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FRESH FRUIT SAFETY

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Abstract: The problem of food safety is extremely relevant nowadays due to the general characteristics of the modern world, such as environmental pollution and urbanisation. Foods of plant origin, and in particular fresh fruits (FFs), are contaminated before they are offered to consumers or processed into food products. Fresh fruits are classified as low-risk foods (foods with a low risk of foodborne illnesses), as they have a protective cuticle and epidermis on the surface compared to most vegetables. The aim of this paper is to present and analyse the essence of FF safety, factors affecting FF safety, legislation in the field of fresh fruit safety and the indicators that should be analysed for determination of FF safety according to the regulations and research carried out up to this moment.

Keywords: food safety, agricultural commodity safety, fresh fruit safety, safety regulations.

1. INTRODUCTION

Global food security is one of the most important challenges to be considered in order to ensure that the growing demand for quality in foods and especially fresh fruits (FFs) is provided to consumers. The problem of food safety is extremely topical because of the common features of the modern world, such as environmental pollution and urbanisation. Foods of plant origin are usually contaminated before they are offered to consumers or processed into food products. With the consumption of FFs, some substances with a harmful effect enter the human body and cause acute or chronic diseases. There are various hazards that can contaminate FFs and harm the health of consumers. Every year, millions of people around the world suffer from food poisoning. The uncontrolled use of pesticides, unregulated food additives, biological hazards and many others are some of the factors that can make FFs unsafe and unfit for their intended use [Doyle and Erikson 2008].

The preferences and demand for fresh fruits are due to their high and balanced nutritional value, taste properties and positive health benefits for consumers. However, they are a perishable product, and this requires the development of new, appropriate preservation technologies to meet the increased consumer demand for healthy, safe and quality fresh fruit. The safety differs significantly from the quality

characteristics of FFs, since they can be defined as high-quality, but not safe, because they can be contaminated with microorganisms and toxic chemical contaminants. Importantly, it is possible that FFs may be safe when high results for the studied quality indicators have not been established. The properties and quality of FFs are the main reason that it is not possible to offer them to consumers and to commercialise them while the risks related to the safety of fresh fruits remain undisclosed to consumers [Grunert 2005; Gupta and Prakash 2019].

Consumers express their concern about biological, chemical, physical and radiation hazards and contamination, as well as unacceptable and uncontrolled methods of food production and processing, which can lead to the appearance of various hazards at all stages of the food chain from primary processing to the final consumer. At present, this consumer concern is constantly increasing, and globalisation in all areas is increasing interest in the problem of food safety worldwide. The purpose of the present study is to make a short and reasoned analysis of the essence of FF safety, factors affecting fresh fruit safety, and legislation in the field of fresh fruit safety according to the regulations and research carried out until now. The article is based on a study of numerous legislation and literary sources, clarifying the nature of fresh fruit safety, and factors that influence it. After the analysis of the results presented in regulations and studies, the factors that influence the safety of FFs and indicators that should be analysed to determine FF safety were summarised. The accepted thesis is that FF safety is influenced by specific factors and that, for its determination, FFs should be analysed according to the methods applied in the regulations. In order to determine whether FFs are safe for consumers, the results should be compared with the requirements presented in the regulatory documents. For the purposes of this study, literary sources from Bulgarian and foreign authors, as well as regulations from 2023 until now were used. The methods of scientific analysis of existing concepts and scientific synthesis of the author's views were applied.

2. ANALYSIS of FF SAFETY

According to the Codex Alimentarius, food safety is described as the process of ensuring safe and good food for all consumers, everywhere. Food safety as defined in ISO 22000:2018 is: 'ensuring that food will not cause an adverse effect on the consumer when prepared and consumed according to its intended use'. Food safety is also considered as the extent to which the requirements related to a specific characteristic or property that has the potential to be harmful to health or cause illness within the intended shelf life or the shelf life and the storage methods indicated. The assurance that a food will not cause an adverse effect on health, including injury or illness, is determined by the absence, or reduction to an established acceptable level, of the hazards contained therein. FF safety is a priority over all other quality

characteristics [Codex Alimentarius; Regulation (EC) No. 178; 2002; Food Act, 2020; ISO 22000:2018/Amd 1:2024].

The problem of food safety is relevant because of the dynamic development of the modern world, environmental pollution and urbanisation. Food raw materials of plant origin are contaminated even before they are processed into food products. Very often, dangerous agents go unharmed because of their nature.

On the other hand, during the production, storage and sale, there is again the possibility of contamination, and hence danger. With FF products, a significant portion of the substances with a harmful effect enters the human body and can cause acute or chronic diseases. There are various hazards that can contaminate them and damage human health [Gupta and Prakash 2019].

Hazards specific to FF safety are biological, physical and chemical. Their sources have multiple origins: biological (microbial) contamination – sources are soil, water, and handling, physical contamination – from things like soil, insects, or pieces of equipments, and chemical contamination – from sources such as heavy metals or radionuclides, agricultural chemicals such as insecticides and fungicides, packaging materials, cleaning/sanitising agents, certain toxins, and misuse of food chemicals [FAO/WHO 2008] (Tab. 1).

The European Food Safety Authority (EFSA) published a scientific opinion of the risk posed by pathogens in foods of non-animal origin (Part 1: Outbreak Data Analysis and Risk Ranking of Food/Pathogen Combinations) (see the section on the EFSA for more information). In it are presented results connected with certain foods of plant origin and pathogens that are usually found therein. The food/pathogen combination ranked on top was Salmonella spp. and leafy greens eaten raw. The main problem nowadays in Europe and countries from the EU is microbiological contamination of FFs [Johannessen and Cudjoe 2014].

The relationship between reducing the hazards associated with FFs and the risk of adverse health effects for consumers requires the implementation of appropriate controls to ensure their safety [Gyurova 2021]. Fresh fruits are classified as low-risk foods (foods with a low risk for foodborne diseases) because they have a cuticle and protective epidermis on the surface with a greater thickness compared to most vegetables, and also a significant portion of them is harvested from trees or shrubs. The sources of contamination of FFs are most often soil, fertilisers, irrigation water, animal/poultry wastes, harvesting, processing, distribution, trade and consumption of fresh fruit [Khalil et al. 2024], which is why they are usually controlled for biological and chemical hazards and conclusions about FF safety are only drawn after an analysis of the obtained results.

Table 1. Hazard types specific to FFs

Hazard type	Common sources	Prevalence and severity	References
Biological	Soil, water, and handling	Pathogenic fungi, bacteria, viruses, prions, protozoans and helminthic parasites, namely certain trematodes. Cause foodborne illness due to pathogen–host interaction	FAO/WHO 2008; Nguyen-The 2012; Johannessen and Cudjoe 2014; Avila-Novoa et al. 2024; Khalil et al. 2024; Van Blair et al. 2024; Nève de Mévergnies et al. 2025
Physical	Environment – soil, insects, Packaging – pieces of equipment	Unwanted field matter (stones, wood, metal, pieces of insects, etc.); inadvertent processing residues (pieces of plastic, personal objects, etc.); unintentional materials (employee sabotage) and miscellaneous particulates and fragments or food itself (pits, stones, stems)	Johannessen and Cudjoe 2014; Lee et al., 2024; Syifa, Widoretno and Hapsari 2025
Chemical	Environment – heavy metals or radionuclides; agricultural chemicals – insecticides, pesticides, fungicides, etc.; packaging materials; cleaning/sanitising agents; certain toxins; misuse of food chemicals	May appear in FFs by natural occurrence (e.g. naturally occurring toxin in certain FFs) or by deliberate or unintentional addition during primary production and/or processing	Johannessen and Cudjoe 2014; Varanasi, Prasad and Jugulam 2016; Bouzembrak and Marvin 2019; Topping, Aldrich and Berny 2020; Sharma et al. 2020; Adejumo and Vogele 2021; Ahmadi, Khazaei and Mehri 2024; Philippe et al. 2021; Centanni et al. 2023; Balkrishna et al. 2024; Si et al. 2025

Source: own study.

3. IDENTIFICATION OF FACTORS AFFECTING FF SAFETY

Fresh fruits contain minerals, vitamins, fibre, and antioxidants, which are the main components of a healthy diet for humans [Kaparapu, Pragada and Geddada 2020]. The presence and evolution of food safety risks are determined by factors within and outside the chain of food production and supply, such as climatic, economic and agricultural. The interactions between these factors and the supply chain are complex, and a systematic approach is needed to uncover causal relationships in order to be able to carry out effective actions to minimise the safety risks of FFs.

Climatic factors include temperature, precipitation, etc. Most of the research on the effects of climate on agriculture has focused on yields [Lobell et al. 2006], production and the risk of famine [Parry et al. 2004]. Other aspects of climate impacts on the safety of fresh fruit include the consequences for the agricultural sector due to: mycotoxins formed by moulds; pesticide residues and persistent

pollutants; pathogenic microorganisms [Miraglia et al. 2009]; weed growth and potential variations in herbicide efficacy under changing climatic conditions [Varanasi, Prasad and Jugulam 2016].

Economic factors include information related to the product, such as monthly and annual prices, total production, quantities imported annually into Europe, total area per year, general information about the country (annual budget for agriculture, percentage of GDP spent on agriculture, etc.), industrial development, etc. In Bulgaria, the sources of pollution with heavy metals from the soil, with respect to the plant species, are the factories for non-ferrous metals. The heavy metals most frequently identified as pollutants in the composition of FFs are lead and cadmium [Balkrishna et al. 2024].

Agricultural factors include the use of water for irrigation, pesticides, fertilisers, herbicides, insecticides, fungicides and rodenticides [Official Journal of the European Union 2017; Bouzembrak and Marvin 2019]. The water used in agriculture is considered as a factor that affects the risk of microbiological contamination of FFs, for example: the type of water source, the method of irrigation (drip irrigation, sprinkling, etc.), contact of the edible part of the FFs with the irrigation water, etc. Water sources and the quality of water used for irrigation have an impact on the microbiological contamination of FFs. Poor-quality water can cause the spread of localised pollution on farms. It has been proven that when water is in direct contact with the product, its quality affects the contamination of FFs with pathogens. When pathogens on the product survive, they can cause foodborne illness. The pathogens most often transmitted through low-quality water are intestinal bacteria, such as *Salmonella spp., Listeria monocytogenes, and Campylobacter spp.*, certain strains of E. coli (VTEC) and viruses [Official Journal of the European Union 2017; Avila-Novoa et al. 2024]. In order to improve the quality of water for irrigating farms, producers use broad-spectrum disinfectants against pathogenic bacteria and demonstrate positive results in achieving a reduction in the identified microorganisms in the composition of this irrigation water [Van Blair et al. 2024].

In order to improve the efficiency and quality of production, pesticides are used during the planting, harvesting and storage stages, therefore, it is possible to establish different concentrations of pesticide residues in the composition of FFs [Philippe et al. 2021; Ahmadi, Khazaei and Mehri 2024]. Pesticides are widely used chemicals in agriculture, where they are used to kill insects, pests and weeds. In particular, perennials and fresh fruits are susceptible to many pests and diseases of plants, so they are treated with pesticides in order to protect against them. The extensive use of chemical preparations has increased the yield of FFs and has also led to a significant reduction in crop losses and thus an increased availability of high-quality FFs. On the other hand, the indiscriminate use of these chemicals has led to adverse effects on the environment and has caused adverse effects on human health. The harmful effects of the use of pesticides on various organs, including the liver,

brain, lungs, colon, etc., have been proven. It has also been found that pesticides can lead to fatal consequences, such as cancer, among consumers.

It should be borne in mind that there are processes in the industry that can reduce pesticide residues. In the case of fresh fruits, post-processing processes are not applied before they are exported to the commercial network and offered to consumers, so it is possible that they contain pesticide residues in their composition. Therefore, it is believed that pesticides enter the human body through the consumption of FFs [Topping, Aldrich and Berny 2020]. The pesticides that are most commonly used to treat perennials include organophosphates, organochlorines, and carbamates [Sharma et al. 2020; Centanni et al. 2023].

Control over pesticide residues in food is carried out on various goods of plant origin offered in the commercial network. It has been found that most often the pollution is from representatives of some groups of pesticides (organophosphorus, carbamate and dithiocarbamate), and the responsibility lies with the farmers. The maximum residue levels (MRLs) of pesticide residues in foodstuffs and FFs are reflected in regulations and a directive of the European Union [Regulation (EC) No. 396/2005].

At present, the main perspective that can be applied is the use of biopesticides, through which an increase in the production of FFs can be achieved without compromising the health of consumers. Biopesticides are derived from natural materials (plant, animal, bacterial or minerals) and are used to control various pests, including insects, pathogens and weeds. Biopesticides are safe for humans and the environment; they are of lower toxicity, targeting a specific pest or several pests [Adejumo and Vogele 2021].

Based on the above, it should be summarised that the most important factors that can be related to the production of safe FFs with properties that are desirable and expected by consumers are: the influence of climatic conditions on the average annual yields of FFs, the development of industry in agricultural areas, the quality of water used for irrigation of farms, and the number of chemical substances used for processing and fertilising perennials.

4. LEGISLATION OF FF SAFETY

The availability of safe food is a fundamental human right proclaimed by the United Nations. The European Union puts this problem in the spotlight and develops regulations, directives and decisions in Brussels for this purpose, which are the basis of the national policies of the Member States. Currently, there is a significant regulatory base related to food safety, which is constantly updated and adapted as new developments emerge. This legislation is based on risk analyses in food and feed production, food processing, storage, transport and sales, imports and exports. The basic principles of food safety are presented in Regulation (EC) No. 178/2002, which requires businesses to ensure that all foods, food additives and feed are

certified traceable throughout the supply chain, including backward tracing to their source; that they are safe for consumers. Contaminants usually found in the composition of foods are chemical, biological, physical or radiological in nature. Their safety should be considered in the following areas: chemical safety, biological safety, physical safety and radiological safety [Stefanova 2021b].

The main risks that appear in FFs are biological and chemical. Biological risks (biofood safety) to consumer health are related to exposure to bacteria, viruses, moulds, other microorganisms and related toxins. These microorganisms are widespread in nature and pose a potential health hazard to consumers. Biological risks exist in food, especially in products of animal origin. Chemical risks (chemical food safety), in contrast, are usually pharmacologically active substances used to combat diseases and pests in agriculture. A significant share of such chemical substances enters the environment as pollutants and also settles in the composition of some raw materials and food. In this regard, an EU regulation (REACH) has been developed that is aimed at improving the protection of human health and the environment from the risks that can be caused by chemical substances, and also regulates the registration, evaluation and authorisation of their use [Pashova 2021; European Chemical Agency 2024].

The changes that have taken place in Bulgaria related to the economy, market mechanisms and food trade require compliance with national and international requirements and standards. Therefore, the regulatory framework has been updated, and the basic principles of the current European law in the field of food safety have been introduced into the national legislation. After Bulgaria's accession to the EU, a Methodological Guide was developed, which reflects the Bulgarian national microbiological criteria for food products. The methodology of microbiological regulation and the basic principles reflected in Regulation (EC) No. 2073, 2005, the Codex Alimentarius, etc. are used [Regulation (EC) No. 2073/2005] and the microbiological safety criteria that are applied throughout the food chain in Bulgaria are presented.

4.1. Legal framework in the field of fresh fruit safety

The legal framework in the field of FF safety is examined by presenting national regulations and EU policies (Tab. 2).

The Food Act is a major national document defining the requirements for food safety and business operators working in food production, processing and/or distribution facilities [Food Act 2020]. The Food Act defines the requirements that are valid for each stage of food production and aims to ensure the application of EU law and national measures related to this area [Food Act, 2020; Stefanova 2021a,b]. The Agri-Food Chain Management Act regulates the state policy on safety, consumer protection, contaminants in food, and in particular pesticide residues in them [Agri-Food Chain Management Act 2020]. Offering safe FFs on the market and the prevention of their impact on consumer health are approaches set back in 2004 by the European Union

when introducing the so-called Safe Products, New Approach legislation. The existing legislation until the accession of the Republic of Bulgaria as a member of the European Union has been revised, and since 2007 new acts of the Union have been mandatory for application [Johannessen and Cudjoe 2014; Stefanova 2021a,b].

Table 2. Legal framework in the field of food safety

Policy Area	Document
National legislation	
Legal provisions on food safety	Food Act 2020
State policy regarding food safety	Agri-Food Chain Management Act 2020
Union legislation	
EU food safety policies	Regulation (EC) No. 178/2002 laying down the general principles and food requirements, the establishment of a European Food Safety Authority and the definition of procedures on food safety
	Regulation (EC) No. 625/2017 on official controls, etc., activities carried out to ensure the enforcement of food law and animal health and welfare rules, plant health and plant protection products
EU food hygiene policies (hygiene package)	Regulation (EC) No. 852/2004 on food hygiene
EU policies on maximum levels of certain contaminants in food	Regulation (EC) No. 1317/2021 maximum levels of lead in certain foods
	Regulation (EC) No. 915/2023 maximum levels of certain contaminants in foodstuffs
International legislation	
International Production and Food Safety Policies	Codex Alimentarius

Source: own study.

With the publication of Regulation (EC) No. 178/2002, called the European Food Act, the European Union created a new legal framework that sets out principles to ensure a consistent approach and the promotion of principles, obligations and definitions related to food security. The regulation provides food safety requirements, according to which a specific product should not be offered to consumers if it is not safe. A particular food is considered unsafe if it is harmful to the health of consumers or unfit for human consumption. In order to establish equivalent systems of official controls on food and feed in all Member States, the European Commission is introducing a harmonised system of common rules at the community level governing such controls [Regulation (EC) No. 625/2017].

FF safety is determined on the basis of some microbiological criteria, and the content of heavy metals and pesticides. Microbiological hazards in the composition of foods are a major source of some foodborne diseases in humans. Therefore, the composition of food products, and in particular FFs, is not allowed to contain microorganisms (including their toxins or metabolites) in quantities that pose an unacceptable risk to human health [Regulation (EC) No. 2073/2005].

The main provisions and requirements of Regulation (EC) No. 852/2004 are reduced to: the responsible persons for food safety; the need to ensure food safety

throughout the food chain; the guidelines for good practice as a tool to support food business operators at all levels of the food chain; and the establishment of microbiological criteria and requirements for temperature control based on risk assessment. In accordance with Article 4 of Regulation (EC) No. 852/2004, food producers and traders must comply with microbiological criteria. Measures to be taken by food producers and traders include controlling raw materials, hygiene, temperature and shelf life of the product. Obtaining a safe product in food production is the primary aim for producers and traders, and is a major commitment in terms of achieving compliance with these requirements. The content of Regulation (EC) No. 1317/2021 presents the maximum levels of lead in the composition of certain foods, and Regulation (EC) No. 915/2023 reflects the maximum levels of certain contaminants (mycotoxins, heavy metals, plant toxins, processing contaminants, halogenated persistent organic pollutants, and other contaminants – melamine, nitrates, perchlorate) in the composition of food.

In conclusion, it should be summarised that there are national, European and international regulations and policies outlining the legal framework in the field of food safety and in particular for FFs. They are constantly evolving and regularly updated, so it is necessary to keep stakeholders well informed with the latest updates in order to offer consumers safe FFs.

4.2. Regulatory requirements for the safety of fresh fruits

Fresh fruits are low-risk foods, as they are covered with a cuticle and have a thick, protective epidermis, different from that of vegetables, and they are also harvested from trees or shrubs. It has also been proven that a significant subset of microorganisms is not able to continue its vital activity in the composition of fruits due to their low-pH environment. Contamination of fruits can occur at different stages of their growth, with such sources of contamination being: soil, natural fertilisers, irrigation water, etc., during harvesting, processing, logistics, storage, and the use of FFs for their intended purpose in processing, distribution, trade [Zhechev 2024] and consumption.

The regulatory requirements for the safety of FFs have been regulated over the years in national standards and regulations, and currently, regulations with precisely defined requirements have been developed and are in force. Their content reflects requirements related to biological hazards, content of heavy metals and pesticides. Regulation (EC) No. 1441 reflects the microbiological criteria for food, presenting the criteria and requirements for biosafety of food, criteria for technological hygiene and the preparation of test samples [Regulation (EC) No. 1441/2007]. Regulation (EC) No. 333 presents the methods for sampling and analysis of heavy metals in food formulations. The requirements for maximum levels for certain contaminants, including lead and cadmium, in the composition of FFs are set out in Regulation (EC) No. 915/2023 [Regulation (EC) No. 333/2007; Commission Regulation (EU) No. 915/2023]. Regulation (EC) No. 396/2005 lays

down the principles on the need to ensure consumer protection and provisions on pesticide residues in food and feed [Regulation (EC) No. 396/2005].

At present, the requirements for FF safety are regulated in both national and European Union legislation (Tab. 2). There is another group of documents that present the methods used for studying FF safety indicators, such as the content of heavy metals, certain microorganisms and pesticides (Tab. 3).

Table 3. Documents presenting the methods for examining certain criteria, related to FFs

Normative document	Scope of action
BDS EN 15763:2010 Food products. Determination of traces of elements. Determination of arsenic, cadmium, mercury and lead in foodstuffs by inductively coupled plasma-mass spectrometry (ICP-MS) after pressure separation	Presents the methodology and principles for determining traces of heavy metals in the composition of foodstuffs
BDS EN 15662:2018 Foods of plant origin. Multimethod for determining pesticide residues by analysis based on gas chromatography (GC) and LC with subsequent extraction/separation with acetonitrile and purification by dispersing SPE-QuEChERS-method	Presents the methodology and principles for determining pesticide residues in foods of plant origin
BDS EN ISO 6579-1:2017/A1:2020 Microbiology of the food chain. Horizontal method for detection, enumeration and serological typing of *Salmonella*. Part 1: Detection of *Salmonella spp.* Amendment 1: Extension of the range of cultivation temperatures, change of Annex D status and adjustment in the composition of MSRV and SC (ISO 6579-1:2017/Amd 1:2020)	Presents the methodology for detecting *Salmonella* in food products
BDS EN ISO 11290-1:2017 Microbiology of the food chain. Horizontal method for detecting and enumerating *Listeria monocytogenes* and *Listeria spp.* Part 1: Detection method (ISO 11290-1:2017)	Presents the methodology for establishing *Listeria monocytogenes* and *Listeria spp.* in food products
BDS EN ISO 21528-2:2017 Microbiology of the food chain. Horizontal method for detecting and enumerating Enterobacteriaceae. Part 2: Colony enumeration technique (ISO 21528-2:2017, revised version from 2018-06-01)	Presents the methodology for determination *Enterobacteriaceae* in food products
BDS EN ISO 15213-1:2023 Microbiology of the food chain. Horizontal method for detecting and enumerating Clostridium spp. Part 1: Enumeration technique for sulfite-reducing colonies of Clostridium spp. (ISO 15213-1:2023)	Presents the methodology for detecting and enumerating sulfite-reducing *Clostridium spp.* in food products

Source: own study.

FF traders, in the modern legal framework, require their suppliers to prove the compliance of products with independently verifiable standards. One such standard is Global G.A.P., recognised by the Global Food Safety Initiative and ranks among the norms relating to voluntary certification, such as IFS Food (International Standard for Conformity Assessment of Products and Processes with regard to Food Safety and Quality), BRC (BRC Standard Certification by Third-Party Audit gives assurance to customers and partners about the quality and safety of food products), FSSC 22000 (Food Safety Standard under the Global Food Safety Initiative – GFSI) and others, ensuring the safe production of raw materials and food. The principles set out in the international standard are based on sustainable agriculture with minimal impact on the plant protection products used, with the aim of limiting residues in the

produced FFs. Through the application of the rules, in accordance with the requirements of the Global G.A.P. standard, it is ensured that agricultural products come from certified producers and are processed in a way that is safe for consumer health and environmental protection. The standard is divided into modules for the different products, such as fresh fruits and vegetables, crops for processing, production of planting material, and others. The individual chapters of the standard reflect requirements for planting material, soil management, irrigation and fertigation, harvesting and processing for production. The system generates reports and is supported by traders, manufacturers, suppliers and retail chains [GLOBAL G.A.P. 2025].

As a result of the carried-out studies, it can be summarised that during the analysis of the regulatory documents related to FFs safety, there are documents presenting the methodology and requirements for certain controlled biological and chemical contaminants that pose a risk to the health of consumers. The submitted contaminants should be controlled when establishing the safety of FFs, before being offered commercially to consumers or their use as raw materials in the processing industry.

The presented article shows that in the studied area of food safety, there are a lot of researchers who study and analyse different problems connected to foods, but no research works were found that present complex analyses of FF safety and the regulations controlling them. This is why the results and their analyses in the area of FF safety is of great importance and should be considered when establishing the safety of FFs that will be consumed by consumers, in the processing sector as a raw material for the production of preserves, for freezing, for drying, or for export.

5. CONCLUSIONS

The studies performed, the analysis of the data, and the results of the scientific studies carried out related to FF safety, factors affecting FF safety, and legislation in the field of FF safety give us the following important conclusions and generalisations:

- Factors that can be outlines, related to the production of save FFs with desirable and expected properties by consumers are: the influence of climatic conditions on the average annual yield of FFs, the development of industry in agricultural areas, the quality of water used for irrigation of farms, the number of chemical substances used for processing and fertilising perennial crops.
- Hazards specific to FF safety are biological, physical and chemical. Their sources have multiple origins: biological (microbial) contamination – sources are soil, water, and handling; physical contamination from things like soil, insects, or pieces of equipments; chemical contamination – sources such as heavy metals or radionuclides; agricultural chemicals such as insecticides, or fungicides;

packaging materials; cleaning/sanitising agents; certain toxins; and misuse of food chemicals.

- There are national, European and international regulations and policies outlining the legal framework in the field of food safety, and in particular FFs. Over the years, they have been constantly evolving and regularly updated, so it is necessary to keep stakeholders well informed with the latest updates in order to offer consumers and processors safe FFs.
- At present, the requirements for FF safety are regulated in national and European Union legislation. There are other documents that present the methods that should be used and that apply when investigating the safety of FFs, such as: content of heavy metals, detection of certain microorganisms, content of pesticides.
- The results presented by the regulations and the science were analysed, and a summary of the factors that influence FF safety, the indicators that should be analysed to determine FF safety were outlined and presented in this work.
- As a result of the studies of the regulatory requirements, it can be summarised that after the analysis of the regulations related to FF safety, there are specific documents presenting the methodology and requirements for certain controlled biological and chemical pollutants that pose a risk to the health of consumers that should be observed. The contaminants should be controlled when establishing FF safety before they are made commercially available to consumers and their use as raw materials in the processing industry.

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