findings have highlighted a strong linkage between adhering to the specified dietary patterns and the propensity for developing metabolic disorders related to gout [40]. Research has demonstrated that favorable dietary patterns aimed at counteracting hyperuricemia generally involve increased consumption of vitamins, fiber, and unsaturated fatty acids. These patterns often incorporate suitable quantities of minerals and high-quality protein, fostering a state of health conducive to enhancing systemic metabolism and ameliorating disease conditions [35][41].

In the context of the impact of a vegetarian diet on gout symptoms, the scientific information available is multifaceted. The effectiveness of this dietary approach hinges on the specific composition of the diet, considering that certain plant-based foods also have elevated purine content[42].

Soluble urate serves as an inflammatory trigger, spurring the maturation and generation of interleukin (IL)-1β. This process significantly contributes to the initiation of acute gout-related inflammation and lays the foundation for the enduring chronic inflammatory ramifications associated with the ailment [43]. The deposition of urate crystals is as well widely acknowledged as a signaling mechanism that triggers the recruitment of innate immune cells [44]. Dietary choices exert notable influence over the overall characteristics of the innate immune system. For instance, adhering to meat-centric patterns results in a lasting inclination of the immune system toward a proinflammatory state [45]. Conversely**,** the vegetarian diet has been documented to deter systemic inflammation and mitigate episodes of gouty inflammation [46].

Opting for a vegetarian diet holds the potential as a favorable dietary regimen that addresses several pathways implicated in gout development. By adopting a vegetarian diet, individuals steer clear of purine-rich meat and seafood, opting instead for increased consumption of vegetables, whole grains, seeds, and nuts [47]. Among the potential

approaches, the vegetarian strategy emerges as particularly advantageous, as evidenced by a study conducted by Schmidt et al. In this study, the group adhering to a vegetarian diet showcased the lowest serum uric acid levels, in comparison to individuals who consume meat[48]. Also, numerous cross-sectional investigations have indicated that individuals adhering to a lacto-ovo vegetarian diet typically exhibit lower uric acid levels compared to those following nonvegetarian dietary habits [49][50].

Polyphenols present in plant-based foods possess the capability to potentially diminish uric acid levels through the inhibition of xanthine oxidase activities and the augmentation of uric acid excretion [51]. Based on research, adopting a vegetarian diet led to a significant 93% reduction in the risk of uric acid crystallization in comparison to the conventional diet. Furthermore, vegetarian dietary patterns have demonstrated the capacity to diminish accompanying conditions linked with gout, including hypertension, diabetes, and cardiovascular ailments[52] [53] [54].

Vegetarian foods are as well naturally rich in vitamins such as vitamin C, vitamin A, folate, and various B vitamins. Vitamins function as regulators of bodily processes, including engagement in immune reactions, antioxidative functions, and redox processes. Research has indicated that maintaining sufficient vitamin levels through supplements or incorporating vitamin-enriched fruits and vegetables into one's diet emerges as a viable strategy for addressing hyperuricemia and managing gout. Vitamins like vitamin A, vitamin E, and vitamin C demonstrate advantageous impacts in combating oxidative stress and inflammation, along with successfully reducing serum uric acid levels[55] [56].

Based on scientific findings, the inclusion of a vegetarian diet, abundant in dietary fiber, presents an advantageous dietary approach for managing and preventing gout. This strategy exhibits promise by exerting effects on multiple fronts, encompassing urate excretion, inflammation modulation, promoting regular bowel movements, and the composition of gut microbiota[57]. Scientific evidence confirms that a diet abundant in fiber swiftly alleviates the inflammatory response mediated by urate crystals in a mouse model simulating gout [58].

5. Obesity

Obesity is one of the most common diseases among society in developed countries and during the last 50 years has become one of the most important public health issues [59]. Body-mass-index (BMI; weight in kg/height in m^2) and waist circumference are used as

measurement tools for obesity screening. Both of them are also good predictors of health risk [60]. There are a lot of diseases associated with obesity, such as diabetes, chronic kidney disease, gastrointestinal diseases and cardiovascular diseases which result in shortening life span [61][62].

The treatment of obesity has been discussed in various articles and is based on both pharmacological and surgical procedures [63][64]. However, reducing daily calories intake and lifestyle changes are still being considered the primary step in treatment [65]. The proper diet combined with increased physical activity and behavior change is the most effective approach to lose weight.

Vegetarian diets are significantly lower in energy [66]. Moreover, it contains less cholesterol and the majority of its energy comes from carbohydrates rather than fat [67]. In a 5-year prospective research, which was conducted on 22,000 participants and monitored different food patterns, omnivores (who eat meat and fish), gained more weight than vegetarians [68]. Research shows that vegetarians average not only lower BMI (25,7kg/m^2 compared to 28,8kg/m^2 for omnivores [69]), but also their serum lipid levels are favorable [70]. The risk of developing Metabolic Syndrome (in which obesity plays an important role) is smaller by around 50% than for people who use other diets. It affects waist circumference, blood pressure, concentration of triglycerides and LDL. In addition, compared to the Mediterranean Diet and DASH (Dietary Approaches to Stop Hypertension), vegetarian diets show respectively 38% and 20% lower risk of cardiovascular diseases such as coronary heart disease [71][72].

This healthy impact of diet is associated with improved nutrition and quality of food and cut down such products as red and processed meat, which lead to an increased chance of cardiovascular incidents, type II diabetes, and certain types of cancer, such as colorectal cancer [73].

6. Conclusion

Many research studies have shown the positive effects of adopting a vegetarian diet, making it a potent addition to first-line treatments. This dietary approach demonstrates significant benefits in preventing various diseases, including hypertension, diabetes, and obesity. By aiding in weight reduction, improving blood test indicators (such as LDL

cholesterol and uric acid levels), and lowering the risk of disorder recurrence, it contributes to maintaining good health. One of its notable advantages is its accessibility - it can be easily implemented for all types of patients and isn't constrained by cost considerations.

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