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*Vorobiov L.Y., Shevchenko O.Y., Kuzmin O.V., Romanyuk O.N., Antonenko A.V. et al.*

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**KAPITEL 5 / CHAPTER 5<sup>5</sup>**  
**FOOD SAFETY AND QUALITY MANAGEMENT SYSTEM IN THE RESTAURANT INDUSTRY**

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## **Introduction**

The organization of food services in restaurant establishments must comply with the requirements for food safety and quality. In today's highly competitive market for restaurant services, the quality and safety of food products are key factors that determine the competitiveness of a restaurant, increase the number of potential customers, and contribute to the profitability of the business. Ensuring the production of high-quality and safe products is possible only if the current food legislation of Ukraine is followed and the HACCP system is implemented in restaurant establishments [1].

Adherence to HACCP principles allows for the optimization of technological and auxiliary processes, reduces the risks of producing unsafe products by identifying non-conformities at early stages of production, and ensures product safety through control of all stages of the food chain. The food safety and quality management system in the restaurant industry should be based on preventive methods that guarantee stable production of safe and high-quality products for consumers.

Restaurant establishments offer a wide range of products capable of satisfying the tastes and preferences of any customer. Broths, which are intended for direct consumption and further processing, add a special taste and aroma to the dishes [2].

Broth is a liquid that contains extractive substances obtained by boiling food bones (beef, pork) of the first category, bone residue (beef, pork, chicken), or heads and feet (chickens, chicks, broiler chickens) in water [2].

The quality of broths is formed at the development stage (by creating technological documentation), ensured during production, and maintained during storage and sale to the consumer, with strict adherence to the requirements set forth in

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regulatory, technical, and technological documentation. To consistently ensure the quality of broths, it is important to follow the production technology, use high-quality raw materials, and have the necessary technical equipment and qualified personnel who strictly adhere to sanitary and hygiene standards and regulations.

### **5.1. Defining safety and quality requirements for broths**

The development of a prospective plan for the implementation of the HACCP system for broth production will be carried out for a food service establishment. The basis for the introduction of the HACCP system [1, 3], which encourages producers to focus on critical technological processes and production conditions that are important for food safety [4, 5], is the prerequisite programs [6, 7]. The prerequisite programs contain information regarding the objectives and scope of application, control procedures, responsible persons, the order of actions, their correction and monitoring, as well as a list of regulatory documents on which the prerequisite programs were developed.

In accordance with regulatory requirements, the prerequisite programs provide for [6]: proper planning of all premises of the food service establishment to prevent cross-contamination; maintaining the proper condition of the premises, equipment maintenance, and protection of food products from contamination; adherence to hygiene rules by the staff; proper cleaning of premises, washing and disinfection of tools, communication systems, kitchen utensils, and equipment; regular pest control measures; proper transportation and storage of raw materials; disposal of production waste; compliance with safety requirements for water, raw materials, and materials that come into contact with food products; proper storage and use of toxic substances; control of suppliers and technological processes; ensuring consumer awareness through food labeling, etc.

To implement the HACCP system in a food service establishment, the manager must form a safety team (HACCP) consisting of 5-7 specialists with experience in this



field. The team should also include consultants who possess knowledge and skills in implementing the HACCP system in food service establishments. It is recommended to include in the team: the production manager, technologist, procurement manager, head chef, maître d'hôtel, and a public health risk consultant.

Functions of the HACCP safety team leader of the food service establishment:

- ensuring the development, implementation, and maintenance of the HACCP system in accordance with the requirements [3];
- organizing the work of the HACCP safety team;
- reporting to the management of the establishment on the functioning of the system and the need for its improvement.

Functions of the HACCP team members of the food service establishment:

- conducting training for personnel on the implementation of the HACCP system, familiarization with the prerequisite programs, and performing the functions defined for team members in these programs;
- keeping documentation related to the implementation of the HACCP system;
- controlling the quality and safety of food products and raw materials;
- monitoring the production technology of the food service establishment;
- controlling the sanitary condition of the establishment's premises;
- ensuring personnel compliance with personal hygiene rules, their health status, and timely medical check-ups;
- monitoring the conditions of transportation, reception, storage, and distribution of raw materials and containers;
- monitoring the conditions and shelf life of raw materials and finished products;
- ensuring metrological control of production processes;
- controlling the output, quality, and safety of dishes.

Depending on the composition, production technology, and thermal state, broths are produced in the following types [2]: liquid in a cooled or hot state; concentrated in a cooled or hot state; dry; dry broth (protein) semi-finished product.

According to organoleptic characteristics, liquid broths must comply with the requirements presented in Table 1.1.

**Table 1.1** – Organoleptic indicators of liquid broths [2]

Indicator	Characteristic	
	Liquid broth	
	Hot	Chilled
Appearance	Homogeneous liquid	A homogeneous jelly-like mass
Color	From gray with a yellowish tint to yellow	
Taste and smell	Inherent in broth with or without the aroma of vegetables. Without extraneous taste and smell	

In Table 1.2, the physicochemical indicators of liquid broths are presented.

**Table 1.2** – Physicochemical indicators of liquid broths [2]

Indicator	Characteristic	
	Liquid broth	
	Hot	Chilled
Transparency	Slightly turbid	
Mass fraction of dry substances, %, not less than	2	3
Moisture content, %, not more than	–	
Mass fraction of fat, %	From 0.8 to 1.2	Not more than 3,0
Mass fraction of protein, %, not less than	–	
Mass fraction of table salt, %, not more than	1	
Temperature at the time of release for sale, °C	Not less than 80	From 0 to 4

Tables 1.3-1.5 present the safety indicators of liquid broths.

**Table 1.3** – Microbiological indicators of liquid broths [2]

Indicator	Characteristic	
	Liquid broth	
	Hot	Chilled
The number of mesophilic aerobic and facultative anaerobic microorganisms, CFU per 1 g of product	5·10 <sup>4</sup>	
Coliform bacteria, per 1 cm <sup>3</sup> of product	10	
Sulfite-reducing clostridia per 1 g of product, CFU, no more than	–	
Pathogenic microorganisms, including Salmonella bacteria, in 25 g of product	Not allowed	

The content of aflatoxin B1, hormonal drugs, and pesticides in broths must not exceed permissible levels [2].

**Table 1.4** – Maximum permissible levels of toxic elements in liquid broths [2]

Name of the toxic element	Maximum permissible levels	
	Liquid broth	
	Hot	Chilled
Lead, mg/kg	0,50	
Cadmium, mg/kg	0,05	
Mercury, mg/kg	0,03	
Copper, mg/kg	5,00	
Zinc, mg/kg	70,00	
Arsenic, mg/kg	0,10	

**Table 1.5** – Radionuclide content in liquid broths [2]

Name of the toxic element	Maximum permissible levels	
	Liquid broth	
	Hot	Chilled
<sup>137</sup> Cs, Bq/kg	200	
<sup>90</sup> Sr, Bq/kg	20	

In the restaurant establishment, a series of measures have been identified and implemented to comply with the current legislation of Ukraine to ensure the production of high-quality and safe liquid broths. In particular, an analysis of liquid broths was conducted, and their organoleptic, physicochemical, and safety indicators (microbiological indicators, toxic elements, radionuclides, mycotoxins, hormonal drugs, pesticides) were described, for which a quality and safety monitoring system is being developed.

## 5.2. Safety and quality management system for broths at production stages

In accordance with HACCP principles, a hazard analysis has been conducted at each stage of liquid broth production. This process involves identifying and assessing potential hazards that may affect the safety of the product for consumers [6]. The following hazards may arise during broth production:

- biological: bacteria, parasites, viruses, or other microorganisms;
- physical: glass, metal, plastic, film, bones, stones, threads, rubber, jewelry, nails,



paint, plaster, hair, paper, bristles, and similar objects;

– chemical: mycotoxins, hormonal drugs, pesticides, herbicides, plant growth regulators, antibiotics, toxic elements (lead, cadmium, mercury, copper, zinc, arsenic), radionuclides, cleaning and disinfecting agents, lubricants, preservatives, acids, food additives, etc.;

– allergens: cereals containing gluten; peanuts, nuts, sesame seeds, and their products; celery, mustard, and their products; eggs and egg products; milk and dairy products; fish, crustaceans, mollusks, and their products; soybeans, lupin, and their products; sulfur dioxide and sulfites.

The assessment of hazards should be conducted using the methodology [6], presented in Table 1.6.

**Table 1.6** – Methodology for hazard assessment [6]

	Significance of harmful impact $C$			
	$K = B \cdot C$	low ( $C = 1$ )	average ( $C = 2$ )	high ( $C = 3$ )
The probability of occurrence of a dangerous factor $B$	low ( $B = 0,1$ )	$K = 0,1$ (-)	$K = 0,2$ (-)	$K = 0,3$ (-)
	average ( $B = 0,2$ )	$K = 0,2$ (-)	$K = 0,4$ (-)	$K = 0,6$ (+)
	high ( $B = 0,3$ )	$K = 0,3$ (-)	$K = 0,6$ (+)	$K = 0,9$ (+)

If the calculated coefficient  $K > 0.6$ , the hazard is significant (in Table 1.6: (-) insignificant; (+) significant).

In a restaurant establishment, mandatory control must include allergens that may be part of the broth recipes.

To prevent secondary contamination of allergen-free products with allergens, the control procedure should include:

1. Label verification. All substances or products used as ingredients that may cause allergic reactions must be listed in the product composition regardless of their quantity.

2. Thorough packaging inspection. The integrity of consumer packaging and transport containers must be checked, as well as the absence of traces of allergens



(spills, breakage). It is prohibited to accept food raw materials with signs of decay and mold.

Proper storage compliance. Products that may cause allergic reactions should be stored according to the recommended storage conditions.

Allergen storage requirements:

- the premises where allergens are stored must be appropriately labeled;
- flour should be stored separately from other products on the lower shelf;
- eggs, egg products, and dairy products should be stored in refrigerated chambers separately from other products;
- frozen fish and fish products should also be stored separately in refrigerated chambers;
- nuts and nut products should be stored separately from other products.

A monitoring system has been developed to control the presence of food allergens in broths, which includes procedures for controlling, storing allergens, and informing consumers about their presence in the finished product.

### **5.3. Monitoring system for sanitary and hygienic conditions in broths production**

To ensure continuous and effective control of hazardous factors that threaten food products, pests, and other agents that can contaminate food, it is necessary to implement a monitoring system in a food service establishment that will allow [8]:

- ensuring adequate and proper maintenance and cleanliness of the establishment's premises;
- controlling pests;
- properly managing waste and monitoring the effectiveness of procedures aimed at maintaining and conducting sanitary and preventive measures.

The environmental monitoring system involves the implementation of the following documents in the establishment:

- a prerequisite program that establishes requirements for the condition of



premises, equipment, repair work, equipment maintenance, calibration, and measures to protect food from contamination and foreign substances;

– a prerequisite program that defines requirements for the planning and condition of utilities—ventilation, plumbing, electrical supply, gas supply, lighting;

– a prerequisite program that ensures the safety of water, ice, steam, auxiliary materials for food processing, items, and materials that come into contact with food products;

– a prerequisite program that regulates the cleanliness of surfaces (cleaning, washing, and disinfection procedures for production, auxiliary, and household premises, and other surfaces);

– a prerequisite program to protect products from foreign substances, manage production waste and garbage, and their collection and removal from the establishment's territory;

– a prerequisite program that establishes pest control, identification of pest types, prevention of their appearance, preventive measures, and control methods;

– a prerequisite program for the storage and use of toxic compounds and substances;

– a plan for cleaning and disinfecting production areas, indicating the frequency of treatments;

– an instruction for sanitary treatment of premises, equipment, and inventory;

– a schedule for sanitary days and general cleaning of premises;

– a list of cleaning and disinfecting agents (instructions for use, documentation confirming their quality and safety);

– a log for preparing working solutions of cleaning agents, monitoring disinfection quality, and instructions for preparing working solutions;

– a log for controlling the concentrations of cleaning and disinfecting agents;

– a log of the operation of specialized disinfection equipment (sterilizers, bactericidal lamps, etc.);

– a contract for disinfection work.

The implementation of these prerequisite programs will create a comprehensive



approach to maintaining sanitary and hygienic conditions and ensure the production of high-quality and safe products.

According to sanitary and hygienic requirements, the layout of the food service establishment premises ensures the consistency and continuity of technological processes, as well as the optimal route of raw materials from the moment of receipt to the release of finished products. The establishment excludes the crossing of raw material, semi-finished product, and finished product flows, as well as dirty and clean dishes.

To prevent food contamination, the establishment ensures appropriate conditions, taking into account technological processes, the range of food products, and the assessment of contamination risks. The production and storage premises for food products must be kept in proper condition. The surfaces of walls and floors should be made of waterproof materials that prevent the accumulation of dirt, mold growth, and condensation, and facilitate cleaning, washing, and disinfection. The interior finishes of the premises should not have unnecessary architectural details to avoid dust accumulation.

The ceiling and suspended elements (pipes, cables, lamps, etc.) must be installed in such a way as to minimize dirt accumulation, paint peeling, condensation, mold growth, and facilitate cleaning and prevent food contamination. Doors and windows must be free of cracks, paint peeling, and corrosion, and must be easy to clean and disinfect [6].

The establishment's technological equipment should be used according to specifications and have a maintenance system. Internal calibration schedules are introduced for equipment critical to food safety [6].

Water supply to the establishment must come from a centralized network, and drinking water must meet requirements [9]. Since the microclimate in the production area affects working conditions and staff health [10, 11], the establishment's sewage and ventilation systems must meet sanitary requirements [10]. Lighting in the premises of the food service establishment must comply with standards [11], and noise levels should not exceed 70 dBA, according to current sanitary norms.



The establishment should have a procedure for storing and labeling chemical substances used for cleaning and sanitation. Chemicals, containers, and bottles should be properly labeled and stored at a safe distance from food products to avoid the risk of cross-contamination.

## **Conclusions**

A food safety and quality management system has been developed for the food service establishment, which complies with the legislation of Ukraine to ensure the production of high-quality and safe food products [12-15]. This system provides hazard analysis and control at all stages of liquid broth production within the establishment. Thanks to the implementation of this system, the preparation of dishes in the establishment becomes a safe process, provided that all sanitary and hygienic standards are followed by the staff. As a result, customers gain confidence in the safety of the dishes, which contributes to increased trust in the establishment and improves its rating, providing a significant marketing advantage in the highly competitive restaurant business.

To ensure the production of safe broths, an HACCP plan has been developed, along with a recommended list of HACCP system documents that should be available in the food service establishment. These measures, in combination, will enable the implementation of an effective food safety and quality management system within the establishment.