



## Effects of organic food consumption on human health; the jury is still out!

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### ABSTRACT

It has recently been discovered that the nutritional makeup of organic vs conventional foods differs significantly, according to current systematic literature reviews and meta-analysis. As a result, organic vegetables had greater antioxidant concentrations, while cadmium and pesticide levels were lower. Organic meat and dairy products also had higher omega-3 fatty acid concentrations. Organic food intake has been linked to a lower risk of some acute disorders (e.g. pre-eclampsia, hypospadias) and obesity in a limited number of human cohort studies. Some people are concerned about the possible negative effects of organic food intake on their health (such as the danger of iodine deficiency in organic milk), although human cohort studies have yet to provide data to back up these claims. The lack of published data on (1) long-term cohort studies looking at chronic illnesses (such as cardiovascular disease, diabetes, cancer, and neurodegenerative ailments) or (2) controlled human dietary intervention trials comparing the effects of organic and conventional diets is troubling. As a result, it is presently impossible to determine how organic food intake affects human health.

### Introduction

Many affluent nations in Europe, North America, and Asia/Oceania have seen the demand for organic food soar in the previous two decades [1]. Consumers believe that organic farming is better for the environment, biodiversity, animal welfare, and food quality and safety than conventional farming, and this drives demand. Organic farming has gained growing scientific support for biodiversity and environmental sustainability, but there is still much scientific debate on whether or not and to what degree organic production techniques result in food quality and safety, and human health advantages [7–11]. As a result, we'll go through the current research on organic food's compositional changes and possible health effects below.

### Meta-analyses of variations in composition

The amounts of nutritionally important components in organically and conventionally produced foods vary significantly, according to recent systematic reviews and meta-analyses [12–14]. These systematic reviews found the following findings:

- Higher antioxidant activity and between 18 to 69 percent higher individual antioxidant concentrations in organic crops have been linked to reduced risk of certain chronic diseases, such as cardiovascular disease,



neurodegenerative disease, and cancer (discussed by Baraski et al. [12]), as well as increased consumption of polyphenolics and antioxidants.

- There are general recommendations to minimise pesticide and cadmium consumption to prevent possible negative health implications (reviewed by Baraski et al. [12]) in conventional crops, which have greater amounts of the hazardous metal cadmium and are four times more likely to have detectable pesticide residues.
- Both favourable and negative health effects have been connected to increasing consumption of these chemicals (as reviewed by Baraski and colleagues [12]) in traditional crops.
- A greater concentration of nutritionally beneficial omega-3 fatty acids may be found in organic meat, milk, and dairy products.
- It has been recommended by the EFSA (European Food Safety Authority) to at least increase the consumption of omega-3 fatty acids in Western diets [13,14].
- However, the health advantages of CLA are mostly derived from animal and in vitro research, and the nutritional value of organic milk has been shown to be greater than conventional milk (e.g., higher iron and -tocopherol contents).
- Iodine deficiency may occur in pregnant women and/or people who don't drink enough milk because organic milk has lower levels of the mineral iodine than conventional milk, which has higher concentrations of the elements selenium and chromium. Milk is not a major source of selenium, but it may be the only way to get enough iodine in countries where iodized salt isn't widely available or used.
- In conventionally raised beef, the saturated fatty acids myristic and palmitic acid concentrations are marginally but considerably greater, which have been associated to an elevated risk of cardiovascular disease (discussed by rednicka-Tober et al [14]).

Overall, the strength of evidence was good or moderate in many of the parameters listed above (e.g. total antioxidant activity, phenolic acids, flavonoids, flavanones, flavanols, anthocyanins stilbenes and nitrites in crops; total PUFA in milk and meat; n-3 PUFA, CLA, I, Fe, Se in milk), but low in others (e.g. specific antioxidants or groups of antioxidants). GRADE evaluation also demonstrated high inconsistency, poor accuracy, and/or publication bias across a wide variety of characteristics (particularly meat) for which substantial differences were detected by meta-analyses [12–14]. As a result, meta-analyses for a number of parameters could not be performed because the evidence base was too small, or because of confounding factors (such as the differences in agronomic and/or pedoclimatic conditions across study countries) (further limitations of the currently available evidence base for composition differences are described below). Even though the number of published studies and data included in previous meta-analyses was less, they all yielded comparable findings when the same factors were taken into consideration [7–11]. In their study, Brandt et al. [9] found that organic crops had greater antioxidant levels. Pesticide residues are more likely in organic crops, the omega-3 fatty acids present in milk are more abundant, and the bulk of published research have indicated greater cadmium amounts in conventional crops, according to Smith-Spangler et al. [11].

Studies on the composition of milk published between March 2008 and April 2011 were examined by Palupi et al. [10], who found that organic milk had considerably greater levels of omega-3 fatty acids, CLA, and tocopherols. [15] Pooling data for milk, meat, and eggs, Dangour and colleagues discovered a tendency toward greater omega 3 polyunsaturated fatty acid (PUFA) concentrations in organic animal products, but did not include these findings in the published publication. Organic food consumption raises dietary intake of a variety of nutritionally desirable compounds such as antioxidants, certain vitamins, and omega-3 fatty acids (with the exception of iodine intake with milk), while decreasing



consumption of nutritionally unfavourable pesticides, cadmium, and saturated fatty acids. Due to a lack of information on organic and conventional food composition, it is very hard to reliably quantify changes in dietary intakes over time. mycotoxin levels in crops (especially cereals) and/or differences in the composition of eggs from organic and conventional farms need to be reviewed, and there is currently insufficient data to accurately estimate the magnitude of differences for individual crops and meat products from different livestock species, which means it is currently impossible to accurately estimate differences in dietary intakes of the most desirable and undesirable compounds from these sources. The comprehensive evaluation of composition data has also identified a number of methodological concerns that must be addressed [16].

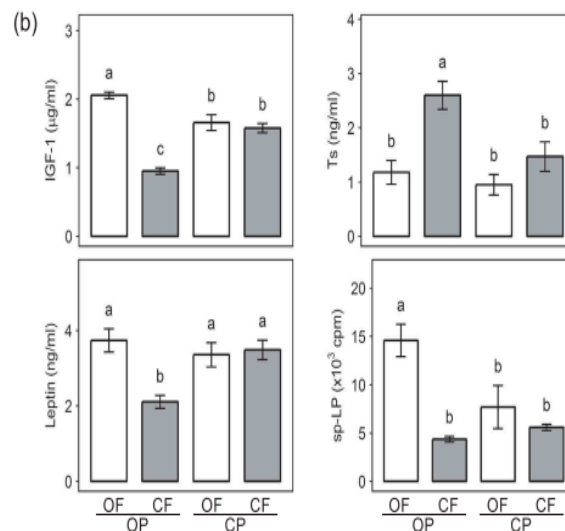
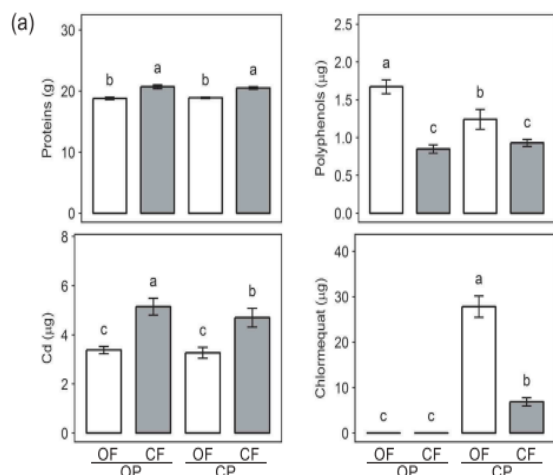


FIGURE 1: Effects of organic or conventional crop protection (OP) and fertilisation management (OF or CF) on protein, polyphenols, cadmium and chlormequat levels in 100 g of experimental animal feed and plasma insulin-like growth factor 1 (IGF-1), testosterone (Ts), leptin and spontaneous lymphocyte proliferation (sp-LP) in Wistar rats fed with these feeds (Figure 1). Tukey's HSD test was used to evaluate significant differences (P 0.05) between the means of the four field replications and the mean of 24 animals. Permission from the authors of the publication [26] was granted to use their data.

### Cohort studies on humans

Studies on humans and animals have shown correlations between organic food intake and particular health and health-related physiological markers. Organic vegetable and/or dairy intake was shown to be associated with a lower incidence of pre-eclampsia in women [17], hypospadias in male babies [18,19], and/or eczema in newborns [20].

Overweight and obesity were shown to be significantly lower among frequent organic food users in the French Belgian NutriNet-Sainté cohort sub-study (of about 54 000 persons) [21]. The link between organic food consumption and a lower risk of obesity was also established when data were



adjusted for age, physical activity, education, smoking status, caloric intake, restricted diet, and adherence to official dietary guidelines. Because of the study's many limitations, the authors advise readers in their publication. The use of organic foods was shown to be associated with a lower incidence of non Hodgkin's lymphom, even though the trial only lasted seven years [22], in a subset of a larger UK cohort study that examined cancer incidence in middle-aged women. Although the results of all cohort studies may have been influenced by a variety of confounding factors because organic and conventional consumers are known to differ in a variety of other lifestyle factors (e.g. diet composition, use of medicines, health supplements and vaccinations, and/or levels of exercise, alcohol consumption and smoking) which are often difficult to properly factor out in cohort studies [16,23,24].

## Experiments on the diets of animals

A few animal diet ary intervention experiments have evaluated the effects of organic vs conventional food intake (reviewed by Velimirov et al. [25] and rednicka-Tober et al. [26]). Studies found that switching from conventional to organic feed has substantial impacts on animal development as well as physiological measures (such as body composition, plasma antioxidant and hormone levels, immunoglobulin concentrations and immune system responsiveness) (Figure 1). As a result, it's impossible to draw any conclusions about patterns across research since the parameters measured and the analytical techniques, animal species, and/or experimental designs utilised vary from study to study (as reviewed by Velimirov et al. Gaps in knowledge and the need for more study Organic foods may have a nutritionally important composition difference from conventional meals, and human cohort studies have shown that organic foods may have health advantages. In spite of this, there is a great deal of uncertainty as to whether or not these composition discrepancies have an impact on human health. A range of methodological issues need to be addressed in both the available meta-analyses of

composition data and dietary cohort studies [16,23–24], as well as additional well-designed food composition comparisons for specific crops and meat types to allow reliable comparisons of dietary intakes of nutritionally relevant compounds between organic and conventional foods [13–14]. Also, research that provide a better understanding of the mechanisms through which organic food intake affects health are needed. These studies could, for example, be based on animal models that are susceptible to certain diseases.

## Statement of facts

Agricultural land owned by Professor Carlo Leifert is managed according to conventional farming standards in Germany and an organic farm in Greece.

## Funding

It was made possible, in part, thanks to a grant from the Sheepprove Trust.

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