



Review Article

Vegetarian Diets: Health Benefits and Associated Risks

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How to cite this article: Navneet Kumar Kaushik, Anup Aggarwal, Mohita Singh, Shelja Deswal, Priyanka Kaushik. Vegetarian Diets: Health Benefits and Associated Risks. IAIM, 2015; 2(3): 206-210.

Available online at www.iaimjournal.com

Received on: 28-01-2015

Accepted on: 09-02-2015

Abstract

Recently, vegetarian diets have experienced an increase in popularity. A growing body of scientific evidence indicates that wholesome vegetarian diets offer distinct advantages compared to diets containing meat and other foods of animal origin. A vegetarian diet may be adopted for various reasons that can include ecological, economic, religious, ethical, and health considerations. In the latter case they arise from the desire to lose weight, in tackling obesity, improving physical fitness and/or in reducing the risk of acquiring certain diseases. It has been shown that properly applied vegetarian diet is the most effective way of reducing body mass (expressed as BMI), improving the plasma lipid profile and in decreasing the incidence of high arterial blood pressure, cardiovascular disease, stroke, metabolic syndrome and arteriosclerosis. In addition, improved insulin sensitivity together with lower rates of diabetes and cancer has been observed. Some studies have however found that a vegetarian diet may result in changes adversely affecting the body. These include: hyperhomocysteinemia, protein deficiency, anemia, decreased creatinine content in muscles and menstrual disruption in women who undertake increased physical activity. Some of these changes may decrease the ability for performing activities that require physical effort. Nevertheless, on balance it can be reasonably concluded that the beneficial effects of a vegetarian diet significantly, by far, outweigh the adverse ones. It should also be noted that the term 'vegetarian diet' is not always clearly defined in the literature and it may include many dietary variations.

Key words

Vegetarian diet, BMI (Body Mass Index), Hyperhomocysteinemia.

Introduction

Vegetarian diets are the one that are based on foodstuffs of plant origin such as cereals, legumes, oilseeds, fruits, vegetables, nuts and mushrooms. The many types of vegetarian diets devised all share the same characteristic in the elimination of meat, fish and poultry consumption, while some also eliminate egg, milk and dairy products (**Vegan Diets**). Classification of the different types of vegetarian diet is as per **Table – 1**.

Vegetarian diets are usually rich in carbohydrates, n-6 fatty acids, dietary fibre, carotenoids, folic acid, vitamin C, vitamin E, magnesium and phytochemicals, and relatively low in proteins, calories, saturated fat, long chain n-3 fatty acids, choline, retinol, vitamin D, vitamin B12, calcium, iron, zinc and iodine. American Dietetic Association states that well-balanced vegetarian diets can meet recommended daily requirements of all the nutrients and are appropriate for all stages of the life cycle including pregnancy, lactation, infancy, childhood, adolescence, and for athletes. Such plant-based foodstuffs are unfortunately now also contaminated with many industrial toxins that include nitrates. It is however very well recognised that such foodstuffs contain ingredients beneficial to health. Moreover, non-dietary factors may also contribute towards the efficacy of a vegetarian diet such as following a healthy lifestyle, which includes physical activity and the avoidance of harmful practices, particularly smoking and alcohol consumption. It has been shown that vegetarians possess good health and suffer fewer from illnesses and have a higher self-respect concerning their proper eating habits than those eating a traditional diet [1]. However, many controversies have arisen over the efficacy of adopting a vegetarian diet and thus the aim of this study was to investigate and review the

evidence within the literature on the impact that such diets have on the human body.

Table – 1: Classification of the different types of vegetarian diet.

Type of vegetarian diet	Definition
Lacto-ovo-vegetarian	Excludes all types of flesh foodstuffs (meat, poultry, fish), but permits eating all other animal products (e.g. eggs, milk, honey).
Lacto-vegetarian	Excludes flesh foodstuffs and eggs but allows dairy products, honey, etc.
Ovo-vegetarian	Excludes consumption of all animal products with the exception of eggs.
Vegan	Excludes all animal products.
Vitarian	Permits consumption of organic, raw and fresh foods only. Excludes coffee and tea.
Liquidarian	Consumption of vegetarian food in the form of juices.
Fruitarian	Excludes flesh foodstuffs, animal products and vegetables.
Sproutarian	Eating foods in the form of sprouted plant seedlings, such as grains, vegetables, fruits.
Semi-vegetarian	Transitional form between vegetarian and meat based diets; limited amount of meat eaten.

Method

In order to identify relevant articles, we conducted an independent literature review via internet using PubMed/Medline and Google databases through 1990 to 2014. The following search terms were used: vegetarian diets, vegan diets, beneficial effects of vegetarian diets, harmful effects of vegetarian diets. For the



purpose of this study, articles reporting relevant health outcomes (either beneficial or harmful) associated with vegetarian diets were included. Animal studies and case studies with small size were excluded.

Discussion

The obsession of modern society with weight reduction is reflected by the creation of numerous and varied diets. Many indeed demonstrate real effectiveness in tackling obesity and overweight with the proviso that success can only be guaranteed if a given diet is strictly adhered in conjunction with performing additional physical activity. Numerous studies have demonstrated lower Body mass index (BMI) values in people adopting a vegetarian diet. In the Sabate and Wien study, the mean body mass of males and females was respectively 7.6 kg ($p < 0.001$) and 3.3 kg ($p < 0.005$) lower compared to those consuming meat in their diets [2]. A study by Spencer, et al. showed that meat-eating subjects, aged 20–97 years, had a mean BMI higher by 1.92 kg/m² ($p < 0.05$) in men and 1.54 kg/m² ($p < 0.05$) in women compared to vegans [3].

The potential effectiveness of vegetarian diets for dealing with obesity was observed in a study by Tonstad, et al. conducted on a group of 22,434 men and 38,469 women where BMI was measured in six treatment groups (vegetarians, vegans, lacto-ovo-vegetarians, semi-vegetarians, fish eaters, and meat eaters). The mean BMI was found lowest in the vegans (23.06 kg/m²) and gradually increased as follows, lacto-ovo-vegetarians (25.7 kg/m²), fish eaters (26.3 kg/m²), semi-vegetarians (27.3 kg/m²) and meat eaters (28.8 kg/m², $p < 0.001$) [4]. A study by Newby, et al. confirmed that the BMI was significantly lower in vegetarians of all types [5]. The data thus suggest that adopting a vegetarian diet can be an effective means for reducing body mass.

Eating large amounts of vegetables and fruits, which form a major part of all vegetarian diet types, also has a beneficial effect on the cardiovascular system. Plant based foodstuffs provide the body with multiple antioxidants. A study by Somannavar and Kodliwadmth confirmed that vegetarians have significantly higher antioxidant levels compared to those eating a mixed diet ($p < 0.001$) [6]. The most active of these include the antioxidant vitamins (α -tocopherol, ascorbic acid), flavonoids and carotenoids (lycopene, lutein, β -carotene, cryptoxanthin, zeaxanthin). Their biological activity is based on inhibiting the oxidation of LDL cholesterol (LDL-C), increasing HDL cholesterol and reducing total cholesterol (T-C) concentration in circulation. This results in a lower risk of developing arteriosclerosis.

The plasma lipid profiles of vegetarians and those eating a traditional diet was studied by Dourado, et al. which demonstrated that the latter group had significantly higher average T-C (207.11 mg/dl) and LDL-C (143.79 mg/dl) blood concentrations compared to the former at respectively T-C; 160.06 mg/dl, LDL-C; 87.40 mg/dl ($p < 0.001$). The aforementioned study also showed that meat eaters have a significantly higher systolic blood pressure (123.76 mmHg) compared to vegetarians (114.86 mmHg) ($p < 0.05$) [7]. In conclusion, it is clear that a properly applied vegetarian diet can effectively protect against high blood pressure and reduce the risk of heart disease, stroke and arteriosclerosis.

The authors take the view that the high amounts of carbohydrates and low amounts of fat as seen in vegetarian diets increases cellular insulin sensitivity thereby affording some protection against diabetes. This hypothesis was checked in a study by Tonstad, et al. conducted on a group of 38,469 women and 22,434 men. It was found that the incidence of type 2 diabetes occurred in



the following groups in descending order of magnitude; meat eaters (7.6%), semi-vegetarians (6.1%), fish eaters (4.8%), lacto-ovo-vegetarians (3.2 %) and vegans (2.9%), ($p < 0.05$). A related study by Wolfram and Ismail-Beigi suggested a correlation between increased cellular insulin sensitivity with the consumption of vegetables and whole grains [8]. Indeed, the lower risk of metabolic syndrome in vegetarians as compared to semi-vegetarians and meat eaters ($p < 0.001$) has been documented by Rizzo, et al. whose data showed that it is reasonable to hypothesise that a vegetarian diet can also be used in tackling metabolic syndrome [9].

Improperly applied vegetarian diets can lead to lowered levels of vitamin B12, producing an increase in blood levels of homocysteine, which is associated with increased risk of cardiovascular morbidity, a reduction in the blood levels of sex hormones and disruption of the menstrual cycle. The problem of vitamin B12 deficiency in vegetarians was confirmed by Herrmann, et al. [10].

Controversies remain concerning the safety of a vegetarian diet when adopted by athletes. The concerns relate to a sufficient supply of proteins, iron and creatinine together with the occurrence of irregular menstrual cycles, especially in hard-training women. However, study by Barr, et al. demonstrated that a vegetarian diet can provide large amounts of proteins if dairy products and eggs are included [11]. Vegetarians can additionally supplement their diet with proteins derived from legumes, nuts, seeds and whole grains. In most cases, vegetarian athletes can adjust the level of iron by eating foods rich in vitamin C, citric acid, malic acid, tartaric acid, fructose and sorbitol. Lower creatinine levels found in vegetarian athletes can be increased by administering creatinine as a dietary supplement improving physical performance and muscle strength.

The viewpoints expressed concerning the benefits of a vegetarian diet and its effect on exercise capacity are not sufficiently documented in power sports, endurance sports or even in everyday life to permit anything more than a tentative conclusion to be drawn at the moment. Further research is essential in this regard.

Conclusion

It can be reasonably concluded that the beneficial effects of a vegetarian diet significantly outweigh the adverse ones. The published studies paint a consistent picture associating vegetarian diets with lower body mass index, coronary heart disease, hypertension, type 2 diabetes, and metabolic syndrome. Vegetarians also have lower risks for colon, gastrointestinal tract, prostate and overall cancer. The lower risk among vegetarians of several high prevalent chronic diseases results in a greater life-expectancy compared to non-vegetarians. The reasons for choosing a vegetarian diet often go beyond health and well-being and include economical, ecological and social concerns which are the subject of the new field of nutritional ecology that is concerned with sustainable life styles and human development.

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Source of support: Nil

Conflict of interest: None declared.