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Plant based diet and cardio-metabolic disease

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Abstract

Introduction: Modern lifestyle, especially diet have a great impact on health. The number of people suffering from conditions related to lifestyle is growing rapidly. Illnesses related to lifestyle, specifically to diet are large health and economic burdens, which makes them the leading priorities of our time. Coronary heart disease (CHD), stroke, type 2 diabetes, and obesity are some of cardio-metabolic diseases related to diet. Plant-based diets are dietary patterns in which a high intake of plant food is emphasized and the intake of animal products is limited. Plant based diet was associated with decreased risk of cardio-metabolic disease.

The aim of the study: The purpose of this systemic review was to collect and analyse current data of plant based diet and its effect on health.

Material and method: Standard criteria were used to review the literature data. The search of articles in the PubMed and Google Scholar database was carried out using the following keywords: plant based diet, vegetarian diet, cardiovascular disease, type 2 diabetes, hypercholesterolemia.

Description of the state of knowledge: Red meat and, especially processed meat, is source of cholesterol, saturated fatty acids, and sodium, which makes it a risk factors for metabolic disorders. Healthy plant based diet can positively affect cardiovascular health in many ways. High fiber content makes those diets low in energy density, flavonoids that are present in fruits and vegetables and also high content of antioxidants. Plant based diet was also shown to be helpful in reducing weight.

Summary: Many risk factors of cardio-metabolic disease are related to our lifestyle and dietary choices . Changes towards plant based diet can be beneficial for our health in many ways. Healthy plant based diet should be considered as a nonpharmaceutical approach to prevent and treat cardio-metabolic diseases.

Key words: plant based diet, cardiovascular disease, type 2 diabetes

1. Introduction

Plant-based diets are dietary patterns in which high intake of plant food is emphasized and the intake of animal products is limited [1]. Moreover, plant based diets are a large group of dietary patterns depending on what kind of animal products are excluded. Pescovegetarians or pescetarians consume fish in addition to eggs and dairy, but poultry and red meat are excluded. The only animal food that is consumed by lacto-vegetarians are dairy products. Lacto-ovo-vegetarians consume also eggs, but no other animal products. The most restrict is vegan diet, which exclude all animal products. The main contributing factor to chronic disease and premature death in the United States and worldwide is suboptimal nutrition [2]. Coronary heart disease (CHD), stroke, type 2 diabetes, and obesity are some of cardio-metabolic diseases related to diet [3]. Illnesses related to lifestyle, specifically to diet are large health and economic burdens, which makes them the leading priorities of our time [3].

In this review, we summarize the findings on the positive effects of following plant-based diet on health.

2. Obesity

Obesity is a rapidly increasing pandemic as recognized by WHO [4]. It has increased epidemically during the past 4 decades. Now, worldwide more than half a billion adults are obese ($\text{BMI} \geq 30 \text{ kg/m}^2$) [5]. Overweight and obesity are associated with a number of chronic diseases, including type 2 diabetes [6], metabolic syndrome, truncal obesity, hypertriglyceridemia, hypertension and their collective effects on cardiovascular disease risk [7]. Obesity is also associated with gastrointestinal disorders, joint and muscular disorders, respiratory problems, and psychological issues [8]. Even modest weight loss—5% decrease in body weight—has been shown to lower the risk of chronic disease [9]. Various diets are proposed as a way of weight reduction. Many of those diet plans tend to have conflicting recommendations, which can cause confusion for those trying to lose weight. Most of the popular weight-loss plans are efficacious for weight reduction in the short term [10]. The results of randomized clinical trials concerning vegetarian diets and their effects on weight reduction have been inconclusive, which is why longer-term intervention trials are needed. Nevertheless, vegetarian diets, in particular vegan diets, appear to have beneficial effects on weight reduction [11]. In 16-week randomized clinical trial the effect of a plant-based diet on body composition and insulin resistance were studied. 75 overweight participants followed a plant-based or a control diet. The results showed significant reductions in body weight only in the vegan group. Moreover, the plant based group had better outcomes in improving body weight, fat mass, and insulin resistance markers [12]. The findings from the two large studies Adventist Health Study (AHS) and European Prospective Investigation into Cancer and Nutrition (EPIC-Oxford) study have shown positive effects of vegetarian diets. Results from AHS showed the association between increased BMI and increased amount of animal food in the diet. Thus, vegans had the lowest BMI [13]. Results from EPIC-Oxford study have shown that vegans gain significantly less weight as they age compared to omnivores [14]. Plant based diets should be considered as a way of losing weight and improving quality of a diet for patients in case of chronic disease prevention and treatment [9].

3. Cardiovascular health

Vegetarian diets are associated with lower all-cause mortality [15]. There is an association between vegetarian diet and increased risk of cardiovascular disease in general [2]. It has been shown that a plant based diet can be another effective approach in the clinical setting for reducing cardiovascular risk factors like hypertension or hypercholesterolemia. Therefore, reducing overall medication usage [16]. Healthy plant based diet consists mainly of legumes, vegetables, fruits and nuts, but also whole grains. Such diet ingredients can positively affect cardiovascular health in many ways. As it was mentioned above, this kind of diet seems to help in reducing weight. Plant based diets are more likely to be low in saturated fat. This advantage in combination with high fiber content makes those diets low in energy density. Dietary fiber is a non-digestible form of carbohydrates. The recommended daily allowances (RDAs) for total fiber intake for men and women aged 19–50 are 38 gram/day and 25 gram/day, respectively [17]. Whole grain cereals, legumes, and dried fruits have high fiber content. However, foods that are commonly consumed are low in dietary fiber [18]. Studies have shown that increased intakes of fiber is associated with a lower risk of cardiovascular disease and coronary heart disease [19]. Thus, dietary fiber is a cardio protective factor [20].

Another studies show that blood cholesterol profiles can be improved by increasing cereal fiber intake. Moreover, oat fiber compared to wheat bran fiber improves intestinal cholesterol metabolism more effectively [21]. The intake of dietary fiber differs across the world. Western diets are high in animal protein, fat, sugar but have low fiber content. On the contrary, the diets in unindustrialized parts of the World have higher intake of fibrous plants, which results in up to seven times more fiber intake [22]. In recent decades highly processed foods have become much more available and affordable. Due to all the processes that the food is undergoing, it is more palatable and convenient. This can also be the reason of choosing processed over home-cooked meal. Most food of typical western diet can be considered as processed. However, within this group there are many differences [23,24]. The variety of processed food like soft drinks, pre-prepared frozen dishes or savory snacks make it difficult to categorize them [25]. It was also noticed that lower income and levels of education is linked with fewer fruits, vegetables, and whole grains consumption [26]. Population based cohort study in France with 105 159 participants showed the impact of processed food. Results of the study showed that high consumption of ultra-processed foods is linked to greater risk of cardiovascular, coronary heart, and cerebrovascular diseases [27]. Red meat and, especially processed meat, is source of cholesterol, saturated fatty acids, and sodium, which makes it a risk factors for metabolic disorders [28]. Relatively low consumption of red and processed meat was also linked to higher all-cause and CVD mortality comparing to zero intake [29]. The main risk factor for cardiovascular diseases is hypertension [30]. Lifestyle and diet are factors with major impact on blood pressure. However, those can be changed. Studies show that vegetarians have lower blood pressure than patients on regular diets. Vegans also have lower blood pressure both systolic and diastolic. Moreover, they are less likely to use antihypertensive medications [31]. Plant based diets can be effective in both prevention and treatment of hypertension [32]. Recommendations for patients with hypertension are: high intake of fruits, vegetables, low-fat dairy products and reduction of sodium intake [33]. Those positive effects on blood pressure may be due to flavonoids that are present in fruits and vegetables. Whereas, flavonoids can affect vasodilation [34]. Another reason is high content of antioxidants in vegetables and fruits such as commonly known polyphenols [35]. Moreover, phenolic and other natural compounds that can be found in vegetables, fruits, legumes or cereals bring anti-inflammatory effect due to their free radical scavenging properties [36]. It was also observed that high consumption of green leafy vegetables may positively influence cardiac autonomic function and thus decrease the risk of cardiovascular disease [37].

4. Lipid profile

Another factor contributing to atherosclerosis and cardiovascular disease is increased level of cholesterol [38]. However, positive effects of plant based diet concerning lipid profile were also observed. Vegetarians tend to have lower total or LDL cholesterol [39]. Vegetarian diet can also result in lowered triglycerides [40]. Phytosterols are natural components in food of plants origin such as vegetables, especially in vegetable oils, nuts and cereals [41]. Phytosterols are structurally similar to cholesterol. Although, they are not synthesized in humans they are capable to influence the cholesterol metabolism [42]. It has been known that phytosterols are able to lower LDL-cholesterol concentrations [43]. Recommended intake of

phytosterols for reducing LDL-cholesterol level is 2 g/day, although typical western diet provides only about 300 mg/Day [44]. The results of randomized, double-blind, placebo-controlled in which participated 161 individuals with increased risk of or established type-2 diabetes mellitus showed positive effects of plant sterols. Among the participants who consumed 2 g/d of low-fat spreads with added plant sterols for 6 weeks resulted in low-density lipoprotein cholesterol and triglycerides [45]. Many studies point the possibility of using vegetarian diet as nonpharmaceutical way of managing dyslipidemia. Decreased levels of total cholesterol, low-density lipoprotein cholesterol, high-density lipoprotein cholesterol, and non-high-density lipoprotein cholesterol were observed due to vegetarian diet [46].

5. Diabetes

The number of people suffering from type 2 diabetes is increasing rapidly and contributing to higher risk of other conditions like cardiovascular disease or neuropathies [47]. Studies showed the association between higher consumption of vegetables, such as root vegetables or green leafy vegetables and fruits, especially blueberries, grapes, and apple and lower risk of diabetes [48,49]. While red meat, processed meat are linked to higher risk of diabetes [50]. The study which compared vegetarian diet and conventional diabetic diet both with aerobic exercise resulted in positive health effects due to vegetarian diet. Participants with type 2 diabetes from vegetarian diet group showed greater loss of visceral fat. Also, oxidative stress markers and plasma concentrations of adipokines were improved, suggesting that this diet may be more effective in improving insulin sensitivity [51]. Diet with high plant food consumption and limited intake of animal products was associated with about 20% lower risk of diabetes. However, plant based diet focused on healthy plant food was linked to even lower risk of diabetes [52]. Whole fresh fruits are characterised as low glycemic index food which makes them a great substitute for high glycemic index desserts or snack especially for people at risk of developing or diagnosed with diabetes [53]. Healthy plant based diet which limits processed food works for the benefit of insulin sensitivity due to its components such as fiber, antioxidants, and magnesium [54]. The study of effects of different diets approach for patients with type 2 diabetes compared a low-fat, vegan diet with a diet following 2003 American Diabetes Association (ADA). Individuals from vegan diet group showed greater reduction in consumption of fat, saturated fat, and cholesterol and also more increased consumption of fiber and complex carbohydrate. Moreover, the vegan diet was not viewed as less acceptable [55]. Nevertheless, it is important to mention that not all clinicians have the training or time to present their patients healthful plant based diet, thus the help of dietitians is needed [56].

6. Summary

Our lifestyle, especially diet have a great impact on our health. The number of people suffering from conditions related to lifestyle is growing rapidly. Plant based diet was shown to be effective in managing weight loss, reducing cardiovascular risk factors like hypertension or hypercholesterolemia and reducing risk of type 2 diabetes. Healthy plant based diet should be considered as a nonpharmaceutical approach to prevent and treat cardio-metabolic diseases.

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