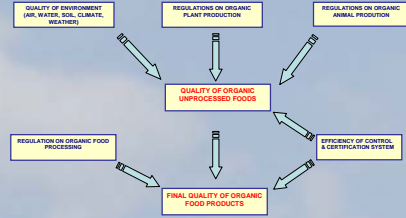
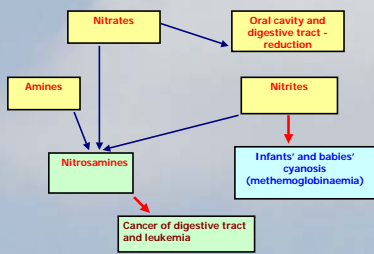




Ewa Rembalkowska

Organic food quality – axioms and ambiguities

Why the nitrates' excess is harmful to human health?



Factors influencing the quality of organic food products

Pesticides cause at least four serious problems:

- > acute and heavy poisoning of people; there are every year 26 millions such accidents in the world, and about 200 000 people die;
- > chronic poisoning of people leading to serious diseases – various soft tissue cancers, prenatal damages of children, nervous and psychological changes;
- > disturbances of biological balance in agroecosystems and surrounding ecosystems, lower plant resistance to diseases;
- > decreased content of nutrients in crops, e.g. pesticide tetrachlorophenvinphos diminishes the content of carotene in carrots by 15 - 20% and content of vitamin C by 20 - 30%, carbaryl and parathion also decrease vitamin C content in cabbage, maize, spinach and beans

The content of the nitrates in the organic (ORG) and conventional (CONV) crops according to Polish studies

| Author of the study | Plant species | CONV crops – Na NO ₃ in mg/kg f.m. | ORG crops - Na NO ₃ in mg/kg f.m. |
|-------------------------|---------------|---|--|
| Kunachowicz et al. 1993 | Beetroots | 2690 | 1871 |
| | Leeks | 499 | 370 |
| Leszczyńska 1996 | Parsley root | 383 | 234 |
| | Carrot | 293 | 154 |
| | Potatoes | 203 | 145 |
| | Beetroots | 2255 | 932 |
| Rutkowska 1999 | Turnip | 928 | 147 |
| | Head cabbage | 512 | 99 |
| | Red cabbage | 643 | 176 |
| | Carrot | 461 | 102 |
| Rembalkowska 2000 | Parsley root | 381 | 116 |
| | Potatoes | 229 | 99 |
| | Carrot | 266 | 155 |
| | Head cabbage | 908 | 344 |
| | Beetroots | 2217 | 1343 |

Comparison of the pesticide residues in crops from different production systems in several countries

| Country | Organic farming % samples with residues | Integrated farming % samples with residues | Conventional farming % samples with residues |
|----------------------|--|---|---|
| USA1 1994-1999 | 23 | 47 | 73 |
| Sweden2 2002-2003 | 3 | 11 | 44 |
| Poland3 2004 | 0 | 50 | 44 |
| Belgium4 | 12 | Lack of data | 49 |

1 USDA (Baker et al. 2002)
2 National monitoring of plant origin food 2003
3 Official control of national plant origin food 2005
4 FSCA – FAVY 2001; big-scale studies 1995 – 2001

Differences in nutritional content between organic and conventional vegetables (Worthington 2001)

| Vegetable | Vitamin C | Iron | Magnesium | Phosphorus |
|-----------|-----------|------|-----------|------------|
| Lettuce | +17 | +17 | +29 | +14 |
| Spinach | +52 | +25 | -13 | +14 |
| Carrot | -6 | +12 | +69 | +13 |
| Potato | +22 | +21 | +5 | 0 |
| Cabbage | +43 | +41 | +40 | +22 |

* plus and minus signs refer to conventional crops as the baseline for comparison. For example, vitamin C is 17 % more abundant in organic lettuce (conventional 100 %, organic 117%)

Content of bioactive compounds in plant products from organic and conventional cultivation

| Type of product | Type of bioactive substances and unit of content | Content of bioactive compound | | Difference in the content of bioactive compound in favour of the organic product * | SOURCE |
|-------------------------|--|-------------------------------|-------|--|-----------------------------|
| | | ORG | CONV | | |
| Tomato Atut | Flavonoids (mg% quercetin) | 0,33 | 0,15 | +120 % | Rembalkowska et al. 2003 a |
| Tomato Jontek | As above | 0,50 | 0,33 | +51,5 % | As above |
| Apples Cortland | As above | 1,42 | 0,33 | +130,3 % | Rembalkowska et al. 2003 b |
| Apples Lobo | As above | 0,33 | 0,76 | -56,6 % | As above |
| Apples Jonagold | As above | 2,26 | 1,09 | +107,3 % | As above |
| Apples Golden Delicious | Polyphenols (mg / g dry matter) | 4,66 | 3,93 | +18,6 % | Weibel et al. 2000 |
| Marion berries frozen | Polyphenols (mg / g fresh mass) | 600 | 400 | +50,0 % | Asami et al. 2003 |
| Corn frozen (grain) | As above | 40 | 25 | +60,0 % | As above |
| Strawberries frozen | As above | 280 | 240 | +16,7 % | As above |
| Peach fruit | As above | 26,7 | 19,6 | +36,2 % | Carbonaro and Matterna 2001 |
| Pear fruit | As above | 49,5 | 48,2 | +2,7 % | As above |
| Swiss chard (leaves) | Chlorophyll (mg / 100 g fresh mass) | 321,3 | 298,6 | +7,6 % | Moreira et al. 2003 |
| Apples Cortland | Anthocyanins (g/100 g fresh mass) | 7,58 | 3,29 | +130,4 % | Rembalkowska et al. 2003 b |
| Apples Lobo | As above | 9,51 | 1,14 | +734,2 % | As above |
| Apples Jonagold | As above | 10,49 | 2,18 | +381,2 % | As above |
| Average ** | | | | + 119,3 % | |

* content in conventional product accepted as 100%
** average counted as (sum of positive differences – sum of negative differences) / divided by the results number (15)

Comparison of weight gain and reproductive performance in rodents and rabbits fed organic or conventionally grown feed (after Williams 2002)

| Species | Study | Animals fed organic feeds showed: | Effect |
|---------------|---|--|--------|
| Rats and mice | McCarrison (1926) | Greater weight gain | + |
| | Rowlands & Wilkinson (1930) | Superior weight gain | + |
| | Scheunert et al. (1934) | Shorter lifespan, worse health | - |
| | Miller & Dema (1958) | No difference in weight gain or reproduction | 0 |
| Rabbits | Scott et al. (1960) | Better reproduction with organic feeds; worst performance with mixed organic and conventional feed | + |
| | Mc Sheehy (1977) | No difference in weaning weight | 0 |
| | Neudecker (1987), Veldimirov et al. (1992) | No difference in gestation rate litter weight or weaning weight. Lower stillborn and perinatal mortality | 0 / + |
| | Hahn et al. (1971), Aehnelt & Hahn (1973, 1978) | Greater no. of eggs, higher fertilisation rate, beneficial histological changes in female genital organs | + |
| Rabbits | Bram (1974), Alter (1978), Meinecke (1982) | No differences in reproductive performance, ovaries, uterus | 0 |
| | Gottschewski (1975) | Lower mortality of newborn | + |
| | Staiger (1986) | Long-term fertility rate (three generations) higher | + |
| | Edelmuller (1984) | More young born alive | + |

Dry matter content in organic vs. conventional crops (Rembalkowska 2000)

| Crop | Year | Organic | Conventional |
|--------------------------|-------------|-----------------------------|-----------------------------|
| Potato (mixed cultivars) | 1991 - 1993 | 22.4 ± 2.09 a ¹ | 21.1 ± 2.25 b ¹ |
| Potato 'Bryza' | 1994 | 21.43 ± 1.50 a ¹ | 20.21 ± 1.96 a ¹ |
| Potato 'Sokół' | 1994 | 20.64 ± 1.86 a | 20.79 ± 2.00 a |
| Potato 'Sokół' | 1995 | 21.91 ± 1.61 a | 20.21 ± 1.89 a |
| Potato 'Ania' | 1995 | 24.12 ± 1.61 a | 21.60 ± 2.79 b |
| Potato 'Anielka' | 1996 | 24.3 ± 1,2 a | 23,3 ± 1,5 b |
| Carrot 'Regulska' | 1996 | 15.22 ± 2.26 a | 14.11 ± 0.91 a |
| Carrot 'Monanta' | 1997 | 11.55 ± 0.84 a | 11.10 ± 0.80 a |
| Cabbage 'Atria F1' | 1997 | 8.37 ± 0.51 a | 7.25 ± 0.48 b |
| Beetroots * | 1997 | 16.76 ± 0.58 a | 13.86 ± 1.39 b |
| Carrots * | 1997 | 11.78 ± 1.43 a | 11.42 ± 1.42 a |
| Potatoes * | 1997 | 18.08 ± 0.91 a | 16.85 ± 1.55 b |

¹ the same letters (a - a) mean that there was no statistically significant difference; different letters (a - b) mean that a difference was statistically significant
*vegetables bought in organic shop (cultivar not known)

Organic foods

Positives:

- > Less unwholesome substances (nitrates, pesticide residues, synthetic antibiotics, growth regulators, food additives)
- > More nutritious components indispensable for human and animal health (some vitamins, phenolic compounds, sugars, unsaturated fatty acids, essential amino acids, mineral components)
- > Better sensory quality and culinary usefulness
- > Better storage quality (higher dry matter content, lower losses during storage period)

Negatives:

- > Lower yields in plant and animal production
- > More frequent parasitic afflictions in organically reared animals

Ambiguities:

- > Environmental contamination (heavy metals, dioxins)
- > Bacterial contamination
- > Mycotoxins
- > Impact on animal and human health

