Benefits of a Plant-Based Diet in Patients with Metabolic Syndrome and The Use of Eggs in This Dietary Pattern: A Review

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Abstract. Plant-based diet (PBD) is considered a dietary pattern with superior health advantages. A PBD can lead to better BMI index, better blood pressure and blood lipid status, and better blood sugar control in patients with metabolic syndrome. Eggs are frequently absent from PBDs, which lead to certain limitations of PBDs. Studies have shown that patients who have metabolic syndrome (MetS) who eat a PBD and consume eggs see an improvement in their plasma biomarkers and patients with MetS can benefit from eggs in two ways. This review covers the potential use of eggs in vegetarian diets and includes information on the health advantages of PBDs, with a focus on additional benefits of these two dietary patterns for people with metabolic syndrome.

Keywords: Eggs; Plant-Based Diet; Nutrition; Metabolic Syndrome; Plasma Biomarkers.

1. Introduction

A vegetarian diet is a dietary plan that forgoes all products with animal origins. Ethics, health, and environmental concerns are factors most influence people to follow this dietary plan. Beta-carotene, folic acid, vitamin C, vitamin E, potassium, magnesium, omega-6 fatty acids, dietary fiber, and carbs are frequently found in abundance in vegetarian diets. Vegetarian food generally has low levels of animal protein, cholesterol, and saturated fat. [2] A PBD has many health benefits as evidenced by better BMI, better glycemic control, lower blood pressure. Research shows that vegetarians typically live longer and healthier. The prevalence of obesity, type II diabetes, high blood pressure, coronary heart disease, and several malignancies is lower in vegetarians.[10]

MetS is a collection of at least three different disorders, including abdominal obesity, high blood pressure, diabetes, high serum triglycerides, and low serum high-density lipoprotein (HDL). Many stategies have been proposed for the prevention of MetS [23], and the PBD also plays a vital role. Despite advantages of a PBD for patients who have metabolic syndrome, this dietary pattern has limitations, such as nutrient deficiencies. [25] Besides that, higher levels of triglycerides (TG) and lower levels of high-density lipoprotein cholesterol (HDL-C) are also two main risk factors. [26]

Previous research has pointed to the positive effects of eggs in metabolic syndrome patients following a PBD. [1] This study examined the function of whole eggs in comparison to egg substitutes as part of a PBD in preventing the antioxidant stress and inflammatory biomarkers in metabolic syndrome patients. In comparison to egg substitute and spinach, the combination of whole eggs and spinach in a PBD raised choline, zeaxanthin, and lutein plasma concentrations. Take the LDL cholesterol as an example, during the egg treatment, the parameters was (112.3±25.9) (mg/dL), as the data for egg substitute treatment was (108.1±19.8) (mg/dL) and baseline was (109.9±26.6) (mg/dL). Whole eggs may enhance the benefits of PBDs, which have been demonstrated to benefit those with metabolic syndrome, by offering a superior strategy for modifying disease biomarkers. [1]

The purpose of the present review is to describe the advantages of a PBD for health and discuss their importance for people with metabolic syndrome. This review article also summarizes the implementation of egg treatment in PBDs, with a particular focus on their role in improving plasma biomarkers in metabolic syndrome patients.

2. Benefits of PBDs for Patients with MetS

2.1 PBDs and Glycemic Control

A previou study has shown that vegetarian diets in all their forms, including vegan, lacto-ovo, pesco, and semi-vegetarian, were found to significantly decrease the likelihood of type 2 diabetes compared to nonvegetarian diets. [3] In addition, compared to non-vegetarians, the incidence of type-2 diabetes is lowest in vegetarians (OR 0.381; 95%), lactic egg vegetarians (OR 0.618; 95%), and semi-vegetarians (OR 0.486, 95%). [4]

Several clinical trials proved that PBDs are helpful both in the management and avoidance of type 2 diabetes. These research projects shown that the combination of PBDs with exercise led to a considerable decrease in plasma glucose levels. [5] In other situations that didn't involve exercise, vegetarian diets also had beneficial effects including better glycemic control. [6]

Two potential mechanisms are likely responsible for better glycemic control. Research showed that incretins, as a part of gastrointestinal hormones, play an important role in post-meal plasma insulin increase. [7] According to a previous study, the release of digestive hormones was hindered by consuming processed meat. [8] As the reduction of incretin effect in diabetes type 2 patients is probably impacted by dietary ingredients, vegetarianism may be conducive to improving the release of gastrointestinal hormones in diabetes type 2 patients. Increased insulin sensitivity in response to PBDs has also been shown in controlled trials to be another mechanism. In a randomized crossover trial, the insulin sensitivity increased as a result of a use of soy products to partially replace beef. [9] Overall, the totality of data suggest a positive effect of a vegetarian diet on glycemic control.

2.2 PBDs and Blood Lipids

Serum TG concentrations and the TC to HDL-C ratio typically lower in persons consuming PBD. Several studies have shown that PBD can reduce plasma lipids, especially TG, compared with omnivores [10]. In this aspect, PBD adherents typically display lower LDL-C readings than omnivores. [11]. Compared to a processed meat and cheese diet, the PBD enhanced postprandial gastrointestinal hormone levels in healthy, obese, and diabetic males and improved satiety in a sixty subject three-group randomized crossover research [12]. Therefore, in some metabolic situations, these characteristics may have practical applications for the treatment of hypertriglyceridemia. Participants in a cross-sectional research were told to adhere to a PBD-based program broken down into short-term, intermediate, and long-term interventions. Dietary modifications, in example, lasted between 0.5 to 10 years. Women who adhered to PBD for a longer time had significantly reduced plasma TG and LDL-C readings when compared to other women. [13]. PBD is related with reduced plasma lipids, according to another systematic review. The authors specifically discovered reduce TC, LDL-C, and HDL-C concentrations but not plasma TG. [14].

2.3 PBDs and Obesity

It has been proven that PBDs are quite effective for promoting weight loss. According to previous research, individuals who followed PBDs have lower BMIs [15] and patients who are interested in the treatment or prevention of chronic diseases should also take PBDs into consideration. In addition, evidence from clinical trials illustrates that prescriptions for vegetarian diets reduce average body weight, suggesting that it might aid in the treatment and management of diseases linked to excess weight. [16]

Turner-McGrievy examined a vegetarian diet's impacts on weight loss in a further randomized controlled experiment [17]. After six months of follow-up, the study found that the vegetarian diet significantly enhanced weight loss in comparison to other dietary patterns. During the study, the five groups' tendency to lose weight was statistically significant at two months (P 0.01) and six months (P 0.01), with the vegan group shedding the most weight (-7.54.5%), followed by the veg (-6.36.6%), pesco-veg (-3.23.4%), semi-veg (-3.23.8%), and omni (-3.13.6%) groups. A vegetarian diet can

improve the intake of mega nutrients, fiber, and cholesterol, leading to a pattern that can help to treat or prevent obesity.

2.4 PBDs and Blood Pressure

Numerous fatal conditions, such as diabetes, stroke, cancer, and heart ailments are frequently linked to hypertension. [18] Dietary patterns are extremely important for both treating and preventing hypertension.

A meta-analysis of several observational studies and some randomized controlled trials demonstrated that the PBD considerably lower blood pressure than the omnivore diet. In the observational study, vegetarian diets resulted in an average 6.9 mm Hg lower systolic and 4.7 mm Hg lower diastolic blood pressure. A PBD was shown in randomized controlled trials to lower systolic and diastolic blood pressure. [19] The basal SBP in the research by Lopez et al. was 130 mm Hg. Following the vegetarian diet, the researchers noticed a 4 mm Hg average reduction in SBP and DBP. [20]

3. PBDs and Metabolic Syndrome

3.1 Basic Information on MetS

As metabolic syndrome (MetS) is a grouping of at least three of these health issues, it is associated with an increased risk of abdominal obesity, high serum triglycerides, hyperglycemia, hypertension, and low levels of high-density lipoprotein (HDL) in the blood.

The primary symptom of MetS, which is defined by adipose tissue accumulation primarily around the waist and trunk, is central obesity. [21] Low fasting HDL cholesterol, elevated fasting serum triglycerides, low fasting glucose, insulin resistance, or prediabetes are further indicators of metabolic syndrome. According to research, the MetS can cause major, chronic complications such as kidney disease, non-alcoholic fatty liver disease, type 2 diabetes, cardiovascular disease, and stroke.[22]

Studies point to a variety of prevention measures for MetS, including increased physical activity (walking for 30 minutes each day) and dietary adjustments (diet with less calories) [23,24]. The vegetarian diet is one of these strategies that is crucial for the management and prevention of MetS.

3.2 Metabolic Syndrome and PBD Strategies

The metabolic syndrome is a collection of at least three different diseases discussed previously. As a dietary pattern which is important in the therapy and prevention of certain disease disorders, PBDs have proven benefits for people with MetS. As previously discussed, PBDs are of great benefit to patients with metabolic syndrome, documented by reduced blood lipids, blood pressure, and glycemic control, as well as better weight management.

3.3 Limitations of PBDs for Patients with MetS

There are certain restrictions to following a PBD, despite the many advantages it offers. It can lead to nutrient deficiencies and heighten health risks. It is possible to experience a nutritional shortfall when following a vegetarian diet, as research shows that definitions of the diet might differ depending on how they are used and the kinds and amounts of food actually consumed.. [25] The restrictions of iron, calcium, zinc, vitamin D, vitamin B12, omega-3 fatty acids, and protein are among these nutrient deficits. Additionally, studies on vegetarian diets show greater triglyceride (TG) levels and lower levels of high-density lipoprotein cholesterol (HDL-C) .[26]

In order to avoid possible health risks of PBDs for patients with metabolic syndrome, eggs are being used in PBDary patterns to bring additional benefits to patients with metabolic syndrome. Eggs add protein, fatty acids and some vitamins needed by the human body to the vegetarian diet. In addtion, eggs contribute to a rise in HDL cholesterol, which lower the chance of developing cardiovascular disease. Eggs also led to greater plasma lutein and zeaxanthin and choline concentrations, which may

shield MetS patients against chronic illnesses like cardiovascular disease, AMD, type II diabetes, and Alzheimer's. [1]

4. Additional Benefits of Eggs in People with MetS Following PBDs

4.1 Egg Intake and Dietary Changes

According to a prior study, eggs' high biological value of protein can increase satiety and decrease food consumption later in the day. [27] As a result, having eggs for breakfast lowers the glycemic response after meals and subsequent food consumption. This might be what caused the crossover study's considerable drop in daily dietary carbohydrate intake. [1]

The study also demonstrated significant increases in the intakes of vitamin A, D, E, B2 and B12 in participants' dietary intake. Additionally, eggs are the most bioavailable source of choline and significantly enhance the amount of choline in the diet. Another critical nutrient betaine also increased significantly.

4.2 Egg Intake and BMI

According to a randomized crossover study, participants following a PB diet experienced significant reductions in body weight and BMI after consuming an egg breakfast. [1] Previous research has shown that low-carb diets may lead to better satiety than low-fat diets. [28] In that case, nutritious egg breakfast, as well as the PB diet, which reduced the carbohydrate intake, may lead to better satiety. This demonstrates that the implement of eggs in a vegetarian diet has many benefits for weight management.

4.3 Egg Intake and Carotenoids, Choline

According to a randomized trial, when compared to other food sources, plasma lutein and zeaxanthin lipophilic carotenoids have the best gastrointestinal absorption.[29] Following egg treatment, there are improvements in diet and plasma zeaxanthin and lutein because the additional egg yolk intake supplies lipid matrix. Another study used oil to cook spinach, a great source of lutein. The added fat enhanced its absorption and plasma lutein levels, which explained the increase in plasma lutein. Further evidence that HDL particles play a part in the transport of this carotenoid comes from the association of plasma zeaxanthin with big HDL particles formed by egg consumption. [1]

Previous research has pointed out that there were a considerable number of people who do not meet adequate choline intakes (AIs), which may raise the risk of a number of negative outcomes. [30] As the main source of choline is from animal products, there are certain health risks in the vegan diet. In that case, adding eggs to vegan diet offers additional health benefits. Another study confirmed that in the metabolically equivalent group, low plasma betaine concentrations are linked to a poor cardiovascular risk profile, as well as a higher risk of acute myocardial infarction and subsequent heart failure. [31] The trial demonstrated a considerable rise in dimethylglycine and betaine as compared to baseline following the consumption of EGG and SUB, [1] suggesting a possible benefit of eggs intake in population with MetS following a PBD.

4.4 Egg Intake and Blood Lipids

According to the results of the randomized experiment, HDL-C dramatically raised after receiving the EGG treatment and one MetS criteria was reversed. [1] Through its anti-inflammatory and antioxidative properties, HDL promotes antiatherogenic benefits by preventing endothelial dysfunction, inhibiting LDL-induced monocyte transmigration, and inhibiting LDL oxidation.[32] Previous study also demonstrated that daily consumption of whole eggs encourages positive changes in HDL lipid structure and function in addition to raising plasma HDL levels. [33] The atheroprotective impact is demonstrated by the significant increases in large HDL and total HDL that followed the PBD and two eggs each day. [1]

5. Conclusion

This article offers a succinct overview of the advantages of a vegetarian diet for metabolic syndrome patients and discusses the implementation of egg treatment as part of this diet. Vegetarian diets afford great benefits for weight control, as it improves better BMI index. In addition, vegetarian diets reduce the incidence of high blood pressure, improves glycemic control, and plays a significant part in the management of type 2 diabetes. PBDs also offer many benefits in terms of blood lipids. These aspects underscore the advantages of a vegetarian diet for patients with metabolic syndrome.

In comparison to vegan and lacto-vegetarian diets, entire eggs as part of the PBD seems to either maintain or enhance lipid profiles, as well as the markers of inflammation and oxidative stress in people with MetS. Eggs increase HDL cholesterol, which has great benefits in preventing cardiovascular disease risk. In addition, eggs increased plasma levels of lutein, zeaxanthin, and choline, compounds that protect patients with metabolic syndrome from chronic diseases.

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