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Impact of Plant- Based Diet in Prevention of Non-Communicable Diseases

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Abstract: *Plant-Based diet includes fruits, vegetables, nuts, seeds, oils, whole grains, legumes, and beans. A vegan diet excludes all animal products. A plant-based diet provides necessary proteins, fats, carbohydrates, vitamins, minerals as well as abundant fibre and phytonutrients required for optimal health. Essential nutrients present in plant diet helps to alleviate inflammation in our bodies. The covid pandemic has prompted many people to switch to a more organic, plant-based diet that includes nutraceuticals or supplements.*

This trend is gaining popularity globally. A literature search of plant based protein, food sources, nutritional composition and health benefits, effect on cardiovascular risk, insulin resistance, benefits of plant protein intake vs animal protein in the prevention and management of cancer, effect of vegan diet on coronary heart disease was carried out. As per the literature, studies were conducted on functional and bioactive properties of soy protein in terms of reducing disorder risk, modulating inflammation and their systemic effects.

Dual X-ray Absorptiometry assessed body composition, Homeostasis Model Assessment (HOMA-IR) assessed insulin resistance, and a linear regression model was used to find out effect of plant based diets on weight loss. Using a data from Nurses Health Study 2, substituting 5% energy intake from vegetarian protein for animal protein was associated with 23% lower risk of type-2 diabetes mellitus.

The study involved a supervised resistance educational programme was conducted twice a week for 12 weeks to compare a vegan diet with omnivores diet. This review article gives an overview of plant based diet and emphasises the benefits of a plant based diet, and its impact on the body and mind.

Keywords: *Plant-based diet, vegan, functional foods, phytonutrients*

I. INTRODUCTION

Plant-based diets focus primarily on foods derived from plants, which include not only fruits and vegetables, but also nuts, seeds, oils, whole grains, legumes, and beans. Eating high amount of plant-based foods does not imply that we are vegan. [1]

A vegan diet excludes all animal products and is primarily composed of grains, legumes, vegetables, and fruits. Even though a plant-based diet is adequate in macro and micronutrients, people are sceptical about its ability to meet all the protein requirements. A sufficient protein intake is necessary to provide nitrogen and amino acids to our cells, maintenance of the protein pool, supporting growth and functioning in the body.

A diet based entirely on plants provides all essential amino acids as well as an adequate levels of protein without the use of any special food combinations. An all-plant protein diet has been linked to weight loss, has been seen to lower blood lipid concentrations, obesity, and other related disorders.[2]

A vegetarian diet lowers the risk of developing coronary heart disease, increasing longevity, and lowering the risk of diabetes. A plant-based or vegan diet provides all of the protein, fats, carbohydrates, vitamins, phytonutrients and minerals as well a high fibre which is required for optimal health. Typically, a vegan diet must be supplemented with a couple of additional vitamins, such as Vitamin-B12, to ensure that all of the nutrients required are adequately utilised.

Plant based diets come in all shapes, sizes, and varieties.

- 1) A Semi- Vegetarian or Flexitarian diet may include eggs, dairy products, and, on occasion, meat, poultry, fish, and seafood.
- 2) Pescatarian diet includes eggs, dairy products, fish, and seafood but no poultry or meat.
- 3) A vegetarian diet includes eggs and dairy products but no meat, poultry, or seafood.
- 4) A vegan diet excludes all animal derived foods.[4]

II. BENEFITS

A healthy diet is essential for lowering the risk of various diseases.

A. *Plant foods are anti-inflammatory.*

Essential nutrients present in plants help to alleviate inflammation in our bodies. To reduce inflammation, it is necessary to eat plant-based foods. Prolonged inflammation can harm the cells and tissues and has been linked to cancer and other inflammatory diseases such as arthritis. A plant-based diet is protective because it eliminates many of the trigger factors of these diseases.

B. *A plant-based diet can help to maintain a healthy weight.*

One of the most important things to do is to maintain a healthy weight. Being overweight causes inflammation and hormonal imbalance. Plant based diets eliminate many of the foods that contribute to weight gain. Exercise also helps in losing weight and in maintaining a optimal weight.

C. *Plants Contain a lot of Fibre.*

Fibre is present in all unprocessed plant foods.

Eating a plant-based diet improves gut health, allowing better absorption of nutrients from the food that support our system and reduce inflammation. Fibre lowers cholesterol, stabilises blood glucose levels and aids in long-term bowel health.

D. *A plant-based diet and risk of developing other diseases.*

A plant-based diet has also been shown to reduce the risk of heart disease, stroke, diabetes, and a few psychological illnesses. [2]

III. FUNCTIONAL PLANT FOODS.

A. *Plant Proteins as Functional Foods*

Plant based proteins have been investigated for their potential use as functional foods. Studies are being conducted to explore their effect on cardiovascular risk, glycemia, and satiety. Many studies have been conducted on the functional and bioactive properties of soy protein, particularly in terms of reducing risk of disorders, modulating inflammation, and for its systemic effects. A recent review looked at the bioactive properties of plant protein sources other than soy, such as peas, fava bean, rice, oat, hemp, and lentil protein. The majority of trials examined postprandial concentrations of blood sugar, insulin levels, and appetite-regulating hormones to report the benefits of plant protein ingredients. Similarly, the benefits of plant protein as a functional food for satiety yielded mixed results. The bioactive components of a plant diet are more likely to be attributed to whole food sources than isolated protein. It has been established that numerous plant components, such as carotenoids and flavonoids, confer bioactive health benefits.[2]

B. *Food Protein And Body Composition*

A 16-week vegan diet trial was carried out to assess its effect on weight loss. The plant-based vegan diet outperformed the control diet in terms of weight loss, fat mass loss, and insulin resistance markers. Only the vegan group experienced significant weight loss. The decrease in fat mass was associated with an increase in plant protein intake and a decrease in animal protein intake ($r = 0.30$, $p = 0.011$; and $r = +0.39$, $p = 0.001$, respectively). In both unadjusted and adjusted models for changes in BMI and energy intake. A decrease in leucine intake was associated with a decrease in fat mass ($r = +0.40$; $p = 0.001$). Lower per cent of histidine intake was also associated with lower insulin resistance ($r = +0.38$; $p = 0.003$), which was independent of changes in BMI and energy intake. Having enough protein is critical for providing nitrogen and amino acids to the cells and for maintaining adequate protein levels in the body. Even without the use of special food combinations, a purely plant-based diet delivers all the required amino acids and an acceptable amount of total protein. The above study showed that plant protein, as part of a plant-based diet, and the associated restriction of leucine and histidine intake, are linked to improvements in body composition and weight loss as well as reduced insulin resistance.[4]

C. *Relation Between Plant Diet And Metabolic Risk Factors*

Studies have been conducted to investigate the impact of dietary plant proteins on cardiometabolic risk factors. A study published in 2017 was one of the first study to show the effectiveness of plant protein consumption as a substitute for animal protein. The systematic review and meta-analysis of 112 randomised clinical trials across adults with or without hyperlipidemia showed reduced

disorder markers in favour of adults consuming plant based diets. Most of the studies showed a reduction in blood lipids, including lowering of low-density lipoprotein cholesterol, non-high-density lipoprotein cholesterol, and Apolipoprotein B. The authors used higher-quality randomised trials to validate their findings and this evidence supports plant protein as an effective substitute for animal protein in the diet to help reduce disorder risk factors in adults. A more recent meta-analysis was conducted on the impact of plant protein versus animal protein in 32 intervention trials in hypercholesterolemic patients. While there was evidence that plant proteins can help lower lipid profiles, the majority of trials in this study focused on soy products because the intervention was compared to a variety of animal protein sources. [4]

D. Plant Protein and Diabetes

While vegetarian diets are associated with a significant risk reduction for diabetes, it is unclear whether substituting plant protein for animal protein contributes to this risk reduction. Malik et al discovered, using data from the Nurses' Health Study II, that substituting 5% of energy intake from vegetable protein for animal protein was associated with a 23% lower risk of type 2 diabetes. A 400kcal breakfast containing a meal replacement beverage containing about 29g soy protein was compared to an isocaloric, higher glycemic index, lower protein breakfast in a similar study. The soy protein beverage was linked to lower postprandial glycemic and ghrelin responses to breakfast, as well as lower postprandial insulin secretion from a uniform lunch fed 4 hours later. In a 2015 meta- analysis of randomised control trials that replaced animal protein sources with plant protein for at least 35% of total dietary protein intake over a median study length of eight weeks, the authors reported significant but modest, improvements in HbA1c, fasting glucose, and fasting insulin levels in diabetics. These findings were encouraging, but there were some caveats.[4]

E. Plant Protein Intake and Incidence of Cancer

Another area of investigation for the benefits of increasing plant protein intake rather than animal protein is cancer risk reduction. Multiple factors influence the risk of developing cancer, including genetic predisposition, environment, dietary and other lifestyle habits. One group has concentrated on examining the risk of colorectal cancer in individuals using gene-environment interaction analyses, which incorporate a variety of lifestyle factors, genetic factors, and cancer risk. The authors found a link between certain genetic polymorphisms for carboxylic acid metabolism and colorectal cancer in their study of a large, prospective Danish cohort, which was also linked to a high meat intake. They reported that prime meat consumption was associated with an increased risk of colorectal cancer in some gene carriers when compared to those with an equivalent genetic polymorphism who consumed diets with less meat. As a result, substituting plant protein for animal protein in the diet may be a method to reduce the risk of colorectal cancer in people with certain gene variants. However, there is conflicting evidence about whether switching from animal protein to more plant protein reduces the risk of colorectal cancer. A recent study, for example, included 79 pre-diabetic adults on a one-year weight loss dietary intervention. This study looked at total dietary protein intake, meat consumption, and the animal to plant protein ratio. These dietary habits were compared to the extent of faecal ammonia concentrations, a biomarker for colorectal cancer risk, at baseline and after a one-year intervention. While there was a dose dependent association between faecal ammonia concentration and thus the amount of meat consumed in this study, there was no association between faecal ammonia and total protein intake or the animal to plant protein ratio in these individuals.[4]

F. Increased Awareness of Plant-based Diets

Due to greater health awareness consumers are looking for personalized nutrition products and there is a growing interest in the nutraceuticals market. Global focus on health and nutrition has also opened up an export segment for Indian superfoods such as turmeric and moringa. There is also a trend where people are interested in locally grown and sourced food.

The Indian Institute of Processing Food Technology (GOI), has developed vegan meat, vegan milk, and iron-fortified rice kernels to meet the nutritional needs of the population. Edible plates and cups from jackfruit, which can provide good nutrition are being developed. Environmentally friendly choices like these cups and plates are becoming popular.

Commercial production of plant-based meat and alternative dairy products is also being attempted along with a relook at generic and biomolecular science to transplant DNA and create nutritious food like higher protein banana, high fibre and low-sugar potato and allergen free nuts in our country.

[10]

G. *Plant-based diets and cardiovascular health*

The majority of studies on vegetarian diets have been conducted in Europe, with one study in Japan and three among Seventh-day Adventists in the United States. Key et al. found a 24 per cent lower rate of coronary heart disease mortality among vegans compared to omnivores in an analysis of 5 of the above cohorts, but no relation with stroke mortality was found; two recent meta-analyses with more studies found similar results.[6] In many of these studies, inverse associations were stronger among younger people, people with longer adherence to a vegan diet, and men compared to women. The most recent meta-analysis, in particular, discovered a 22% lower stroke mortality rate among vegetarian men, but not among women. [7]

H. *High-Protein Plant-Based Diet Versus a Protein-Matched Omnivorous Diet to Support Resistance Training Adaptations.*

The programme was designed to look into the effects of protein source [exclusive plant diet vs mixed diet] on muscle mass change in young adult men who were doing resistance training.

A supervised resistance educational programme was conducted twice a week for 12 weeks among nineteen young men who were habitual vegans and nineteen young men who were habitual omnivores. Supplemental protein was used to increase protein intake to 1.6 g/kg/day (soy for vegan or whey for omnivore). During the intervention, dietary intake was checked every four weeks. During the intervention, the pre and post comparison results for leg lean mass, whole muscle, and muscle cell cross-sectional area were accessed (CSA).

Results: Both groups increased their leg lean mass significantly (all $p < 0.05$), with no between-group differences in any of the variables (all $p > 0.05$).

As a result, the programme concluded that a high protein (1.6 g/kg/day) exclusively plant-based diet (plant-based whole foods + soy protein isolate supplementation) does not differ from a protein matched mixed diet (mixed whole foods + whey protein supplementation) in supporting muscle strength and mass accrual, implying that protein source does not affect resistance training-induced adaptations in untrained young men consuming adequate amounts of protein. [8]

IV. NEGATIVE EFFECTS OF A VEGAN DIET

A. *Low Energy and Weight Issues*

In a vegan diet, it becomes difficult to track total consumption of calories because plant-based foods are less calorie dense than animal-based foods thereby risking not only health problems by not getting enough nutrition, but may also increase the chances of abandoning plant-based diet and reverting to old habits.

B. *Problems with Leaky Gut*

The vegan diet eliminates all animal protein sources and replaces them with plant-based protein sources such as legumes. While legumes are high in protein, they also contain antinutrients such as phytates and lectins, which can increase intestinal permeability and cause a condition known as "leaky gut." Animal-based protein sources, on the other hand, are devoid of antinutrients.

C. *Disruptions in Hormones*

Vegans also use soy as a major source of plant protein. Soy products that have been processed, such as soy milk and tofu, are essential components of a vegan diet. Soy in all forms when consumed in large quantities may disrupt the hormonal balance especially in women.

D. *Iron Deficiency*

Plant-based foods contain iron, but it is of the 'low-heme' variety, and is poorly absorbed by the body. Vegetarians are thus at a high risk of iron deficiency. A lack of heme iron in the body can result in a variety of symptoms, including fatigue and anaemia. While iron supplements can be used to address the problem, they may have a few unfavourable side effects.

E. *The Dangers of Vitamin B12 Deficiency*

B12 is an essential vitamin, and a lack of it can result in a variety of irreversible health problems. Because vitamin B12 is primarily obtained from animal products, vegans are at a high risk of developing a deficiency of this essential nutrient. Vitamin B12 supplementation is therefore advisable for Vegans.

F. Depression Risk

Due to fewer omega-3 fatty acids Vegans are more likely to suffer from depression. They can eat algae-based omega 3 rich foods, but they are expensive and difficult to find.

G. The Possibility of Developing an Eating Disorder

Eating disorders like orthorexia, in which people have an unhealthy obsession with healthy eating patterns and over-restriction, is more common in people who follow a strict vegan diet. Doctors who treat eating disorders like orthorexia do not recommend sticking to a restrictive diet like vegetarianism or veganism. [9]

V. CONCLUSION

This review article discusses the benefits of a plant-based diet and its impact on health. The need for education on how to put a plant diet into practice is important. There are however some negative effects of strict Vegan diet that must be considered. A plant-based diet can be followed with the use of minimal supplements. Plant based diets are protective against chronic diseases, they also provide a safe and powerful treatment option and in many cases help in reversing the disease.

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