



ISSN Print: 2394-7500
ISSN Online: 2394-5869
Impact Factor (RJIF): 8.4
IJAR 2025; 11(1): 123-127
www.allresearchjournal.com
Received: 09-11-2024
Accepted: 16-12-2024

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Plant-based diets and weight management: A comprehensive review of efficacy and mechanisms

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DOI: <https://doi.org/10.22271/allresearch.2025.v11.i1b.12268>

Abstract

There is growing demand for diets based on plants as a potential weight management tool due to the rising incidence of obesity and the health problems that go along with it. This thorough analysis investigates the effectiveness and underlying processes of diets based on plants in avoiding weight gain and encouraging weight loss. This review offers a rigorous examination of the research, focusing on both short- and long-term effects. It sheds light on the several components that make plant-based dietary patterns successful.

Adopting a diet made up of plants has been shown in numerous studies to result in substantial decreases in physical weight as well as body mass index (BMI). Furthermore, diets based on plants have been linked to long-term weight loss with a lower chance of comorbidities related to obesity. This study looks at how various plant-based diets, such as vegan and vegetarian diets, affect people's ability to control their weight.

There are several different theories underlying how plant-based diets help people lose weight. Three main components of plant-based diets that help people lose weight are high fibre content, lower calorie density, and improved satiety. Furthermore, these diets' metabolic effects-such as enhanced insulin sensitivity and altered gut microbiota-are critical for preserving a healthy body weight.

The research also addresses the possible drawbacks and issues with diets based on plants for managing weight, like making sure you're getting enough nutrients and dealing with social and cultural influences on food preferences.

This analysis emphasises the benefits of plant-based diets for general health and its potential as a workable weight-management regimen. For those seeking evidence-based dietary advice for achieving and keeping a healthy weight, policymakers, healthcare professionals, and individuals seeking weight control solutions, an understanding of the mechanisms underlying the effectiveness of plant-based diets can be quite beneficial.

This thorough research concludes by highlighting the potential of diets based on plants as a viable and long-term strategy for managing weight that offers a number of health advantages beyond weight loss.

Keywords: Vegetarianism, vitamin b12, omnivorous, lacto-ovo vegetarian, obesity

Introduction

A "plant-based diet" refers to a broad range of dietary approaches that prioritise plant-based foods, such as fruits, vegetables, whole grains, legumes, nuts, and seeds, as well as plant-based substitutes, while limiting or avoiding foods derived from animals (Satija *et al.*, 2018)^[33] Although it can contain minor amounts of food with animal origin, such as milk, eggs, meat, and fish, the phrase "plant-based" is more inclusive because it emphasises the consumption of foods largely derived via vegetation (the fruits, vegetables, nuts, oil, grain products, and legume) (Fehér A *et al.*, 2020)^[12].

There are many justifications for adopting a diet that is vegetarian or vegan, such as those pertaining to animal welfare and rights as well as ethical, moral, spiritual, or religious considerations (Ruby M.B *et al.*, 2012)^[32].

Cohort studies also indicate that meat ingestion is linked with an increased likelihood of developing type-2 diabetes (Fung TT *et al.*, 2014; Song SJ *et al.*, 2012)^[15, 35]. A meta-analysis and systematic review of 8 prospective investigations among Seventh-day Adventists found that vegetarian meals were associated with a 40% lower chance of coronary

coronary artery disease incidents and a 29% reduction in cardiovascular events, compared with people who are not vegetarian (Kwok *et al.*, 2014) [21]. Clinical research have shown that switching from an omnivorous to a vegetarian diet improves glycemic control (Barnard ND *et al.*, 2009) [4]. Between 2014 and 2018, the proportion of vegans in the United States rose by 600% (Forgrieve J *et al.*, 2012) [14] can partially account for the rise in interest in plant-based diets, as does an intensifying concern over the effects of animal consumption on greenhouse gas emissions worldwide (Watts N *et al.*, 2019) [42].

Diets Based on plantations

Vegetarianism: Vegetarianism includes a range of dietary habits, such as diets that exclude all animal products and meats (vegan), diets that include dairy, eggs, and milk-based goods (lacto-ovo vegetarian), and diets that include fish in addition to these foods (pesco-vegetarian). (Spencer EA *et al.*, 2003) [8].

Vegan diet: Due to the widespread use of social networking sites as a platform for opinion-sharing and information

sharing, vegan diets may be more well-known now [The Telegraph in ten years, the population of vegetarians in Britain has increased by 360% 2016] promoted by some on the grounds that it lowers blood pressure, LDL, heart disease risk, type II diabetes risk, and cancer risk [Marsh K *et al.*, 2012; Larson C.L. *et al.*, 2002] [24, 22].

Even the strict vegan diet, which forbids the consumption of dairy, eggs, meat, and fish, is becoming more and more well-liked, particularly among younger people (Forestell CA *et al.*, 2018) [13].

Pescatarian diet: According to Melina V *et al.* (2016) [26] and Derbyshire EJ *et al.* (2017) [10], pescatarians are vegetarians who additionally eat fish and seafood products.

Flexitarian diet

The term "flexitarian diet," also known as "semi-vegetarian diet," has gained popularity recently. It describes people who occasionally eat meat, though there isn't a consensus on the amount of meat that must be consumed per week or month to be classified as part of this diet (Diet and Nutrition Survey., 2008) [11].

Table 1: Vegetarian diet types

Dietary classification	An explanation of the food schedule
Half-vegetarian, or demi-vegetarian	sometimes consumes fish, poultry, and meat.
Pesco-vegan	Contains fishes (and likely other seafood) but excludes meat and poultry.
	May include dairy products and eggs.
Lacto-ovo vegetarian	Omits all foods made of meat. consists of eggs and dairy products.
Ovo vegetarian	Excludes dairy products and any meat dishes. contains eggs.
Lacto vegetarian	Omits eggs and all items made of meat. includes produce that is dairy.
Vegan	Steers clear of all animal-based foods.

Adapted from Robinson and Hackett (1995)

Effects of a plant-based diet on health

All subjects' individual food data was divided into nine aggregates of nutritionally significant food groups: beans and pulses, nuts and seeds, vegetables, meat (apart from seafood), milk, various dairy goods (not including milk), plant-based dairy products (not including milk), plant-based milk substitutes, and plant-based meat substitutes (Yokoyama *et al.*, 2017) [44]. A plant-based diet was linked to lower levels of total cholesterol, low- Density lipoprotein that is cholesterol, and higher-density lipoprotein cholesterol, according to a meta-analysis by Yokoyama *et al.* that included 30 purely observational investigates and 19 clinical evidence trials (Tantamango-Bartley Y *et al.*, 2013). Dietitians of Canada and the American Dietetic Association's position on vegetarian eating habits (J Am Diet Assoc., 2003) states that following a vegetarian diet is linked to a lower incidence of gastrointestinal tract malignancies as well as a lower incidence of all cancers combined. Vegetarians often have a decreased risk of obesity, type 2 diabetes, cardiovascular disease (CVD), and some malignancies (David *et al.*, 2014) [9]. Only one article that included the gut microbiota as a unique outcome for clinical studies examining the impact of animal-based meals compared to vegetarian or vegan diets was found through our comprehensive evaluation (Kahleova *et al.*, 2011) [20]. Vegetarian diets are nearly twice as effective as more conventional diets in the treatment of type 2 diabetes, even in the absence of exercise, with benefits including decreased blood cholesterol, improved glycemic control, and

decreased body weight (Barnard *et al.*, 2006; Nicholson *et al.*, 1999; U.S. Department of Agriculture) [3, 29].

Dietary guidelines for the healthiest plant-based diets

A sufficient intake of calcium is necessary to provide strong bones and preserve the calcium balance (Dietary Guidelines for Americans, U.S. Government Printing Office, Washington, DC 2005) [41]. However, compared to cow's milk, which has 1200 mg/L of calcium, natural soymilk only has 200 mg/L (Zhao Y *et al.*, 2005) [45].

Ready-to-eat cereals, rice and soy beverages, oranges and apple beverages, and other beverages are among the foods fortified with calcium. According to Anderson MB *et al.* (1996) [1] and Davey GK *et al.* (2003) [8], the bioavailability of calcium carbonate in soy drinks and calcium citrate malate within apples or juice from oranges is comparable to that of calcium in milk. A higher plant-based diet is associated with a lower dietary intake of vitamin B12; meat eaters' average daily consumption of B12 is known to be 7.2 µg, but vegans' intake is only 0.4 µg (Norris J *et al.*, 2012) [30].

If a vegan choose to take vitamin B12 pills, they should take them on a regular basis, either alone or with a multivitamin. A large vitamin B12 consumption does not seem to be absorbed, despite the fact that a food supplement may contain more than the necessary quantity of the vitamin. According to Woo *et al.* (2008), this indicates that you need to consume daily vitamin B12 supplementation containing 25–100 micrograms or a twice-weekly vitamin B12

supplement containing 1000 micrograms to meet your needs.

Strict vegans may, however, consume less vitamin B-12 due to restriction or elimination of all animal foods, especially dairy and egg products. This could lead to a metabolic vitamin B-12 shortage and harmful vascular surrogates, such as carotid IMT and brachial FMD. (Fact sheet on dietary supplements: vitamin D (Bethesda, MD: National Institutes of Health, Office of Dietary Supplements; 2011. Jun 24)

A prevalent condition among the general public is vitamin D insufficiency. To ensure that they include enough Vitamin D, plant-based foods such as cereal grains and soy milk can be fortified (Silva MC *et al.*, 2018) [34]. The two primary forms of vitamin D found in food and dietary supplements are D2 (ergocalciferol) and D3 (cholecalciferol), which only differ chemically in their side-chain configurations. The small intestine is able to absorb both types effectively. Simple passive diffusion and a mechanism involving gastrointestinal membrane carrier proteins are the two ways that absorption happens (Cober *et al.*, 2022) [6].

Legumes, whole grain products, nuts, and seeds are plant-based proteins that are a good supply of important amino acids. More ethical and sustainable sources of protein are being produced by using plant-based proteins from grains, peas, and soy in burgers, sausages and bacon, and meat substitutes. Because soy has a high protein content, plant-based meat substitutes have frequently been developed on soy-derived products (F. Subar *et al.*, 2018) [37].

Plant-based diets and weight management

According to study set out to compare how participants who were randomly assigned to follow an omnivorous and semi-vegetarian, pesco-vegetarian, vegan diet lost weight. Greater gains in fibre may result from switching to a plant-based diet (D.J. Jenkins *et al.*, 1981; G.M. Turner-McGreevy *et al.*, 2011; Tonstad S *et al.*, 2011) [19, 40, 39]. Vegans had the lowest BMI, which was followed by vegetarians, pesco-vegetarians, semi-vegetarians, and omni diets, according to data collected by the Adventist Health Study (AHS). BMI increases with the proportion of animal products in the diet increases (Moore MP *et al.*, 2020) [27].

Many diets have been suggested as effective treatment plans for obesity. The alleged benefits of dietary approaches like Palaeolithic, ketogenic, Mediterranean, high in protein, plant-based, low-carb, and intermittent fasting for weight loss and metabolic disease have made them popular. However, a number of studies indicate that plants may be the secret to an effective weight-control strategy (Ivanova S *et al.*, 2021; Greger MA *et al.*, 2020; Guess ND *et al.*, 2022) [18, 16, 17]. Whole plant foods often have a low calorie density because they are largely composed of water by weight. Furthermore, while fibre adds to weight, it does not entirely account for the anticipated calories of carbohydrates that are digestible.

Approximately 2 kcal/g are contributed by short-chain fatty acids (SCFA), which are formed by gut bacteria as a result of fibre fermentation. When compared to non-vegetarians, vegetarians generally have lower BMIs (body mass index) scores (Berkow, S.E. *et al.*, 2006) [5]. It has been demonstrated that avoiding foods with animal origin lowers the risk of cardiovascular disease, also known as CVD, hypertension, obesity, type 2 diabetes (T2DM), and some malignancies (Craig WJ *et al.*, 2009; McEvoy CT *et al.*, 2012) [7, 25].

Conclusion

A comprehensive assessment of plant-based diets is included in the report's conclusion, emphasizing the value of eating whole grains, vegetables, fruits, legumes, nuts, and seeds in addition to limiting or avoiding meals that come from animals. Plant-based diets are growing in popularity for a variety of reasons, including their positive effects on the environment, animal welfare, and health. The study highlights the diversity of plant-based diets, such as vegetarianism, flexitarianism, pescatarianism, and veganism, each with unique nutritional needs and components. It also discusses potential nutrient deficiencies in plant-based diets, emphasizing the need of taking B12 (vitamin), calcium, and calcium as well as vitamin D into account while making dietary decisions. It highlights the need for supplements in specific circumstances-such as B12 for strict vegans-and offers fortified foods as stand-ins that can meet dietary requirements. Research elucidates the possible health benefits of plant-based diets, acknowledging their positive effects on several health metrics. It contributes to the growing body of evidence that encourages health-conscious individuals to choose plant-based lifestyles by providing informative details on a range of dietary patterns, nutritional components, and their impacts on overall well being.

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