Gary E. Fraser

The Vegetarian Advantage: Its Potential for the Health of Our Planet, Our Livestock, and Our Neighbors!

Gary E. Fraser

School of Public Health, Loma Linda University, Loma Linda, CA, USA

Although vegetarianism has existed for thousands of years, the motivation originally came from philosophical and religious practices and traditions. Beginning about 200 years ago (particularly in the U.K., Germany and soon after the USA) there were prominent advocates for the positive effect of vegetarian diets on physical, and possibly mental health [1]. More recently there have been greater concerns about animal rights, in the last few decades the increasing focus on global warming, and the effects of modern society on the planet that have highlighted the predicted ecological benefits of vegetarian diets [2]. Consequently, motivations are now varied and often mixed.

Vegetarian Diet – Attempts at a Definition

The definition of a vegetarian diet is particularly simple, being at a minimum the absence of meat from the diet, or more strictly the absence of all animal products. This simple definition is as useful as most people are familiar with the ‘vegetarian’ concept – perhaps in contrast to a ‘Mediterranean diet’ where definitions differ and are more complex. However, this simplicity also produces the complexity of diets with possibly marked differences in nutrients and phytochemicals sitting under the same label (e.g. diets of Adventists in the USA, British vegetarians, Indian Hindus). Some nutritional societies have been reluctant to publish dietary recommendations for a vegetarian diet as its definition was considered insufficiently specific. A more detailed definition of a ‘healthy vegetarian diet’ is now possible and would be most helpful, particularly if simplicity in its main points is retained.

For research purposes the inadequacies of the definition have been partially overcome by dividing vegetarians to several subgroups, such as vegan, lacto-ovo-, pesco-, semi-, and non-vegetarian [3], although according to our definition only the first two are real vegetarians. However, pesco- and semi-vegetarians are intermediate on the continuum of intakes of meats and dairy products. The value of such an approach is borne out by noting that appetites tend to balance calories. This means that the absent animal foods are substituted with extra plant foods. Consequently it is nutrients, vitamins, and minerals associated with both animal and plant foods that show monotonic trends between these groups [3, 4]. This reminds us that any health effects of the diets may also come from the extra content of plant foods.

Health Effects of a Vegetarian Diet

The focus of the meeting that this editorial accompanies is the health effects of a vegetarian diet. These appear to be substantial despite the relative paucity of large prospective

studies of vegetarians or randomized trials with clinical endpoints. First considering risk factors, there is good evidence for protective effects of vegetarian diets on blood cholesterol [5–7], blood pressure [7–10], fasting blood sugar [11], overweight (possibly an acute effect at adoption of the diet followed by a smaller long-term effect) [11, 12] and cross-sectional evidence suggesting benefits on blood insulin [13, 14], C-reactive protein [13, 15], many amino acids [16], and insulin-like growth factor-1 [13, 17]. Other studies find that vegetarians have a very different microbial bowel flora from omnivores [18] which may have beneficial implications for diabetes, cardiovascular disease, and some cancers. The evidence for lower rates of new cardiovascular disease events and mortality in vegetarians is impressive and consistent [19–21]. Studies of incident diabetes have also found substantially lower rates in vegetarians [11]. Lower all-cause mortality has been repeatedly reported in studies of American Adventists and particularly in the vegetarians [22, 23], but not clearly so in British vegetarians [24]. The evidence about cancer is also controversial with some inconsistencies between studies. In the USA studies of Adventists there is evidence of a modest but statistically significant decreased risk for all cancers combined [25] and for at least colorectal [26] and prostate (vegans only) [27] cancers. Other less common cancers have not yet been examined with data having sufficient statistical power. Other studies suggest adverse effects of meat consumption on risk of diabetes, cardiovascular disease, and some cancers [28–32]. Presumably these reflect that part of the vegetarian advantage. Despite the largely observational nature of this evidence, in my view it is now appropriate to talk with some confidence about certain health benefits of a ‘good’ vegetarian diet, given the consistency of much of the evidence and the lack of obvious confounding. Differences between the USA and the U.K. regarding some results may illustrate different effects of rather different vegetarian diets even within Western societies.

Popular perception has sometimes associated vegetarianism with social oddness. However, more recently, vegetarian cuisine and dietary practices that trend in that direction have become more desirable – perhaps in part due to the evidence cited above. It was striking that our recent paper in *JAMA Internal Medicine* [26] reporting that vegetarian as compared to non-vegetarian Adventists in the USA had lower rates of colorectal cancer, was the second-most widely read paper in that journal for the year. This is a diet that the public can understand and is increasingly acknowledged to have more variety, to be less expensive, tastier, and healthier than many other choices.

What Are Future Research Directions?

It is important to better understand the differences (and their possible health implications) between vegetarian diets found in different countries and cultures. A great deal remains unknown about associations between vegetarian diets and risk of medium frequency cancers (e.g. lung, endometrial, ovary, lymphoma, etc.). Also of interest is the association of vegetarian diets with risk of e.g. autoimmune disorders, inflammatory bowel disease, or common causes of dementia. Given that long-term randomized trials of effects of vegetarian diets are not possible, causal inference can be strengthened by a better understanding of mechanisms and the study of associations between diet and various aspects of cellular biology. These include effects of vegetarian diets on bowel flora as well as possible effects on gene expression and the metabolome. Finally, life-course dietary studies [33] may be informative, as dietary habits often change across many years. This will require additional large cohorts that include many vegetarians and provide a biological as well as dietary data pool.

A vegetarian can hardly avoid speculating about the likely profound effects on public health, animal rights, and health of the planet if much of the world were to become vegetarian as unlikely as that may seem. The challenge is to make this a more attractive and practical choice!

References

- Spencer C: *The Heretic's Feast – a History of Vegetarianism*. Hanover/London, University Press of New England, 1993.
- Soret S, Mejia A, Batech M, et al.: Climate change mitigation and health effects of varied dietary patterns in real-life settings throughout North America. *Am J Clin Nutr*. 2014;100(suppl 1):490S–495S.
- Orlich MJ, Jaceldo-Siegl K, Sabaté J, et al.: Patterns of food consumption among vegetarians and non-vegetarians. *Br J Nutr* 2014;112:1644–1653.
- Rizzo NS, Jaceldo-Siegl K, Sabaté J, Fraser GE: Nutrient profiles of vegetarian and non-vegetarian dietary patterns. *J Acad Nutr Diet*. 2013;113:1610–1619.
- West RO, Hayes OB: Diet and serum cholesterol levels: a comparison between vegetarians and non-vegetarians in a seventh-day adventist group. *Am J Clin Nutr* 1968;21:853–862.
- Appleby PN, Thorogood M, McPherson K, Mann JL: Associations between plasma lipid concentrations and dietary, lifestyle and physical factors in the Oxford Vegetarian Study. *J Human Nutr Diet* 1995;8:305–314.
- Fraser G, Katuli S, Anousheh R, Knutsen S, Herring P, Fan J: Vegetarian diets and cardiovascular risk factors in black members of the Adventist Health Study-2. *Public Health Nutr* 2014;17:1–9.
- Rouse IL, Beilin LJ, Armstrong BK, Vandongen R: Blood pressure lowering effect of a vegetarian diet: controlled trial in normotensive subjects. *Lancet* 1983;1:5–10.
- Margetts BM, Beilin LJ, Vandongen R, Armstrong BK: Vegetarian diet in mild hypertension: a randomized controlled trial. *Br Med J* 1986;293:1468–1471.
- Pettersen BJ, Anousheh R, Fan J, Jaceldo-Siegl K, Fraser GE: Vegetarian diets and blood pressure among white subjects: results from the Adventist Health Study – 2 (AHS-2). *Public Health Nutr* 2012;15:1909–1916.
- Tonstad W, Stewart K, Oda K, Batech M, Herring RP, Fraser GE: Vegetarian diets and incidence of diabetes in Adventist Health Study-2. *Nutr Metab Cardiovasc Dis* 2013;23:292–299.
- Rosell M, Appleby P, Spencer E, Key T: Weight gain over 5 years in 21,966 meat-eating, fish-eating, vegetarian, and vegan men and women in EPIC-Oxford. *Int J Obes (Lond)* 2006;30:1389–1396.
- Jaceldo-Siegl K, Fan J, Haddad E, Knutsen S, Bellinger D, Fraser G: Vegetarian dietary patterns associated with biomarkers of cancer risk (Abstract). *Am J Epidemiol* 2013;177(suppl 11):S110.
- Kahleova H, Matoulek M, Malinska H, et al.: Vegetarian diet improves insulin resistance and oxidative stress markers more than conventional diet in subjects with type 2 diabetes. *Diabet Med* 2011;28:549–559.
- Paalani M, Lee JW, Haddad E, Tonstad S: Determinants of inflammatory markers in a bi-ethnic population. *Ethn Dis* 2011;21:142–149.
- Schmidt JA, Rinaldi S, Scalbert A, et al.: Plasma concentrations and intakes of amino acids in male meat-eaters, fish-eaters, vegetarians and vegans: a cross-sectional analysis in the EPIC-Oxford cohort. *Eur J Clin Nutr* 2015;23:doi 10.1038/ejcn.2015.144.
- Allen NE, Appleby PN, Davey GK, Kaaks R, Rinaldi S, Key TJ: The associations of diet with serum insulin-like growth factor I and its main binding proteins in 292 women meat-eaters, vegetarians, and vegans. *Cancer Epidemiol Biomarkers Prev* 2002;11:1441–1448.

- 18 Wong JM: Gut microbiota and cardiometabolic outcomes: influence of dietary patterns and their associated components. *Am J Clin Nutr* 2014;100(suppl 1):369S–377S.
- 19 Key TJ, Fraser GE, Thorogood M, et al.: Mortality in vegetarians and nonvegetarians: detailed findings from a collaborative analysis of 5 prospective studies. *Am J Clin Nutr* 1999;70(suppl 3):516S–524S.
- 20 Crowe FL, Appleby PN, Travis RC, Key TJ: Risk of hospitalization or death from ischemic heart disease among British vegetarians and nonvegetarians: results from the EPIC-Oxford cohort study. *Am J Clin Nutr*. 2013;97:597–603.
- 21 Fraser GE: A comparison of first event CHD rates in two contrasting California populations. *J Nutr Health Aging* 2005;9:53–58.
- 22 Fraser GE, Shavlik DJ: Ten years of life. Is it a matter of choice? *Arch Int Med* 2001;161:1645–1652.
- 23 Orlich MJ, Singh P, Sabate J, et al.: Vegetarian dietary patterns and mortality in Adventist Health Study-2. *JAMA Int Med* 2013;173:1230–1238.
- 24 Key TJ, Appleby PN, Spencer EA, Travis RC, Roddam AW, Allen NE: Mortality in British vegetarians: results from the European Prospective Investigation into Cancer and Nutrition (EPIC-Oxford). *Am J Clin Nutr* 2009;89:1613S–1619S.
- 25 Tantamango-Bartley Y, Jaceldo-Siegl K, Fan J, Fraser G: Vegetarian diets and the incidence of cancer in a low risk population. *Cancer Epidemiol Biomarkers Prev* 2013;22:286–294.
- 26 Orlich MJ, Singh PN, Sabaté J, et al.: Vegetarian dietary patterns and the risk of colorectal cancers. *JAMA Intern Med* 2015;175:767–776.
- 27 Tantamango-Bartley Y, Knutsen SF, Knutsen R, et al.: Are strict vegetarians protected against prostate cancer? *Am J Clin Nutr* 2016;103:153–160.
- 28 Bernstein AM, Sun Q, Hu FB, Stampfer MJ, Manson JE, Willett WC: Major dietary protein sources and risk of coronary heart disease in women. *Circulation* 2010;122:876–883.
- 29 Kaluza J, Åkesson A, Wolk A: Long-term processed and unprocessed red meat consumption and risk of heart failure: a prospective cohort study of women. *Int J Cardiol* 2015;193:42–46.
- 30 Fretts AM, Follis JL, Nettleton JA, et al.: Consumption of meat is associated with higher fasting glucose and insulin concentrations regardless of glucose and insulin genetic risk scores: a meta-analysis of 50,345 Caucasians. *Am J Clin Nutr* 2015;102:1266–1278.
- 31 Pan A, Sun Q, Bernstein AM, et al.: Changes in red meat consumption and subsequent risk of type 2 diabetes mellitus: three cohorts of US men and women. *JAMA Intern Med* 2013;173:1328–1335.
- 32 Lippi G, Mattiuzzi C, Cervellin G: Meat consumption and cancer risk: a critical review of published meta-analyses. *Crit Rev Oncol Hematol* 2016;97:1–14.
- 33 Parekh N, Zizza C: Life course epidemiology in nutrition and chronic disease research: a timely discussion. (See comment in PubMed Commons below.) *Adv Nutr* 2013;4:551–553.