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DEVELOPMENT OF HACCP PLAN FOR MOUSSE FROM WHEY WITH ADDITION OF PLANT RAW MATERIAL

Annotation: *The basics of a food safety management system and hazard identification are covered in this paper. Critical control points that may impact the end product's safety can be found during the whey mousse production process. The technological method of making whey mousse is examined while keeping the HACCP system's tenets in mind. Whey is crucial for human health since it contains high-quality protein and other beneficial compounds. In this sense, it's critical to maintain all of whey's advantageous qualities when making mousse. The requirements for crucial control points are identified after an analysis of each technological level. Raw material receipt and inspection, whey preparation, raw material processing, component whipping, packing, and storage are the most crucial steps in the production process. A monitoring, control, and corrective action system based on the HACCP / MS ISO 22000:2018 Food Safety Management System standards is suggested in order to prevent adverse causes and dangerous factors.*

Key words: *mousse, HACCP, whey, technology, dangerous factors, quality control, safety.*

INTRODUCTION

With the growing interest in healthy eating and environmental aspects, the use of whey in dessert production is a significant prospect. Combined with the growing interest in low-calorie, functional products, whey-based mousses can become an excellent alternative to traditional sweet desserts. Whey mousse is a light and tasty product with a number of beneficial properties.

Whey is a by-product of cheese production. Whey is the liquid, usually yellowish-green in color, that remains after the coagulation process during cheese production. This liquid contains whey proteins, which have many important properties such as emulsification, gel formation, foaming, fat binding and thickening, and has a wide range of uses in the food industry. Whey protein can be used to improve and support people's health due to its rich amino acid content and as a source of dietary nitrogen [1].

This article discusses the development of a HACCP plan for mousses from whey with addition of plant raw materials. Research shows that whey contains up to 20% proteins, including important components such as alpha-lactalbumin and beta-lactoglobulin, which have high biological value [2]. These proteins have broad functional properties such as gelling and emulsifying, making whey a valuable ingredient for the production of mousses and other textured desserts. The capacity of whey proteins to generate foam allows for the formation of foam in the products [3]. The key stages of whey mousse preparation are pasteurization, processing of components and whipping. Whey pasteurization is necessary to destroy harmful microorganisms, as well as to improve its taste and texture [4]. Heat treatment increases the stability of the whey and reduces microbiological risks. An important stage in the production of mousse is whipping, which gives the product lightness and airiness. To stabilize the mousse and improve its consistency, stabilizers such as gelatin or agar-agar are often used, as well as milk fats, which help improve the texture structure of the final product [5]. The readings from the texture analyzer show that when pectin is employed as a fixative, the mousse exhibits greater resistance to mechanical stress, and its strength is enhanced [6]. Despite all the advantages, the production of whey mousses is associated with a number of technological difficulties. Firstly, whey is highly vulnerable to microbiological contamination, which requires careful control of storage conditions and processing of raw materials [7].

Secondly, like other dairy products, whey has a limited shelf life due to the rapid reproduction of microorganisms at ambient temperatures. This necessitates the introduction of effective pasteurization and packaging technologies. The implementation of a food safety management system is a strategic step that helps improve the efficiency of an organization in the field of food safety. The requirements of the standard ST RK ISO 22000:2019 FSMS, concerning "Requirements for organizations participating in the food chain", are not aimed at specific types of products or

services, but at the enterprise management system in the field of food safety. The main goal of the FSMS is to prevent or minimize the introduction of food hazards into products. One of the effective ways to protect consumers is the HACCP system, which allows you to identify, evaluate and control hazardous factors that are critical to the safety of food products [8].

Food safety means ensuring that food items are safe for consumers when they are prepared and eaten in appropriate conditions. To uphold this principle and guarantee the creation of safe food, it is essential to establish a food safety management system. Investing in food safety management systems is a key necessity for the steady and trustworthy supply of safe food products and for the growth of international trade [9].

The risk assessment can obtain an objective picture of the level of danger and determine the measures that must be taken to minimize or eliminate threats at every stage of the production and trading process, risk evaluation through a thorough analysis of all factors enables effective management of product safety, reducing potential risks to consumer health. The Hazard Analysis and Critical Control Points (HACCP) system provides a clear and logical framework for control, focusing on preventing problems by recognizing possible hazards, determining critical control points, and establishing strategies for monitoring, preventing, and rectifying these hazards. This system should be formulated based on seven key principles:

1. Conducting an analysis of possible hazards;
2. Identifying Critical Control Points (CCP);
3. Establishing Critical Limits for the CCP;
4. Creating a monitoring system for controlling the CCP;
5. Defining corrective actions;
6. Establishing verification procedures;
7. Setting up principles for record-keeping and documentation [9].

Risk assessment in the HACCP (Hazard Analysis and Critical Control Points) system is based on several key criteria that help to identify hazards at various stages of production and develop measures to control them. The main risk assessment criteria applied in HACCP consist of: high likelihood that is a risk with a significant chance of happening during the process (e.g. microbiological contamination during the packaging phase). Also, moderate likelihood that is a risk that could arise in specific situations (e.g. chemical contamination resulting from inadequate processing). And low probability is a hazard with a rare occurrence, which does not always depend on the stage of the process.

Risk assessment also includes an analysis of what damage or harm can be caused to the consumer if the hazard occurs. The higher the potential impact on health, the higher the risk.

Sample risk assessment criteria:

1. Microbiological safety – high probability, high severity.
2. Chemical contamination – medium probability, high severity.
3. Physical contamination (e.g. glass in packaging) – low probability, high severity.
4. Food allergens (e.g. milk proteins in non-dairy products) – high probability, high severity.

The objective of this research is to pinpoint the key control points in the manufacturing process of whey-based mousse that includes black currant.

REASERCH METHODS

This research focused on whey, plant-based components, stabilizers (raw materials) and the finished mousse products created in a lab setting. To determine critical control points (CCPs) within the production process, the «Decision Tree» method, as outlined in the ISO 22000:2005 standard was employed [10]. This method, known for its simplicity and systematic approach, is widely used to identify CCPs by providing a clear, logical framework for hazard assessment at each production stage. Through a systematic process of addressing the decision tree's questions, the HACCP team identifies if critical control points are required at each step of the process. In order to evaluate potential hazards linked to whey-based mousse production, information regarding risks and the circumstances under which they could occur was gathered and evaluated. We initially assembled a comprehensive inventory of potential hazards, encompassing physical, chemical, and microbiological risks. To pinpoint potential threats across the entire production process, we meticulously examined the finished product, ingredients, and raw materials, conducting a thorough analysis of each stage.

Particular attention is paid to possible risks related to storage, personnel who may be a source of danger, as well as equipment, packaging and the production environment.

At each stage, specific measures and conditions that could lead to the emergence or aggravation of risk factors are considered. The risk assessment is carried out based on two key parameters: the severity of the possible consequences for consumer health and the likelihood of these risks occurring.

RESULTS AND DISCUSSION

As part of the risk analysis, we carefully examined the probability of occurrence of each identified risk factor and the significance of the consequences for consumer health. Based on this data, a list of situations in which the risk exceeds the permissible safety level was created. Certain risk factors that meet the requirements of the Technical Regulations of the Customs Union (TR CU 033/2013 «On the safety of milk and dairy products» and TR CU 021/2011 «On food safety») were classified as significant risks, regardless of the assessment results [11]. The next step was to determine Critical Control Points (CCPs), which is an important element of the risk analysis and control system, such as in the HACCP methodology.

CCPs indicate stages at which the probability of hazard occurrence is highest and which require strict control to prevent possible risks. For each CCP, specific parameters such as temperature, time, pH are set, which must be strictly controlled. The importance of CCPs can be classified into different levels, depending on the degree of impact on the safety of the final product in table 1.

Table 1 – Classification of critical control points

Levels of importance critical control points	Control of risks
CCPs of high importance	Pasteurization temperature control, which directly affects the safety of dairy products.
CCPs of medium importance	Control of packaging cleanliness or hygienic condition of equipment, which reduces the likelihood of product contamination
CCPs of low importance:	Control of storage time under favorable conditions, which does not have such a critical impact on safety, but is still important for maintaining optimal standards.

Critical points are those stages at which it is possible to prevent or significantly reduce a potential threat. If there is a hazard in the production process that could exceed the permissible level and this threat is not eliminated at a later stage, these points must be strictly controlled. This is particularly important because at these stages, if control measures are not correctly implemented, it may not be possible to eliminate the hazard to an acceptable level.

In the technological process, the stages of raw material acceptance and whey pasteurization were classified as Critical Control Points (CCPs) that must be controlled and monitored to minimize or eliminate the potential hazards in Table 2. CCPs are thoroughly checked and all data about them are recorded. Next, CCP monitoring was organized, the purpose of which is regular control and measurements that allow for timely detection of deviations from the established limits and the implementation of appropriate preventive or corrective measures. Each CCP was assigned a corrective action, such as checking the measurement area, adjusting equipment, and removing products that do not meet the requirements. In the future, for the

The HACCP system must be continuously improved and maintained for it to function effectively. To accomplish this, regular internal audits should be conducted regularly. The HACCP team is required to operate continuously, promptly executing corrective actions and documenting their implementation.

To ensure product safety at all stages of whey mousse production, it is necessary to: regularly conduct laboratory tests of raw materials for microbiological safety and maintain strict control over compliance with temperature conditions at all stages (storage, processing).

Establish a logging system to document all activities at each phase, including the reception of raw materials, processing, and packaging. Conduct routine inspections of equipment to avert contamination. Should any risks or instances of non-compliance arise during production, it is imperative to promptly remove sources of contamination, such as substituting inferior raw materials or implementing additional heat treatment. In case of violation of temperature conditions, conduct an analysis of the product for microbiological safety and, if necessary, destroy the batch. Regularly conduct personnel training on safety and hygiene rules.

Table 2 – Risk assessment and critical points of mousse from whey

Production stage	Potential risks	Critical points	Control measures
Receiving and checking raw materials	Microbial contamination, use of poor-quality raw materials	Control over suppliers, checking expiration dates and external condition of raw materials	Acceptance of only certified and verified supplies, laboratory tests for microbiological safety
Preparation of whey	Improper storage, microbial contamination	Temperature storage conditions	Storage at a temperature not exceeding 4°C, storage time control
Raw material processing	Insufficient heat treatment, ineffective pasteurization	Pasteurization temperature regime	Pasteurization of whey at 85-90°C for 1-2 minutes
Whipping process of the ingredients	Inadequate homogenization and contamination resulting from equipment.	Sanitation of apparatus.	Equipment must be cleaned and disinfected following each shift, and the condition of the beaters should be assessed.
Approaches to packaging and storage.	There is a threat of microbiological contamination along with the risks posed by the storage of materials without proper authorization	Temperature conditions for storage, tightness of packaging	The packaging is conducted in sterile conditions, with storage temperatures limited to a maximum of 4°C.

CONCLUSION

In light of the aforementioned information, it can be concluded that the HACCP system stands out as one of the most efficient mechanisms for guaranteeing product safety and quality. The implementation of the HACCP system in the production of whey mousse can significantly reduce risks and ensure the safety of the finished product.

The essential aspect of the production process is the rigorous oversight at every stage, coupled with the training of staff in the appropriate management of both raw materials and finished products. A meticulous application of the control system ensures that consumers receive desserts of high quality and safety. The analysis identified the most probable hazards associated with the production of mousse desserts and established potential Critical Control Points (CCPs) by considering biological, chemical, and physical risks.

The critical stages of production include the acceptance and inspection of raw materials, whey preparation, processing of raw materials, component whipping, packaging, and storage. To mitigate adverse factors, a system for monitoring, control, and corrective actions is recommended, aligned with the standards of the HACCP and MS ISO 22000:2018 food safety management system.

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РАЗРАБОТКА ПЛАНА НАССР ДЛЯ МУССОВ ИЗ СЫВОРОТКИ С ДОБАВЛЕНИЕМ РАСТИТЕЛЬНОГО СЫРЬЯ

В данной работе рассматривается идентификация опасностей и принципы системы управления безопасностью пищевых продуктов. В процессе производства мусса из молочной сыворотки могут быть выявлены критические контрольные точки, которые могут повлиять на безопасность конечного продукта. С учетом принципов системы ХАССП, технологический процесс

производства мусса из молочной сыворотки подвергается анализу. Молочная сыворотка как источник высококачественного белка и других полезных веществ имеет большое значение для здоровья человека. Важным аспектом является сохранение всех полезных свойств сыворотки в процессе производства мусса. Каждый этап технологического процесса подвергается тщательному анализу, и выявлены ключевые точки, требующие контроля. Ключевыми этапами производства являются: прием и проверка сырья, подготовка молочной сыворотки, обработка сырья, взбивание компонентов, упаковка и хранение. Для минимизации негативных воздействий предложена система мониторинга, контроля и корректирующих мер, основанная на стандартах ХАССП / MS ISO 22000:2018 Системы управления безопасностью пищевых продуктов.

Ключевые слова: мусс, ХАССП, сыворотка, технология, опасный фактор, контроль качества, безопасность.

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ӨСІМДІК ШИКІЗАТЫ ҚОСЫЛҒАН САРЫСУ МУССЫНА АРНАЛҒАН ХАССП ЖОСПАРЫН ӨЗІРЛЕУ

Бұл жұмыста тамақ өнімдерінің қауіпсіздігін басқару жүйесінің негізгі принциптері мен қауіптерді анықтау мәселелері қарастырылды. Сүт сарысуынан жасалған мусс өндірісі барысында соңғы өнімнің қауіпсіздігіне әсер ететін сыни бақылау нүктелері анықталды. ХАССП жүйесінің принциптеріне сүйене отырып, сүт сарысуынан мусс өндірудің технологиялық процесі егжей-тегжейлі талданды. Сүт сарысуы – жоғары сапалы ақуыздар мен басқа да пайдалы заттардың бай көзі, бұл оның адам денсаулығына пайдасын арттырады. Осыған орай, мусс өндірісі кезінде сарысудың барлық пайдалы қасиеттерін сақтау маңызды болып табылады.

Технологиялық процестің әрбір кезеңі мұқият талданып, сыни бақылау нүктелерін анықтаудың негіздері қаланды. Өндірістің маңызды кезеңдері ретінде шикізатты қабылдау мен тексеру, сарысуды дайындау, шикізатты өңдеу, компоненттерді шайқау, сондай-ақ орау және сақтау көрсетілді. Теріс факторлардың алдын алу мақсатында ХАССП / MS ISO 22000:2018 стандарттарына негізделген бақылау, мониторинг және түзету әрекеттері жүйесі ұсынылды. Бұл жүйе азық-түлік қауіпсіздігін қамтамасыз ету мақсатында тиімді басқару тәсілдерін ұсынады, сонымен қатар өнімнің жоғары сапасы мен қауіпсіздігін сақтау үшін қажетті шараларды жүзеге асырады.

Түйін сөздер: мусс, ХАССП, сүт сарысуы, технология, қауіпті фактор, сапаны бақылау, қауіпсіздік.

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«СУ-ВИД» ӘДІСІ БОЙЫНША ДАЙЫНДАЛҒАН СИЫР ЕТІ, ҚОЙ ЕТІ ЖӘНЕ ТАУЫҚ ЕТІНІҢ ФИЗИКА-ХИМИЯЛЫҚ ӨЗГЕРІСТЕРІ

Аңдатпа: Мақалада инновациялық жабдық «су-видті» пайдалана отырып, ет өнімдерінің технологиясының негізгі принциптері мен тамақ өнеркәсібіндегі маңызы және әсері қарастырылады. Бұл зерттеуде шикізат көзі ретінде сиыр еті, қой еті және тауық еті пайдаланылды. Әртүрлі жылу өңдеу әдістері қолданылған: дәстүрлі әдіс және «су-вид» технологиясы.

Азық-түлік өнімдерін жеткілікті мөлшерде функционалды көрсеткіштермен өндіру қазіргі тамақ өнеркәсібінің маңызды міндеттерінің бірі, себебі адамның денсаулығы негізінен күнделікті тұтынатын тағамдарға байланысты. Жоғарыда аталған әдістер бойынша ет үлгілерінің дайындалу барысында өнімнің сапасы, тиімділігі өңдеу әдістерімен зерттеулер жүргізілді.

Жергілікті шикізаттардың (сиыр, қой, тауық еті) потенциалын толық пайдаланудың бір жолы – инновациялық жабдықтарды қолдану болып табылады. Су-вид әдісінің теориялық негізі өнімнің сұйықтықпен байланысын және температураның тағамның ішіне біркелкі таралуын қамтамасыз ету болып табылады. Су-вид әдісі өте төмен температурада (50-дан 85°C аралығында) ұзақ уақыт бойы (1-ден 72 сағатқа дейін) азық-түліктерді пісіруді қамтиды. Бұл процесс тағамды дәстүрлі тәсілдерге қарағанда әлдеқайда жақсы сақтайды, өйткені су-вид технологиясында сыртқы температураның шектелген диапазоны ішкі температураның тұрақты болуын қамтамасыз етеді.

Тәжірибе барысында анықталғандай сиыр, қой және тауық еттерінің технологиялық көрсеткіштері әртүрлі ерекшеліктерге ие. «Су-вид» технологиясы арқылы алынған еттің сапасын сақтау және өңдеу барысында әрбір ет өнімінің өзіндік ерекшеліктері ескерілді.

«Су-вид» технологиясы арқылы өңделген еттің сапасы мен дәмі жоғары сақталады, бірақ әртүрлі ет түрлерінің құрамындағы май, ақуыз және минералды заттардың қатынасы олардың тағамдық құндылығына және қасиеттеріне әсер етеді.

Түйін сөздер: су-вид, жылулық өңдеу, әдістер, түстік сипаттамалар, вакуум, төменгі температурада өңдеу, сақтау мерзімі.