



Review

Health Benefits and Precautions of The Vegetarian Diet

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Abstract. Vegetarians are often pointed out to be deficient in protein, some vitamins, minerals, and n-3 polyunsaturated fatty acids. But vegetarians can also select appropriate food for necessary nutrients from plant food and effectively improves and maintains health in many cases. A vegetarian diet reduces the prevalence of lifestyle-related diseases such as cardiovascular diseases and malignant neoplasms. On the other hand, there are also biased perspectives. Some people are swept away by populism, blindly believing that plant foods are suitable for the body and the environment and that animal foods are harmful and unhealthy. There are various backgrounds to a vegetarian diet. Suppose you practice a vegetarian diet for health. In that case, you need to be interested in a vegetarian diet, better understand nutrition and food science, and have a scientific perspective. This review outlines vegetarianism's current state and the essential nutrients for vegetarians to practice a healthy vegetarian diet.

Key words: vegetarian, health, plant food, nutrient, benefit, lifestyle-related diseases

1. Introduction

The history of vegetarianism is ancient, and it has reportedly originated from the Indus Valley Civilization around the 7th century BC. After that, vegetarianism developed in various regions with the influence of religions and philosophies. Ethical vegetarianism has been spread among those who oppose killing animals have rooted worldwide.

Early 20th century, the vegetarian diet's health became known for Western developed countries' therapeutic aspect, attracting widespread attention. Nowadays, vegetarian food is being adopted by people with various ideas and positions

due to ecological, environmental, and economic burdens, religion, ethical aspects, and health concerns. Especially when it comes to health, vegetarian diets are often chosen based on the desire to improve physical fitness, obesity, and reduce the risks of developing lifestyle-related diseases in different cultures, countries, and regions. However, in this case, many people take it easy to adopt a vegetarian diet, even though vegetarian cannot guarantee their health. No matter what purpose you practice a vegetarian diet, it is a significant premise that you are healthy, so we should be well aware of this and be vegetarian.

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2. Background of vegetarian diet adoption

Today, the number of starved people who have difficulty survival and social life for a long time

due to chronic malnutrition reaches about 700 million people. On the other hand, in developed western countries, the efficiency of agriculture and livestock industry improved according to science and technology development starting from the industrial revolution. Along with this, the lifestyle has changed. As a result, many people suffering from lifestyle-related diseases such as cancer and cardiovascular diseases increases. Vegetarian nutrition has an increasing international following and is increasingly accepted. This trend's main reasons are health concerns, ecological, economic, religious, and ethical aspects [1]. In the case of a health problem, they arise from the desire to lose weight, tackle obesity, improve physical fitness, and reduce the risk of acquiring certain diseases.

Vegetarian diets are generally low-calorie, low-glycemic index, rich in dietary fiber, folic acid, vitamins C and E, potassium, magnesium, and contain functional ingredients called phytochemicals such as polyphenols. It has been shown that adequately applying a vegetarian diet is the most effective way to reduce body mass index, improving the plasma lipid profile. And they are decreasing high arterial blood pressure, cardiovascular disease, stroke, metabolic syndrome, and arteriosclerosis. Besides, improved insulin sensitivity and lower rates of diabetes and cancer have been found [2].

However, some studies also suggest that vegetarian diets can harm the body. Concerns include protein deficiency, anemia, decreased creatinine content in muscles, and impaired menstruation in women with increased physical activity.

These can also reduce your ability to perform exercises that require physical effort. Nevertheless, with the right food choices, a vegetarian diet's beneficial effects far outweigh the disadvantages and can be reasonably concluded [3].

3. Vegetarian health and risks and benefits

Vegetarians, who do not eat from animals, poultry, fish, and dairy products, is constituted a minority of the world's population. Concerns about the health, economic, and environmental impacts of diets containing animal foods have excluded some or all of these foods from the diet. This chapter introduces the main findings from a large cross-sectional and prospective cohort study in Western countries with many vegetarian participants to understand vegetarian health.

Vegetarians have a lower prevalence of obesity and a lower risk of ischemic heart disease than non-vegetarians from a similar background, whereas the data are equivocal for stroke. There is a piece of evidence that the risk for all cancer sites combined is slightly lower in vegetarians than in non-vegetarians. Still, findings for individual cancer sites by gender are inconclusive. Vegetarians have also been revealed to have lower risks for diabetes, diverticular disease, and eye cataract. Overall mortality is similar for vegetarians and non-vegetarians. The long-term health of vegetarians seems to be generally favorable, and for some diseases and medical conditions, it can be better than omnivores [4].

Since the Adventist Health Study 2 (AHS2) in 2013, several prospective dietary studies have demonstrated and challenged the vegetarian diet's health benefits and risks. Annual sales of plant foods are on the rise. Still, a 2018 Gallup survey indicates that the overall stagnation proportion of self-reported vegetarians and vegans compared to the ratio obtained with AHS2 six years ago. The latest vegetarian studies show a significant reduction in mortality from cardiovascular disease, cerebrovascular disease, diabetes, and chronic kidney disease compared to the Adventist Health Study. Recent studies have correlated certain food groups with early death rates or increased longevity.

4. Nutrients of concern for vegetarians

Vegetarian health risks are explored protein deficiencies, n-3 polyunsaturated fatty acids (n-3PUFA), vitamin D, vitamin B₁₂, iron, calcium, and zinc [5]. These eight nutrients have in common that the diet is mainly from animal food. Therefore, vegetarians are often deficient, and it is a nutrient that can be confirmed in research papers and other reports regarding insufficient intake and malnutrition.

It is equally a fact that there are no nutrients that humans must from animals, as indicated from the food composition table. However, a vegetarian diet can lead to deficiency and chronic deficiency [5-7]. The low bioavailability of vitamin B₁₂, iron, and zinc in vegetables can also affect vegetarians' nutritional status. Further, vegetarian diets are usually deficient in the n-3PUFA, such as EPA and DHA [8]. This chapter reviews an overview of each of the eight nutrients that vegetarians have pointed out to be deficient.

4.1. Protein

Protein is one of the specific nutrients that vegetarians are concerned about deficiency. To take in enough protein containing nine essential amino acids to maintain a healthy body is critical. Depending on a research method and a standard to adopt, uncertainty remains about the protein requirements; in any case, the data of the vegetarian of recent adults indicate that the diet of the usual vegetarian supply quantity adequate protein and amino acids. Suppose food supply fluctuations are not large, as in the western developed countries. In that case, there is no problem with adequate intake of individual essential amino acids from a vegetarian diet as long as lysine is sufficient. There is little evidence of the adverse physiologic effects of the protein intake low moderately to be seen in an adult taking in a vegetable diet [9].

A vegetarian diet can quickly meet dietary protein requirements as long as energy needs are met and various foods are taken. Vegetarians should obtain protein from different plant sources,

including legumes, soy products, grains, nuts, and seeds. The human body has a functioning pool of amino acids that can be used to supplement dietary protein. If you are eating various foods every day without being too biased, you do not need to combine plant proteins. The intake of vegetable protein by vegetarians can reduce the risk of chronic illnesses such as diabetes and heart disease [10]. For a small proportion of vegans, the risk of underdose may be moderate.

Additionally, any evidence for a functional impact and a higher absolute risk of sarcopenia in the healthy elderly is currently concerned. Children who consume energy to cover their growth requirements should automatically obtain sufficient protein intake from vegetarian diets. Further data are needed to evaluate people's actual dietary patterns to an insufficient intake of total energy and protein [9].

4.2. Vitamin B₁₂

Vitamin B₁₂ is an essential nutrient to consider when practicing vegetarian diets. Even lacto- or ovo-vegetarians run the risk of becoming deficient in B₁₂. Since vegetarians have a lower intake of vitamin B₁₂ than non-vegetarians, they are at greater risk of developing B₁₂ deficiency.

Vitamin B₁₂ deficiency contributes to the formation of red blood cells, which causes megaloblastic anemia, spinal and brain white matter disorders, and peripheral neuropathy. If we are not careful about vitamin B₁₂ intake, it will gradually harm our body, and one day you may suddenly have an abnormality in your body. A loss of 0.1 to 0.2% of the body's vitamin B₁₂ storage per day is complicated. Even if you stop taking vitamin B₁₂ altogether today, the adverse effects of deficiency may not be apparent for several years [11].

Besides, pseudo vitamin B₁₂ in food cannot be used as vitamin B₁₂ by humans [12]. Vitamin B₁₂ contained in seaweed is analytically recognized, but there is no nutritional basis for its effectiveness. There is also the view that supplements and fortified cereals are essential only for vitamin B₁₂ [13]. Vegetarians are

recommended regularly to take supplements of B₁₂, and they should be kept informed of the lacking content of B₁₂ of plant products and the hazards of B₁₂ deficiency [14].

4.3. Calcium

Vegetarians consume more plant products that contain oxalic acid and phytic acid, which can result in lower calcium absorption than those who eat anything [15]. Calcium intake is similar between vegetarians (people who eat eggs and dairy products) and non-vegetarians [16]. However, vegetarians who do not eat any animal products and ovo-vegetarians who eat eggs but not dairy products do not consume dairy products. They may not have sufficient calcium intake [17].

The Oxford cohort of the European Prospective Cohort Study on Cancer and Nutrition show vegetarians probably average calcium intake. However, in vegetarian, elevated fracture risk [18]. On the other hand, dietary calcium intake is not related to fractures' risk, and no evidence in clinical trials increasing dietary calcium intake prevents fractures. Definitive proof that calcium supplements prevent fractures is low, and inconsistent has been reported [19].

4.4. Vitamin D

Even omnivorous people who eat meat and fish tend to be deficient in fat-soluble vitamins [20], but vegetarians need to be more careful. Vitamin D deficiency may be more typical than omnivorous animals, especially during the winter months when UV exposure is reduced, and skin synthesis is minimal. When commonly intake mushroom species are irradiated to ultraviolet (UV) such as sunlight or a UV lamp, they produce sufficient amounts of vitamin D. The most common form of vitamin D in mushrooms is D₂, with lesser amounts of vitamins D₃ and D₄. In contrast, vitamin D₃ is the most common form of animal foods. Worldwide, mushroom consumption has increased markedly, and mushrooms have the potential to be the only non-animal food source of vitamin D, which can provide a sufficient amount of vitamin D₂ in a single-serve. The levels of

vitamin D₂ in UV-exposed mushrooms may decrease with storage and cooking. But vitamin D₂ level in mushrooms is above 10µg/100g fresh weight, which is higher than the level in most vitamin D containing foods and similar to the daily requirement of vitamin D recommended internationally [21].

In adults, vitamin D deficiency causes osteomalacia and bone weakness. Vitamin D deficiency causes bone pain and weakness symptoms, but the signs are so insignificant in the early stages that they may be neglected [22]. Several recent studies have looked at plant-based nutrition and bone health markers, using measures such as bone mineral density, bone turnover markers, or fracture rates. Although population-based and cross-sectional studies can be prone to confounding effects, most did not indicate differences in bone health between vegetarians or vegans and omnivores as long as calcium and vitamin D intake was adequate. On the other hand, a few longitudinal studies or prospective cohort even show few longitudinal studies or prospective cohort benefit from plant foods. Still, this claim has not been proven [23].

4.5. n-3 Polyunsaturated fatty acids

A vegetarian diet tends to have a lower total fat intake, saturated fatty acids, and cholesterol than a non-vegetarian diet. Vegetarian, mostly vegan, diets are deficient in EPA and DHA compared with linoleic acid (LA) and alpha-linolenic acid (ALA) [24]. EPA and DHA, although synthesized initially by microorganisms in the oceans, are primarily obtained from the consumption of fish. By definition, vegetarians do not eat fish and thus intake virtually no EPA and DHA [25].

Clinical studies indicate that tissue contents of n-3 PUFA are depressed in vegetarians, particularly in vegans. n-3 PUFA has numerous physiologic benefits, including potent cardioprotective effects. These effects have been demonstrated for ALA and EPA and DHA, although the physiologic effectiveness is inferior for ALA than for EPA and DHA in most cases. Conversion of ALA in the body to the more active

longer-chain fatty acids is inefficient; < 5-10% for EPA and 2-5% for DHA. Because of the beneficial effects of n-3 fatty acid, ALA required amount can be higher for vegetarians than for non-vegetarians, as vegetarians must rely on the conversion of ALA to EPA and DHA [24].

While intake of the ALA is similar in vegetarians and non-vegetarians, intakes of EPA and DHA are low in vegetarians. Blood, plasma, and tissue levels of EPA and DHA are more deficient in vegetarians than in non-vegetarians. Vegetarians do not have clinical signs of DHA deficiency, but further research is needed to ascertain whether vegetarians' levels are sufficient to support optimal health. Vegetarians with increased require or reduced conversion ability can obtain some advantage from DHA and EPA supplements derived from microalgae. A supplement is suggested for high requirements, such as pregnant and lactating women, and those with decrease conversion ability, such as older people or chronic disease diabetes [26].

Vegetarian diets have a specific possible concern: vegetarians have high intakes of LA compared to omnivore/non-vegetarian diets. High intakes of LA competitively interfere with the endogenous conversion of ALA to EPA and DHA. High somatic levels of LA and low ALA indicate a decreased ALA conversion to EPA and DHA. Besides, vegetarian diets are rich in dietary fiber, possibly interfering with fat absorption [27].

4.6. Iron

Vegetarians do not feed meat, seafood, and related products. Although the vegetarian lifestyle could lead to better health status in adults, it may also bear certain nutritional deficiencies. Cross-sectional studies and vegetarian reviews show that a meatless diet does not contain bio efficient haem iron. Vegetarian foods are not well suited for the supply of vegetarian iron because they contain substances that impair non-haem iron's bioavailability [28]. Therefore, a vegetarian diet absorbs less iron than a diet containing meat. Due to the low intestinal absorption of non-haem iron in vegetable foods, vegetarians who do not

consume any animal products from their diet need about twice as much dietary iron as non-vegetarians per day [29]. Also, vegetarians have lower iron stores in their bodies, and compared to non-vegetarians, had iron deficiency anemia. This fact is especially actual for premenopausal vegetarian women [30].

Vegetarians will improve non-haem iron absorption by simultaneously taking non-haem iron sources as abundant vitamin C sources such as citrus fruit. A diet rich in whole grains, legumes, nuts, seeds, dried fruits, iron-fortified cereals, and green leafy vegetables provides an adequate iron intake. Vitamin C and other organic acids enhance non-haem iron absorption, a process that is regulated by the gut. People with depleted iron stores or higher physiological need for iron will absorb more iron and excrete less [31]. However, vegetarians who eat a varied and well-balanced diet are out of any more significant iron deficiency anemia risk than non-vegetarians.

4.7. Zinc

Zinc is the abundant trace mineral in the body after iron, the essential trace element [32]. Zinc has many physiologic roles, particularly being required for the growth and functioning of the immune system. Deficiency impairs physiologic processes, leading to clinical consequences that include failure to thrive, skin rash, and impaired wound healing. The mild lack that is not clinically overt may still cause nonspecific results, such as susceptibility to infection and low growth [33]. Zinc is also contained in plant foods, but the efficiency of zinc absorption decreases due to zinc absorption inhibitors in plant food such as phytic acid reduces zinc effectiveness [34].

The results of studies investigating zinc intake and zinc status in vegetarian populations are inconsistent. Because vegetarians high phytic acid intake as a zinc absorption inhibitor, zinc bioavailability is lower in vegetarian diets [35]. Vegetarians should have a strategy for optimizing this by appropriate food intake. It is more beneficial to use food recipes that suppress phytate binding to zinc and increase zinc

bioavailability. Also, vegetarians can relatively easily supplement zinc through beans, seeds, nuts, and grains.

4.8. Iodine

Today, the rise in vegetarians may increase the incidence of iodine deficiency [36]. Iodine is an essential component of fetal neurodevelopment and thyroid hormone synthesis. Iodine deficiency causes goiter, hypothyroidism, cretinism, and cognitive developmental disorders. Iodine deficiency impairs thyroid hormone production, adversely affects life, especially early in life, and impairs cognition and growth [37].

Seaweed (such as kelp and wakame) is an essential iodine source, but its content varies considerably. Other iodine sources are dairy products, cereal products, eggs, and significant iodine source in the American diet [38]. Plant food contains a small amount of iodine. But its content depends on the iodine content in the cultivated soil, and the fertilizer used [39].

5. Conclusion

Vegetarians need to be aware of ingenuity by knowing nutrition, food science, and culinary science. Vegetarians should be mindful of what nutrients can be deficient and how many nutrients they can get from what ingredients they are low in by eliminating animal foods.

If you become a vegetarian because of anxiety about your health, you may notice an improvement in your physical condition after eating a vegetarian diet. At that time, vegetarianism = imprinting of good things may occur, and it may become a more crude vegetarian diet that corresponds to delusion. Vegetarians have fewer smokers and drinkers than non-vegetarians and often develop a lifestyle in which exercise habits, rest, sleep, and stress management are desirable. Such daily life plays a role in expecting health to be maintained. If vegetarians are obsessed with stoic psychology, unaware of nutrients, and eat without meat, fish, eggs, and dairy products, it can be unhealthy.

Continuing an unbalanced vegetarian diet for long periods can lead to fatigue, weakened skin, hair, nails, and unknowingly developing physical upset. It is essential to care that many physical changes and health problems caused by malnutrition rarely appear as immediate symptoms and gradually affect the body over months to years.

The risk of long-term malnutrition is different between those who know the weaknesses of vegetarian diets and how to cover them. The effects of a vegetarian diet are closely related to your constitution and past dietary habits. Whether you are already a vegetarian or just starting, truly understanding vegetarianism's nutritional weaknesses helps support your positive beliefs and thoughts and get you closer to a better condition.

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菜食の利点と注意事項

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菜食主義者は、タンパク質、いくつかのビタミン、ミネラルおよびn-3系高度不飽和脂肪酸の摂取が不足していると指摘されることがよくある。しかし、菜食主義者は植物性食品から摂取すべき栄養素に適した食品を選択することもでき、多くの場合、健康を効果的に改善および維持できる。菜食主義者の食事は、心血管疾患や悪性新生物などの生活習慣病の有病率の低下につながるが、一方で偏った見方もある。一部の人々は、植物性食品が体と環境に適していること、そして動物性食品は環境に悪く、不健康であると盲目的に信じて、ポピュリズムに流されている。菜食にはさまざまな背景がある。健康のために菜食を実践する場合は、菜食に興味を持ち、栄養学と食品科学についてより深く理解し、科学的な視点を持っている必要がある。このレビューでは、菜食主義の現状と、菜食主義者が健康的な菜食主義の食事療法を実践するために不可欠な栄養素について概説する。

キーワード: 菜食主義・健康・植物性食品・栄養素・利益・生活習慣病

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