

The impact of organic agriculture on food quality

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During last decades the consumer trust in food quality has drastically decreased, mainly because of the growing ecological awareness and several food scandals like Bovine Spongiform Encephalopathy (BSE), dioxins and bacterial contamination. It has been found that intensive conventional agriculture could introduce contaminants into food chain, first of all nitrates and nitrosamines, residues of pesticides, antibiotics and growth hormones. Consumers started to look for safer and better controlled foods, produced in more environmentally friendly, authentic and local system.

Organically produced foods are widely believed to satisfy the above demands, providing better environment and higher nutritive values. Several research studies conducted in many European countries have partly confirmed this opinion.

Organic crops contain fewer nitrates and nitrites and fewer residues of pesticides than conventional ones. They contain as a rule more dry matter, more vitamin C and B-group vitamins, more phenolic compounds, more exogenous indispensable amino acids and more total sugars; however the level of β carotene is often higher in conventional plant products. Organic crops contain statistically more iron, magnesium and phosphorus, and they have usually better sensory quality. Vegetables, potatoes and fruits from organic production show better storage quality during winter keeping. Farm animals from organic herds show less metabolic diseases like ketosis, lipidosis, arthritis, mastitis and milk fever. Small experimental mammals (rats, rabbits) fed organically grown feed show better health and fertility parameters.

However, there are also some negatives: plants cultivated in organic system have as a rule 20 % lower yield than conventionally produced crops. Milk and meat yield is also lower in organic animal production, partly because parasitic afflictions are more frequent.

Several important problems need to be investigated and settled in coming years: environmental contamination of the organic crops (heavy metals, polychlorinated biphenyls (PCBs), dioxins, and aromatic hydrocarbons), bacterial and fungi contamination (Salmonella, Campylobacter, mycotoxins). Last but not least, the impact of the organic food consumption on human health and well being still remains unknown and needs explanation.

Key words: food quality, organic plant products, organic animal products, animal health

INTRODUCTION

Organic agriculture is understood as determined in the Council Regulation no 2092/91 on Organic Production of Agriculture Products and Indications referring thereto on Agriculture Products and Foodstuffs. Organic crops are obtained in the controlled conditions according to the guidelines of the mentioned Regulation.

Organic plant crops are produced without chemical pesticides and easy soluble mineral fertilizers and with application of the natural animal manure and composts, green manure and diversified turnover. Communal wastes and composts are forbidden. Animal production is conducted according to the animals' needs and on-the farm produced fodder is used as the main food for animals.

Certification in the organic farming means that a control unit testifies the product as produced according to the accepted rules and production system is obligatorily controlled.

The last decade brought along several food scandals (a. o. BSE, dioxins, Salmonella, Campylobacter, pesticides, toxic fungi) regarding the food safety. It had influence on the growth of consumer awareness and scientific interest in the agro-food chain safety, in that in organic production system.

Organic farming is more and more popular in Europe and other parts of the world; it is doubtless one of the fastest growing sectors of agricultural production. For example, the United Kingdom organic market has increased rapidly over recent years with growth rates of 30 to 50% per annum (Department for Environment Food and Rural Affairs 2003). According to Mercola (2004), specialists expect that 10 percent of all agricultural land in Western Europe will be organic by 2005. Organic products are becoming the number one choice for more and sales will top \$162 million this year, compared to just \$8 million three years ago (Mercola 2004).

The main reason is growing demand of the consumers seeking more safe and controlled foodstuffs, and consumer

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concern about healthy environment and life.

Organic agricultural production is considered friendly to environment, mostly because of the basic principles of harmonious cooperation with nature and due to the lack of chemicalization. It concerns plant production as well as animal husbandry and food processing. There are already many evidences that environment, soil and groundwater improve as a result of the organic farming application (Haas et al. 2000). Organic farming is also often regarded as a system to improve crops quality.

The main reason of such opinion is connected with the rules of organic plant and animal production which have fundamental impact on the products quality (Figure 1). The relevant regulations, later presented in details, directly extort higher safety level in the content of produced raw materials, mainly because they forbid the use of several chemical compounds commonly used in conventional agriculture. It's important to remember, that accordingly to well known sentence "trust is good but control is better", only high efficiency of the control and certification system can fully guarantee high quality of organic raw products.

Similarly, only following the regulation on organic food processing together with the efficient control system can provide the best final quality of the organic processed foods.

I. PLANT PRODUCTS

IMPACT OF REGULATION ON ORGANIC PLANT PRODUCTION

The regulations for organic plant production are versatile and detailed (Hansen et al. 2002). The European Union (EU) regulation published in 1991 (2092 / 91) contains parts which relate directly to the composition of organic plant

products. The most important aspects of this regulation include (Hansen et al. 2002):

- a ban on genetic engineering and Genetically Modified Organisms (GMOs)
- lower nitrogen levels: maximum limits for manure application of 170 kg N / ha / yr
- a ban on synthetic pesticides
- a ban on synthetic mineral fertilizers
- a ban on growth promoters.

The organic farmers have to follow the above regulations if they want to pass the inspection procedure repeating every year and to receive a certification document. If all requirements are complied, several qualitative results can be expected. The most important conclusions from scientific comparisons are given below.

CONTAMINANTS

Nitrates and nitrites

Many data testify to distinctly bigger content of the nitrates and nitrites in the conventionally cultivated crops compared to the organic ones. It is important because the nitrates easily converted into nitrites can cause dangerous illness called methemoglobinaemia in infants, small babies and elderly people (Szponar and Kierzkowska 1990).

Moreover the nitrites can react with the amines creating nitrosamines, carcinogenic and mutagenic substances causing cancer of digestive tract and leukaemia (Mirvish 1993). This process is dangerous not only for young children but also for the adults irrespective of the age.

Basing on many data the content of the nitrates in the organic and conventional crops has been compared. Accepting the nitrate content in conventional crops as 100 %, on average 49 % of this content is found in organic

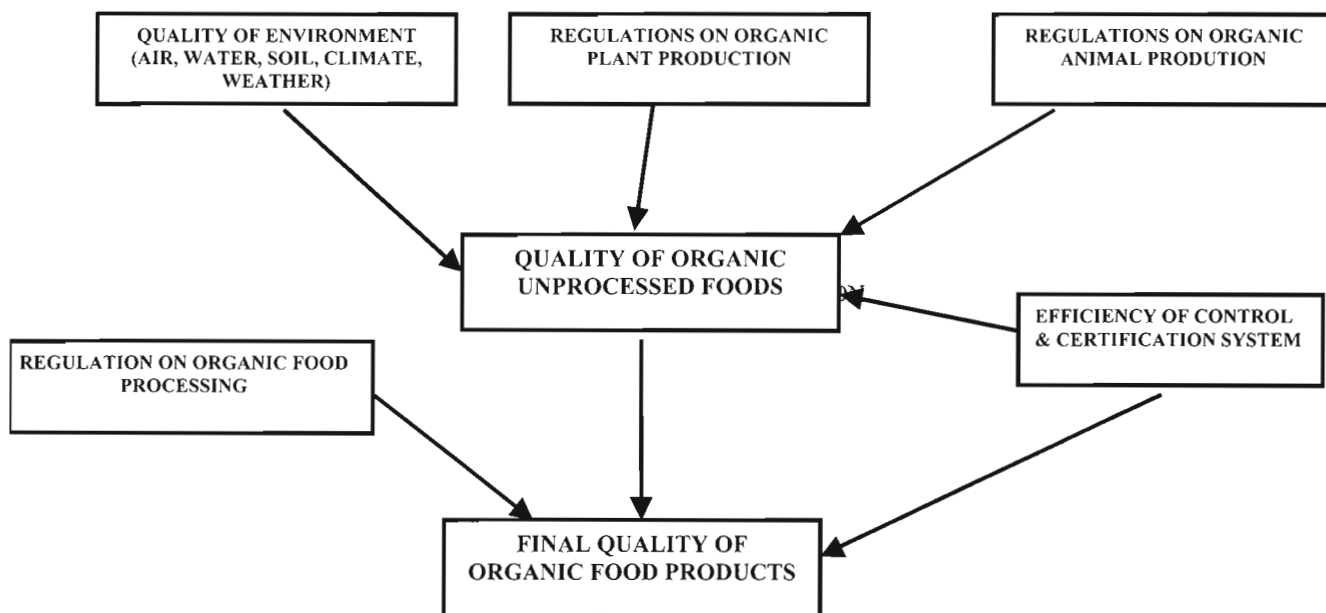


Figure 1. Factors influencing the quality of organic food products

crops (Rembalkowska 2000).

These and other data give a reason to state that organic methods allow to diminish the intake of nitrates and nitrites to human organism by approximately 50 %.

Pesticides

Governments place legal limits on the level of pesticides, known as the Maximum Residue Level

(MRL) that can be present in food. The MRL is usually estimated by testing individual pesticides on rats. Governments maintain that consumption of pesticides below the MRL is not a health risk. However at lower levels pesticides are known or suspected to cause many diseases and health problems including cancer (British Medical Association 1992).

The main problem is that MRL for pesticides is usually estimated by testing individual pesticides on rats for a relatively short period. Virtually nothing is known about the effects of consuming combinations of potentially hundreds of different pesticides over the course of a lifetime.

The levels of the pesticide residues found in organic plant crops are definitely lower than in the conventional ones (Hansen et al. 2002).

It can be expected that eating organic should result in lower pesticide content in human milk and body tissues. There are some evidences confirming this hypothesis. In France they found that the residues level of pesticides in breast-feeding women milk had significantly decreased together with the increase of the organic food part (from 25 % to 80 %) in everyday diet (Aubert 1987).

All available results show that the content of pesticide residues is significantly lower in the organic agricultural crops what creates safer health conditions for the consumers eating organically.

Heavy metals

Heavy metals like cadmium, lead, arsenic, mercury, zinc and others are introduced into food chain from different sources: industry, transport, communal wastes and agriculture. For example, mineral phosphoric fertilizers used in conventional agriculture can introduce cadmium to plant crops, but metal industry and transport also cause the cadmium contamination of soils and crops. Therefore there are no clear results in the studies comparing the level of heavy metals in the organic and conventional crops. Some data testify to higher level in conventional crops but other data show opposite results (Rembalkowska 2000). A problem to solve is whether the organic methods in farming (composting, organic matter increase in soil, pH increase in soil etc.) could diminish the intake of heavy metals by cultivated plants.

DESIRABLE COMPOUNDS IN PLANTS

Vitamins, phenolic compounds, mineral compounds

Nutritive value of foods depends mainly on the appropriate content of the compounds indispensable to the proper functioning of human organism.

The content of phyto-compounds in plant foods is a topic of high interest in food science nowadays. A growing amount of evidence indicates that secondary plant metabolites play a critical role in human health and may be nutritionally important (Lundegårdh and Mårtensson 2003).

There are two main theories explaining the factors influencing the level of compounds in plants (Brandt and Mølgaard 2001). Carbon/Nitrogen (C/N) Balance Theory tells that when nitrogen is easily available, plants will at first make compounds with high nitrogen (N) content, e.g. proteins for growth and N- containing secondary metabolites such as alkaloids.

When N-availability is limiting for growth, metabolism changes more towards carbon (C) containing compounds, like starch, cellulose and non-N-containing secondary metabolites, such as phenolics and terpenoids.

The second, newer is Growth / Differentiation Balance Hypothesis (GDBH) theory (Brandt and Mølgaard 2001). It says that the plant always will assess the resources available to it and optimise its investment in processes directed toward growth or differentiation.

The term „differentiation” comprises increased formation of defence compounds as well as accelerated maturation and seed development.

The C/N balance theory is a special and typical case of the growth/differentiation balance theory, since low nitrogen availability is the most common growth-limiting condition in natural ecosystems (Brandt and Mølgaard 2001). To verify the above theories, several authors investigated the content of some vitamins and phyto-compounds in organically and conventionally produced crops.

In order to summarize different data, for each organic – conventional comparison, a percent difference was calculated:

$$(\text{organic} - \text{conventional}) / \text{conventional} \times 100$$

The collected data for several desirable compounds is presented in a Table 1.

Table 1. Compounds and nutrients content of organic versus conventional crops

Compound	Mean % difference	Range	Number of studies
Vitamin C	+ 28.7 %	- 38 % ± 135.5 %	21
Phenolic compounds	+ 119.3 %	- 56.6 % ± 734.2 %	15
Iron	+ 21.1%	- 73 % ± 240 %	16
Magnesium	+29.3%	- 35 % ± 1206 %	17
Phosphorus	+13.6 %	- 44 % ± 240 %	18

Source: Worthington 2001, own calculations

The role of vitamin C in human organism is basic for several metabolic functions, mainly because it provides the proper immune system. The higher content of vitamin C in organic crops has high health importance also because vitamin C inhibits the in-situ formation of the carcinogenic nitrosamines, so diminishes the negative impact of the nitrates on human organism (Mirvish 1993). Therefore the organic vegetables can help in anti – cancer prevention.

Plant-based phenolic metabolites are particularly interesting because of their potential antioxidant activity and

medical properties including anti-carcinogenic activity (Brandt and M_lgaard 2001). Mineral compounds, in that iron, magnesium and phosphorus, are fundamental for human health. According to Worthington (2001) the possible reason of higher mineral content in organic crops is connected with higher abundance of micro organisms in organically managed soil. These micro organisms produce many compounds that help plants to combine with soil minerals and make them more available to plant roots.

Unfortunately there are only few studies on other vitamins like β -carotene, B1 and B2 and the results are contradictory. Therefore no general conclusions can be drawn about these compounds.

Total sugars

The total sugar content in plant crop not only causes better taste but is an important component of the technological quality, e. g. in a case of the sugar beets. The studies clearly indicate higher content of total sugars in organically produced vegetables and fruits like carrots, sugar beets, red beetroots, potatoes, spinach, Savoy cabbage, cherries, red currants, and apples (Rembialsowska 2000; Zadoks 1989).

Proteins

Several studies analyzed in review papers (Rembialsowska 2000) show that the quantity of crude protein is lower in organic compared to conventional crops but the quality is better as measured by essential amino acid content.

According to Worthington (2001) nitrogen from any kind of fertilizer affects the quantity and quality of protein produced by plants. Big amount of nitrogen provided to a plant increases protein production and reduces carbohydrate production. Moreover, the increased protein produced in response to high nitrogen levels contains lower amounts of certain essential amino acids such as lysine and therefore has a lower quality in respect of human nutrition.

SENSORY VALUE OF ORGANIC FOODS

Many studies have proved quite univocally that vegetables and fruits from organic farms were distinguished by better taste and smell. It was found for carrots and potatoes, celery and red beetroots, head cabbage and tomatoes, but also for apples, cherries and red currants (Rembialsowska 2000). Organic fruits contained more total sugars what probably influenced better taste perception by the consumers.

Better taste and smell has been also found for bread from the organic grain – it had moreover better crumb elasticity (Rembialsowska 2000). Interesting studies had been conducted on the animal food preference where animals were given organic or conventional fodder. Most studies have proved clear animal preference towards food produced organically; they have been conducted on rats, mice, hens, and on rabbits (Rembialsowska 2000).

Preference for organic fodder were observed also in such cases in which – according to chemical analyses - both organic and conventional fodder fulfilled all physiological needs of tested animals (Rembialsowska 2000). The probable factor was different taste of the organic and conventional fodder.

STORAGE VALUE OF ORGANIC PLANT CROPS

The transpiration losses and decay processes, as well as the changes in the nutritive value, normally take place during the storage period of potatoes and vegetables. However these changes can proceed with different intensity.

Most of the available data testify that a decay process is slower in the organic crops which therefore show better storage quality after the winter period.

From the review study based on many sources (Bulling 1987) resulted also that storage vegetable and fruit quality was better when plants were grown in the organic farms (table 2). Author connects the better storage quality of the organic crops with higher content of dry matter in their flesh what causes less intensive processes of decay and decomposition.

Lower losses in organic production have not only nutritive but also economic profits; in conventional system high yields are produced but big storage decrements undermine economic sense of this production;

Table 2. Storage losses of vegetables and potatoes from organic and conventional farms

	Carrots		Potatoes		Various fruits and vegetables	
	ORG	CONV	ORG	CONV	ORG	CONV
Number of quoted studies	15	15	22	22	53	53
Storage losses in % of initial mass average data based on literature review (Bulling 1987)	33	40	22	30	28	38

ORG – organic ; CONV - conventional

II. ANIMAL PRODUCTS AND ANIMAL HEALTH

EFFECTS OF REGULATION ON ORGANIC ANIMAL PRODUCTION

The regulation of organic animal production is many-sided and comprises several aspects of feeding, housing, demarcation, care, medical treatment and slaughter (Hansen et al. 2002). An EU regulation on organic animal husbandry was published in 1999 (1804 / 99), and several aspects of it are supposed to have a direct influence on the quality of organic animal products. This regulation obliges to (Hansen et al. 2002):

- Extended access to out-door areas with a lower stocking density
- Restriction on animal feeds:
- Compulsory use of roughage feeds
- Ban on antibiotics, growth promoters and additives
- Ban on GMOs
- Ban on meat and bone meal
- Double retention time after medicine treatment.

Following the above instructions should have a clear impact on the composition of the animal products from the organic husbandry. The research studies conducted in last years allow drawing some conclusions listed below.

QUALITY OF ORGANIC ANIMAL PRODUCTS

Milk

Organically produced milk compared to conventionally produced milk contains (Lund and Algers 2003):

- more dry matter, more fat, more calcium and vitamin C
- more α – tocopherol and β – carotene
- regularly higher level of conjugated linoleic acid (CLA) which is suggested to have an immunomodulating, anticarcinogenic and anti-atherosclerosis properties
- less somatic cells (if abundant they indicate the possibility of udder inflammation in cow)
- more coliform bacteria what indicates worse hygiene regime during milking

Meat

Investigations comparing the quality of meat from the organically and conventionally reared animals show the following results (Hansson et al. 2000; Pastuschenko et al. 2000; Castellini et al. 2002; Olsson et al. 2003):

- beef and veal from organically reared cattle contained much higher level of polyunsaturated fatty acids (PUFA) than meat from conventionally raised animals; PUFA are considered important for human health;
- the organic chickens had carcasses with a higher meat content and lower levels of abdominal fat (leaner meat)
- meat of organic chicken contained more polyunsaturated fatty acids of n-3 series; the main reason is grass-based diet of the animals in organic system and grass is a rich source of PUFA
- cooking losses were higher in organic chicken meat but sensory evaluation for the breast muscles was better
- the pigs housed and fed organically had higher intramuscular fat content, a lower ultimate pH in ham and loin and redder meat; organic pork had also higher drip loss and lower cooking losses than conventional pork.

HEALTH OF ANIMALS FROM ORGANIC PRODUCTION

Farm animals

Basing on several big studies comparing the health status of dairy cows from the organic versus conventional system (Karwowska 1999; Hansson et al. 2000; Hardeng et al. 2001) it is possible to conclude as follows:

- Milk yield is significantly lower in the organic herds
- Parasitic afflictions are more prevalent in organic herds

- Cows and heifers from organic herds show significantly lower incidences of metabolic diseases: abscesses, arthritis, milk fever, ketosis, and liver diseases
- There is no significant difference in the number of somatic cells between organic and conventional milk, but heavy mastitis is significantly less frequent in organic herds (in Northern and Central Europe)
- Immune system of the organically reared cows functions better, what enables more efficient fight against diseases

Experimental animals

The impact of the organically and conventionally grown feed on important vital parameters in small animals has been investigated in several studies, reviewed by (Williams 2002). The studies compared the development rate, fertility and reproductive performance of the rats, mice, rabbits and hens.

Most of available data indicates that animals fed with organically grown feed show:

- Better fertility indexes: greater no. of eggs, higher fertilisation rate, beneficial histological changes in females
- Long-term fertility rate over three generations: higher pregnancy rates, more embryos, larger litters, lower prenatal mortality
- Better health of newborn animals: greater weight gain, lower mortality of newborn, more young born alive

It can be thus concluded that organic feed may have beneficial effects on animal health, particularly with respect to reproduction and pregnancy outcome (Williams 2002). It is especially interesting that fertility and condition of animals fed organically increases over several generations. In the light of diminishing human fertility in civilized countries this fact can be of big importance.

MICROBIOLOGICAL HAZARDS

A general view on food safety problem in organic agriculture needs to consider not only the content of several compounds in food products but also potential microbiological hazards connected with the organic system of production.

Contamination from natural fertilizers and animal bacteria

Composted animal manure is the most common fertilizer in organic farming. Composting is known to markedly reduce levels of pathogens but composted manure is not completely free of microbes. Contamination with faecal pathogens (especially *E. coli* O157) poses a potential threat for food-borne illness if the produce contains the sufficient levels of viable pathogens. Composting also will not necessarily destroy spore-formers such as *Clostridium sp.*

Another problem is connected with the animal infections (zoonoses) which can be transmitted from animals to humans through the consumption of food. In comparison with conventional farming practice, the extended access to out-door areas encouraged in organic systems more greatly exposes animals to disease-promoting soil microbes. Moreover, the presence of rats, mice and birds increases the risk of animals being infected with *Salmonella* or *Campylobacter* bacteria, especially in poultry production. A report presented in 2001 by the EU (Europa 2001) shows that compared to conventional agriculture organic production leads to a higher *Salmonella* contamination in eggs, poultry and pork meat. However other studies don't confirm it.

To summarize, the recently conducted studies didn't give any clear answer whether organic system creates any real problem with food-borne illnesses (Kouba 2003).

Mycotoxins

Mycotoxins are toxic compounds produced by the secondary metabolism of toxic fungi (moulds) in the *Aspergillus*, *Penicillium* and *Fusarium* genera occurring in food commodities and foodstuffs (Kouba 2003). Mycotoxin production is dependent mainly on temperature, humidity and other favorable environmental conditions. The impact of mycotoxins on human health includes carcinogenic and immunosuppressive activity.

It has been suggested that organic food may be more susceptible to contamination by mycotoxins than conventional food because no anti-fungal pesticides are permitted in organic farming. However several recent studies have shown no evidence that organic food was more prone to mycotoxin contamination than conventional food (Kouba 2003). Scientific data are contradictory so the problem needs to be solved in the future.

Parasites

In organic production systems the animals are especially threatened by parasites because of the outdoor rearing and ban on prophylactic veterinary drugs (Kouba 2003). Therefore in organic livestock production parasites are one of the most serious problems in terms of animal health and consequently in terms of product quality for the consumer. Several studies in Northern Europe have indicated that outdoor production of pigs, primarily sows and laying hens, results in more prevalent helminth and ascaris infections compared to conventional intensive production under indoor conditions. There remains the open question whether parasites really threaten human health, because they are destroyed by cleaning and cooking treatments. However, for the consumers the presence of parasites in farm animals can be perceived negatively (Kouba 2003).

EFFECTS OF PROCESSING ON ORGANIC FOOD QUALITY

The processing of organic food aims to maintain nutritional value and limit the number and quantity of additives and processing aids in food products (IFOAM -

International Federation of Organic Agriculture Movements 2001). The regulations for organic processing in relation to food safety prohibit (Hansen et al. 2002):

- The use of more than 5% non-organic constituents
- Irradiation, colouring agents, sweeteners,
- Synthetic additives;
- The flavouring of animal products and artificial flavouring in vegetable food products;
- GMOs;
- Artificial trans fatty acids.

These regulations have a direct influence on the composition and nutritional value of food products, so they are strictly connected with food safety (Hansen et al. 2002). It can be presumed that the impact of organic processed foods on human health should be more positive than of conventional foods, but till now there is no scientific evidence to support this hypothesis.

The ban on most of food additives in organic food processing means the lack of potentially negative compounds in food. Moreover the information and transparency in organic food sector seems to be higher than in conventional sector (Hansen et al. 2002). Strict control systems during farm certification and organic labelling provide consumer with more clear information about the method and place of production and the whole production chain. This situation creates good conditions to increase the consumer trust and psychological safety.

Regardless the direct impact of the food components on health parameters, the feeling of security can also enhance the general well – being of the consumers. Psychological and sociological findings tell that meals make a very important contribution to the quality of daily life (Hansen et al. 2002). Therefore the consumption of organic foods may improve the frame of mind and thereby the perceived safety of organic foods.

CONCLUSIONS

The recent food crises (BSE and foot and mouth diseases, food contamination by dioxins, toxic fungi, *Salmonella* and *Campylobacter* bacteria) had pushed the consumers to look for more authentic and safer food. Organic food production is widely recognised as more friendly to environment, more controlled and better for animal welfare.

On the other hand many data indicate that a lot of the food contaminants have their source in the conventional methods in agriculture, animal production and food processing. A negative role of chemicalization in agriculture can be very big. Therefore safer methods of agricultural production, mostly organic methods, are very important.

The studies conducted in several countries indicated several positive aspects of the organic food quality but also few negative aspects and some uncertainties (Table 3 and 4).

Table 3. Positive nutritive attributes of the organic plant and animal products

Nr	Attribute
1	Organic crops contain fewer nitrates and nitrites and fewer residues of pesticides than conventional ones. There is no clear difference in the content of heavy metals between organic and conventional crops
2	Organic plant products contain as a rule more dry matter, more vitamin C and B-group vitamins, more phenolic compounds, more indispensable amino acids and more total sugars; however the level of β -carotene is often higher in conventional plant products
3	Organic plant products contain statistically more iron, magnesium and phosphorus; they show a trend to contain also more chromium, iodine, molybdenum, selenium, calcium, boron, manganese, copper, potassium, sodium, vanadium and zinc
4	Organic plant products have usually better sensory quality – they have more clear smell and taste and they are sweeter and more compact because of higher dry matter content
5	Preference for organic products is typical not only for humans but also for animals like rats, rabbits and hens. This phenomenon was observed also in such cases in which – according to chemical analyses - both organic and conventional fodder satisfied physiological needs of tested animals
6	Vegetables, potatoes and fruits from organic production show better storage quality during winter keeping – clearly fewer mass decrements, caused by transpiration, decay, and decomposition processes. The possible reason is connected with higher content of dry matter, minerals and total sugars.
7	Farm animals from organic herds show less metabolic diseases like ketosis, lipidosis, arthritis, mastitis and milk fever
8	Milk and meat from organically reared animals have more beneficial fatty acids composition and contain regularly more CLA (conjugated linoleic acid), what is regarded to have an immuno-modulating and anti-carcinogenic effect on human health
9	Animals fed organically grown feed show better health and fertility parameters: fewer incidents of prenatal deaths, larger litters, and higher weight of young at birth and after 90 days and better immunity to the illnesses
10	Organically processed foods contain much less synthetic additives (colouring and flavouring agents, sweeteners, artificial trans fatty acids etc.)

Table 4. Negative and unclear aspects of the organic food quality

Nr	Negatives	Open questions
1	Plants cultivated in organic system have as a rule significantly lower yield; on average 20 % lower than conventionally produced crops. The same problem concerns animal production, where yield of milk and meat is significantly lower. It increases the prices, and creates a barrier for many consumers to buy organic food.	Environmental contamination (heavy metals, PCB, dioxins, aromatic hydrocarbons) can be similar in the organic and conventional crops because the impact of industrial, transport and communal sources is similar on the organic and conventional farms located in the same area.
2	More frequent parasitic afflictions in organically reared animals are typical. It decreases the yield of milk and meat, and can create some problems for the consumers.	Bacterial contamination, mainly Salmonella and Campylobacter, can be sometimes higher in the organic produce, but scientific evidence is not clear till now.
3		Mycotoxins can contaminate both organic and conventional foods. Scientific data are contradictory.
4		The impact of the organic food consumption on human health and well being remains unknown, in spite of some positive indications, so the problem needs further studies.

To summarize the positives, organic food should be recommended for all people but especially for young babies, pregnant and breast-feeding women, elderly or chronically ill people and vegetarians. The last group consumes a lot of vegetables which can contain too high levels of carcinogenic substances when produced conventionally.

The lower content of nitrates and higher content of phenolic compounds and vitamin C in organic crops have a special importance for health. The nitrates are easily converted in our digestive tract into the poisoning nitrites, which are the precursors of the carcinogenic nitrosamines. This process is hampered by vitamin C, and carcinogenesis is retarded by phenolic compounds. Therefore the organic vegetables can play an important role in anti – cancer prevention.

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Received: July 12, 2004

Accepted: December 23, 2004