MEDICAL EVALUATION OF THE POTENTIAL BIOLOGICAL AND CHEMICAL DANGERS IN HIGH-RISK FOODS

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SUMMARY

Purpose: The current European legislation assigned the responsibility for food safety to the food producers and traders. In this aspect, the aim of the survey was to provide critical analysis of the functioning of Hazard Analysis and Critical Control Point (HACCP) systems in the production of foods, presenting certain risks of specific public health hazards - foodborne toxicoinfections, infections and intoxications, for chemical contamination and additives, etc.

The survey covered HACCP-systems and prerequisite programmes of 4 enterprises manufacturing confectionery products, ready-to-serve foods, pasteurized egg products, sterilized canned foods.

Material/methods: Monitoring and critical analysis of the In-plant control system and HACCP of four enterprises for the production of: confectionery products, ready-to-serve-dishes in public catering, sterilized canned foods, pasteurized egg semi-ready products

Results: The current experience has revealed major defects in hazard analysis, adequacy of critical points, corrective actions and verification procedures. The article contains recommendations and suggestions for improving the work of manufacturers and harmonizing relationships with regulatory authorities in the event of inconsistencies in production.

Conclusions: The authors concluded that a comprehensive medical evaluation of the HACCP systems was necessary for the prevention of foodborne diseases.

Keywords: Food safety, Confectionery products, Ready-to-serve dishes, Sterilized canned foods, Pasteurized egg products,

INTRODUCTION

Due to the enormous international interest in food safety, there has been a need to examine how the needs of society, the environment and health prevention have been addressed. This interest emphasizes whether society is sufficiently aware of the criteria by which the food chain and food production, in particular those at high risk to consumer health, are assessed and monitored. The main purpose of the application of HACCP in all enterprises where food is produced and/or offered to humans is to minimize the possibility of an outbreak of food poisoning, as well as to protect the consumer from chemical contaminants, additives, mycotoxins and other potentially hazardous substances. [1, 2, 3, 4, 5, 6, 7]. This systematic preventive-medical activity and the associated responsibilities are totally assigned to food business operators.

The aim of the study is a medical analysis of the production of high-risk food products and the HACCP systems currently in place.

Part of our reasoning for this study is to formulate these understandings and emphases and put them at the heart of the modern validation of the principles of production in order to release safe foods on the market.

MATERIAL AND METHODS

Monitoring and critical analysis of the In-plant control system and HACCP of four enterprises for the production of:

- Confectionery products;
- Ready-to-serve-dishes in public catering;
- Sterilized canned foods;
- Pasteurized egg semi-ready products. [4].

RESULTS

The analysis and health assessment of the food safety management systems and the available documentation in the production of different food risk groups showed the following results:

1. Confectionery products - The analysis covered confectionery products with high water content, such as pastry, cakes, rolls etc. On pastries basis garnished with glazes, couverture, milk containing ones, chocolate, cream and buttercreams. Stored food is kept in the refrigerator. Shelf life from 5 to 8 days. This carries a scientifically proven risk of foodborne illness, mainly salmonella and staphylococcal food poisoning. [8, 9]. (Fig. 1).

Fig. 1. The HACCP scope for confectionery products in the food chain

	Correctly identified critical control point		Incorrectly identified critical control point
	Control point		Additional critical control point identified by the analysis

CCP 1 (CCP – Critical Control Point) and CCP 3 are identified correctly – in the first case, it is the place of prevention of physical hazards and in the second – prevention of the reproduction of unwanted flora of the ready product (Table 1).

Table 1. For ready confectionery products in CCP 3.

Criteria	Limits				Periodicity
	<i>n</i> **	<i>c</i> ***	<i>m</i> ****	<i>M</i> *****	
<i>Coliforms</i> , CFU*/g	5	2	10	100	Monthly
<i>Coagulase-positive staphylococci</i> , CFU/g	5	2	10	100	Each trimester
<i>Salmonella spp.</i>	5	0	Not present in 25 g		Once per 6 months

* CFU - colony-forming unit; ***n* - number of units in the sample; ****c* - number of units above certain limits; *****m* – limits; ***** *M* – limits.

• The place of CCP 2 is not at the thermal processing of the bases but in the part of the chain containing the manual operations – garnishing and decoration of the products and cold preparation of the creams. Secondary contamination with unwanted microorganisms is possible (Table 2).

Table 2. Microbiological samples taken from the equipment, environment and staff responsible for garnishing and decorating that is done in direct contact with the confectionery products in CCP 2.

Sample type	Microbiological criteria	Limits	Periodicity
Working surfaces and equipment	<i>Coliforms</i>	Not admitted	Monthly
Staff hands	<i>Coliforms</i>	Not admitted	Once per 2 months
	<i>Coagulase-positive staphylococci</i>	Not admitted	
Working clothes	<i>Coliforms</i>	Not admitted	Once per 2 months
Upper respiratory tract (nose, throat)	<i>Coagulase-positive staphylococci</i>	Not admitted	Once per 6 months

2. Ready-to-serve dishes - There are two omissions in the technical documents and in HACCP as well. [8, 9, 10].
- The temperature at which the dishes are stored warm before the consumption is not set (Fig. 2).

Fig. 2. The HACCP and outlined CP for these ready-to-serve meals.

- The other omission is the lack of adequate microbiological requirements for ready-to-serve production (Table 3).

Table 3. Ready-to-serve meals (soups, cooked dishes, baked products) at CCP 3.

Criteria	Limits				Periodicity
	<i>n</i> **	<i>c</i> ***	<i>m</i> ****	<i>M</i> *****	
<i>Escherichia coli</i> , CFU*/g	5	2	10	100	Monthly
<i>Bacillus cereus</i> , CFU/g	5	2	10	100	Once per 3 months
<i>Sulfite reducing clostridia</i> , CFU/g	5	2	10	100	Once per 6 months
<i>Listeria monocytogenes</i>	5	0	Not present in 25 g		Once per 6 months
<i>Salmonella spp.</i>	5	0	Not present in 25 g		Once per 6 months

* CFU - colony-forming unit ; ***n* - number of units in the sample; ****c* - number of units above certain limits; **** *m* – limits; ***** *M* – limits.

3. Sterilized canned foods - There is overwhelming scientific evidence for a major biological risk in the manufacture of sterilized cans. They are anaerobic non-spore-forming bacteria, especially *Clostridium botulinum*. This helps to clearly define the main CCP - sterilization. The products considered and analyzed by us are sterilized multicomponent canned vegetables. [11, 12].

- The HACCP team used a “decision tree” to identify three CPs (CP – Critical Point) and one CCP. (Fig. 3).

Fig. 3. HACCP scope in the food chain (Sterilizes green peas).

• The real assessment is given by the microbiological control of industrial sterility, which lies on in the basis of the recommended verification procedures. A check of CCP 1 (sterilization):

Once per month:

- Mesophilic aerobic and facultative anaerobic microorganisms – non spore forming and vegetative forms of spore forming ones;
- Spores of mesophilic aerobic and facultative anaerobic microorganisms;
- Mesophilic anaerobic microorganisms;
- Molds and yeasts.

Once every three months:

- Thermophilic microorganisms – vegetative and spore forms.

4. Pasteurized egg products - Egg melange, egg yolk and egg white are produced here. These are semi-finished products that are used mainly in the production of confectionery goods at catering establishments, bakeries, etc. These semi-finished products hide the risk of biological contamination - salmonella, listeria, etc. [13, 14].

• Heat treatment is used to remove bacterial contamination of the raw egg mass. It is in the low pasteurization range of 57 °C to 67 °C at a flow rate of 1500 to 3000 l / h.

• Scientifically based and correctly determined $\bar{N}$ during production. A study of the documentation revealed one major drawback - an inconclusive check of pasteurization and storage (Fig. 4).

Fig. 4. The Technological process and CCP for pasteurized egg products

• The results and proposals from our finding were presented to the business operators. Verification tests in HACCP for pasteurized egg products at CCP 2:

Once every three months:

- Total count of mesophilic aerobic and facultative anaerobic microorganisms - <50 000 cfu*/g;
- Enterobacteriaceae - <10 cfu/g;
- Molds and yeasts - <10 cfu/g;
- Salmonella spp. - n**=5; c***=0; m**** – absence in 25,0 g of the product.

* CFU - colony-forming unit;

**n - number of units in the sample;

***c - number of units above certain limits;

**** m – limits.

DISCUSSION

In the case of the confectionary products after the manual operations, there is practically no factor to eliminate or reduce to a safe level the introduction of microflora, and as a result of the analysis, we propose to place CCP 2 in the manual operations in the baking to remain only as CP.

As far as ready-to-serve dishes are concerned, the temperature at which the dishes are stored should be not lower than 65 °C. Lower temperatures, such as 30 °C - 45 °C, would play the role of a thermostat for mesophilic and thermophilic microorganisms, place to reproduce and accumulate high infectious doses. This is the main cause of foodborne disease outbreaks in food service establishments, especially food service establishments. The definition of CCP 4 at this stage is required (Fig. 2). On the other hand, the criteria for the three types of food production are minimal and do not take into account real hazards. Based on the results of the analysis, we recommend the following microbiological criteria for the safety and hygiene of processes on the basis of which control and verification should be carried out (Table 3).

Sterilized can foods processes have little to no improvement improve to make due to the clear vision and outline of the process of sterilization, which eliminates the risk of the dominating biohazards.

In the case of pasteurized egg products, the existing risk of microbial contamination must be taken into account.

The heat treatment that is carried out preserves their properties and prevents protein denaturation but does not guarantee the absence of epidemiological risk. With this in mind, after analysis, we propose appropriate checks corresponding to the degree of risk (Fig. 4). At the production sites analyzed by us, potential chemical contaminants are regulated through the incoming control of the received materials, which are possible carriers. The proposed checks and procedures for controlling the risks at the sites, as well as the documentation reviews performed, are provided to the HACCP teams to optimize risk management.

CONCLUSIONS

The analyzed production sites and the products manufactured there are classified as high risk. Produced food is a potential source of bacterial contamination and poses a potential health risk to consumers.

The food safety management systems developed by the teams comply with the requirements of European and national legislation.

Biological hazards are dominant in four types of production. They can be caused by primary or secondary contamination and can be a potential cause of undesirable consequences in terms of both the quality and safety of the finished product.

A drawback in the development of HACCP is the misidentification of CP and CCP as a result of underestimation of biological hazards.

The weak point of the presented food safety management systems is the insufficiently reliable system for checking the effectiveness of the processes.

The application of HACCP systems, especially for foods with a high potential risk of bacterial foodborne diseases, requires consultation with a healthcare professional. A medical hazard assessment in industrially produced food is mandatory.

Abbreviations

HACCP - Hazard Analysis and Critical Control Point

CCP – Critical Control Point

CP – Critical Point

CFU - colony-forming unit

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