XXVI INTERNATIONAL
ECO-CONFERENCE® 2022
21–23th SEPTEMBER

XII SAFE FOOD

PROCEEDINGS

NOVI SAD, SERBIA

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SAFE FOOD

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2022

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Ecological Movement of Novi Sad

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Official host of the XXVI International Eco-conference 2022 – **Institute for Nature Conservation of Vojvodina Province in Novi Sad**

THE ECOLOGICAL MOVEMENT OF THE CITY OF NOVI SAD AN IMPORTANT DECISION OF ITS PROGRAMME COUNCIL

Since 1995, the Ecological Movement of the City of Novi Sad organizes "Eco-Conference® on Environmental Protection of Urban and Suburban Areas", with international participation. Seven biennial conferences have been held so far (in 1995, 1997, 1999, 2001, 2003, 2005, 2007, 2009, 2011, 2013 and 2015). Their programs included the following environmental topics:

Session 1: Environmental spheres: a) air, b) water, c) soil, d) biosphere
Session 2: Technical and technological aspects of environmental protection
Session 3: Sociological, health, cultural, educational and recreational aspects of environmental protection
Session 4: Economic aspects of environmental protection
Session 5: Legal aspects of environmental protection
Session 6: Ecological system projecting (informatics and computer applications in the field of integrated protection)
Session 7: Sustainable development of urban and suburban settlements-ecological aspects.

Conference participants have commended the scientific and organizational levels of the conferences. Conference evaluations have indicated that some aspects are missing in the conference program. In addition, since a team of conference organizers was completed, each even year between the conferences started to be viewed as an unnecessary lag in activity.

Eco-Conference® on Safe Food

With the above deliberations in mind, a decision was made that the Ecological Movement of the City of Novi Sad should embark on another project – the organization of Eco-Conferences® on Safe Food. These Conferences were planned to take place in each even year. Preparations for the first Eco-Conferences® on safe food started after the successful completion of the Eco-Conference® '99.

So far four Eco-Conferences® have been held (in 2000, 2002, 2004, 2006, 2008, 2010, 2012 and 2014.) focusing this general theme.

Theme of the Eco-Conference®

By organizing the Eco-Conference® on Safe Food, the organizer wishes to cover all factors that affect the quality of human living. Exchange of opinions and practical experiences should help in identifying and resolving the various problems associated with the production of safe food.

Since 2007 Eco-Conference gained patronship from UNESCO and became purely scientific Conference.

Objectives of the Eco-Conference®

– To acquaint participants with current problems in the production of safe food.

– To make realistic assessments of the causes of ecological imbalance in the conventional agricultural production and the impact of various pollution sources on the current agricultural production.

– Based on an exchange of opinions and available research data, to make long term strategic programs of developing an industrialized, controlled, integral, alternative and sustainable agriculture capable of supplying sufficient quantities of quality food, free of negative side effects on human health and the environment.

Basic Topics of the Eco-Conference®

Basic topics should cover all relevant aspects of the production of safe food.

When defining the basic topics, the intention was itemize the segments of the production of safe food as well as the related factors that may affect or that already have already been identified as detrimental for food safety and quality. The topics include ecological factors of safe food production, correct choice of seed (genetic) material, status and preparation of soil as the basic substrate for the production of food and feed, use of fertilizers and pesticides in integrated plant protection, use of biologicals, food processing technology, economic aspects, marketing and packaging of safe food.

To paraphrase, the envisaged topics cover the production of safe food on the whole, individual aspects of the production and their mutual relations, and impact on food quality and safety.

Sessions of the Eco-Conference®

1. Climate and production of safe food.
2. Soil and water as the basis of agricultural production.
3. Genetics, genetic resources, breeding and genetic engineering in the function of producing safe food.
4. Fertilizers and fertilization practice in the function of producing safe food.
5. Integrated pest management and use of biologicals.

6. Agricultural production in view of sustainable development
7. Production of field and vegetable crops.
8. Production of fruits and grapes.
9. Lifestock husbandry form the aspect of safe food production.
10. Processing of agricultural products in the framework of safe food production.
11. Economic aspects and marketing as segments of the production of safe food.
12. Food storage, transportation and packaging.
13. Nutritional food value and quality nutrition.
14. Legal aspects of protecting brand names of safe food.
15. Ecological models and software in production of safe food.

Attempts will be made to make the above conference program permanent. In this way will the conference become recognizable in form, topics and quality, which should help it find its place among similar conferences on organized elsewhere in the world.

By alternately organizing conferences on environmental protection of urban and suburban areas in odd years and conferences on safe food in even years, the Ecological

Movement of the City of Novi Sad is completing its contribution to a higher quality of living of the population. Already in the 19th century, Novi Sad was a regional center of social progress and broad-mindedness. Today, owing first of all to its being a university center, Novi Sad is in the vanguard of ecological thought in this part of Europe.

It is our duty to work on the furtherance of the ecological programs of action and, by doing so, to make our contribution to the protection of the natural environment and spiritual heritage with the ultimate goal of helping the population attain e higher level of consciousness and a higher quality of living.

Director of the Ecological
Movement of Novi Sad
Nikola Aleksic

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FOREWORD

Ecological Movement of Novi Sad continuously for twenty-six times is successfully organizing international scientific Eco-conference. Every odd year a conference devoted to the ecological problems of cities and suburbs is organized and even years a conference devoted to safe food is organized. This year the program of the conference represent various aspects of safe food production. Population nutrition and in this regard, correctness and biological value of food represents not only local but also a global problem, which is why this problem attaches great importance worldwide. Population nutrition is a multilayered problem of population and includes quantitative and qualitative indicators which have a great impact on the health and prosperity of the human population, but also represent the social, political, economic, and environmental problem.

It is estimated that in the world, every ninth inhabitant is starving or about 800 million, of which 98% in developing countries, 500 million in Asia and the Pacific region and 23 million in Africa. The reasons for insufficient amounts of food on a global scale are numerous: local and regional wars for which it is not possible to cultivate the land, the production of fuels from vegetable products, increasing production and thus consumption of meat, which requires a greater quantity of plant products, food price growth and reproduction materials for which farmers are not able to establish manufacturing.

In addition, there is lack of agro-technical knowledge, corruption, inefficient use of natural resources, environmental pollution, global climate change and others. It is believed to be due to climate change by 2030.

Yields of cultivated species reduced by approximately 30%, while, at the same time, there will be a reduction in arable land per capita, which in 1970, amounted to 3205 in 1990, to 2372, and in 2050, it will be reduced to 1500 m^2. At the same time it is estimated that the Earth's globe in 2050 to live more than ten billion people. An interesting fact is claiming that 30,000 edible plant species in the world, only four species: rice, wheat, maize and potatoes provide 60% of energy needs in nutrition.

Using large edible plant species on a large scale would contribute to partially solving the problem of hunger, and probably better quality food. There is also an

ECO-CONFERENCE® 2022
ECOLOGICAL MOVEMENT OF NOVI SAD

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Review paper

FOOD CONTROL SYSTEMS AND PROTECTION OF HUMAN HEALTH

Abstract

Providing a sufficient amount of safe food with defined desirable quality parameters is an imperative for every producer, but also an unmatched demand of a modern consumer. Globalization of the food market, development and introduction of novel foods and new production processes, ever more present centralized method of preparing and distributing food, growing demand for minimally processed food with increasing use of ready to eat food, as well as the creation of ever longer and more complex food chains, have contributed to a significant increase of risk level in the area of its safety. The issue of food spoilage and its safety is an indispensable part of all national structures' activities involved in public health care, which, in recent decades has gained a new integrated approach, known as „One Health".

Key words: *food spoilage, foodborne diseases, food control, „One Health"*

INTRODUCTION

Given that modern food trade and transport have an international character, food safety is a common issue and subject of attention of both developed and developing countries (Vesković Moračanin et al., 2015). In order to respond to the challenge, the governments of many countries have established new institutions, standards and methods for regulating food safety and increased investments in systems for controlling potential hazards. The very fact that withdrawal of a product from the market can lead to serious financial losses, damage to manufacturer's reputation, as well as to the occurrence of foodborne illness, and in the worst case, even fatal outcomes, contributed to the issue of food safety being at the forefront of national policies today.

The principles „from field to table" (Italy), „from farm to fork" (England) or „from producer to consumer" (Germany) are synonyms on which the new integrated food

safety system is based in the European Union, as well as in our country (Vesković Moračanin et al., 2015; Vesković and Đukić, 2018). The principle suggests that food safety begins, before all, at the level of primary production, i.e. production on the agricultural land and in the barn, and ends with the consumption of food by the final consumer. This system establishes the responsibility of all participants in the integrated food chain, starting with production, processing, and ending with food transport and distribution (Vesković-Moračanin et al., 2014). In addition to the defined and shared responsibility, other actual challenges are directed towards the need to: *i*) reduce economic losses caused by food spoilage, *ii*) lower the cost of the food production process, *iii*) reduce the possibility of transmitting pathogenic microorganisms, as well as *iv*) meet the growing needs of consumers for *ready-to-use* food, which has a fresh taste, high nutritional and vitamin value, and which, in addition, is minimally processed and treated with preservers (Vesković-Moračanin et al., 2015; Vesković and Đukić, 2018).

Apart from the above requirements, according to FAO projections, in decades to come, agricultural and food production will have to increase by at least 70% in order to be able to keep up with the expected growth of the world's population. At the same time, it is completely realistic to expect that the aforementioned necessary increase in production will open up new challenges in the area of food quality and safety, as well as human health (WHO, 2022). The issue of food spoilage and its safety is an indispensable part of all national structures' activities involved in public health care, which, in recent decades has gained a new integrated approach, known as „One Health".

FOOD SPOILAGE

In the 21st century, food spoilage with its consequent loss is of great importance. In addition to direct material damage, a significant loss is also reflected in lost work, used water, energy, land, as well as other resources that enter the food production chain (Lipinski et al., 2013).

Food spoilage is a natural, metabolic process that leads to sensory changes in the texture, smell, taste, or appearance of food that becomes undesirable or unacceptable for human consumption. (Doyle, 2007; Nychas and Panagou, 2011). Irrespective of its origin (vegetable or animal), due to its composition (moisture, proteins, lipids, carbohydrates and other organic and mineral substances) food represents an ideal environment for the development of unwanted microbiological, chemical and physical processes that lead to the emergence of unpleasant sensor changes, i.e. spoilage. The nutritional value of the food does not change during the mentioned process, while the sensory properties (color, smell, texture and edibility) become changed, and the food itself is unusable for human consumption (Rahman, 2007). Although microorganisms are the most common carriers of the food spoilage process, this process does not always lead to illness in consumers, given that pathogenic microorganisms or their toxins do not have to be present in spoiled food. However, the resulting changes in sensory properties mean that this type of food cannot be used further in human diet.

Explaining the processes of food spoilage, certain ecologists believe that the created harmful metabolic products, primarily, characteristic unpleasant smells, represent a

protective mechanism of microorganisms – the cause of spoilage, which in this way keep the necessary nutrients for themselves, while other potential users of the same food, e.g. large animals, including humans, are repulsed (Burkepile et al., 2006).

Food spoilage is a major concern of the entire world population, with developing parts of the world particularly affected. At the same time, the research results indicate that there is a global lack of information about this problem, especially in the part of quantifying food loss in relation to the etiology of the cause, as well as the extent of economic damage that accompanies such loss (FAO, 2011). In parallel with these unfamiliarities, there are no adequate assumptions about the potential costs that could be spent on activities aimed at reducing or preventing food loss due to food spoilage. On the other hand, expert predictions suggest that food production should be significantly increased in order to meet global demand in the future (Fonnesbech et al., 2005). Due to all of the above, the issue of food spoilage is of great international importance, both from the aspect of efforts to suppress and reduce hunger in the world, improve its safety during the intended period of use, and from the economic aspect, due to the damage caused by food losses.

It sounds paradoxical but the data of the United Nations Department of Economic and Social Affairs (DESA) indicate that the food sector at the beginning of the XXI century has produced enough food for the needs of the entire human population. On the other hand, it is estimated that more than 690 million people in the world are still hungry. In addition to the different economic development of the countries, the aforementioned situation is conditioned by the fact that a third of the produced food is unused due to its spoilage or some other reason (Gustavsson et al., 2011). Research has shown that in developing countries, due to the lack of modern processing and preservation technologies, as well as adequate storage methods, much more food is lost during the production/processing phase and immediately afterwards. In contrast, in industrialized countries one-third of food spoilage and write-offs occur at the retail or consumer level (FAO, 2011). The highest percentage of food loss was found in root vegetables (40–50%), fruits and vegetables (35%), fish and seafood (30%), cereals (20%), meat, oilseeds and dairy products (20%) (FAO, 2019).

The worrying data is that in the countries with medium and high incomes, food is to a large extent wasted, even if it is still suitable for human consumption, but also due to its increased production in relation to the actual needs of end users.

Regardless of the level of economic development and maturity of the system in the country, it is necessary to strive to reduce food losses to a minimum. Considering the importance of this problem, many countries in the EU have, as part of their national policies in the area of food production, and an important part of their strategies, raised the issue of reducing food loss and wastage, asking that legally binding activities that will contribute to this reduction be established within the legislation (UNEP, 2021). However, in most countries, legislation is designed in such a way that food safety is treated separately from the issue of food spoilage. Despite such a prevailing approach, from the microbiological-economic point of view, the mentioned areas cannot be separated or considered individually. The occurrence of diseases with accompanying health problems, as well as economic losses due to foodborne diseases, are directly related and complementary to economic losses due to food spoilage (Di Renzo et al., 2015).

THE MOST COMMON FOOD BORNE DISEASES

Food safety issue is receiving ever-increasing attention worldwide since high correlation has been found between consumer diet and health. As much as the essential need for food is, so is safe food consumption a basic human right. Food safety is a global issue with significant implications on human health. World Health Organization (WHO) has been warning that at least two billions of people worldwide get sick from eating unsafe food. Unsafe food contains dangerous agents or contaminants, which can lead to the appearance of diseases in people, or to the creation of an increased risk of developing chronic diseases. Such contaminants can reach food in many different ways during processing, and they can also be found in it due to poor or inadequate production and hygiene conditions. The most common danger for the creation of unsafe food is the presence of various pathogenic microorganisms, parasites, mycotoxins, residues of veterinary drugs and pesticides (Vesković et al., 2011).

Experience so far has shown that food safety is a common problem and subject of attention, both in developed and developing countries. Research indicates that the most common risks to food safety, and thus directly to human health risks, are greater in developing countries than in developed countries (Gizaw, 2019). However, highly developed countries, such as Japan, the US, etc., have also experienced incidents where hundreds and thousands got sick or died (Fung et al., 2018). Based on a comprehensive overview, it can be said that the level of risk varies depending on the sanitary condition of the soil (Đukić et al., 2008, 2011), climatic conditions (Vesković and Đukić, 2018), the way people eat, the level of their social status, that is, the height of the state public revenue and established infrastructure.

The constant need for a larger amount of food due to the increase in the population, the increase in the volume of its production, the establishment of complex transport and supply chain with trade globalization, as well as the existence of an inevitable demand for a lower price and increased competitiveness, contributed to an increased number of incidents in the area of disease occurrence that are directly related to food. Also, the uncontrolled and frequent application of agrochemicals in primary agricultural production, along with the appearance of an increasing number of new pathogens with changes in their virulence, further increases the risk of disease. The emergence of antibiotic resistance of microorganisms, which is consequently followed by an intense increase in the number of multiresistant species, is also very worrying. At the root of this problem is, of course, the uncontrolled and inadequate use of antimicrobial agents in animals, with the consequent incalculable harmful effect on this issue.

Foodborne diseases today are public as well as the main problem in the whole world. The WHO defines them as "diseases of an infectious or toxic nature that are or suspected to be food and waterborne". There are various agents like bacteria, viruses, and parasites causing foodborne diseases, among which, the bacterial agents are more prevalent. According to estimations of the Centers for Disease Control and Prevention (CDC, 2021), of more than 250 different food-borne diseases registered in total, over 48 million people get sick from a foodborne illness every year, 128.000 are hospitalized, and 3.000 die. The most severe cases of the disease occur in infants, small children, the elderly, immune-compromised (such as those with HIV/AIDS, cancer,

diabetes, kidney disease, and transplant patients), but also in healthy people who are exposed to high doses of the causative germs. The largest number of causative agents of these diseases are bacteria (about 66%), while other causative agents are viruses, parasites, natural and synthesized chemical substances, as well as microorganism toxins, among which, in addition to bacterial toxins, mold toxins are particularly important (Škrinjar et al., 2013).

The gate of infection for foodborne pathogens and their toxins is gastrointestinal tract where preliminary symptoms are most commonly registered. Nausea, vomiting, abdomen cramps and diarrhoea are frequent symptoms of the diseases.

Foodborne diseases significantly burden the world economy on an annual basis. The estimated costs of registered incidents in the US economy ten years ago, and which refer only for the purposes of notifying consumers, withdrawing food from market circulation and compensating damaged users in lawsuits, were approximately 7 billion dollars per year (Hussain and Dawson, 2013). According to the reports of U.S. Department of Agriculture Economic Research Service (USDA ERS, 2018) the total economic burden was about $17.6 billion, an increase of about $2 billion, or 13 percent, over the 2013 ERS estimate of $15.5 billion.

Table 1. The most common animal products and foodborne bacteria causing disease in humans

Type of product	Foodborne bacteria	Disease symptoms
Fresh and thermally underprocessed meat and meat products	*Campylobacter jejuni, Escherichia coli, Salmonella* spp. *Listeria monocytogenes*	Abdominal pain, nausea, vomiting, diarrhoea
Fresh milk and dairy products	*L. monocytogenes, Salmonella, Shigella, Staphylococcus aureus, Campylobacter jejuni*	Abdominal pain, nausea, vomiting, diarrhoea, increased temperature
Fresh eggs and thermally underprocessed egg products	*Salmonella* Enteritidis	Abdominal pain, nausea, vomiting, diarrhoea, increased temperature

The 2018 World Bank report indicates that the total productivity loss associated with foodborne diseases in low- and middle-income countries is estimated at $95.2 billion per year, while the annual cost of treating illness caused by contaminated food is estimated at $15.6 billion dollars (World Bank, 2019). Therefore it can be said for sure that foodborne diseases represent a significant problem for individuals, communities and the entire food industry (Fung et al., 2018). Epidemiologic data worldwide have shown that food of animal origin is in 50 –90% cases involved in etiology of foodborne disease. According to the European Food Safety Authority (EFSA, 2014) data, eggs and egg products are considered one of the most important vectors of

foodborne outbreak (22.8%), while meat and meat products account for 20.2%, seafood 13.8%, and cheese for 5.4%. Today, several thousands of different products of animal origin can be found on the global food market. Analyses have shown that fresh, thermally unprocessed food is a very suitable environment for growth and propagation of foodborne pathogens, which classifies it in the high-risk foodborne disease (Table 1).

It is considered that *Salmonella* spp., excluding *S. typhi*, and *Campylobacter* spp. are major causes of foodborne diseases in the US, England and Australia (Scallan et al., 2011). Today, the most common is norovirus with an estimated 15 million cases, followed by *Campylobacter* spp., which is responsible for almost 5 million cases. When it comes to meat chain, classical zoonoses, such as tuberculosis, cysticercosis, trichinellosis or anthrax infection became much less important (Bunčić et al., 2019), while causative agents like *Campylobacter, Salmonella*, Shiga toxin-producing *Escherichia coli* (STEC)*, Listeria monocytogenes* and *Yersinia enterocolitica,* mostly excreted by asymptomatic animals or coming from the surrounding environment, became predominant (Nastasijević et al., 2020).

In 2018, 26 EU member states reported a total of 5.146 outbreaks caused by foodborne pathogens and 48 outbreaks caused by waterborne pathogens. 4.588 ill was hospitalized, while the number of deaths was 40. Campylobacteriosis was the most commonly reported zoonosis. Apart from *Campylobacter*, causative agents of these outbreaks were *Salmonella*, norovirus, bacterial toxins other than *Clostridium botulinum* and *Campylobacter* (EFSA, 2019). WHO (2019) reports that 70%, of the total of approximately 1.5 billion registered diarrhoeas was caused by biologically contaminated food, whereby these poisoning, primarily in undeveloped countries, were responsible for deaths of approximately 3 million children. Morbidity caused by food poisoning in Europe is second right behind respiratory diseases, with estimated 50.000–300.000 cases of acute gastroenteritis annually per million inhabitants (Luchansky, 1999).

FOOD SAFETY

Food control – historical aspects

The issue of food safety is probably as old as the human race itself. The first elements are contained in the intuitive recognition and subsequent avoidance of foods that are naturally toxic and harmful to consume. As human patterns of living, eating, habits and food characteristics changed, the issue of food safety took the form of formalization, and later the framework of legislation. In the beginning, there was, as in laws of ancient Israel, some advice on foods to avoid, ways of preparing them, as well as the importance of food hygiene during consumption. In the third book of Moses (the book of Leviticus), from 2000 BC, it is said that Moses introduced laws to protect his people from food-related diseases, which included mandatory washing of clothes and bathing after animal sacrifices. It is also stated that the Chinese, Greeks and Romans had similar thoughts (Mossel et al., 1995), and that the Egyptians stored and

marked their food thousands of years ago. In 375 BC, the Indian teacher, philosopher and economist, Chanakya, mentioned the issue of food adulteration in his book „Arthashastra".

Observed throughout history, the concern for food quality and safety increased and over time took its regulatory form. The early period of legislation was, first of all, based on the need to prevent the possibility of food adulteration, as well as the need for food to be accurately described. The first English law on food from 1202 (*the Assize of Bread,* proclaimed by King John of England) referred to the ban on the use of ground peas or beans during the production of bread, which is equivalent to nowadays bans on food adulteration. Also, in 1266, the UK parliament prohibited unsafe food. The term „unwholesomeness" was introduced as official terminology in public life and legislation. Four centuries later, in 1646, the American colonists passed a similar regulation on the origin of bread, and a century and a half later (in 1785) they passed *the Massachusetts Act against Selling Unwholesome Provisions*, which can be considered America's first food safety law. The aforementioned law aimed to prevent the sale of adulterated food in Canada and the USA, primarily tea, coffee, milk, etc., given that the turnover of these goods at that time was extremely high (up to 50% of the total amount) (Mahmoud, 2020).

Since then, and up to the present day, many key milestones have occurred in the field of food safety. The most important can be considered: the formation of the US Department of Agriculture (USDA) in 1862; the establishment of the Food and Drug Administration (FDA) in 1906, which in the same year adopted the first American laws dealing with food safety in public supply procedures – *the Pure Food and Drug Act* and *the Federal Meat Inspection Act*. The first law prescribed norms that prevented the production, transportation and sale of adulterated food and drugs, while the second (the Federal Meat Inspection Act) regulated the trade of meat and meat products, providing that animals must be slaughtered, as well as that meat processing must take place in sanitary conditions (Johnson, 2016). The 19th and 20th centuries are marked as a period with a high prevalence of food-related diseases (e.g. botulism, tuberculosis, typhoid fever, etc.). At the same time, the mentioned diseases had the highest incidence and prevalence, as well as the mortality rate in the whole world. That is why laws on food safety, as well as accompanying sanitary conditions during its production, have increasingly been the subject of national legislation. This trend was particularly pronounced after World War II, when many countries of the world developed food laws that remained, with certain changes, in effect until two decades ago (Johnson, 2016; Mahmoud, 2020).

Food control – today

In order to be able to respond to the complex challenges that appeared at the end of the 20th and the beginning of the 21st century, modern food safety control systems were directed to follow the latest scientific and professional achievements, to work on the basis of the concept of risk analysis and to be in line with international standards and the practices recommended by *Codex Alimentarius* (CXC 1-1969).

Namely, after the outbreak of an epidemic caused by *Escherichia coli* O157:H7 (1993) in the USA, it was necessary to thoroughly and critically review the existing food safety system, as well as to find a faster, more efficient and safer system than the previous one. Parallel to this incident in Europe, in the United Kingdom, an outbreak of bovine spongiform encephalopathy (BSE) was recorded, which had great economic consequences in the world, due to the ban on the import and export of beef. At the same time, this epidemic has significantly undermined public confidence in food safety systems in Western Europe. In such an environment, there was an increased interest in the implementation of the system of the *Hazard analysis critical control points* (HACCP) worldwide. Although the basic principles of this system were developed several decades earlier, intensive work has been done on its implementation in the field of food production since the nineties of the last century. The aforementioned concept, based on seven principles, in this area was harmonized with the recommendations of *Codex Alimentarius*.

The most significant downside of the former traditional control method, which anticipated testing of a representative final product at the end of the production process, was the fact that the results obtained could not provide a high level of warranty regarding the safety, stability and microbiological quality of the product. There was a high risk of the unwanted presence of pathogenic microorganisms, because it was impossible to claim with certainty that the untested part of the finished product does not contain pathogenic microorganisms, that is, that the entire production line of the given product is safe for consumption

Many parts of the world, including our country, have HACCP implemented in their food safety systems today, as a mandatory regulatory requirement. HACCP is regarded as a systemic approach to ensure safety and as a better method than end-product testing. This preventive system, which is managed by the food industry today, implies an objective assessment of all potential hazards (biological, chemical, physical), as well as the establishment of appropriate control along the food production chain, which aims to eliminate or reduce the risk of an unsafe product. In other words, at the base of the system lies a preventive approach, not inspection one (Herrera, 2004). In addition to risk assessment and adequate risk management, the system involves continuous record keeping, which proves that the established system is alive and that the stipulated requirements have been met. In modern conditions of food production, the importance of applying HACCP is immeasurable, given that unsafe food can lead to serious financial losses due to the withdrawal of products from the market, damage to the producer's reputation, but also to the occurrence of foodborne illness, which in some cases can have a fatal outcome.

To date, the EU has, in its 28 member countries, proactively adopted food laws that imply the mandatory application of HACCP. The same conditions apply to other countries (i.e. third countries) intra-trading with EU member states. Besides, EFSA has been established in Europe since 2002, which is responsible for risk assessment (EFSA, 2018).

Today's food safety policy of our country is fully based on the EU food safety policy, and aims to protect the domestic consumer, while, at the same time, creating conditions for the smooth functioning of the single food market. By implementing the

national Food Safety Act, as well as other accompanying legal acts, along with the implementation of the HACCP system, the entire food chain "from farm to table/fork" is covered in an integrated manner. The implementation of the aforementioned legal norms enables the achievement of prescribed food hygiene in all stages of production, guarantees the creation of a safe finished product, takes care of the health and well-being of animals, plant health and affects the prevention of environmental contamination. Also, established legislation obliges food producers to be ready at all times to provide adequate evidence of the proper and safe functioning of the system. The requirements of the standard are identical, both for food produced for the domestic market (e.g. meat) and for food intended for export from our country.

FOOD SAFETY: A HOLISTIC APPROACH

Regardless of the fact that foodborne diseases are different, that some of them are zoonotic and some are not, the most effective form of their prevention is the constant application of the integrated, preventive holistic approach of „*One Health*" (formerly One Medicine). This approach implies the implementation of systematic surveillance throughout food production chain, with the mandatory connection of human health with animal health and environmental health. Mandatory integration and exchange of information on animal and human health is the key to the effectiveness of any national, as well as global, health system (FAO–OIE–WHO, 2010). One Health's integrated approach arose from the need to manage food safety with a high level of certainty, as well as to properly understand all aspects relevant to the occurrence of risks and hazards to human, animal and environmental health. By collecting and analyzing all significant data on human diseases that can be food-related, the health consequences of the occurrence of potential foodborne diseases, as well as the accompanying economic losses in the economy, are reduced at the same time. The application of One Health in veterinary and public health represents a significant potential for preventing the occurrence of health incidents, but also an incentive for the development of "healthy" national economies (Boqvist et al., 2018).

Knowledge of potential sources of disease, ways of transmission of pathogens, degree of exposure to environmental influences, level of humans-to-animals contact, as well as the level of direct human-to-human contact, are important factors for defining disease control strategies. In addition, it is necessary to look at consumer behavior, the existence of trends in diet and the type of food consumed, the nature of current economic incentives, as well as trade and politics trends, etc (Zinsstag et al., 2011).

A deep understanding of all socio-economic factors in the food chain, starting with food producers, regardless of whether they are small farmers or large entities in the food business, to the consumers themselves, contributes to the adequate selection of appropriate health protection methods. Also, many experiences from the past, both positive and those that led to mistakes, should be thoroughly analyzed in order to be able to serve for the enhancement of future food safety systems. It is obvious that this approach requires a strong and integrated cross-sectoral cooperation of national economic and health institutions. In other words, only a coordinated, collaborative,

multidisciplinary and cross-sectoral approach to solving existing and unknown risks within the interaction of people - animals - ecosystem, may have sufficient strength and ability to respond to new and unknown challenges and threats to human health (Mackenzie et al., 2019).

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