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ASPECTS OF FOOD SAFETY CORRELATED WITH CONVENTIONAL OR ECOLOGICAL PRODUCTION TECHNOLOGIES

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ABSTRACT - Foodstuffs, in our case vegetables and fruits, may constitute a valuable source of nutritive principles that give us the necessary energy and contribute to a healthier life by preventing deficiencies or diseases, fortifying the human body at different ages. In certain situations, we may lose the initial favourable benefit by appealing to inferior technologies in terms of food safety and following the quantity and the volume of merchandise for trading. The biological horticulture (organic or ecological) does not use industrial chemical products in its specific technologies, and the resulted vegetables and fruits are healthier, lacking more or less chemical residues. In the future, an ascending trend of production and consumption of these products is foreseen. However, there are also some aspects of food hygiene and safety that may raise problems or even risk the consumer's health.

Key words: food safety, ecological products, innocuousness, pathogenic bacteria, micromycetes, mycotoxins

REZUMAT - Aspecte ale siguranței alimentare în corelație cu tehnologiile convenționale sau ecologice de producție. Alimentele, în cazul nostru legumele şi fructele, pot constitui o sursa valoroasă de principii nutritive, care ne asigură necesarul energetic şi contribuie la o viaţă mai sănătoasă, prevenind carențe sau boli, fortificând organismul uman la cele mai diferite vârste. În anumite situații, se pierde însă beneficiul inițial, favorabil, apelându-se la tehnologii deficitare sub raportul siguranței alimentare, urmărindu-se, în primul rând, cantitatea, precum şi volumul de producție marfă destinată comercializării. Horticultura biologică (organică, ecologică) nu utilizează produse chimice industriale în tehnologiile sale specifice, iar legumele sau fructele realizate în acest mod sunt considerate mult mai sănătoase, fiind mai mult sau mai puțin lipsite de reziduuri chimice. În viitor, se prevede o dinamică ascendentă a producției şi a consumului pentru aceste produse. Aceasta nu înseamnă că nu există şi aici aspecte de igienă şi

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securitate alimentară, care pot ridica probleme sau chiar cauza diverse situaţii, în măsură să pună în pericol sănătatea consumatorului.

Cuvinte cheie: siguranța alimentară, produse ecologice, inocuitate, bacterii patogene, micromicete, micotoxine

Consumption of horticultural products and their innocuousness

Looking sometimes irreproachable as appearance and having an adequate preservation period, horticultural products are often contaminated with diverse substances that might jeopardize, on a long or medium term, the health of different categories of consumers. We may add that in small quantities or doses, the effect is not obvious, because the human body reacts differently depending on numerous factors and every person has his own specific metabolism.

There are several groups of toxic compounds that may form and contaminate the vegetal origin foodstuffs. We must take into account both the hygiene condition, namely the microbiological and chemical contamination of the product, and the innocuousness, namely the presence in the product of some toxic compounds that normally appear.

As for the **transformed products**, made from fruits, vegetables and grapes, the safety problems become more complex.

There is a strong impact, which may be avoided, of the contaminants from fresh products used as raw materials. They frequently quote the case of some mycotoxins, such as **patulin,** thermally resistant, that accumulates in the canned products by concentration, due to the specific technological processes. Only the products lacking alterations (mouldiness) are accepted as adequate raw materials in such cases. The nature and type of used equipments or technological lines, preservation and conservation methods, used food additives or applied technologies also represent specific sources of pollution and contamination.

The conservation of foodstuffs prevents their degradation in time, by avoiding the loss of their nutritive and organoleptic qualities. For the total elimination of the biodegradation germs, we resort to physical treatments or to the use of some chemical products that may also have negative effects by the presence of their residues in the finite products (Derache, 1986).

Food additives are substances added to foodstuffs, both to prevent the unfolding of some unwanted processes (antioxidants, antiseptics, acidulants and sequestrants) and to give superior characteristics to the finite products (sweeteners, flavour enhancers and colorants). The additives must meet some conditions: lack of acute or chronic toxicity, lack of interaction with different compounds of the product, lack of toxic compounds after administration, reduced active dose, etc (Banu, 1982; Nunnelley et al., 1988; Hill, 1988).

Sulphur dioxide, very used in the past in the preliminary conservation technologies of raw materials (semi-industrialization), was subsequently limited, due to the possibility of causing allergic reactions in some people. Food colorants

represent a highly criticized additive category, because it is not always necessary to add them to foodstuffs, and the synthesis colorants will be gradually forbidden even if they failed to prove their negative interaction with the human body. Monosodium glutamate (flavour enhancer) is forbidden in children's foodstuffs, because it was proved to affect the nervous cells of the animals in the process of development (Nunnelley et al., 1988).

The contamination of foodstuffs with heavy metals and microorganisms or the formation of some toxic compounds such as mycotoxins may occur frequently during manufacturing and subsequent storage. The formation of nitrosamines in foodstuffs on the basis of the content of nitrites and nitrates (exogenous origin) depends on the processing temperature (frying, smoking), storage temperature, storage period, product pH or the presence of some inhibiting compounds (ascorbic acid) (Banu, 1982).

An important source of contamination of foodstuffs with heavy metals may be the contact with unprotected processing machines (enamel, stainless steel, anticorrosive layers), their keeping in metal cans (unprotected at the inside) or the use of containers from stainless steel, also containing heavy metals (lead, iron, chrome, aluminium, copper, zinc, tin and arsenic) (Banu, 1982).

Technological specificity of the production alterative systems

According to Jongen (2005), the trend in recent years consists in the increase of demand for chemically untreated, safer and healthier products. Some consumers, not only the sceptic ones about the technological progress and its repercussions, consider that a product that has a reduced technological intervention is more natural, better for health and environment. Some people consume "organic" or ecologic (bio) products out of curiosity or sensorial reasons (better taste and aspect). But these technologies are often accused due to the small production, often weak preservability and high cost price. Despite all these, we may foresee a stable increasing trend in the coming decades. For this reason, they represent the object of many detailed studies, a practically impossible thing due to the small and very diverse volume of the offer.

The term of organic agriculture does not confine itself only to the products and exploitations certified as such, but it covers the entire domain of agricultural systems that use with priority the natural resources, recycling in their own ecosystem the resulting wastes without triggering external inputs.

According to *Codex Alimentarius* 2001, the organic agriculture is a managerial production system highly promoting the ecosystem health, including the biological cycles and the biological activity of soil. The organic agriculture is based on minimizing the use of external contributions, avoiding the use of fertilizers and synthetic pesticides. The practices of organic agriculture may not ensure completely free-residue products, residues caused by the general pollution of environment. However, they use methods to diminish the level of air, soil and

water pollution. Those who produce, process and trade organic foodstuffs have adhered to certain standards, in order to maintain the integrity of the organic products. The first requirement of the organic agriculture is to optimize the health and productivity of some interdependent ecosystems where people, animals, plants and microorganisms live together.

We may speak of a diversity of systems following these principles, besides the mediatised and better known ones, there are also systems of biodynamic agriculture or permaculture and uncertified traditional systems.

According to data of 2004, at the world level, they cultivated about 24 million hectares, especially in Australia, Argentina and Italy. In Europe, they mention Great Britain and Norway where these cultures have a significant evolution.

IFOAM (International Federation of Organic Agricultural Movements) has elaborated the first basic standards since the 80's. At European level, Directive 2092/91 reproduced these standards. They followed the instructions of *Codex Alimentarius* for FAO and WHO, which are UNO bodies. Gradually, national legislations also appeared, the most complete one being NOP (National Organic Program) from USA. We notice some generalized provisions, such as the forbiddance of using fertilizers coming from industrial complexes for animal breeding. At the same time, the use of fertilizers containing human excrements and urban wastes is strictly regulated, supervising closely their hygienic state. There are no standards for green fertilizers. Household wastes are allowed only after the treatment by composting and fermentation or separation, depending on the origin source and after checking up the contamination level. In many countries, there are specific standards regulating the temperature and period of treatment/composting or the evaluation criteria for the pathogen content (mainly *Salmonella*, coliform faecal bacteria *Escherichia coli*).

Synthetic pesticides are forbidden, they emphasis the crop rotation and the choice of cultivars used in correlation with the local ecosystem. To avoid the attack of pests, they use unconventional methods (traps and natural repellents) and plant preparations or other natural sources.

Food safety of ecological products – a hazard factor

The biological horticulture (organic or ecological) does not use industrial chemical products in its specific technologies and vegetables or fruits obtained in this manner are considered much healthier and lacking chemical residues. This does not mean that there were no aspects of hygiene and food safety that may raise problems or even cause diverse situations that may jeopardize the consumer's health. In the last decade, food safety represented an actual concern and a research domain where permanently emerge new important contributions. More advanced studies effectuated in this field signal the substantial increase in the content of certain toxins produced by the "natural" parasite bacteria and fungi.

The bacterial and, generally, the parasitary load of these products, considered untreated or alternatively treated, is often more than considerable. They found that not always the hygienic quality and the contamination degree with potentially pathogen microorganisms is checked, so much the less ensuring the control according to HACCP principles.

According to Jongen (2005), the risks concerning food safety in the microbiological and bacteria field refer to the incidence of pathogenic species causing infections in human body (*Salmonella, Escherichia coli, Shigella, Yersinia entericolitica, Listeria monocytogenes, Campylobacter* spp and some species of *Aeromonas*), while in the toxicological field, they refer to the formation of mycotoxins.

The mycotoxin formation is initiated in foodstuffs during preparation or storage (*Bacillus cereus, Clostridium botulinium* and *Staphylococcus aureus*). Toxins may also be produced in the intestine after ingestion (*Clostridium perfringens, Bacillus cereus, Vibrio cholerae, Escherichia coli* and species of *Aeromonas*).

Salmonella, Escherichia coli (producing the shiga toxin), *Campylobacter* and *Yersinia entericolitica* are occasionally isolated from the bowels of domestic and wild animals with warm blood. *Clostridium perfringens* and *Listeria monocytogenes* can also be isolated from animals' faeces, whereas *Vibrio cholerae* and *Shigella* may be isolated mainly from humans.

Studies show that *Salmonella* and *Escherichia coli* resist well in vegetables. However, *Escherichia coli* is more resistant to different environment conditions than *Salmonella. Salmonella* is more able to survive in unfriendly environments than *Escherichia coli* and represents an infection factor with an increased probability.

The contamination with *Campylobacter* is traditionally associated to poultry breeding technologies, raw milk (freshly milked, raw material) and untreated drinking water, but it may also be identified on fresh vegetables.

Yersinia entericolitica is more related to pork products and untreated water. The surface waters and swine faeces may be a source of contamination for irrigated vegetables.

Listeria monocytogenes is spread in the environment and can be isolated from animals' faeces. It could be found in vegetables, because it resists quite well. The infection with animal faeces lasts until six weeks.

Shigella is also found in vegetables, coming from contaminated sewerage water. It was found in some plots of salad imported from Norway.

Clostridium and *Bacillus* are spread in the environment and may be isolated from soil, wastes or human and domestic animal intestinal tract. The sporulated forms may be isolated from vegetables and may produce diseases if they get into the intestine.

When manure is used in agriculture, often raw (uncomposted), it is more a risk factor. Manure may be a host for other microorganisms, such as micromycetes, parasites and viruses.

Mycological risk

Aflatoxins are produced by *Aspergillus flavus*, in nuciferous fruits, while patulin is produced by different species of micromycetes (*Penicillium expansum, Aspergillus clavatus* and others), in apples or grapes that did not benefit of adequate treatments or a well-organized good use. They investigate at present more elaborated technologies within the sustainable agriculture that may prevent the appearance of these natural compounds, which are much more dangerous than the most dangerous chemical substances with which we control pests.

In foodstuffs there is a reduced number of micromycetes, causing infections in humans. From the viewpoint of food safety, the mycotoxins produced by micromycetes contaminate foodstuffs (especially vegetables). The most important species are *Fusarium, Alternaria, Penicillium* and *Aspergillius,* encountered both in the field and during storage. Their presence depends on species, climatic conditions and storage. Despite all these, the potential presence of the above-mentioned micromycetes does not always or implicitly lead to the presence of the respective mycotoxins.

The absence of using pesticides or other technological links, such as crop rotation, sowing or fertilization system, may be more important than using organic fertilizers. The food safety of organic vegetables represents a relatively recent object of research.

Microbiologic aspects – they noticed a significant presence of *Escherichia coli* on the organic products, as compared to the conventional ones. They say that the contamination degree may not necessarily be attributed to the quality of the used manure. In Great Britain, for the organic products from the IVth category, they noticed a percent of 99.5% products of acceptable hygienic quality. Other British scientists carried out studies only on *Escherichia coli*, identifying such pathogenic bacteria for human. A study draws the attention on the presence of *Escherichia coli* in the organic salad produced by private suppliers, which was more important than in the organic salad from import.

At the European level, they signalled several accidents related to the consumption of organic products. They mention a case from Germany, where some children got sick after eating sandwiches. From the investigations, they noticed the presence of shiga toxin in butter (green assortment with organic parsley, originating from a culture fertilized with swine manure). Another relatively similar situation (for other vegetables) led to sickening with *Escherichia coli* (four cases) after the fertilization with manure.

The aspects related to micromycetes and mycotoxins – They give the case of vegetables of the onion group (especially garlic) that is often infected with

Penicillium allii (producer of roquefortine C) and *Petromyces alliaceus* (producer of ochratoxin A). The few studies effectuated did not highlight the significant presence of these mycotoxins in the above-mentioned vegetables.

In tomatoes, they notice the presence of some toxicogenic micromycetes, such as *Alternaria arborescens* and *Alternaria solani*. They generate alternariol, ether monomethyl alternariol and tenuazonic acid, that were found in the infected tomatoes but also in other species, such as olives, green peppers or other fresh/processed products.

The potato tubercles attacked by *Fusarium sambucinum*, *Fusarium crookwellense* and *Fusarium solani var. coeruleum* generate mycotoxins, such as diacetoxyscirpenol and other trichothecenes, besides deoxynivalenol.

As for the organic products, there are very few studies. An Italian study from 2004 evaluates the carrot infection with *Alternaria*, identifying the radicinine, produced by *Alternaria radicina*. Another study of France from 2002, that compared samples of organic and conventional products, found a higher level of deoxynivalenol in the organic wheat as well as patulin in organic apples.

The impact of the modernization of technologies for producing food raw materials and their processing also involves a re-dimensioning of the quality management of the products for trading.

Discussion and interpretations regarding the food quality

We showed that, in order to be a foodstuff, a product must have at least three basic qualities: ***innocuousness*** (to be hygienic and unpolluted), ***nutritive value*** and ***positive sensorial qualities*** (good taste).

Diaconescu (1998) considers that a foodstuff has nine functions:

Innocuousness focuses on the ***hygienic-sanitary function (1)***.

Nutritive value focuses on the ***nutritive (2), plastic (3), energetic (4) and catalytic functions (5)***. We could also add the ***protection-sanogenesis function (6)*** and the ***therapeutic*** one ***(7)***.

The positive sensorial qualities are correlated with the ***psychic-sensorial and aesthetic function (8)*** and with the ***symbolic function (9)*.**

We have serious reasons to affirm that **not everything that is natural is always healthy and nor what is healthy is always natural.**

If we take as an example a product of the alternative farming systems (organic, bio, ecological or other similar names), we notice the **great capital of trust and hope** invested by the consumers, ready to pay more to consume "natural, healthier, untreated, additive-free, E-free products".

We bring the following objections that are more or less sustained:

- In every country, certification and approval of these products is made at a specific professional level;

- Without trying to discredit the rigour and correctness of those who approve these products, we find that the export products are given an increased

attention, which is reflected in the obtained prices, whereas in the internal market these products are lacking;

- Innocuousness of the ecological products represents, in our opinion, a field and a quality that must be better defined.

The manner of fertilization with urban household wastes (dejections, urines, faeces with putrescines, cadaverines and parasites) is potentially forbidden, but it should be controlled. The level of disease attack (provoked by bacteria, fungi, moulds and other micromycetes) is much more important for bio products that may lead to the appearance of some dangerous mycotoxins. The low obtained productions and their quality (among others, they might not be preserved correctly) are only two of the factors that increase the cost price. The specific technologies provide composting dejections and animal/vegetal wastes or their treatment corresponding to the food hygiene rules (a phase hard to control, where very dangerous organic origins are found) (Munteanu et al. 2008).

Bio products are also treated, and phytosanitary **alternative treatments should be known by consumers (**type, substances or procedures, effects, etc**)**. Despite all these, there are still debatable aspects, except the possible falsification, functioning in many countries.

We mention several questions related to the **natural quality** of foodstuffs:

- How many bio-labelled products (organic, ecological, etc) are consumed per inhabitant/year in Romania?

- Are Romanian vegetables and fruits healthier than the ones from import?

- Do they know the anti-nutritive or even toxic substances found in the fresh vegetal products?

- May the consumption of **natural** raw foodstuffs be considered healthier than of the processed ones?

- How real the information mentioned on the label of a canned product "without additives, without preservatives" is?

- Is **natural** drying of vegetables, herbs and fruits benefit to their nutritive value and bioactive content?

- Is **natural** smoking healthy for consumers?

- Are **natural** wines (hybrids, table wine, etc.) healthier than the noble ones?

- Is a distilled alcoholic drink (named incorrectly "**natural**" in our opinion) a healthy product and "foodstuff"?

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