The Influence of Bias on Research Regarding Health Advantages of Organic Foods

Audience

This article is written with the researcher conducting studies on the health benefits of organic food in mind. It is meant to bring together the current state of research in this area, the gaps in the research and the philosophical divide that clouds the issue. A secondary audience is the popular press writers who may use this as a resource to understand the confusion around the organic foods issue.

POTENTIAL FOR BIAS IN NUTRITION RESEARCH

The dilemma with nutritional research is that it is innately complicated and any complicated science is open to significant bias based on your point of view. (Nestle, 2006) Much debate has occurred in recent years over industry funding of nutrition research and the potential bias in results due to funding sources. (Lesser, Ebbeling, Goozner, Wypij, & Ludwig, 2007) If we move past the more sinister charge of bias of results based on financial considerations, might we consider that there is potential for bias based on a great philosophical divide that inherently produces divergent research results based on the paradigm or even ignorance of the researcher? In a recent report on conflicts of interest in funding food science and nutrition research, the authors point out that there are many forms of scientific and publication bias. In addition to the potential bias based on funding sources and their expectations, philosophical bias and group think bias are two that potentially threaten the credibility of scientific research in this area. (Rowe et al., 2009)

Philosophical Bias

Nutrition research is ultimately linked to the role that nutrition plays in human health. Although there are many studies that validate the role of nutrition in health, (Anderson et al., 2009; Ratliff, Mutungi, Puglisi, Volek, & Fernandez, 2008; Turnbaugh et al., 2009) there is still a great deal of confusion over the clinical significance of foods among those trained under a conventional medical model. (Nestle, 2006; Shimizu, Sakamoto, Nishizawa, Iguchi, & Yamaoka, 2007)

Those trained under a naturopathic or holistic model tend to value the role of food as healing and view the human body as innately moving toward healing with science as a support. Those trained under the conventional medical model view science as a dominant force bringing healing to a body that is breaking down and in need of repair with nutrition playing a minor supporting role in health. Obviously, there is a spectrum of views in between and yet ultimately each group, when pressed, will show their true philosophical belief to be in one camp of the other by the actions they take either personally or in practice. (Pizzorno, 2010)

This philosophical bias influences the approach to research and therefore the results and interpretation of research. Consider the basic question, "Are foods raised organically better for human heath that foods raised in the industrial model (with pesticides, fungicides and synthetic fertilizers)?" Until the recent decades, there was little funding available to research the health benefits of organic food over industrial food. Most of the studies were designed to determine if there were any quality differences in the foods grown under each method or to prove the general safety of industrial agricultural methods. Many of these were industry funded studies where one could reasonably argue that the results would impact regulations and market growth of the funding organization. (Lesser, et al., 2007; Popelut, Valet, Fromentin, Thomas, & Bouchard, 2010) We will discuss more on funding bias momentarily but here we will address the structure of the studies.

If you start with the point of view that the body is innately healing if given the right building materials and spared toxic inputs then you would likely structure the study from a more holistic perspective. It would involve looking at the whole diet of groups of individuals and measuring the health outcomes based on organic vs. conventional diets. (Kummeling et al., 2008) Because of the synergistic way that nutritional components work together, measuring the mineral, phyto-nutrient and toxic mineral profiles of the foods themselves would be secondary to measuring those attributes within the tissue of the individual and ultimately how that influences their health.

However, if you view science in the role of finding the solution to health issues, the main focus is to find the isolated component that will most quickly influence health in a positive way in order to synthetically reproduce and provide this component at higher doses for the intended effect. Few scientists with this philosophy really believe that the nutrient value in any particular

food is significant enough to make a difference in a specific health issue. (Nestle, 2006) Because of that, the main purpose of the studies in organic vs. conventional foods is to show that there is minimal difference in nutrient content and therefore measuring nutrient content in individual foods is the vital component of the study. (Dangour et al., 2009)

Group Think Bias

Over the past century, this philosophical divide has produced two main philosophical groups. Each group has their own educational institutions, researchers, industries, health professionals and professional publications. With the advent of the internet and the explosion of print media, this has extended to consumer publications, websites and blogs creating distinct consumer groups as well. To highlight this, consider three well known organizations in the field of nutrition. The International Life Sciences Institute states that they are "a nonprofit, worldwide organization whose mission is to improve public health and well-being by engaging academic, government and industry scientists in a neutral forum to advance scientific understanding in the areas related to nutrition, food safety, risk assessment, and the environment. ILSI receives its funding from its industry members, governments, and foundations." The industries that provide funding are predominantly agrichemical, biochemical, pharmaceutical and food processing companies. The dollar value of their annual budget was not disclosed on the website or in the annual report. ("International Life Sciences Institute (ILSI)," 2009) The Center for Science in the Public Interest states "three main goals: 1)to provide useful, objective information to the public and policymakers and to conduct research on food, alcohol, health, the environment, and other issues related to science and technology; 2)to represent the citizen's interests before regulatory, judicial and legislative bodies on food, alcohol, health, the environment, and other issues; and 3) to ensure that science and technology are used for the public good and to encourage scientists to engage in public-interest activities." CSPI receives the vast majority of it's funding from over 900,000 subscribers to their newsletter with less than 10% from private foundation grants. They do not accept corporate or government funding and their annual budget was $17 million in 2009. ("Center for Science in the Public Interest," 2009) The International and American Associations of Clinical Nutritionists "is the Professional Membership Organization of practicing clinical nutritionists in many health care professions who strive to attain the highest standards of competency and practice. IAACN recognizes each individual's

innate ability to heal and sustain health and is committed to the exploration and support of that process." IAACN receives funding from membership and corporate sponsors from the nutrition supplement industry and educational organizations within the nutrition and holistic health model. Their annual budget was not disclosed on the website. ("International & American Associations of Clinical Nutritionists (IAACN),")

These groups provide value in that they provide professional certification, publish both within the research community and among consumers, monitor legislation for the purpose of informing members and they often educate the public. However, they also provide a like minded professional group that can serve to limit perspective. The point here is not to debate the intention, intelligence or motives of each of these groups but simply to suggest that in the interest of scientific integrity we must consider the possibility of group think bias and take steps to broaden our perspective as we structure and conduct research in this arena.

Funding Bias

The vast majority of funding for food science and nutrition research comes from industry sources. This is due to the limited investment of public research dollars by the federal government. The federal science and technology budget for 2008 appropriates $1.8 billion for agricultural research and much of that of that goes to agricultural methods designed to increase yield. Compare these numbers to the $29 billion in research dollars of the NIH. However, the NIH invests only $1.8 billion in the category entitled "kidney, urology, digestive, metabolic and endocrine diseases as well as diabetes and nutrition." Environmental health science has $637 million appropriated. The vast majority of NIH spending occurs in biomedical research appropriated through a variety of agencies including the National Cancer Institute ($4.8 billion), the National Heart, Lung and Blood Institute ($2.9 billion) and the National Institute of Allergy and Infectious Diseases, including AIDS, ($4.6 billion). ("National Institute of Health," 2010) The assumption that the results of industry funded studies may be biased toward those that support the funding industry is logical and was clearly demonstrated in the 2007study that found in comparing industry funded interventional studies vs. non-industry funded, the likelihood of an unfavorable conclusion was 0% for the industry funded vs. 37% for non-industry. (Lesser, et al., 2007; Popelut, et al., 2010; Thomas et al., 2008))

The real question that remains is, "Where is the source of funding for research on food?" If we want to research the health benefits of food grown from heirloom seeds (non patentable), organically (no chemicals in use, closed loop sustainable) and sold for consumption as whole food (little or no processing) what industry would fund this study? There is no amount of disclosure that will solve the issue of lack of funding to conduct this type of basic research. (Fuglie et al., 1996)

Although I agree with the small steps taken in a recent proposal by the International Life Sciences Institute to formalize guidelines in the conduct of public/private research relationships (Rowe, et al., 2009), I in no way believe that this is more than a small step. I also note that their members and board are comprised of major global food processors, chemical, pharmaceutical and cosmetic companies. They appear to argue the case for the critical role that industry plays in research and public policy in response to an outcry from consumer groups denouncing the role of industry in these efforts. ("Letter to US FDA from a Consortium of Consumer Groups," 2007)

In all fairness, the main purpose of a business is to make a profit. In a public company, this is the fiduciary responsibility of the officers. If research goals are in line with this purpose, then that is an appropriate endeavor. If, however, research goals and findings consistently conflict with the company purpose then continuing to fund research in that area is not only unwise but it also leaves the officers open to legal liability. This is demonstrated in the proportion of research expenditures devoted to basic, applied and developmental research. Public funding is 47% basic research, 45% applied research and 8% developmental. Contrast that with the 15% spent on basic research by the private sector followed by the 44% spent on applied research and 41% on developmental research. There is no amount of private/public partnership disclosure that will solve the inherent incentive of industry to invest in research that supports their purpose and avoid basic research that has little hope of increasing profitability or even risks damaging profitability. (Fuglie, et al., 1996) That being said, it is wise for governing bodies to take this potential bias into consideration when reviewing research with the purpose of developing public policy.

OVERVIEW OF PAST RESEARCH – WHAT DO WE KNOW?

In the last two decades, many studies have been conducted to evaluate the nutritional value of organic foods. The growth of the U.S. organic food market of $1 billion in 1990 to $24.8 billion

in 2009 has created much interest in funding additional research, although these markets pale in comparison at only 3.7% of the conventional market. ("Industry Statistics & Projected Growth," 2010) For the purposes of this article, I will focus on several studies conducted in the previous three years and acknowledge that there are many additional studies over the past two decades. I found that these summarized best what we know and what we do not know without the emotional overtones and personal attacks found in some reviews. (Rosen, 2010)

Issues Regarding Food Quality

Let's start with the quality of the food. Food can be grown under the industrial food system that potentially involves genetically modified seeds, the use of pesticides and fungicides, shipping from long distances in less regulated countries for local consumption and irradiated along the way. In contrast, food can be grown with heirloom seeds, using organic methods, on a mature, sustainable organic farm whose only input from the outside world is the crates and bags to package the foods and eaten within one hundred miles with little processing or shipment. There are obviously many complex variables to address in these two scenarios. Because of ignorance or bias, these issues have not been addressed in a comprehensive way in previous research. In fact, a significant issue in evaluating the value of organic foods is the poor quality of the research methods and reporting in this area.

In a systemic review of the nutritional quality of organic foods by Dangour in 2009, his team reviewed studies over fifty years finding 162 studies with only 55 of satisfactory quality to analyze. (Dangour, et al., 2009) This review only evaluated nutrient content, not contaminants or environmental impacts. The conclusion was that organically and conventionally produced foods are comparable in their nutrient content. However, it is difficult to conduct a systemic review of research that is admittedly poor quality. In addition, the studies selected were not made available for review and therefore this study was left out of a review by Crinnion. He came to a different conclusion, finding that in fact there is a nutritional quality difference, lower levels of pesticides and the potential for health benefits for the consumer. (Crinnion, 2010) These results are based on two studies that indicate the importance of mature organic plots versus recently converted plots in making comparisons of nutritional and contaminant quality. (Chassy, Bui, Renaud, Van Horn, & Mitchell, 2006; Mitchell et al., 2007)

Does Food Quality Influence Human Health?

Crinnion points out that there is only one study to date measuring whether an organic diet makes any difference in human health. A study of 312 lactating Dutch women divided into conventional diets (<50% organic), moderately organic (50-90% organic) or strictly organic (>90% organic) showed that their two year old offspring had a 36 percent reduction in risk of having eczema for those who consumed organic milk and milk products. (Kummeling, et al., 2008) This is a complex and difficult topic to study because of the number of variables involved, but there is certainly a need for additional research in the effects of organic food on human health.

MOVING FORWARD

The fundamental question surrounding the debate on bias in research in the area of food science and nutrition is one of scientific integrity. Integrity encompasses far more than funding bias, group think and philosophical bias but addressing these issues would certainly be a step forward. I would agree with the recommendations of the ILSI for guidelines on industry research as stated in number 1-8 below. (Rowe, et al., 2009) However, I would add two additional recommendations that would account for these additional areas of potential bias (see number 9, 10).

In the conduct of public/private research relationships, all relevant parties shall:

1. conduct or sponsor research that is factual, transparent, and designed objectively; according to accepted principles of scientific inquiry, the research design will generate an appropriately phrased hypothesis and the research will answer the appropriate questions, rather than favor a particular outcome;
2. require control of both the study design and the research itself to remain with scientific investigators;
3. not offer or accept remuneration geared to the outcome of a research project;
4. prior to the commencement of studies, ensure that there is a written agreement that the investigative team has the freedom and obligation to attempt to publish the findings within some specified timeframe;
5. require, in publications and conference presentations, full signed disclosure of all financial interests;
6. not participate in undisclosed paid authorship arrangements in industry-sponsored publications or presentations;

7. guarantee accessibility to all data and control of statistical analysis by investigators and appropriate auditors/reviewers;
8. require that academic researchers, when they work in contract research organizations or act as contract researchers, make clear statements of their affiliation; require that such researchers publish only under the auspices of the contract research organizations;
9. include scientific researchers from an opposing philosophical point of view in the research design and review phases with the intention of designing an objective study that will be more readily accepted as scientifically factual;
10. seek an equal number of peer reviews from experts outside of the normal channels within the journals and educational background of the researchers and incorporate those into the end of the study as suggestions for future study.

In addition to guidelines for research, there are clear areas from the previous research that would benefit from comprehensive, quality research. The first is the role of soil health in the nutrient value of foods. It is apparent from recent studies that maturity of the organic farm and soil health likely play a significant role in the nutrient quality of the food. (Chassy, et al., 2006; Crinnion, 2010) Secondly, the economic evaluation of the true costs, externalities included, of the organic, sustainable food chain versus the industrial food chain is an area of importance in terms of public policy and health. A series of studies that address the true issues of human health as it relates to nutritional quality, contaminant presence and environmental influence would be enlightening to the debate. Ideally, conduct the studies under the auspices of a multi-disciplinary team that includes scientific investigators who were trained from each philosophical perspective and commit to publish the results in peer review journals, regardless of outcomes. Policy makers need unbiased research and data to determine public policy in many areas. In the absence of a multi-disciplined team as suggested, they at least need checks and balances of solid research from both philosophical points of view. I believe the added guidelines would be a step forward in accomplishing this.

Finally, I recommend that this is an issue for government involvement in appropriating funds for research. In an environment where research dollars generate research results that drive public policy and consumer advertising, imbalances in the proportion of research dollars from industry versus governmental interests can certainly skew research literature. Lesser concluded that "financial conflict of interest is qualitatively different, (over other types of bias) producing selective bias that acts consistently in one direction over time." (Lesser, et al., 2007)

Considering the number of policy decisions made on this research and the implications to human health when bias is involved, common sense and scientific integrity demand that we take a new approach.

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