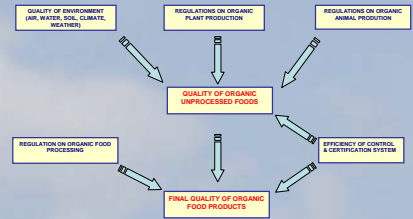
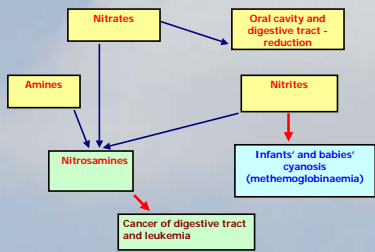




Ewa Rembialska

# 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

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)				
Nutrient*				
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
Tomato Atut	Flavonoids (mg% quercetin)	0.33	0.15	+120 %	Rembialska 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 %	Rembialska 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	As above	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 %	Rembialska 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	+
	Scheuermert et al. (1934)	Shorter lifespan, worse health	-
	Miller & Dema (1958)	No difference in weight gain or reproduction	0
	Scott et al. (1960)	Better reproduction with organic feeds; worst performance with mixed organic and conventional feed	+
Rabbits	McSheehy (1977)	No difference in weaning weight	0
	Neudecker (1987), Velimirov 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	+
	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	+
	Edelmüller (1984)	More young born alive	+

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

Crop	Year	Organic	Conventional
Potato (mixed cultivars)	1991 - 1993	22.4 ± 2.09 a <sup>1</sup>	21.1 ± 2.25 b <sup>1</sup>
Potato 'Bryza'	1994	21.43 ± 1.50 a <sup>1</sup>	20.21 ± 1.96 a <sup>1</sup>
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

<sup>1</sup> 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

