Organic food quality and processing
Organic Science Day, Helsinki 2016

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Dr. rer.nat.habil. Johannes Kahl
Our food related global problems

Dietary share of ultra-processed products and obesity in high income countries (1991-2010)

\[ y = 2.9528e^{0.0374x} \]
\[ R^2 = 0.8332 \]

Source: Multi-country study on ultra-processed products and obesity (preliminary data)

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EU new Food Research Area

Objective:
By taking an integrated 'food systems' approach, the European Commission's research policy objectives aim to extend our understanding of the complex and interrelated factors involved throughout the food chain.

How to do:
“Research …addresses .. affordable and high quality foods,.. sustainability concerns linked to social, environmental, and economic change.

https://ec.europa.eu/research/bioeconomy/index.cfm?pg=policy&lib=foodsec

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A key challenge

„The problem with nutrient-by-nutrient nutrition science is that it takes the nutrient out of the context of food, the food out of the context of diet and the diet out of the context of lifestyle.“

Marion Nestle, New York University
Organic as a sustainable food system including healthy diets?

Organic values and principles

Field/Farm
Processing
Retail/Trade
Consumption

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Impact of organic agriculture on food constituents

- **Pesticide**
  - lower probability (-39%) to have pesticide residues in organic fruit and vegetables

- **Nitrate**
  - lower content in organic.
  - Is it a real health issue for humans?

- **Mycotoxins**
  - no scientific evidence of higher contamination in organic products

- **Antibiotic resistance**
  - lower in organic.
  - Worldwide media coverage

- **Food composition**
  - protein in cereals
  - vitamin C and phenolic compounds in organic fruit and vegetables
  - ω3 fatty acids and CLA in organic milk and dairy products
Factors potentially influencing organic food composition

No herbicide and chemically-synthesized pesticides
No synthetic fertilizer (N)
Less and pure organic fertilization (<179 kg N/ha/y)
No GMO
Restricted animal feeding regime (e.g. grass instead of silage)
Restricted use of antibiotics
Restricted use of food additives (48 instead of several hundreds)
Principle of processing with care (regulation of technologies still open)

(IFOAM Standards, EU-Regulation 834/2007+889/2008+others)
National regulations (e.g. Bio Suisse) or private standards (e.g. Demeter) are more restrictive!

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Impact of the organic food system on health

Flies (*Drosophila melanogaster*) showed greater fertility, longevity and Greater activity and stress-resistance when fed with organic grown feed (Chhabra et al. PLOSone 2013)

Chicken showed enhanced immune reactivity, a stronger reaction to the immune challenge as well as a slightly stronger „catch-up-growth“ after an immunological challenge (Huber et al. Br J Nutr 2010)

Women showed less non-Hodgkin lymphoma, when eating organic food (Bradbury et al. Br J Cancer 2014)

Organic diets significantly reduced pesticide exposure in adults (Oates et al. Environ Res 2014)

Organic diet significantly associated with reduced urinary concentration of pesticide residues in children (Bradman et al. Environ Health Perspect 2015)

Impact of organic agriculture on food quality

Lengths of the 12 flower petals are qualitatively based on the studies and indicate the level of performance of specific sustainability metrics relative to the four circles representing 25, 50, 75 and 100%. Orange petals represent areas of production; blue petals represent areas of environmental sustainability; red petals represent areas of economic sustainability; green petals represent areas of wellbeing. The lengths of the petals illustrate that organic farming systems better balance the four areas of sustainability (Reganold & Wachter, Nature plants, 2016, DOI: 10.1038/NPLANTS.2015.221)

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Structure of a research problem

Problem 1:
Most studies based on comparison of organic versus „conventional“.
„Conventional“ ranges from low input small scale to high intensive farming.
Instead: Best practise examples as driver for innovation! (Zalecka et al, JSFA, 2014)

Problem 2:
Most comparisons based on farm level, or even experimental field level.

Problem 3:
Which level? Instead of food composition: contribution to healthy and sustainable diets

<table>
<thead>
<tr>
<th>Level</th>
<th>Specific organic?</th>
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<tbody>
<tr>
<td>Nutrients</td>
<td>No!</td>
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<tr>
<td>Food</td>
<td>Yes</td>
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<tr>
<td>Meals</td>
<td>Can be composed</td>
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<tr>
<td>Diet</td>
<td>Dietary patterns, life-style</td>
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EU regulations – organic food quality and processing

Article 2: Definitions:
- The definition of food: Reg. EU No 178/2002

Article 3 and 6:
- Products are healthy
- Products are of high quality
- Maintain the vital qualities and organic integrity of the product
- Not mislead regarding the true nature of product

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<tbody>
<tr>
<td>Scope, principles and definitions</td>
<td>Title I - III (Art. 1 - 11)</td>
<td>Art. 3 - 6, 40 (General requirements)</td>
<td>An. I (Fertilisers and soil conditioners)</td>
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<td>Art. 45, 48 - 56 (Seed and propagating material)</td>
<td>An. II (Pesticides)</td>
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<td>An. X (Seed)</td>
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<td>Planned: Desinfection agents</td>
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<td>Plant production</td>
<td>Art. 12 - 13</td>
<td>Art. 7 - 26 (General requirements)</td>
<td>An. III (Housing)</td>
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<td>Art. 39 - 44, 46 - 47 (Exceptional production rules)</td>
<td>An. IV (Stocking densities)</td>
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<td>An. V (Feed)</td>
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<td>An. VI (Feed additives)</td>
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<td>An. VII (Cleaning and desinfection)</td>
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<td>Livestock production</td>
<td>Art. 14 - 15</td>
<td>Art. 27- 29</td>
<td>An. VIII (Substances allowed for processing)</td>
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<td>An. IX (Allowed non-organic ingredients)</td>
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<td>Food and feed processing</td>
<td>Art. 18 - 21</td>
<td>Art. 27- 29</td>
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<td>Control</td>
<td>Title V (Art. 27 - 31)</td>
<td>63 - 69, 91 - 92 (General)</td>
<td>An. XII (Operator certificate)</td>
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<td>70 - 73 (Plant production)</td>
<td>An. XIII (Vendor declaration)</td>
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<td>74 - 79 (Livestock production)</td>
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<td>80, 86 - 90 (Processing)</td>
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<td>Labelling and transport</td>
<td>Title IV &amp; VI (Art. 23 - 26)</td>
<td>Art. 30 - 35</td>
<td>An. XI (Logo)</td>
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Source: IFOAM, Brussels, 2009
Organic food processing „with care“

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How to select technologies?

Organic has the principle of processing with care but yet no regulations f.e. selection of technologies

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Processing: underestimated step in the food chain

**Industrial processing within food systems**

Source: Carlos Monteiro, USP

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Processing: underestimated step in the food chain

The three types of food processes within food systems

Source: Carlos Monteiro, USP
Scaling-up organic.....

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Organic food system - from field to fork

Organic values and principles

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