



Comparison of Organic and Conventional Food and Food Production

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Authors' contributions

This work was carried out in collaboration among all authors. The opinion has been assessed and approved by the Steering Committee of VKM. All authors read and approved the final manuscript.

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ABSTRACT

The Norwegian Scientific Committee for Food Safety performed the present assessment of the differences between organic and conventional foods and food production on plant health, animal health and welfare and human health at the request of the Norwegian Food Safety Authority. The work was divided into five parts: (I) Plant health and plant production, (II) Animal health and welfare, (III) Human health - nutrition and contaminants, (IV) Human health – hygiene and pathogens and (V) Human health - pesticide residues.

The assessments are based on review of the scientific literature. Separate literature searches were performed and one or two expert reviewers from the five working groups examined the literature. Detailed descriptions of the searches and the publication selection are included in the five reports. In addition, relevant assessments for the purpose, prepared by international and national scientific bodies, were included.

There are few Norwegian studies on organic food production and food products and their impact on plant health, animal health and welfare, and human health. The assessments therefore had to rely on scientific studies from abroad. The relevance of these studies for conditions under which Norwegian food and feed production take place varies. There were large variations in study design, exposure (both type and time of exposure), and the measured outcomes among the studies included. Apart from the Norwegian monitoring program on pesticide residue in food, there is no systematic national surveillance on the content of nutrients and contaminants in food and feed from organic and conventional food production. This precludes any assessment of possible differences on the intake of nutrients and contaminants of Norwegian consumers from food of the two production systems.

For plant health and plant production, most studies concluded that crop losses due to plant diseases, plant pests and weeds are higher in organic than in conventional production. Richness and abundance of pollinating insects and natural enemies of harmful insects are higher in organic than in conventional farming. In general, there are small differences in content of nutrients, secondary plant metabolites, and other plant constituents, except for organic berries and fruits where higher levels of dry matter, ascorbic acid and antioxidant activity have been found. In conventionally grown wheat, there are higher levels of protein than in organically grown wheat. Contamination of cereals with *Fusarium*-mycotoxins is widespread. Results from comparison of mycotoxin contamination in organic and conventional cereals vary. While most studies found no difference in DON content, the majority of the remaining studies reported lower levels in organic than in conventional cereals. Most studies showed that organically produced cereals contained lower levels of the T-2 and HT-2 toxins than conventionally grown cereals. Some studies showed higher mycotoxin contamination in organic than in conventional apple products, while other studies reported similar level of contamination. Only few comparative studies of quality in organic and conventional seeds and seed potatoes have been published. Therefore, it is not possible to conclude on quality differences.

For animal health and welfare, it was concluded that the differences between animal health and welfare regulations in Norway for organic and conventional animal production are less than in most other countries. The presence of antimicrobial resistant bacteria in both organic and conventional production systems is very low in Norway. The difference between the two production systems in proportional rate of antimicrobial resistant bacteria is small and insignificant.

There are no differences in disease occurrence between organic and conventional farming except for less clinical mastitis and more milk fever in organic dairy herds.

For cattle, the increased access to pasture and outdoor areas, the use of group housing for milk feeding calves and the increased space allowance for growing cattle is positive for animal welfare in organic production. However, grouping of young calf, suckling for three days, as well as pasturing, could have some hygienic challenges due to more exposure for pathogens and parasites.

For sheep and goats, the differences in animal health and welfare are small.

For pigs, the access to outdoor area and provision of roughage is positive for animal health and welfare in organic production, but prevention and control of parasites and pathogens from wildlife, as well as predators may be a challenge.

For poultry, the increased space allowance in organic production for broilers and layers, use of slow growing breeds, the use of roughage and natural light is beneficial for both health and

welfare. There are no data to support positive effects on welfare and health of small flock sizes. Access to outdoor areas is positive for animal welfare, but increases the risk of parasites, predators and infectious diseases or subclinical infections with zoonotic agents (example: influenza and Newcastle disease).

For honey bees, the ban in organic farming against feeding bee colonies with pollen supplements in periods with low pollen availability, as well as the ban (EU regulation) against the disinfection of equipment with caustic soda, produces welfare challenges compared to conventional honey production.

Concerning feed, the nutrient contents, bioactive secondary plant compounds, as well as contaminants such as mycotoxins and pesticide residues may differ between organically and conventionally produced plants for feed. The impact on animal health and welfare is sparsely documented.

Keyw:

For human health, the main conclusions are that consistent evidence of clear positive or negative effects on human health as a result of consuming an organic diet, in comparison with a conventional diet has not been presented. There are reported indications of health benefits from organic food on risk of atopic diseases in children and a positive impact of organic diets on general health in animal models. The evidence is not sufficient to draw any conclusion. None of the studies on human health reported negative health effects from organic food consumption compared with conventional foods. There are some differences in concentrations of nutrients and other bioactive compounds in organic, compared with conventional foods. However, differences are mostly small and no differences have been found in e.g. biomarkers of antioxidant status, hence the relevance for health in humans on a well-balanced diet is uncertain. There is currently no firm evidence to conclude that organic products are more or less microbiologically safe than conventionally produced foods, and it may be assumed that any possible differences between organic and conventional productions concerning the prevalence of pathogens or antimicrobial resistance in Norway will be small or insignificant. Organic foods contain lower amounts of pesticides than conventional food, and lower urinary concentrations of pesticide metabolites in children have been observed from abroad. In Norway, the estimated exposure to pesticide residues in conventional food is low, and well below what is likely to result in adverse health effects. The finding of pesticide residues which exceeds established regulatory limits in a minority of tested samples, is not considered to result in adverse health effects. Available data suggest that the combined exposure to multiple pesticide residues is not likely to result in increased human health risk.

Keywords: VKM; assessment; Norwegian Scientific Committee for Food Safety; food production.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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