
NUTRITIONAL QUALITY OF ORGANIC FOODS: A SYSTEMATIC REVIEW

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ABSTRACT

Background: Despite rising consumer demand for organically grown foods, there is a scarcity of information based on a thorough assessment of their nutritional qualities. The goal of this study was to quantify the differences in reported nutritional content between organically and conventionally grown foods. Design: From 1 January 1958 to 29 February 2008, we carefully searched Pub Med, Web of Science, and CAB Abstracts, contacted topic experts, and hand-searched bibliographies. If they provided nutritional content comparisons between organic and conventional foodstuffs, we included peer-reviewed publications with English abstracts in the study. Study features, quality, and data were retrieved by two reviewers. The research was limited to the most frequently reported nutrients. In the last two decades, the organic foods sector in the United States has grown dramatically. Organic sales are projected to have grown by almost 20% each year since 1990, with consumer sales reaching \$13.8 billion in 2005. While the early days of organic agriculture centered on small farms but also local distribution of fresh produce, today's organic food system is a complex mix of small and large food producers, local and global distribution networks, and a wide range of products, which include fruits, vegetables, meats, dairy, and processed foods.

KEYWORDS: Antioxidants, Conventional Food, Food Laws, Food Safety, Microbiological Safety, Mycotoxins.

1. INTRODUCTION

Food made organically is becoming more popular. The organic produce industry in the United Kingdom was projected to be worth £2 billion in 2007, up 22% from 2005, while the worldwide market was expected to be worth £29 billion. Organics products are foods in accordance with strict guidelines that, among other things, limit the use of chemicals in agricultural cultivation and animal medicine, and stress a low environmental effect(1). Previous non-systematic evaluations have found that organically grown foods had a better nutritional content than conventionally grown foods, but this conclusion has not been constant. There has been no comprehensive review of the published literature on this subject to date(2)(3). The content of minerals and other nutritionally important elements varies greatly across natural goods. The nutritional content of different cultivars of the same crop may vary, dependent on fertilizers and pesticides use, growth circumstances, season, and other variables(4)(5).

Factors including the animal's age and breed, feeding regimen, and season may all influence the nutritional content of livestock products. This intrinsic diversity in nutritional content could be exacerbated by the foodstuffs' storage, shipping, and preparation before they reach the user's plate. The design and interpretation of studies on variations in the nutritional content of organically produced and conventionally produced foodstuffs need a knowledge of the variables that influence

nutrient variability in crops and animal products(6)(7)(8)(5). Consumers are ready to pay a premium price for organic produce based on their perceived diet and wellness advantages, notwithstanding the present ambiguity in the available data on the nutritional content of foods produced under various agricultural regimes. Establishing the strength of available evidence relating to the nutritional amount of organic meal will allow the development of evidence-based statements on content and potential nutrition-related public health benefits or risks associated with its consumption, allowing the consumers to make better decisions(9). The findings of a comprehensive evaluation of research that describe chemical analyses of foods produced using organic or conventional techniques are presented. The results were limited to the nutrient and nutritionally important content of foods(10)(7)(8). Because it was outside the scope of our study, we did not examine variations in pollutant content, such as herbicide, pesticide, or fungicide residues, or the potential environmental implications of organic and conventional farming methods.

All goods bearing the USDA organic mark must be sourced from a USDA-certified farm or processing facility (11). All “100% sustainably grown” goods must include solely organically produced components, while “organic” products must have at least 95 percent organically produced ingredients. The remaining 5% of materials may come from the National. Approved Substances List The USDA organic mark may be applied to goods that are 100% organic or 95% organic. Goods containing at least 70% organic components may be labeled "produced with organic ingredients" and mention up to three of those ingredients on the main display panel; nevertheless, such products are not permitted to bear the Certified organic stamp (12)(13)(14). Only the organic components may be included on the traditionally attributed for products with less than 70% organic ingredients(15)(16)(17). The USDA created the National Organic Cost-Share Program to help organic farmers in 15 states pay for their organic certification, which is needed for organic farms with an annual revenue of more than \$5000. Since 1990, 15 states (Connecticut, Delaware, Maine, Maryland, Massachusetts, Nevada, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Utah, Vermont, West Virginia, and Wyoming) have used \$1 million in funding to compensate farmers for the cost of organic certification(18)(19). Producers may have up to 75% of their certification expenses refunded, up to a maximum of \$500.

1.1 Safety of Organic Products:

In spite of the positive effects suggested in food chemistry literature of organic cultivation, it has not been fully elucidated whether significant differences exist between foods produced under organic and conventional cultivation, in particular if there are alterations in the chemical composition when foods are subjected to thermal processing, such as cooking or prolonged storage. Furthermore, organic production needs an excellent field handling, and the farmers need to pay attention mainly to the materials used for organic fertilizer (manure), because of the high probability of microbiological contaminations (mainly *Escherichia coli*, mycotoxins, coliforms, etc.) and parasites. Frequent contaminations can occur when the compost production process is not correctly carried out. A problem of great importance that should be taken into account is the use of non composted bovine manure as fertilizer, which could be a possible route of vegetable contamination. It has been suggested that the application of manure and the reduced use of fungicides and antibiotics in organic farming could result in a greater contamination of organic foods by microorganisms or microbial products(20)(21)(22).

The growth of the organic foods industry in the United States has been dramatic in the past 2 decades. It is estimated that organic sales have increased by nearly 20% annually since 1990, with consumer sales reaching \$13.8 billion in 2005. While initial organic food production primarily involved small farms and local distribution of fresh produce, today's organic food system is a complex combination of small and large food producers, local and global distribution networks, and a wide variety of products, including fruits, vegetables, meats, dairy, and processed foods.

This rapid growth may be traced to increased consumer confidence in organic foods as well as to concern about possible health risks and environmental impacts of conventional food production methods. Recent food crises such as mad cow disease and foot and- mouth disease have lessened consumer confidence in foods in general and especially in conventionally produced foods that may use pesticides, antibiotics, and other chemicals in food production. Surveys indicate that many consumers purchase organic foods because of the perceived health and nutrition benefits of organic products. In one survey, the main reasons consumers purchased organic foods were for the avoidance of pesticides (70%), for freshness (68%), for health and nutrition (67%), and to avoid genetically modified foods (55%) (Whole Foods Market 2005). Such consumers appear to be willing to pay the typical 10% to 40% price premium that organic products command(23)(24).

1.2 Organic Practices:

Organic production can be defined as an ecological production management system that promotes and enhances biodiversity, biological cycles, and soil biological activity. It is based on minimal use of off-farm inputs and on management practices that restore, maintain, and enhance ecological harmony. U.S. regulations require that organic foods are grown without synthetic pesticides, growth hormones, antibiotics, modern genetic engineering techniques (including genetically modified crops), chemical fertilizers, or sewage sludge. Organic farming uses various methods to enhance or maintain soil fertility, such as crop rotation, tillage and cultivation practices, cover crops, and natural products (such as natural fertilizers, pesticides, and so on). The use of synthetic materials is not allowed in organic farming unless the materials are on the Natl. List of Allowed and Prohibited Substances. A synthetic material can be defined as a substance that is formulated or manufactured by a chemical process or by a process that chemically changes a substance extracted from naturally occurring plant, animal, or mineral source.

Organic farmers use animal and crop wastes, botanical, biological, or non synthetic pest controls, and allowed synthetic materials that can be broken down quickly by oxygen and sunlight. Organic farmers also use specific methods to minimize air, soil, and water pollution. It takes several years to convert a field from conventional farming to organic farming since land can have no prohibited substances used on it for 3 y before the harvest of an organic crop. Animal herds can be converted to organic by feeding them 80% organic feed for 9mo, followed by 3mo of 100% organic feed. Animals must consume only 100% organic feed for their products to be sold as organic, but the animals can receive vitamin and mineral supplements. Preventive management practices such as vaccinations can be administered when absolutely necessary to keep animals healthy, but those animal products cannot be sold as organic. Antibiotics cannot be used on products to be sold as organic. The European Union has approved a proposal for new organic certification rules. (25). The new regulations, which go into effect on January 1, 2007, are intended to make things simpler for both producers and consumers, and they will be somewhat adaptable for various parts of the European Union (EU). In the EU, organic goods must include at least 95% organic components. Imported organic goods must meet EU criteria or have comparable assurances from the country of origin. Products from nations with similar assurances, such as the EU, are likewise accepted in the United States.

Small samples of apples, peaches, peppers, and tomatoes produced under organic IPM/NDR certification and no-market-claim procedures were tested by the Consumers Union. Residues were found in 79 percent of the 68 samples for which no market claim had been made. Pesticide residues were found in 51 percent of the 45 IPM/NDR samples and 27 percent of the 67 organic samples. In terms of international relations,(12), Pesticide residues were found in 49 percent of conventional product samples and 12 percent of organic food samples in Belgium between 1995 and 2001, according to Pussemier and colleagues.

2. DISCUSSION

The findings of the first comprehensive study of the variations in nutritional content of organically and conventionally produced products are presented in this paper. Over the last 50 years, peer-reviewed articles having an English abstract have been included in the review. The organic movement has a long history, and the fact that so many of the papers in this study were published after 2000 demonstrates the present degree of scientific interest.

According to the findings, the nutritional content of organic and conventionally produced foods is similar. There were no significant differences in production techniques for 10 of the 13 nutritional categories studied. Differences in crop maturity at harvest (titratable acidity) were found and were most likely related to differences in fertilizer usage (nitrogen and phosphorus) and ripeness at harvest (nitrogen and phosphorus). Consumption of these nutrients at the quantities seen in organic foods in this research is unlikely to have any health benefits. Organically produced foods are not inferior to conventionally produced foods in terms of nutritional content, which is a significant consequence.

3. CONCLUSION

Organic foods are becoming more popular: they currently account for more than 2% of total food sales, and sales of organic foods in the United States exceeded \$13.8 billion in 2005. (Organic Trade Assn. 2006). Organic foods are purchased for a variety of reasons, including perceived environmental, animal welfare, and worker safety advantages, as well as the belief that organic foods are safer and more nutritious. The distinctions between organic and conventional foods in terms of food safety and nutritional content are discussed in this review, which reveals many qualitative variances. Pesticide are lower in organic fruits and vegetables, and nitrate levels are lower than in conventional fruits and vegetables. Organic foods may include greater amounts of plant secondary metabolites, which may be helpful in terms of putative antioxidants like polyphenolic chemicals, but can also be harmful when it comes to naturally occurring toxins. Some research have indicated that the restriction of antimicrobial usage may result in higher microbiological risks from organic food or animal products, whereas others have not reached the same conclusion. Bacterial isolates from organically produced food animals seem to have lower antimicrobial resistance than those from conventionally raised food animals.

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