

## MICROBIOLOGICAL SAFETY OF FOOD PRODUCTS IN REPUBLIC OF MACEDONIA FOR THE PERIOD 2001-2009

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### Abstract

This study aim is microbiological safety evaluation of food stuffs which were imported, produced or distributed to the consumers in Macedonia. Evaluation was performed according retrospective analysis of data for microbiological food safety from the annual reports for food safety in Macedonia, for the period from 2001 to 2009. Laboratories are using accredited methods and assessment was made according national legislation for microbiological criteria for food products. Data analysis was performed according origin and groups of the food products.

In 2001 8% of tested samples from domestic origin and market were microbiological unsafe, in 2005 5% were unsafe, and in 2009 the number of unsafe samples decreased to 3%. Percentage of unsafe samples from imported food products was in range from 0.3% to 1%. Most frequently isolated microorganisms were *E. coli*, *Staphylococcus aureus* coagulase positive, *Salmonella*, and most frequently contaminated products were milk and meat products, sweets and ice-cream.

Food products from domestic origin and market were in bigger percentage microbiological unsafe, compared to imported products, but with this study we found decreasing trend of microbiological unsafety. Food operators in the last years have improved their hygienic practice in processing, preparing and storage of food products.

**Key words:** Microbiological safety, food products, domestic production, microorganisms, food operators.

### 1. Introduction

Food and nutrition are major determinants of health, disease and productivity. Safe food and adequate nutrition affect the survival, well-being and functioning of individuals and societies, and should thus be prominent components of policies addressing

health, education, welfare, agriculture and fisheries, trade, environment and infrastructure (Lawley *et al.* [1] and Robertson *et al.* [2]). Recent trends in global production, processing, distribution and preparation of food are creating an increasing demand for food safety research in order to ensure a safer global supply of food. Foodborne diseases pose a considerable threat to human health and the economies of individuals, families and nations. Foodborne diseases, particularly those of zoonotic origin, represent a considerable public health burden and challenge. In some parts of South-eastern Europe, the prevalence of foodborne and waterborne diseases such as hepatitis A, salmonellosis, campylobacteriosis, trichinellosis and echinococcosis are of particular concern. Antimicrobial resistance is an increasing public health problem, which is partly related to non-human use of antimicrobial agents (FAO/OIE/WHO Expert Workshop [3]). There are different ways in which weather conditions can affect the incidence of foodborne diseases. Firstly, the prevalence of specific pathogenic organisms in animals may increase with higher temperatures. Secondly, the food cooling chain is harder to maintain in higher temperatures and prolonged warm weather increases the risk of mistakes in food handling. Thirdly, higher air temperatures may speed up the replication cycles of foodborne pathogenic organisms, which lead to a higher degree of contamination. Higher temperatures, in interaction with inadequate hygienic conditions, improper food handling, and lack of hand-washing, may lead to an increased number of epidemics resulting from consumption of unsafe food (Kendrovski *et al.* [4] and van Kreijl *et al.* [5]).

Infectious diseases in general, represent a health, social, economic and biological problem in Macedonia, but also throughout the world, especially in countries in transition but also in developed countries, too (Table 1) (European health [6]).

**Table 1. Disease burden from foodborne diseases in Southeast Europe, 2007**

Country of Southeast Europe	Foodborne diseases per 100 000	Salmonellosis cases per 100 000
Albania	62.72	9.39
Bosnia and Herzegovina	62.02	11.19
Bulgaria	n.a.	13.19
Croatia	25.1	126.5
Republic of Moldova	3.98	36.52
Romania	11.22	2.98
Serbia	22.55	30.64
Republic of Macedonia	10.47	10.42

From overall number of all diseases, contagious food-born disease related to microbiological contaminants has shown that they have sustainable trend, sometimes it looks like they have decreasing trend, but we still have outbreaks who made picks in morbidity rates. As in the past but also today, these diseases still represent health problem in Macedonia in general health, therefore they are specified as a priority of the Macedonian public health institutions (Institute of public health of Republic of Macedonia [7]).

National system for surveillance of food safety encompass inspection services which oversight import, production and trade of food products and authorized laboratories for testing food safety. Inspection services take samples from border, production facilities, market and deliver samples for testing food safety in authorized laboratories. Food producers have obligation according to law for testing safety of their products and control the food processing. Most of them don't have own laboratories, so they have to deliver samples in the laboratories in public health institutions. Food safety data are collected in Institute of public health in Department for food safety, each year data were processed and published as Report for food safety in Macedonia in Annual report for realization of preventive programs.

Aim of the study is to evaluate microbiological safety of food stuffs which are imported, produced or distributed to the consumers in Macedonia.

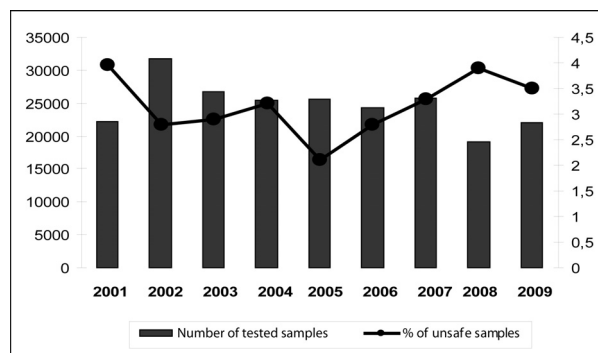
## 2. Materials and Methods

Data were obtained from laboratories involved in national food safety system. They used standard laboratory techniques for testing microbiological

safety and assessment was made according national legislation for microbiological criteria for food products (Official gazette of RM no 78/2008 [8] and European Commission [9]). Analysis was performed according to the origin of the products, imported and domestic production, and according to the groups of food products. We were looking for most frequently isolated microorganism also. The method is based on the use and analysis of epidemiological data. Descriptive component have been used by the epidemiological methods for the period from 2001 to 2009 year (Republic Institute for health protection [10-17]).

## 3. Results and Discussion

In 2001 year 22124 samples were tested for microbiological safety, in 2002 it was the biggest number 31572 samples, and after this year number of tested samples has shown decreasing trend. In 2008 year the lowest number (19065) of samples were tested for microbiological safety (Figure 1). The number of tested sample has shown decreasing trend, but percentage of unsafe samples has fluctuated from 3.9% in 2001 to 2.1% in 2005, and after this year percentage raised to 3,9% in 2008. In 2008 year we found the lowest number of tested samples, the biggest percentage of unsafe and the biggest morbidity rate for toxoinfection alimentaria and salmonelosis.



**Figure 1. Microbiological testing of food samples for the period 2001-2009**

Data analysis according to origin of the products has shown that number of tested samples of imported products has decreasing trend, especially after 2003 year receiving the lowest number in 2009, only 9361 samples. These samples were delivered mostly from inspection services. But number of tested samples of domestic products had sustainable number, approximately 11,100 samples with tendency to decrease in last two years (Table 2).

**Table 2. Microbiological safety of food products according their origin**

Year	Imported products		Products from domestic production and market	
	No of tested samples	No of unsafe samples/ percentage	No of tested samples	No of unsafe samples/ percentage
2001	10976	57/0.5	11148	819/7.3
2002	20618	75/ 0.4	11134	834/7.5
2003	15451	29/ 0.2	11224	760/6.7
2004	13841	57/ 0.4	11244	767/6.5
2005	15095	42/ 0.3	10461	500/ 5
2006	13992	145/ 1	10308	547/ 5.3
2007	14590	197/ 1.3	11124	666/ 6
2008	10216	127/ 1.2	9852	629/6.4
2009	9361	79/ 0.8	12489	711/ 5.7

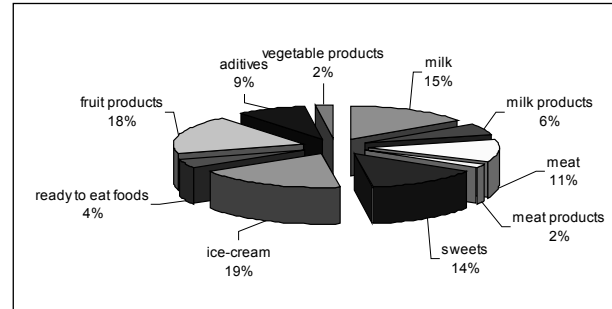
Percentage of microbiological unsafe samples of imported products was in range from 0.2 % in 2003 to 1.3% in 2007 and 1.2% in 2008 year. Percentage of unsafe samples of products from domestic production and market was on higher level, in range from 5% in 2005 to 7.5 % in 2002 year. We can say that microbiological unsafe domestic products had decreasing trend, but the percentage is many times higher than percentage of unsafe imported products.

For this period, domestic food producers, especially small and medium enterprises were in development process of heat-processing regimes and the subsequent control of the chill chain with aim to minimise the numbers of microorganisms present in pasteurised foods. In the last two years they prepared themselves for introducing HACCP system that was forthcoming legal obligation. They brought samples to laboratories to verify their processing and hygienic procedures. Most of them were not safe for consumption and they had to improve processing techniques and to enable strict adherence to chill chain especially during distribution, storage and sale.

Sometimes they missed strict adherence to cleaning regimes and the use of appropriate disinfectant substances in food-processing establishments and markets. Food products placed on the market were grouped in products from domestic origin where we can find products from domestic and import origin. Market is place where manipulation with food raised the possibility for food exposure to many contaminants.

During the analyzed period most frequently contaminated domestic products were milk, milk products, meat, meat products, ice cream and sweets. For example in 2008 we found microbiological

contaminated milk (raw and pasteurized) in 14% of tested samples, ice cream made in pastry shop was unsafe in 17%, sweets made in candy store with 13% meat with 10% (Figure 2). The same year were microbiological unsafe imported meat 5%, imported vegetable or fruit products 1.5%, milk products.

**Figure 2. Most frequently contaminated domestic products**

Most frequently isolated microorganisms were *Escherichia coli*, *Staphylococcus aureus coagulasa positive*, *Salmonella spp*, total number of viable bacteria. *Escherichia coli* was isolated in milk and milk products, meat products, soft drinks, ice cream and sweets, *Staphylococcus aureus* was isolated in ice cream, sweets, milk products etc. *Salmonella* was isolated in meat and meat products. National microbiological criteria for food safety were harmonized with European legislation in 2008 year, and with this regulation we introduce for the first time as obligation testing of *Listeria monocytogenes*, *Yersinia enterocolitica*, and *Campylobacter spp*. So far we don't have available and strong data base for these microorganisms.

Processing of primary products into foods placed on the market ensure opportunity for extremely reducing the number of pathogens. Milk pasteurization is the best example for effectively elimination a range of pathogens, but our results have shown that this process is not sufficiently efficient, because of lack of GMP or lack of monitoring on pasteurization. Good hygiene practice, good manufacturing practice and HACCP should be effective for food processing, but it seems that domestic producers have not developed yet these techniques and practices. The other problem is refrigeration of chilly and frozen foods and maintenance of chilly chain in process of distribution, storage and handling with milk and milk products, meat and meat products, ice cream and sweets. In recent years, efforts to ensure food safety have seen a shift in focus, from inspection of the end product to process control. Process control according to the HACCP system is intended to provide adequate management of all relevant risks. Additional microbiological criteria have been formulated for the purposes of verification of process control.

#### 4. Conclusions

- Food safety was and will be a topical issue attracting considerable attention from the media and public alike. Food born diseases related to food pathogens should remain public health priority and microbiological food safety should be top priority in the national strategy for food safety. Capacity building in small and medium food processing companies, for improvement and introduction of contemporary techniques and methods for food processing, storage and distribution is essential measure. This measure should be provided and performed by food operators, in collaboration with food safety authorities. Training and education of food operators for good hygiene practices is still essential with aim to avoid cross contamination and post contamination of final products.
- Imported products need further surveillance because of emergence of new, serious hazards in the food chain, the globalization of the food trade, demographic changes and an increase in vulnerable groups.
- Primary goal of public food safety authority is to ensure compliance with food safety legislation, which may best achievable by auditing quality control systems of food operators. Analytical control system should be used as support to food inspections made from both inspection services and food operators.

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