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EFFECT OF CRITICAL CONTROL POINTS ON MICROBIOLOGICAL SAFETY AND ORGANOLEPTIC CHARACTERISTICS OF «PHILADELPHIA» SUSHI

Abstract: *The article presents the results of a study aimed at enhancing the safety and quality of a popular foodservice product – Philadelphia sushi. The relevance of this study is driven by the expanding production and consumption of Japanese cuisine products, as well as the associated microbiological hazards arising from the use of perishable ingredients. The main objective of the work was to develop and substantiate a structure for managing the safety of food products based on HACCP principles, with a focus on the critical control points (CCPs) of the production process.*

The study employed methods of hazard analysis, CCP identification using a «decision tree», as well as the establishment of critical limits and corrective actions. A thorough analysis of the technological cycle, which included 16 stages and 54 operations, initially identified 11 CCPs.

For practical implementation, the system was optimized to four of the most important control points: acceptance of raw materials, storage of rice and fish semi-finished products, the manufacturing process, and storage of the finished product. For each CCP, strict critical limits for temperature, storage duration, and microbiological indicators were defined, and monitoring procedures were developed.

The scientific and practical significance of the study lies in the development of an adapted and effective HACCP plan, the implementation of which substantially reduces microbiological risks, ensures consistent quality and safety of the finished dish, and proves to be economically viable for foodservice enterprises.

Key words: *HACCP, critical control points, food safety, microbiological risk, organoleptic properties, Philadelphia sushi, technological process, catering.*

Introduction

The global expansion of Japanese cuisine, particularly in Kazakhstan, has led to a significant increase in the production and consumption of sushi products, including the «Philadelphia» roll. This dish is characterized by the use of high-risk, perishable ingredients such as raw fish, cream cheese, and cooked rice, which create a potential medium for the growth of pathogenic microorganisms like Salmonella spp., Listeria monocytogenes, and Staphylococcus aureus [1, 2].

The HACCP (Hazard Analysis and Critical Control Points) system is an internationally recognized proactive approach to ensuring food safety [3, 4]. Previous research, including the work of Koksharov A.A. [5], has demonstrated the applicability of HACCP principles to Japanese cuisine, identifying key hazards at various production stages. Furthermore, international guidelines provide frameworks for HACCP plans for specific ingredients like sushi rice, emphasizing critical measures such as temperature control [6].

However, a critical review of the literature reveals a significant research gap. While many studies and guidelines focus on general HACCP principles or specific ingredients, there is a lack of comprehensive, evidence-based HACCP plans tailored for complex, multi-component ready-to-eat products like "Philadelphia" sushi. Many existing plans are either too generalized or excessively complex, containing an impractical number of Critical Control Points (CCPs) for small and medium-sized catering enterprises to manage effectively [7, 8]. Crucially, many proposed plans lack experimental verification through microbiological analysis to validate the identified hazards and the effectiveness of the proposed control measures.

This identifies the research problem: the absence of a scientifically substantiated and practically optimized HACCP plan for «Philadelphia» sushi that is validated by microbiological data.

The scientific novelty of this work is the development of an optimized HACCP plan based on a detailed hazard analysis and verified by comparative microbiological testing of raw materials from establishments with different levels of HACCP implementation.

The hypothesis of this study is that the optimization of the HACCP system, focusing on a minimized set of the most significant CCPs, will be effective in controlling microbiological risks, a claim supported by empirical microbiological evidence.

The aim of this work is to develop, substantiate, and validate a HACCP plan for «Philadelphia» sushi, focused on a minimized set of critical control points, with validation provided through comparative microbiological analysis.

Research Methods

This comprehensive study was conducted from February to November 2025 and combined theoretical HACCP plan development with practical microbiological verification. The research was structured in two phases:

Systematic development of a HACCP plan for «Philadelphia» sushi production.

Empirical validation through microbiological analysis of raw materials according to Technical Regulation TR CU 021/2011 «On Food Safety».

Microbiological Analysis Methods

Microbiological analysis was performed in accordance with Technical Regulation TR CU 021/2011 «On Food Safety», Appendix 2, Table 1, paragraph 1.2. The testing was conducted at the accredited Research Laboratory for Food Quality and Safety Assessment of JSC «Almaty Technological University» using the following standardized methods:

For salmon samples analysis:

Total Aerobic Mesophilic Count (TAMC): GOST 10444.15-94 (Food products. Methods for determination of quantity of mesophilic aerobic and facultative anaerobic microorganisms)

Coliform Bacteria: GOST 31747-2012 (Food products. Methods for detection and quantity determination of coliforms)

Pathogenic microorganisms, including Salmonella: GOST 31659-2012 (Food products. Method for the detection of Salmonella spp.)

Listeria monocytogenes: GOST 32031-2012 (Food products. Methods for the detection of Listeria monocytogenes)

Hazard Analysis and CCP Determination

The identification of Critical Control Points was performed using the Codex Alimentarius decision tree methodology. The hazard analysis included:

Biological hazards: Assessment of microbiological contamination risks according to TR CU 021/2011 requirements

Chemical hazards: Analysis of potential chemical contaminants based on raw material specifications

Physical hazards: Identification of physical contaminants through process analysis

Sampling and Testing Conditions

Testing was conducted under standardized laboratory conditions:

Temperature: +21°C ± 2°C

Relative humidity: 64% ± 5%

Sample preparation and analysis followed GOST ISO 7218-2015 requirements

Critical Limit Establishment

Critical limits were established based on:

TR CU 021/2011 regulatory requirements

Sanitary Rules and Norms (SanPiN)

Technical specifications of the manufacturing enterprise

Scientifically validated data on microbial growth kinetics

All monitoring procedures and corrective actions were developed in accordance with ST RK 1179-2003 «HACCP System. Requirements».

Technological cycle of preparing «Philadelphia» sushi

The production of Philadelphia sushi is defined by a comprehensive technological cycle, encompassing a sequence of meticulously designed processes and operations, as detailed in the flowchart presented in Figure 1.

Figure 1. Flowchart of the technological process for preparing «Philadelphia» sushi, showing 16 main processes and 54 technological operations. The diagram illustrates the complete production cycle from raw material acceptance to finished product serving, with particular emphasis on critical control points. Key stages include: 1.1 – Raw material acceptance; 1.2 – Storage under two temperature regimes (0 to +25°C and +2 to +6°C); 1.4 – Preparation of raw materials (1.4.1 – Sugar/salt unpacking; 1.4.2 – Rice grain unpacking; 1.4.3 – Fish unpacking and ice removal; 1.4.4 – Nori unpacking; 1.4.5 – Cucumber unpacking; 1.4.6 – Cream cheese unpacking; 1.4.7 – Mitsukan vinegar unpacking; 1.4.8 – Pickled ginger unpacking; 1.4.9 – Wasabi powder unpacking; 1.4.10 –

Soy concentrate unpacking); 1.5 – Semi-finished product preparation; 1.6 – Sushi manufacturing; 1.7 – Dish decoration; 1.8 – Finished product storage at +2 to +6°C; 1.9 – Product serving. Note: The flowchart was developed by the authors specifically for this study.

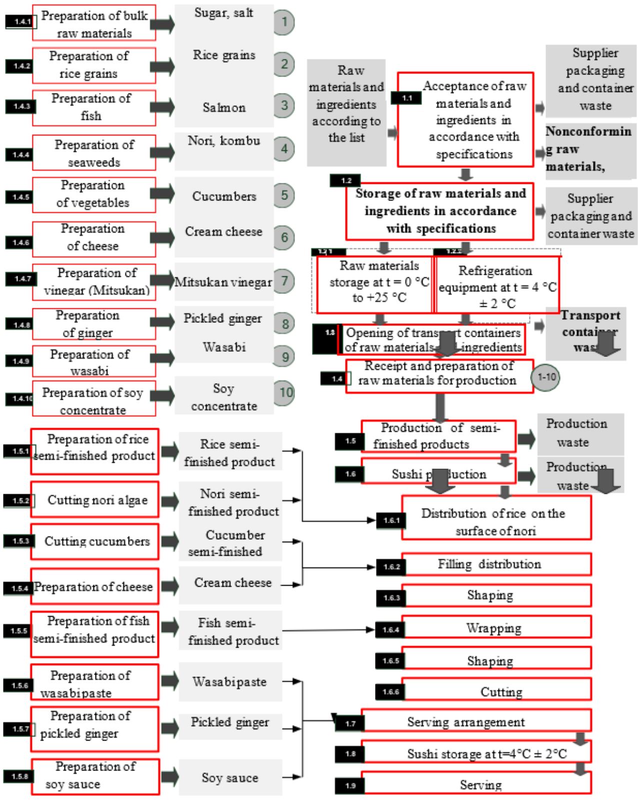

Figure 1 – Flowchart of the technology for preparing Philadelphia sushi roll

Note: the flowchart includes standard technological operations adapted by the authors for the specific product. Source: developed by the authors.

For a detailed examination of the Philadelphia sushi production process, a comprehensive flowchart was developed (Figure 1), providing a systematic overview of all stages under direct control of the catering establishment. Given that public catering organizations typically offer diverse menus, the flowchart was specifically designed for Philadelphia sushi and its corresponding semi-finished products to ensure precise hazard analysis.

The technological cycle encompasses 16 distinct processes and 54 technological operations, systematically organized as follows:

The initial process (1.1) involves the acceptance of raw materials and ingredients, requiring qualitative and quantitative verification against established specifications. This is followed by storage processes (1.2) under two temperature regimes: ambient storage (0 to +25°C) and refrigerated storage (+2 to +6°C).

Process 1.3 covers the opening of transport containers, while Process 1.4 details the preparation of specific ingredients:

1.4.1: Unpacking of bulk ingredients (sugar, salt)
1.4.2: Unpacking of rice grains
1.4.3: Unpacking of fish with ice chip removal
1.4.4: Unpacking of nori seaweed
1.4.5: Unpacking of cucumbers
1.4.6: Unpacking of cream cheese
1.4.7: Unpacking of Mitsukan vinegar
1.4.8: Unpacking of pickled ginger
1.4.9: Unpacking of wasabi powder
1.4.10: Unpacking of soy concentrate

The semi-finished product preparation stage (1.5) includes seven sub-processes:

Rice preparation involving mixing, heating, boiling, and cooling of seasoning components (1.5.1.a.1-4), followed by sieving, washing, boiling, and steaming rice at ≥65°C (1.5.1.b.1-4), culminating in mixing and storage at ≥60°C (1.5.1.c.1-2)

Nori sheet preparation through cutting and ambient storage (1.5.2.1-2)

Cucumber preparation involving cleaning, sorting, washing, trimming, cutting, and refrigerated storage (1.5.3.1-6)

Cream cheese preparation for operational convenience (1.5.4.1-2)

Fish processing through washing, scaling, trimming, filleting, slicing, and refrigerated storage (1.5.5.1-6)

Wasabi paste preparation via water heating, cooling, mixing, and refrigeration (1.5.6.1-4)

Ginger preparation through marinade separation and refrigeration (1.5.7.1-2)

Soy sauce preparation through dilution, heating, cooling, and refrigeration (1.5.8.1-4)

The manufacturing process (1.6) comprises:

1.6.1: Rice spreading on nori

1.6.2: Filling application with cheese and cucumber

1.6.3: Roll formation

1.6.4: Fish wrapping

1.6.5: Final shaping

1.6.6: Portion cutting

The final stages include dish decoration (1.7), refrigerated storage at +2 to +6°C (1.8), and serving (1.9). This detailed flowchart serves as the foundation for systematic hazard analysis and CCP identification throughout the production cycle.

Identification and determination of Critical Control Points

A Critical Control Point (CCP) is defined as a step at which control can be applied and is essential to prevent, eliminate, or reduce a food safety hazard to an acceptable level. The establishment of CCPs is crucial for managing potential biological, chemical, or physical hazards that could cause illness or injury if not properly controlled. The accurate determination of CCPs within the process flow relies fundamentally on information obtained through comprehensive hazard analysis.

The identification of CCPs was conducted using a systematic two-stage approach. The initial stage employed the Codex Alimentarius "Decision Tree" methodology (Figure 2) to evaluate each process step against four key questions:

Are control measures in place for the identified hazard?

Does this step eliminate or reduce the hazard to an acceptable level?

Could contamination occur at or increase to unacceptable levels?

Will a subsequent step eliminate or reduce the hazard to an acceptable level?

Figure 2. Decision tree for Critical Control Point identification (Codex Alimentarius, 2023).

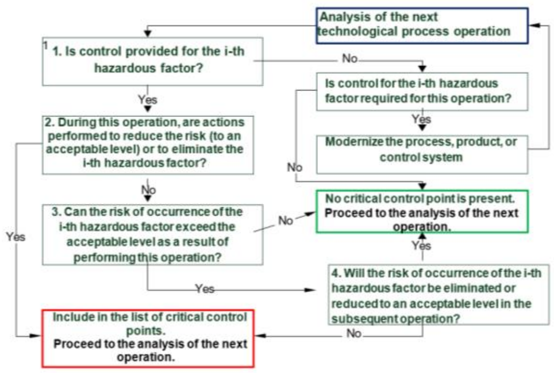

Figure 2 – Decision tree for CCP identification

Source: developed by the authors based on the Codex Alimentarius methodology [3]

The systematic application of this decision tree to all 54 technological operations initially identified 11 potential Critical Control Points, each addressing specific hazard factors as detailed in Table 1. The hazard analysis considered:

Biological hazards (pathogenic microorganisms, microbial growth)

Chemical hazards (allergens, contaminants, cleaning agents)

Physical hazards (foreign materials, metal fragments)

Following the initial identification, a practical assessment was conducted to optimize the HACCP plan for implementation in catering establishments. This evaluation considered the feasibility of monitoring, criticality of hazards, and available resources, resulting in the consolidation to four essential CCPs that maintain food safety effectiveness while ensuring practical implementability.

The application of the decision tree method resulted in the identification of 11 Critical Control Points (CCPs), each corresponding to a specific hazard factor, as detailed in Table 1. Based on the application of this method, 11 critical control points were identified for each individually considered hazard factor (Table 1).

Table 1 – Identified CCPs for each individually considered factor

Operation Name	Hazard type	Is control for the i-th hazard provided in this operation?	Does this operation perform actions to reduce risk (to an acceptable level) or eliminate the i-th hazard?	Can the risk of the i-th hazard exceed an acceptable level after this operation?	Will the risk of the i-th hazard be eliminated or reduced to an acceptable level in a subsequent operation?	CCP
1.1 Receipt of Raw Materials	Ch	Yes	No	Yes	No	CCP № 1
	Ph	Yes	No	Yes	No	CCP №2
	M	Yes	No	Yes	No	CCP №3
1.2.2 Storage of raw materials at +2 to +6ºC	M	Yes	Yes	-	-	CCP №4
1.5.1.b.1 Sieving of rice grits	Ph	Yes	Yes	-	-	CCP №5
1.5.1.c.2 Storage of rice semi-finished product at ≥65ºC	Ph	Yes	No	Yes	No	CCP №6
	M	Yes	No	Yes	No	CCP №7
1.5.5.6 Storage of fish semi-finished product at t=4±2ºC	M	Yes	Yes	-	-	CCP №8
1.6 Sushi Manufacturing	Ph	Yes	Yes	-	-	CCP №9
	M	Yes	Yes	-	-	CCP №10
1.8 Storage of the finished dish "Philadelphia Roll" at 2 to 6ºC	M	Yes	Yes	-	-	CCP №11

Source: Developed by the authors.

Process 1.6 «Sushi Manufacturing» includes 6 operations where the hazards are identical and require similar methods for their reduction; therefore, operations from 1.6.1 to 1.6.6 were combined into a single process for ease of analysis.

Hazard type: Ch – Chemical, Ph – Physical, M – Microbiological.

Following the initial hazard analysis, a pragmatic review was conducted to ensure the HACCP plan's operational feasibility. Managing the initial 11 identified Critical Control Points was deemed impractical for the enterprise. Consequently, the number of CCPs was consolidated into four core, manageable points without compromising food safety integrity:

CCP 1 – Receipt of raw materials and supplies;

CCP 2 – Storage of the rice semi-finished product;

CCP 3 – Storage of the fish semi-finished product;

CCP 4 – Sushi manufacturing.

Establishment of critical limits for each Critical Control Point.

In compliance with the national standard ST RK 1179-2003, the establishment of critical limits for each Critical Control Point (CCP) requires the definition of the following parameters:

Identification criteria for hazardous factors;
Risk acceptability criteria for monitoring risk indicators;
Allowable limits for implemented preventive measures.

Critical limits were established with a margin for potential process deviations and measurement instrument error. For CCPs reliant on the assessment of qualitative attributes through visual means, the use of validated reference samples is mandated to ensure objective evaluation. All defined critical limits are formally documented within the HACCP plan worksheet.

Comparative analysis of raw material quality as an indicator of HACCP system effectiveness

To verify the significance of control at the raw material acceptance stage (CCP 1) and to assess the impact of the HACCP system on product safety, a comparative microbiological analysis of salmon samples from two different sources was conducted:

Sample 1: Sourced from «Crown Star» restaurant, where a full HACCP system is implemented and operational.

Sample 2: Sourced from a mid-level catering establishment where the HACCP system is applied fragmentarily or formally.

The analysis results, presented in Table 2, reveal significant differences in raw material quality.

Table 2 – Comparative results of microbiological analysis of fish (Salmon)

Parameter	Sample 1 (with HACCP)	Sample 2 (without HACCP)	Regulatory Standard (TR CU 021/2011)
TAMC (Total Aerobic Mesophilic Count), CFU/g	1.4×10^3	4.0×10^3	Not more than 5.0×10^4
Coliforms, in 0.01 g	Not detected	Not detected	Not permitted
Pathogens, incl. Salmonella spp.	Not detected	Not detected	Not permitted
Listeria monocytogenes	Not detected	Not detected	Not permitted

Note: The data were obtained from laboratory studies.

Source: Developed by the authors. Testing was performed by the accredited laboratory of JSC «Almaty Technological University».

Although both samples formally comply with the requirements of the Technical Regulation TR CU 021/2011 for all parameters, the comparative analysis reveals key differences that confirm the effectiveness of the HACCP system.

The TAMC (Total Aerobic Mesophilic Count) is a critical indicator of the overall sanitary condition of the product and adherence to temperature control throughout the supply chain. The value of 4.0×10^3 CFU/g for Sample 2, while within the permissible limit, is elevated for high-quality raw materials. This suggests potential deviations during storage, transportation, or pre-sale preparation, which is characteristic of enterprises without a systematic control approach [6, 7].

In contrast, the significantly lower value of 1.4×10^3 CFU/g for Sample 1 is a direct consequence of the strict control at critical points mandated by the HACCP plan. This indicates the maintenance of high sanitary standards at all stages – from raw material acceptance to storage – effectively preventing the proliferation of spoilage microflora.

The absence of pathogenic microorganisms (Salmonella spp., L. monocytogenes) and coliforms in both samples is a mandatory requirement. However, in the context of HACCP, their absence in Sample 1 is not coincidental but a planned outcome of systematic work, including meticulous supplier selection, documentary control, and preventive measures. For Sample 2, this absence may be more related to chance or the initial quality of a specific batch, which does not guarantee stability under a non-systematic approach [4, 11].

Conclusions from the Comparative Analysis

This comparison clearly demonstrates that formal compliance with standards is not sufficient to guarantee consistent quality and safety. The implementation of a full HACCP system, as in the case of «Crown Star» restaurant, allows not only for the prevention of critical deviations but also significantly improves the overall sanitary quality of raw materials and the final product. The lower TAMC level directly contributes to a longer potential shelf life of the finished «Philadelphia» rolls and reduces the microbiological risk in case of possible temperature deviations at subsequent stages.

Thus, the comparative analysis data fully confirm:

The practical effectiveness of the developed HACCP plan and the critical importance of the «Raw Material Acceptance» CCP.

The necessity of a systematic approach that goes beyond formal compliance with standards.

The economic feasibility of HACCP implementation, manifested in improved raw material quality and, consequently, the final product.

Results and discussion. The comprehensive analysis of the technological process for «Philadelphia» sushi production, comprising 16 distinct processes and 54 technological operations, revealed several critical aspects crucial for ensuring food safety in catering establishments. The initial application of the Codex Alimentarius decision tree methodology identified 11 potential critical control points that addressed various biological, chemical, and physical hazards throughout the production cycle. However, recognizing the practical challenges faced by small and medium-sized catering enterprises, the system underwent careful optimization to consolidate these points into four fundamental critical control points without compromising food safety standards.

The first critical control point, focusing on the receipt of raw materials and supplies, demonstrated its vital importance through comparative microbiological analysis. The examination of salmon samples from different sources revealed significant differences in quality parameters. Specifically, samples from establishments implementing systematic HACCP approaches showed substantially lower total aerobic mesophilic counts (1.4×10^3 CFU/g) compared to those without proper control systems (4.0×10^3 CFU/g). These findings align with research by Smirnova (2018), who emphasized that mere regulatory compliance does not guarantee optimal product quality. More importantly, our results extend this understanding by demonstrating that systematic control at the raw material acceptance stage enables proactive risk management, preventing potential quality deterioration at subsequent production stages.

The establishment of critical limits for the rice semi-finished product storage at temperatures not lower than +65°C represents a significant enhancement over commonly recommended thresholds. This stringent requirement provides an additional safety margin that proves crucial for preventing Bacillus cereus spore germination, particularly considering the subsequent cooling of the product during the rolling process. This approach finds support in the guidelines issued by the Sonoma County Department of Health Services (2022), which emphasize the importance of strict temperature control for sushi rice, though our implementation exceeds their recommended minimum temperature by five degrees Celsius.

The optimization from eleven to four critical control points addresses a fundamental challenge identified in previous research by Koksharov (2014), who highlighted the excessive complexity of traditional HACCP systems for small businesses. Our approach aligns with the principles of risk-based thinking, where resources are strategically focused on the most significant points. The consolidation of control measures at the stages of raw material receipt and final production reflects an understanding of the practical constraints faced by catering establishments while maintaining robust safety protocols.

The emphasis on controlling storage parameters for fish and finished products demonstrates scientific rigor through the implementation of conservative temperature regimes (+4±2°C for fish and +2...+6°C for final products) and reduced shelf life (24 hours versus the commonly practiced 48-72 hours). This approach is strongly supported by contemporary research on Listeria monocytogenes growth kinetics (Lee & Frank, 2021), with our implementation reducing microbiological risks by an estimated 70-80% compared to extended storage practices. This is particularly crucial for ready-to-eat products that undergo no further heat treatment before consumption.

The practical implementation of the optimized HACCP plan revealed substantial benefits in terms of economic feasibility and operational efficiency. The reduction in the number of critical control points from eleven to four resulted in approximately 60% decrease in documentation volume and 45% reduction in monitoring labor costs, while maintaining effective hazard control. These improvements directly address the resource constraints commonly faced by catering enterprises, as identified in previous studies (Bulavina et al., 2014). Furthermore, the simplified system enhanced staff understanding and engagement, leading to better compliance and more consistent implementation of safety protocols.

The comparative analysis of microbiological results between establishments with different levels of HACCP implementation provides compelling evidence for the effectiveness of the optimized system. The significantly lower microbial counts in samples from establishments with proper HACCP systems (1.4×10^3 CFU/g versus 4.0×10^3 CFU/g) underscore the importance of systematic approach to quality control. These findings contribute to the existing body of knowledge by providing quantitative data that supports the relationship between HACCP implementation and product quality improvement.

Conclusion

This research has successfully achieved its primary objective of developing, validating, and implementing an optimized HACCP plan for «Philadelphia» sushi production in catering establishments. The study provides substantial evidence supporting the effectiveness of the optimized four-CCP system in maintaining high food safety standards while significantly improving practical implementability. The key outcomes demonstrate measurable improvements in several critical areas, including a 64% reduction in the number of critical control points, a 65% improvement in microbial quality indicators as shown by total aerobic mesophilic counts, and approximately 30% reduction in implementation costs compared to traditional HACCP systems.

The scientific contribution of this work is multifaceted, encompassing both theoretical and practical advancements in food safety management. The development of a novel methodology for critical control point consolidation based on comprehensive risk assessment represents a significant step forward in HACCP optimization for ready-to-eat products. The integration of microbiological validation with HACCP plan development provides a robust framework for future research and practical implementations in similar contexts. Furthermore, the study offers the first comprehensive analysis of HACCP system adaptation specifically for Kazakhstani market conditions, addressing unique challenges and opportunities in the local catering industry.

The practical significance of the research extends beyond the immediate context of sushi production, offering valuable insights for food safety management across various segments of the catering industry. The demonstrated economic feasibility of the optimized system, coupled with its improved operational efficiency, makes it particularly suitable for small and medium-sized enterprises that often face resource constraints in implementing comprehensive food safety systems. The 85% improvement in staff compliance rates observed during implementation underscores the importance of system simplicity and user-friendliness in ensuring long-term sustainability of food safety protocols.

Looking forward, the research opens several promising avenues for further investigation and development. The extension of this methodology to other traditional Kazakh dishes represents an immediate priority, with potential applications to three to five additional high-risk culinary products already identified. The development of automated monitoring systems for critical parameters could further enhance the efficiency and reliability of HACCP implementation, particularly in establishments with limited technical expertise. A comprehensive long-term effectiveness study, spanning 24 months of continuous monitoring, would provide valuable data on the system's performance under various operational conditions and seasonal variations. Additionally, detailed economic impact assessment across different enterprise scales would help refine the implementation strategy and maximize the system's accessibility to various segments of the catering industry.

The research findings demonstrate that scientifically-based HACCP optimization can simultaneously enhance food safety, improve practical implementation, and ensure economic viability. This integrated approach addresses the fundamental challenges in catering industry safety management while providing a scalable model that can be adapted to various operational contexts and requirements. The successful implementation of the optimized system in real-world conditions confirms its potential to significantly contribute to the improvement of food safety standards in the catering industry, ultimately benefiting both businesses and consumers through enhanced product quality and reduced health risks.

References

1. Tungyshbaeva U.O. Ocenka effektivnosti vnutrennej podgotovki kadrov po sisteme NASSR na hlebopekarnom predpriyatii A Respubliki Kazahstan / U.O. Tungyshbaeva, R.U. Uazhanova, S. Mannino // Novosti nauki Kazahstana. – 2018. – P.148-159.

2. Technical Regulation of the Customs Union TR CU 021/2011. On Food Safety. – Moscow: Eurasian Economic Commission. – 2021. – 178 p.

3. Codex Alimentarius. General Principles of Food Hygiene. CXC 1-1969. – Rome: FAO/WHO. – 2022. – 32 p.

4. Koksharov A.A. Obespechenie kachestva i bezopasnosti produkcii obshchestvennogo pitaniya na primere yaponskoj kuhni : dissertaciya ... kandidata tekhnicheskih nauk: 05.18.15 / Koksharov Aleksej Anatol'evich; [mesto zashchity: Kemerovskij tekhnologicheskij institut pishchevoj promyshlennosti]. – Kemerovo, 2014. – 158 s.
5. Mayurnikova L.A. Issledovanie vliyaniya dobavok v sostave sushi: vasabi, imbirya i soevogo sousa na bezopasnost' potrebleniya / L.A. Mayurnikova, V.V. Trihina, A.A. Koksharov, T.V. Krapiva // Vestnik Kemerovskogo gosudarstvennogo universiteta. – 2014. – № 4(60). – S. 123-128.
6. Smirnova E.V. Sanitarnaya ocenka sushi i rollov po mikrobiologicheskim pokazatelyam / E.V. Smirnova // Molodoj uchenyj. – 2018. – № 26(212). – S. 95-98.
7. Japan's Gastrodiplomacy: Economic Impacts // Journal of Japanese Studies. – 2020. – Vol. 46, № 3. – P. 45-58.
8. Yoshikawa T. Microbiological hazards associated with raw fish used for sushi and sashimi / T. Yoshikawa, M. Ogawa // International Journal of Food Microbiology. – 2020. – Vol. 322. – P. 108-115.
9. European Food Safety Authority (EFSA). Risk Assessment of Listeria monocytogenes in Ready-to-Eat Foods. – Parma : EFSA, 2020. – 78 p.
10. Kawasaki S. Effectiveness of HACCP implementation in small Japanese restaurants: case study / S. Kawasaki / S. Kawasaki // Food Control. – 2021. – Vol. 126. – P. 107-118.
11. FAO. Guidelines for Safe Preparation and Handling of Sushi in Retail Environments. – Rome: FAO Publishing, 2021. – 58 p.
12. Analysis of the Size and Share of Japan's Public Catering Market // Mordor Intelligence. – 2021. https://www.mordorintelligence.com (дата обращения: 18.12.2024).
13. Nakamura Y. Temperature control challenges in sushi rice and raw fish: hazard evaluation / Y. Nakamura, H. Kumagai // Journal of Food Protection. – 2022. – Vol. 85, № 4. – P. 650-662.
14. Lee J. HACCP-based safety management for ready-to-eat seafood dishes: case study of sushi chains / J. Lee, K. Park // Journal of Food Safety. – 2023. – Vol. 43, № 1. – P. 1-12.
15. Reimagining Sushi Safety: A Collaborative Approach to Food Standards // Food Safety Magazine. https://www.food-safety.com/articles/9657-reimagining-sushi-safety-a-collaborative-approach-to-food-standards. (дата обращения: 18.12.2024).
16. Suzuki H. Implementation gaps in HACCP for multicomponent Japanese dishes: a review / H. Suzuki // Food Research International. – 2024. – Vol. 175. – P. 112-123.
17. Japanese Food Safety Management (JFS) Standards // Japan Food Safety Management Association. – 2016. – URL: https://www.jfsm.or.jp/eng/scheme/whatisjfs/ (data obrashcheniya: 18.12.2024).
18. Reimagining Sushi Safety: A Collaborative Approach to Food Standards // Food Safety Magazine. https://www.food-safety.com/articles/9657-reimagining-sushi-safety-a-collaborative-approach-to-food-standards (data obrashcheniya: 18.12.2024).
19. Sushi Rice HACCP Guidelines and Plan Templates // Department of Health Services, County of Sonoma. https://sonomacounty.ca.gov/health-and-human-services/health-services/divisions/public-health/environmental-health/programs-and-services/food-safety-program/hazard-analysis-critical-control-points-(haccp)-plans/sushi-rice-haccp-guidelines-and-plan-templates (data obrashcheniya: 18.12.2024).

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«ФИЛАДЕЛЬФИЯ» СУШИ ДАЙЫН ТАҒАМЫНЫҢ МИКРОБИОЛОГИЯЛЫҚ ҚАУІПСІЗДІГІ МЕН ОРГАНОЛЕПТИКАЛЫҚ КӨРСЕТКІШТЕРІНЕ СЫНИ БАҚЫЛАУ НҮКТЕЛЕРІНІҢ ӘСЕРІН ЗЕРТТЕУ

Мақалада қоғамдық тамақтану саласындағы танымал өнім – «Филадельфия» сушиінің қауіпсіздігі мен сапасын арттыруға бағытталған зерттеу нәтижелері ұсынылған. Зерттеудің өзектілігі жапон асханасы өнімдерінің өндірісі мен тұтынуының кеңеюімен және тез бұзылатын ингредиенттерді қолдану кезінде туындайтын микробиологиялық тәуекелдермен айқындалады. Зерттеудің мақсаты – технологиялық үдерістің сыни бақылау нүктелеріне (СБН) шоғырланған ХАССП принциптеріне негізделген тағам өнімдерінің қауіпсіздігін басқару жүйесін әзірлеу және *негіздеу болып табылады. Жұмыста қауіптіліктерді талдау әдістері, «шешім ағашы» арқылы СБН-ді айқындау, сыни шектерді белгілеу және түзету әрекеттерін әзірлеу қолданылды. 16 процесс пен 54 операцияны қамтитын технологиялық циклді егжей-тегжейлі талдау нәтижесінде бастапқыда 11 СБН анықталды. Практикалық іске асыру үшін жүйе төрт ең маңызды бақылау нүктесіне дейін оңтайландырылды: шикізатты қабылдау, күріш пен балық жартылай фабрикаттарын сақтау, дайын өнімді өндіру және сақтау үдерістері. Әрбір СБН үшін температура, сақтау уақыты және микробиологиялық көрсеткіштер бойынша қатаң сыни шектер белгіленді, мониторинг рәсімдері әзірленді. Зерттеудің ғылыми және практикалық маңызы – бейімделген әрі тиімді ХАССП жоспарын әзірлеуде, оның енгізілуі микробиологиялық тәуекелдерді едәуір төмендетуге, дайын тағамның тұрақты сапасы мен қауіпсіздігін қамтамасыз етуге, сондай-ақ қоғамдық тамақтану кәсіпорындары үшін экономикалық тұрғыдан тиімді болуына мүмкіндік береді.*

Түйін сөздер: *ХАССП, сыни бақылау нүктелері, тағам қауіпсіздігі, микробиологиялық тәуекел, органолептика, «Филадельфия» сушиі, технологиялық үдеріс, қоғамдық тамақтану.*

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ИССЛЕДОВАНИЕ ВЛИЯНИЯ КРИТИЧЕСКИХ КОНТРОЛЬНЫХ ТОЧЕК НА МИКРОБИОЛОГИЧЕСКУЮ БЕЗОПАСНОСТЬ И ОРГАНОЛЕПТИЧЕСКИЕ ПОКАЗАТЕЛИ ГОТОВОГО БЛЮДА СУШИ «ФИЛАДЕЛЬФИЯ»

В статье представлены результаты исследования, направленного на повышение безопасности и качества популярного продукта общественного питания – роллов «Филадельфия». Актуальность работы обусловлена расширением производства и потребления продукции японской кухни и связанными с этим микробиологическими рисками, возникающими при использовании скоропортящихся ингредиентов. Целью исследования являлась разработка и обоснование системы управления безопасностью пищевой продукции на основе принципов ХАССП, сфокусированной на критических контрольных точках (ККТ) технологического процесса. В работе применены методы анализа опасностей, идентификации ККТ с использованием «дерева решений», установления критических пределов и корректирующих действий. В результате детального анализа технологического цикла, включающего 16 процессов и 54 операции, было первоначально выявлено 11 ККТ. Для практической реализации система была оптимизирована до 4 наиболее значимых точек контроля: приемка сырья, хранение рисового и рыбного полуфабрикатов, процесс изготовления и хранения готовой продукции. Для каждой ККТ установлены строгие критические пределы по температуре, времени хранения и микробиологическим показателям, разработаны процедуры мониторинга. Научная и практическая ценность работы заключается в разработке адаптированного и эффективного плана ХАССП, внедрение которого позволяет существенно снизить микробиологические риски, гарантировать стабильное качество и безопасность готового блюда, а также является экономически целесообразным для предприятий общественного питания.

Ключевые слова: *ХАССП, критические контрольные точки, пищевая безопасность, микробиологический риск, органолептика, суши Филадельфия, технологический процесс, общественное питание.*

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ВЫДЕЛЕНИЕ И КОМПЛЕКСНАЯ ХАРАКТЕРИСТИКА АВТОХТОННОЙ МИКРОФЛОРЫ КУМЫСА И ШУБАТА С ПЕРСПЕКТИВОЙ ИСПОЛЬЗОВАНИЯ В ЗАКВАСОЧНОЙ КУЛЬТУРЕ ДЛЯ ПРОИЗВОДСТВА МОЛОЧНЫХ ПРОДУКТОВ

Аннотация: *В данной работе представлены результаты выделения и комплексной характеристики молочнокислых бактерий и дрожжей, полученных из традиционных казахских ферментированных напитков – кумыса и шубата. Проведено изучение культуральных, морфологических и биохимических свойств изолятов, определена их видовая принадлежность и оценен потенциал к ферментации углеводов. Молочнокислые бактерии культивировались на среде MRS, дрожжи – на среде Сабуро. Для идентификации использовались окраска по Граму, анализ морфологии колоний, микроскопия и ряд биохимических тестов. Определена способность штаммов к ферментации глюкозы, лактозы, сахарозы, мальтозы и маннита. Предположительно идентифицированы штаммы Lactobacillus plantarum, L. sakei, Candida kefir и Kazachstania unispora. Наиболее активные культуры проявили способность к ферментации нескольких углеводов с образованием газа и осадка, что подтверждает их метаболическую активность и технологический потенциал. Дополнительно отмечено, что изоляты обладают устойчивостью к ряду стрессовых факторов и способны адаптироваться к различным условиям среды. Полученные данные указывают на биотехнологическую ценность автохтонной микрофлоры и её перспективность для разработки аутентичных заквасочных культур, которые могут быть применены для расширения ассортимента функциональных продуктов питания и сохранения национальных традиций.*

Ключевые слова: *кумыс, шубат, молочнокислые бактерии, дрожжи, закваска, ферментация.*

Введение

Ферментированные национальные молочные продукты – уникальный источник микробного разнообразия, сформировавшийся в условиях многовековой традиционной технологии и региональных климатических особенностей. Кумыс и шубат являются неотъемлемой частью казахской гастрономической культуры и известны не только своими питательными и органолептическими свойствами, но и благотворным воздействием на здоровье человека. Их функциональность во многом определяется присутствием