Health effects of organic food – what can we say?

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**Implications**

Debates on health effects of organic food arise from time to time. However, there are not enough scientific clinical studies to give fair objective statements.

**Background and objectives**

Recent review articles and meta-analyses show, that contents of certain nutrients as well as some phenolic compounds are slightly higher in organic than in conventional products. However, a healthy conventional diet contains enough essential nutrients and a slightly higher intake may not have any clinically significant impact. Only a small number of pesticides (some biocides and pyrethrins) and 48 food additives are allowed to be used in organic production, and thus there are fewer pesticide residues and less food additives in organic than in conventional products (more than 300 food additives allowed in conventional products). All pesticides and food additives allowed in conventional production are tested for safety and re-evaluated regularly, and also their use is regulated so that the contents existing in foods should be on safe level. Some conventional products contain more cadmium than organic products, as phosphate fertilizers contain cadmium. Both organic and conventional products may contain environmental toxins.

Comparing health effects of conventional or organic diets is not easy. The golden standard of clinical studies is a randomized controlled cross-over study, but that type of study is not valid for substances affecting also epigenetic regulation. In prospective studies aiming to investigate epigenetic effects multigenerational studies are needed. Pesticides and food additives may also affect indirectly, like via microbiota. There are also large individual differences between the sensitivity to adverse effects.

The objective of this study was to do a literature search of clinical studies comparing health effects of organic and conventional diets and recent reviews of pesticide toxicology to find gaps in research.

**Key results and discussion**

So far there are only few prospective multigenerational studies comparing the effects of organic and conventional diet. According to Brantsæter et al. (2016) there is a general consensus that the scientific evidence from human studies is insufficient to conclude whether organic foods are more beneficial for health in some respects than are conventional foods.

However, several research groups have aroused concern of areas that should be investigated thoroughly.

1. Pesticide mixtures can interact in various manners (Rizzati et al. 2016)
2. Cumulative exposure during embryonal and fetal stage should be studied carefully (Mitro et al. 2015, Strazzullo and Matarazzo 2016). Russ and Howard (2016) suggest, that prenatal exposure to endocrine-disrupting chemicals (EDCs) may contribute to the development of metabolic diseases in children. DDT exposure in utero has been connected also with breast cancer (Cohn et al. 2015) and transgenerational inheritance of obesity (Skinner et al. 2013).
3. Some environmental pollutants (including pesticides) and some food additives affect both animal and human microbiota either indirectly or directly, and more studies should focus on the relationship between environmental pollution, gut microbiota, and human health (Jin et al. 2017)
4. Polymorphism in several genes may increase sensitivity to pesticides. Effects of polymorphism of ApoE (Richardson et al. 2014), PON-1 (Marsillach et al. 2016, Nam et al. 2016) and CYP2B6 (Lind et al. 2017) on pesticide levels in clinical samples and their connections with life-style diseases have been studied recently.
5. Current knowledge of the impacts of pesticides on human thyroid function is still limited and the quality of some earlier studies not valid. Especially exposure during critical windows of brain development and in agricultural population should be evaluated (Campos & Freire 2016).
6. Maternal or paternal exposure to pesticides has been linked with autism and ADHD (Mostafalou & Abdollahi 2017).
7. The methods used in safety evaluations at present are not up-to-date and do not take into account the chemicals combined in commercial products (Vandenberg et al. 2017)
8. A recent large prospective study found a negative association between high frequency of organic food consumption and risk of overweight and obesity (Kesse-Guyot et al. 2017)

**How work was carried out**

A literature search was done first for the recent clinical studies comparing organic and conventional diets and then recent literature concerning genetic and epigenetic effects of pesticides and food additives.

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