Convergence of philosophy and science: the Third International Congress on Vegetarian Nutrition\textsuperscript{1,2}

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ABSTRACT Populations of vegetarians living in affluent countries appear to enjoy unusually good health, characterized by low rates of cancer, cardiovascular disease, and total mortality. These important observations have fueled much research and have raised 3 general questions about vegetarians in relation to nonvegetarians: Are these observations the result of better nondietary lifestyle factors, such as lower prevalences of smoking and higher levels of physical activity?; Are they the result of lower intakes of harmful dietary components, in particular meat?; and Are they the result of higher intakes of beneficial dietary components that tend to replace meat in the diet? Current evidence suggests that the answer to all 3 questions is “Yes.” Low smoking rates contribute importantly to the low rates of cardiovascular disease and many cancers, probably including colon cancer, in Seventh-day Adventists and other vegetarian populations. Also, avoidance of red meat is likely to account in part for low rates of cardiovascular disease and colon cancer, but this does not appear to be the primary reason for general good health in these populations. Evidence accumulated in the past decade emphasizes the importance of adequate consumption of beneficial dietary factors—rather than just the avoidance of harmful factors— including an abundance of fruit, vegetables, and whole grains and regular consumption of vegetable oils, including those from nuts. Although current knowledge already provides general guidance toward healthy diets, accumulated evidence now strongly indicates that diet has a powerful yet complex effect on health and that further investigation is needed. Am J Clin Nutr 1999;70(suppl):434S–8S.

KEY WORDS Vegetarian, health, vegetarianism, diet, cancer, cardiovascular disease, Seventh-day Adventists, colon cancer

VEGETARIAN DIETS: CONVERGENCE OF PHILOSOPHY AND SCIENCE

First, it is appropriate to thank our colleagues at the host institution of Loma Linda University, not only for their sponsorship of the Third International Congress on Vegetarian Nutrition, but also for leading the scientific examination of health aspects of vegetarian diets over a period of many years. In particular, I would like to recognize the pioneering role of Mervyn G Hardinge in leading the scientific investigation of vegetarian diets and health and also the contributions of the late Roland Phillips, whose early work in nutritional epidemiology had an important impact on my own thinking and on the direction of the field of nutritional epidemiology.

The scientific scrutiny of vegetarian diets has as objectives the optimization of nutrition for those who choose to be vegetarians and the enhancement of our overall understanding of diet and health. Thus, such studies have broad implications for all persons. There are many reasons for choosing to be a vegetarian, including religion, sustainability of our food supply, and personal health. In the widest view, the well-being and future of mankind is probably most influenced by the manner with which we treat our fellow humans and other species and by the ability of our planet to provide adequate food for all. Nevertheless, the focus of this introductory review is primarily on the direct health aspects of vegetarian diets. In particular, I will pose questions that we will need to address and give some indication of where we stand in pursuing the answers to them.

In general, populations of vegetarians living in affluent countries appear to enjoy unusually good health, characterized by low rates of cancer, cardiovascular disease, and total mortality (1, 2). These observations have fueled much research and have raised 3 general questions about vegetarians in relation to nonvegetarians: 1) Are these observations the result of better nondietary lifestyle factors such as lower prevalences of smoking and higher levels of physical activity?; 2) Are they the result of lower intakes of harmful dietary components, in particular meat?; and 3) Are they the result of higher intakes of beneficial dietary components that tend to replace meat in the diet? As for the first question, there is clear evidence that low rates of smoking have had a major effect on the health status of at least some vegetarian populations. For example, in the data compiled by Phillips et al (1) and Key et al (2), overall cancer mortality in the Seventh-day Adventist population is lower, in men by about one-half and in women by about one-third, than in the overall US population (3). However, marked differences are seen by type of cancer, with the most dramatic differences being in lung cancer; breast and prostate cancer rates are similar between the 2 populations. The rate of colorectal cancer is lower in Seventh-day Adventist...
men, which may reflect dietary patterns, but which also may in part reflect reduced prevalence of smoking (4, 5). A similar pattern is seen for cancer incidence (Table 1), although the differences in cancer rates when compared with a non–Seventh-day Adventist population are less extreme (3). Ready access to excellent medical care in the Adventist population might contribute to a lower mortality rate for several cancers.

**POTENTIALLY ADVERSE EFFECTS OF MEAT CONSUMPTION**

Much of the early focus in the study of diet and health in vegetarian populations was on the potentially adverse effects of meat consumption. Such interest was motivated not just by comparisons between vegetarian and nonvegetarian populations, but also by international correlations indicating strong positive associations between consumption of meat or animal fat and incidences of many cancers and of coronary heart disease (6). For example, the association between per capita consumption of meat and incidence of colon cancer among various countries is extremely strong (Figure 1). Although these international correlations have appropriately provided the motivation for further research, by themselves they are only suggestive of such an association because other aspects of lifestyle, including physical activity and factors such as body fatness, differ greatly between countries and could provide alternative explanations. However, in more detailed case-control and cohort studies, in which potentially confounding factors were better controlled for, consumption of red meat was associated with a greater risk of colon cancer (7). However, available evidence does not suggest that all flesh foods are similarly associated with a higher risk of colon cancer. In several studies, including the Nurses’ Health Study and the Health Professionals Follow-up Study conducted by our group, consumption of chicken and fish has tended to be inversely associated with colon cancer risk, however the association has not always been statistically significant (7).

Although an association between red meat consumption and colon cancer has been observed in many studies the available evidence suggests that there is little such relation with breast cancer (8). Within Seventh-day Adventist populations, little if any reduction in breast cancer incidence has been observed in comparison with the general US population (Table 1). Positive relations between consumption of red meat and breast cancer were noted in a few studies (9), but a tendency to report positive associations but not to publish negative findings may have resulted in an overall bias in the literature. This bias results in part from the impossibility of publishing findings for all the foods that might be examined in a typical study of diet and any particular cancer. For example, in the Nurses’ Health Study we found no association between red meat consumption and breast cancer, but only noted this result in a sentence in which we indicated that no associations were seen with other foods on the questionnaire (10). Given that red meat is the major source of saturated fat in the diets of most American and European populations, the lack of any overall association between saturated fat and breast cancer risk in a pooled analysis of all large prospective cohorts (11) makes it unlikely that such an association existed in these studies, even though none were reported specifically.

Of all the major cancers in Western populations, the strongest support for an association with animal fat consumption is for cancer of the prostate. Positive associations of prostate cancer with animal- but not vegetable-fat consumption were seen in international studies (6, 12); similar associations were seen in most case-control and cohort studies (13). However, no clear mechanism has been established by which animal fat might increase the risk of prostate cancer, and the possibility that other aspects of foods containing animal fat might be the causative factors should be considered. For example, one of the most consistent observations has been an association between consumption of dairy products and prostate cancer incidence or mortality; in the Seventh-day Adventist population, the strongest association among various foods was with milk consumption (14). Although an association between red meat consumption and prostate cancer has been seen in some studies, this is not an entirely consistent finding (15).

The avoidance of meat is likely to reduce the risk of coronary artery disease, because meat is the major source of saturated fat in the general US diet and also is a major source of dietary cholesterol. Indeed, within the Seventh-day Adventist population, Snowden et al (16) found a > 2-fold risk of fatal coronary artery disease in men consuming beef ≥3 times/wk compared with those who did not eat meat. However, in women there was little relation between beef consumption and coronary artery disease risk. This contrast between men and women was also noted in our studies; there was little relation between consumption of red meat and coronary artery disease risk in the Nurses’ Health Study (17), whereas there was a positive, although nonsignificant, association in the Health Professionals Follow-up Study in men (18). However, when Ascherio et al (18) calculated heme iron intakes, there was a 50% greater risk of coronary disease in those with the highest intakes than in those with the lowest intakes. The hypothesis that accumulation of iron may increase the risk of coronary artery disease could explain a differential effect by sex because menstrual cycles would lead to a lower

![Table 1](https://academic.oup.com/ajcn/article-abstract/70/3/434s/4714903/714603)
accumulation in women. Although the excess saturated fat in red meat might still be anticipated to increase coronary artery disease risk in women as well as men, about half of the fat in beef is unsaturated so that, compared with carbohydrate, there should be little effect on the ratio of total to HDL cholesterol and thus perhaps little effect on coronary artery disease risk. Furthermore, a large part of the saturated fat in beef is stearic acid, which has little effect on blood lipids (19).

In summary, red meat consumption, particularly in high amounts, is likely to have adverse effects on chronic disease risks, particularly those of colon cancer, and coronary disease, and possibly prostate cancer. However, low intake of red meat does not seem to be an adequate explanation for the general good health of vegetarian populations. Moreover, there is little evidence that consumption of fish and chicken in moderate amounts is harmful in regard to either cardiovascular disease or cancer.

**POSITIVE ASPECTS OF VEGETARIAN DIETS**

Most vegetarian diets are characterized by high contents of vegetables, fruit, whole grains, legumes, and nuts that may provide health benefits. Although these dietary sources are not necessarily unique to vegetarian diets, the removal of meat as a major source of energy does create an opportunity for larger consumption of these foods.

The large body of literature indicating low risks of cancers at many sites with high consumption of fruit and vegetables was summarized by Steinmetz and Potter (20) and Block et al (21). This evidence is based on case-control and cohort studies that used assessments of dietary intake as well as biochemical indicators of fruit and vegetable consumption, such as serum carotenoid and vitamin C concentrations. Increased fruit consumption has been associated with reduced risk of both coronary artery disease and cerebrovascular disease (2, 22), although the literature is not as extensive as that for cancers. The beneficial effects of high fruit and vegetable consumption appear to extend to a variety of conditions other than cardiovascular disease and cancer. For example, reduced risks of macular degeneration (23) and cataract (24) have been observed with increased intakes of certain vegetables. Also, the definitive evidence that supplementation with folic acid can reduce the risk of neural tube defect pregnancies by \( \approx 70\% \) provides additional evidence that intakes of fruit and vegetables are suboptimal in Western populations because these are the primary sources of folic acid (25).

A major line of research is presently investigating the constituents of fruit and vegetables that may be responsible for the protective effects of these foods against cancer. The potential candidate constituents are many and present a daunting challenge to disentangle. The failure to observe the beneficial effect of pharmacologic supplements of \( \beta \)-carotene in the prevention of lung cancer (26, 27) has been used by some to cast doubt on the epidemiologic evidence regarding fruit and vegetable consumption in relation to cancer risk. However, this argument is specious because the epidemiologic studies were investigating fruit and vegetable consumption, not \( \beta \)-carotene supplements, and the alternative factors in these foods are many.

One promising candidate to account for some of the anticancer effects of fruit and vegetables is folic acid. Inverse associations between folate intake and risks of colon cancer and adenomas have been observed (7). Furthermore, in 2 recent investigations, functionally important polymorphisms of methylenetetrahydrofolate reductase (EC 1.5.1.20), an enzyme involved in the metabolism of folic acid, were associated with colon cancer risk (28, 29). Such an association would be extremely unlikely if folate was not involved in the etiology of this disease. Inadequate folic acid intakes may also explain in part the associations between fruit and vegetable consumption and lower cardiovascular disease risk because higher intakes reduce the concentration of homocysteine, which has been documented to be an independent risk factor for coronary heart disease and probably stroke (30, 31).

Although the consumption of nuts has been widely condemned by many in the nutrition community because of their high fat content, Fraser et al (32) reported a substantially lower risk of both fatal and nonfatal coronary heart disease in Seventh-day Adventists who consumed nuts \( \geq 4 \) times/wk than in those who consumed nuts \( \leq 1 \) time/wk. This finding was confirmed by Kushi et al (33) in the Iowa Women’s Study. Because the fat content of most nuts is largely unsaturated, a beneficial effect is not surprising.

**FIGURE 1.** Correlation between meat intake (g per person per day) and incidence of colon cancer in women in 23 countries (\( N = 100 000 \)). Reproduced with permission from reference 6.
However, the magnitude of the risk reduction, ≈ 50% in both of the studies noted above, was greater than might be anticipated by changes in blood lipids alone. Walnuts in particular are very high in the n-3 fatty acid α-linolenic acid, which may have uniquely beneficial effects by reducing platelet aggregability and raising the threshold for ventricular fibrillation (34). Several studies have suggested a major potential benefit of α-linolenic acid in reducing coronary artery disease risk. In the Health Professionals Follow-up Study, Ascherio et al (35) found a 50% lower risk of coronary artery disease in men with high α-linolenic acid intakes. Also, de Lorgeril et al (36), in a randomized secondary prevention study, observed a 70% reduction in recurrent coronary events among those assigned to a diet high in α-linolenic acid based on a Mediterranean-type diet. α-Linolenic acid has been specifically and consciously destroyed in the US food supply by the process of partial hydrogenation, in the desire to prolong the shelf life of products containing this fatty acid. Because vegetarian diets typically emphasize minimally processed foods, consumption of α-linolenic acid in the form of nuts as well as other oils is likely to be higher in vegetarians than in nonvegetarians, and the benefits appear to be substantial.

Additionally, vegetarians typically consume greater amounts of whole grains and, thus, greater amounts of fiber from cereal products than do nonvegetarians. The form of carbohydrate consumed has been a relatively neglected area of nutrition because many have assumed that all foods high in starch are good simply because they contain complex carbohydrates and are low in fat. However, the importance of minimal refining of cereal fiber has been emphasized in studies of coronary artery disease and diabetes. An inverse association between fiber intake and risk of coronary disease has been a highly consistent finding (37). When examined by fiber source, the strongest such association in several studies has been with cereal fiber (38, 39). In examining aspects of diet in relation to the risk of type 2 diabetes, we recently found that high cereal-fiber intake was associated with reduced risk; a high glycemic load, an indicator of the amount of food with a high glycemic index, was positively associated with risk of diabetes (10 glycemic load is particularly deleterious. Such a combination is characteristic of diets consumed by many Americans, ie, abundant in white bread, potatoes, white rice, and refined pasta. In contrast, vegetarian diets are more characterized by whole-grain versions of these foods, with less emphasis on potatoes.

CONCLUSIONS

On this basis of the brief introduction, I believe it is possible to draw several conclusions.

1) High consumption of red meat has adverse health consequences; thus, vegetarian diets tend to impart health advantages.

2) In most diets, inadequate consumption of beneficial dietary components, including fruit, vegetables, whole grains, and others high in nonhydrogenated vegetable oils, appears to be more detrimental than is an excessive intake of harmful foods. This conclusion, based on the extensive body of data collected during the last decade, represents a substantial shift in thinking because, previously, the emphasis had been on the avoidance of harmful dietary components. However, this conclusion raises many questions, including, What is the optimal intake of specific fruits and vegetables?, What are the beneficial constituents of these foods?, and What is the optimal intake of vegetable oils and foods high in vegetable oils?

3) Vegetarian diets per se are not necessarily healthful. They can include inadequate amounts of beneficial foods and excessive amounts of overrefined carbohydrates, partially hydrogenated vegetable fats that contain trans fatty acids and that are low in α-linolenic acid, and food subtractives such as olesstra that interfere with the bioavailability of food constituents. For example, an American version of a vegetarian diet favored by some teenagers consists of cola, pizza, and ice cream, which can hardly be considered healthy and may be almost devoid of vegetables.

4) Much additional information is needed to define the characteristics of optimally healthy vegetarian diets. Such information, which is the focus of this supplement, will be of enormous value to both vegetarians and omnivores.

REFERENCES


