

## VEGETARIANISM AND VEGAN DIET

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### Summary

Interest in a healthy lifestyle and different dietary practices that promote health continues at the same time as ecological and environmental concerns increase. Vegetarianism includes a wide variety of eating patterns, and today there is a widespread dissemination of information demonstrating that appropriately planned plant-rich omnivorous diets and plant-based lacto-vegetarian and semivegetarian diets are equally successful in promoting health. Plant-only diets without nutrient fortification do not promote health, because they do not necessarily supply adequate amounts of energy and essential nutrients such as vitamin B-12, vitamin D, calcium, and iron. Further studies are needed on the effects of plant-only diets on health, especially those diets given to children. The positive physiological health consequences of vegetarian diets include the high body antioxidant capacity of dietary antioxidants such as vitamin C, E, and beta-carotene, avoidance of overweight, low blood pressure and low serum glucose and cholesterol levels, and positively changed microflora in the colon. Epidemiological studies indicate vegetarians have lower morbidity and mortality rates from several chronic degenerative diseases than do nonvegetarians. Also the incidence of lung and colorectal cancer is lower in vegetarians, as is the incidence of diabetes, high blood pressure, and rheumatoid disease. In the future when more information about the health effects of different vegetarian dietary practices has been gained, more suitable dietary recommendations for vegetarians can be made.

### 1. Introduction

Vegetarianism includes a wide variety of eating patterns, and is often associated with different lifestyles and attitudes toward health. At present various vegetarian diets are gaining more interest in western societies on an ethical and/or nutritional basis.

However, most of the one billion vegetarians in the world adhere to their diet because of religious reasons or poverty (in, for example, India and China).

Despite the fact that there is no single vegetarian eating pattern, vegetarian diets are distinguished from each other on the basis of the variety of foods included, the extent to which the diets are planned to correspond to dietary recommendations, and also the health attitudes and practices associated with these diets.

The principal difference among vegetarian diets is the extent to which they avoid animal products, the vegan diet being the most restrictive and the semivegetarian diet the most permissive in this respect. Semivegetarians, also called demivegetarians, partial vegetarians, or moderate vegetarians, include some but not all animal foods, and usually exclude red meat. Those who eat fish and vegetables but not meat are called pescovegetarians. Lacto-ovo-vegetarians exclude meat, poultry, and fish, while lacto-vegetarians exclude eggs in addition to these foods. Strict vegetarians (also called vegans, pure vegetarians, or total vegetarians) exclude all foods of animal origin. Based on their original motives and their nutritional habits, vegans can be further divided into four subgroups: ethical, religious, cult, and therapeutic.

In discussing the nutritional adequacy, benefits, and health outcomes of different dietary practices, nutritional scientists distinguish them from each other on the basis of the amount of plant foods consumed (plant-rich, plant-based, and plant-only diets). This is because in many studies consumption of fruits and vegetables has been associated with health promotion. Consequently, the consumption of a plant-rich diet is universally promoted in dietary recommendations. The term “plant-based diet” is used when there is discussion about, for example, lacto-vegetarian and semivegetarian diets, and the term “plant-only diet” used when discussion turns to the diet of vegans, fruitarians, or raw food eaters.

Until the 1950s, adequacy and prevention of deficiency diseases were the main criteria and standards for judging the healthiness of different dietary patterns. At that time discussion and research on vegetarian diets concentrated on defining the possible health risks connected to these dietary practices. Today, the criteria for healthy dietary patterns are broader than those of nutritional adequacy. They include balance, moderation, and a focus on reducing the risks of chronic degenerative diseases. Today it is well established that both plant-rich and plant-based diets promote health, but plant-only diets as such do not promote health. However, the advent of nutrient-fortified foods, the use of vitamin and mineral supplements, and the widespread dissemination of sound information on dietary patterns have increased the convergence between the essential nutrient profiles of plant-only, plant-rich, and plant-based diets.

The health-promoting effects of plant foods are thought to be due to various compounds found in them, only some of which are nutrients in the classic sense. The mechanisms of action include several physiological processes like their antioxidant effect, modulation of biotransformation enzymes, changes in colon microflora, alteration of hormone metabolism, and so on. The challenge is to find out what components are responsible for beneficial effects in both vegetarian and omnivorous dietary patterns.

## 2. Food Safety and Various Eating Patterns

The dietary health risk will increase if food contains harmful or toxic substances of either microbiological origin (microbiological risk) or chemical origin (chemical risk), but especially if the diet is composed inappropriately (nutritional risk), meaning that dietary recommendations have not been taken into account when planning a diet. Harm can be immediate—for example, food poisoning or allergic reaction—or deleterious effects will emerge in the long term such as overweight, atherosclerotic lesions, osteoporosis, and carcinogenesis. In affluent countries, nutritional risk is the most significant and relevant risk. In the developing countries there is more concern about food security and microbiological risk than there is in affluent countries.

It is now well established that appropriately planned plant-rich omnivorous diets, and plant-based lactovegetarian and semivegetarian diets, possess equal qualities in health promotion. However, plant-only diets as such are not health promoting, because they do not supply adequate amounts of essential nutrients such as vitamin B-12, vitamin D, calcium, and iron. Also the intake of energy by vegans has been reported to be scanty.

Nowadays there is, however, more convergence of plant-rich and plant-only diets, because it is possible to compensate for the nutrients that plant-only diets lack through complementation, fortification, and supplementation. However, we need more research on the long-term health of vegans, because the studies available are only based on small numbers of individuals. In particular, we need more research on vegan diets given to children.

Since the eating patterns of vegetarians vary considerably, individual assessment is required to evaluate accurately the nutritional quality of a vegetarian's dietary intake. Plant-only diets, like all diets, need to be planned appropriately to be nutritionally adequate. Since the numbers of vegetarians and vegans are increasing, the health authorities should know the health risks associated with vegan dietary practices in order to give appropriate nutritional guidance.

## 3. Plant-Based Dietary Patterns and Physiological Health Promotion

A well-balanced diet with moderate physical activity (see *Physiological Basis of Exercise*) are two of the basic components in the physiological approach in health promotion. Today, the criteria for healthy dietary patterns include balance, moderation, and focus on reducing the risks of chronic degenerative diseases. Dietary recommendations advise increasing the daily consumption of plant foods, decreasing the consumption of animal origin foods known to contain saturated fat, and decreasing the intake of table salt (sodium). It is also emphasized that energy intake should be adjusted to output in order to avoid overweight.

Several studies indicate that both plant-based and plant-only diets have advantages over the omnivorous diet (Table 1). Every day, vegetarians consume many carbohydrate-rich plant foods such as fruits and vegetables, cereals, pulses, and nuts. As a consequence, their diet contains more antioxidant vitamins (vitamin C, vitamin E, and beta-carotene), flavonoids, folic acid, fiber, and health-promotive non-nutrient substances than that of

omnivores. Since they avoid foods of animal origin, their intake of saturated fatty acids and cholesterol is also significantly lower than that of omnivores.

<b>Dietary factor or observed change in physiology</b>	<b>Health benefit</b>	<b>Possible mechanism</b>
Energy intake is adjusted to output	Optimal body weight is maintained	Overweight and its consequences such as elevated blood lipids, hypertension and glucose intolerance are avoided
Scanty intake of saturated fatty acids	Decreased risk of cardiovascular diseases	Low serum cholesterol concentration
High intake of antioxidant vitamins (vitamin C, vitamin E and $\beta$ -carotene)	Decreased risk of cardiovascular disease and cancer	Oxidation of LDL and PUFA are decreased
High intake of fiber	Stabilizes blood glucose, lowers serum cholesterol, prevents colon cancer	Dilution effect, decreased transit, binding of carcinogens, alteration of hormone metabolism
Low intake of sodium	Beneficial effects on blood pressure	Ion pumps in cell membranes modified?
High intake of health-promotive non-nutrient substances such as flavonoids and glucosinolates	Decreased risk of cancer and cardiovascular disease	Antioxidant effects, induction and inhibition of biotransformation enzymes, alteration of hormone metabolism
Changes in colon microflora	Decreased risk of colon cancer, and possibly decreased risk of rheumatoid diseases and allergies	Low excretion of bile acids, high concentration of faecapentaens, quiescent level of colonic cell proliferation, increased amount of lactic acid bacteria
Abstinence from alcohol and smoking	Decreased risk of lung cancer and blood pressure	Toxic effects of alcohol and tobacco are avoided
High physical activity level	Optimal body weight, good physical health	Food intake mechanisms work better

Table 1. Observed health promotive effects of plant-based and plant-only diets

Measurements of antioxidant blood levels in vegetarians show that a vegetarian diet maintains a higher antioxidant vitamin status (vitamin C, vitamin E, beta-carotene) but a variable antioxidant trace element status compared with an omnivorous diet. Studies have shown also that lacto-ovo-vegetarians who have adhered to their diets for decades

weigh less, have lower total serum cholesterol and serum glucose concentrations, and have lower blood pressure than nonvegetarians.

Some vegan diets have also been shown to modulate colon microflora, which has led to lesser formation of harmful bacterial degradation products. Living food eaters are total vegetarians who consume large amounts of fermented food items. In clinical interventions with healthy and rheumatoid patients, adopting this diet radically changed their colon microflora and decreased the activities of harmful colonial enzymes such as fecal urease and beta-glucuronidase. A drop of both phenol and para-cresol levels in the blood, and in the daily urinary output, were also recorded on a living food regimen. The most outstanding clinical finding was, however, that the disease activity in rheumatoid patients appeared to lessen in relation to the change in the fecal microflora. It is suspected that changes in colon microflora, and especially the increase of lactobacilli in the gut contents, could be the health-promoting agent.

Health-promotive non-nutrient compounds in plant foods include among others polyphenols (for example, flavonols and isoflavones), thiols, terpenes, plant sterols, and degradation products of glucosinolates (for instance, isothiocyanates, indoles, and dithioliols). These compounds have both complementary and overlapping action mechanisms, including the induction of detoxification enzymes, alteration of hormone metabolism, and colon microflora and antioxidant effects. Studies on living food eaters have shown differences in non-nutrient intake. The daily urinary excretion of lignans like enterodiols and enterolactone in vegans was about ten times, and that of secoisolariciresinol about three times, higher than that of the omnivorous controls. The mean daily intake of flavonols (quercetin, kaempferol, and myricetin) by vegans was also double that of omnivores. Instead, the phytic acid content of the living food diet was similar to that of a mixed diet, probably because the food preparation methods used, such as soaking, sprouting, and fermentation, are known to decrease the phytic acid content of cereals.

In addition to the previously mentioned health-promotive dietary habits, vegetarians are often also more physically active than are omnivores; thus, they also benefit from the many positive effects of active lifestyles. Many of them also abstain from smoking and alcohol, which also contributes to their better health status. Beneficial dietary and lifestyle habits will together exert their effects on vegetarians' health status. Epidemiological studies indicate that vegetarians often have lower morbidity and mortality rates from several chronic degenerative diseases than do nonvegetarians. Vegetarian diets have also been successful in arresting coronary artery disease. The incidence of lung and colorectal cancer is lower in vegetarians, and so is the incidence of diabetes, high blood pressure, and rheumatoid diseases. According to many epidemiological studies, consumption of vegetarian foods has beneficial effects on health. Today we know that plant-based omnivorous diets, such as Greek and Japanese eating patterns, appear to offer advantages over certain other patterns. Hence, the challenge is to find out what components are responsible for the beneficial effects in both vegetarian and omnivorous dietary patterns. So far there are no studies showing that a well-balanced vegetarian diet combined with a healthy lifestyle provides better protection against chronic diseases than a well-balanced mixed diet combined with a healthy lifestyle.

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### **Biographical Sketch**

**Anna-Liisa Rauma** was born 1958 in Mikkeli, Finland. She was awarded a M.Sc. in Nutrition in 1983 by the University of Helsinki, Finland, and Ph.D. in Nutrition in 1996 by the University of Kuopio, Finland. Additional academic distinctions include advanced studies in microbiology, general toxicology, and education.

Her master's research involved the determination of the nutrient content of sprouted beans and seeds, and in doctoral research she studied pure vegetarians, their nutritional status and biotransformation. After her Master's degree she has worked for five years as a registered dietitian. Following that she has made an academic career at university, first as a Ph.D.-researcher and then as an Associate Professor in Home Economics. Currently she works as a Professor at the Department of Education at the University of Joensuu, Savonlinna, Finland, undertaking research focusing on nutrition education and nutrition ecology.