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Food security and food safety issues of the long-term storage of meat and milk products

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The state when all people at any time have physical and economic access to safe and wholesome food sufficient to satisfy their physiological needs and benefits necessary for an active and healthy lifestyle is denominated as food security its principal components being: availability as the degree of actual or potential affordability of food in a certain group of the population during a certain period; accessibility, as the degree of the population's ability to receive food at its disposal during a certain period of time; consumption, as the ability of the population to provide enough nutritious food for a certain period of time. The concept of food security, along with economic aspects, incorporates a number of technical components: alimentary and nutritional value of food, other physical and chemical characteristics, suitability for transportation and short-term and long-term storage. The technical regulation is the legal regulation of relations in the field of determining and fulfilling mandatory requirements for product characteristics or related processes and production methods. The principal directions for taking into account food security requirements in technical regulation are rational consumption norms, state food resources, food safety and certain indicators of their quality. Principal directions of implying food security fundamentals in the frames of technical regulation and standardization are specified as well as the algorithm of expedient involvement of the basics of food safety in regulatory norms. The consideration of the principles of food security in technical regulation can be fulfilled by developing normative documents that contain norms concerning long-term storage, amending existing regulatory documents, the scope of which are certain foods, with relevant sections as well as the development of documents that will normalize, if necessary, special methods for research of long-term storage products, such as butter and frozen meats. It is stated that specialized refrigerators and storage facilities, can carry out long-term storage of butter and meats for periods exceeding those specified in the national standards. It is possible to develop standards defining the terms and conditions of long-term storage of foods in the conditions of enterprises of the state reserve system. Another possible solution to the existing problem is the introduction of provisions regarding special requirements for long-term storage of foods in the state reserve, these involved in solving the issues of the food security, to the norms in force.

Key words: food security, long-term storage, food safety, standards, butter, frozen meat, technical regulation.

All the humans seek proper wellbeing and the human security as its important constituent. The said problem is multifaceted, it embraces the protection against such chronic threats as hunger or disease, as well as protection from sudden and

undesirable changes in everyday life. The threats to human security can be specified as seven main categories: economic, food, medical, environmental, personal, public and political [1]. Food security is both a complex and challenging issue to

resolve, currently about one billion people (16 % of global population) suffer from chronic hunger when there is more than enough food for every human on the planet. The food security challenge is thus implementing an ability to deal with increasing food shortages, caused by a combination of waste and an ever expanding world population. At current levels, prediction state that we must increase global food production by 70 % on already over exploited finite infrastructures before 2050 [2]. Food security is now a global problem, the solution of which depends on providing consumers with an adequate supply on a global scale with safe, affordable and nutritious food products – both fresh and properly processed. The task of providing healthy nutrition to 9 billion people by 2050 will be partly solved by increasing the production of food products. Only partly – as other measures in this direction should be taken to reduce food losses throughout the supply chain from production to consumption, to increase the content and improve nutrient preservation, to ensure food safety and proper storage of food by appropriate technological processing [2-5]. The food security is reached when all people at any time have physical and economic access to safe and wholesome food sufficient to satisfy their physiological needs and benefits necessary for an active and healthy lifestyle [2]. There are three principal components of food security: availability as the degree of actual or potential affordability of food in a certain group of the population during a certain period; accessibility, as the degree of the population's ability to receive food at its disposal during a certain period of time; consumption, as the ability of the population to provide enough nutritious food for a certain period of time. Thus, the concept of food security, along with economic aspects, incorporates a number of technical components, such as: alimentary and nutritional value of food, other physical and chemical characteristics, suitability for transportation and short-term and long-term storage [5].

The analysis made in [6,7] shows that the economic aspects of food security are widely characterized in scientific sources, but its technical and technological problems have not yet been widely reflected in the works of scholars, and the information in them is quite rare. Thus, among the factors ensuring the effective functioning of the food safety system, the promotion of the use of advanced technologies in the production, storage and processing of raw materials for food production are recalled [8]. Not only the compliance with the food safety criteria in terms of the amount of food products shall be achieved, but also their proper compliance with good nutri-

tional standards, safety and quality requirements through proper coordination of agriculture and the industry for processing agricultural raw materials and production of foods are necessary [9]. So, the safety and quality of food products are fundamental components of the overall structure of the food security of a state; therefore, their provision is prompted by consolidated targeted actions in areas such as food safety and technical regulation. Accordingly, the proper involvement of technical regulation is necessary in the field of food safety and quality to form an integrated structure of food security of state, ensure regulatory support for this system and its full and accelerated implementation as an important component of the security of state in general [5,7].

The technical regulation is the legal regulation of relations in the field of determining and fulfilling mandatory requirements for product characteristics or related processes and production methods. The principal directions for taking into account food security requirements in technical regulation are rational consumption norms, state food resources, food safety and certain indicators of their quality, this also applying to standardization as part of technical regulation.

First of all, the food security is understood as a set of indicators some of them relating to the safety and quality of raw food materials as well as processed foods in the assortment acceptable for the rational nutrition of the consumers. The said is desirable to be reflected in the national system of technical regulation. The directions of the consideration of the principles of food security and safety in the framework of the development of technical regulation and standardization are illustrated by Figure 1. The algorithm for implementing the principles of food safety in the regulatory documents of the level of national standards is presented in Figure 2.

It shall be noted that physical and chemical characteristics of food products used for state reservation often do not fully correspond to the typical conditions of their market turnover, reflected in standards of different levels, normalizing the specifications for the said products. So, it is expedient to develop special standards, standardizing the specifications for food products intended for reservation or to complete existing standards with provisions that contain special requirements to food products which are probable to be used for the purpose of reserving and to develop, if necessary, the standards for methods for determining different indicators of food produces, which are important in terms of their processing, preparation and practical implementation of the said reservation [6].

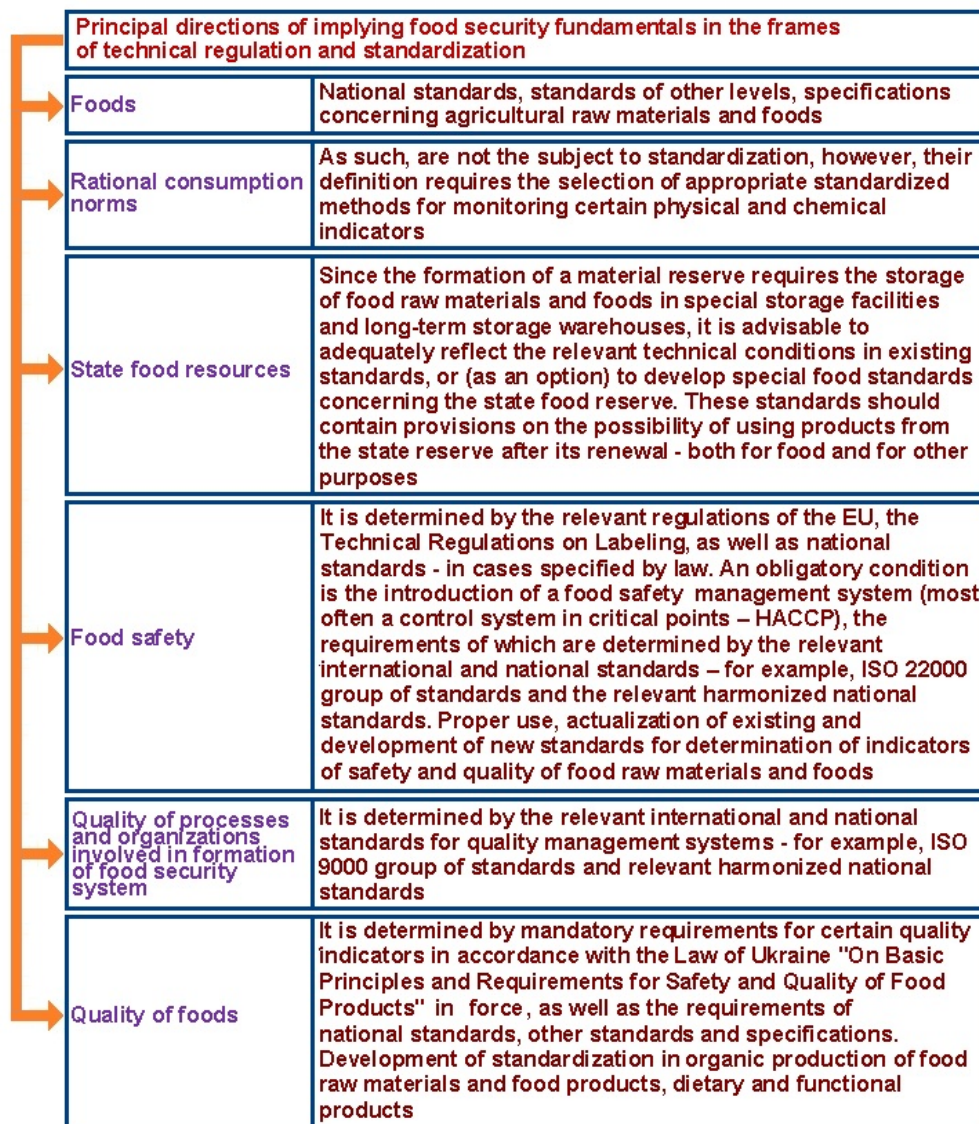


Figure 1. Principal directions of implying food security fundamentals in the frames of technical regulation and standardization.

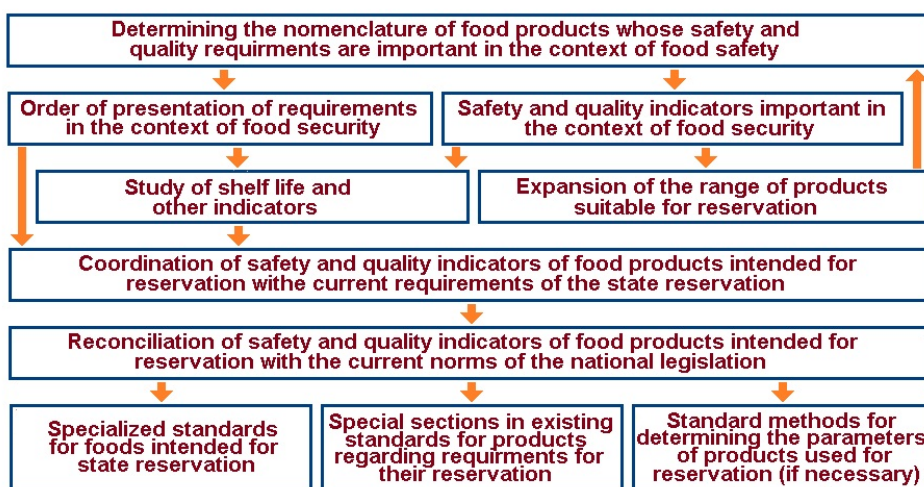


Figure 2. The scheme of the algorithm of expedient involvement of the basics of food safety in regulatory documents of the national standard level.

The appropriate consideration of the principles of food security in technical regulation can be fulfilled by developing normative documents that contain norms concerning long-term storage, amending existing regulatory documents, the scope of which are certain foods, with relevant sections as well as the development of documents that will normalize, if necessary, special methods for research of long-term storage products [10]. Foods which can be stored for a long time at negative temperatures are, among others, butter and frozen meats.

According to the national norms of Ukraine, butter shall be stored at temperatures from 0 °C to -18 °C in freezers for a period of 3 to 12 months. There is the possibility of long-term storage of butter in a monolith in cardboard boxes lined with parchment at a temperature of -25 ± 3 °C for 24 months [11]. The above said packing was used in studies of long-term storage of 20 tons batch of butter at a temperature of -25 ± 3 °C for 30 months [12]. After long-term (24 and 30 months) storage, the titrated acidity and acidity of the fat phase increased by 1.26 times and by 1.32 times (Table 1), which corresponds to the norms of the National Standard of Ukraine DSTU 4399:2005 “Butter. Specifications”, therefore, there is every reason to assert the acceptability of the temperature regime -25 ± 3 °C for proper retention of biochemical processes in butter.

Research results and discussion. The results of experiments [11] show that the mathematical modeling allows predicting the shelf-life of food products based on the study of the mechanism and kinetics of processes that determine the deterioration in the quality (set of relevant indicators) of butter during storage. The predicting the shelf life of this on the basis of a complete factorial experiment makes it possible to evaluate their storage capacity with sufficient reliability. The titratable acidity, acidity of the fat phase, degree of disper-

sion and distribution of moisture, and also the peroxide number were determined as basic storage factors of butter.

Together with cooling, the freezing of meat, as a preservation method, has many advantages in terms of preserving the properties of meat, whose chemical composition is characterized by high-quality proteins, minerals and B-complex vitamins, valuable meat ingredients are also best preserved. The quality of preserved meat primarily depends on the speed and temperature of cooling and freezing process, and on ice crystals that form during freezing, their position and size. The hygienic quality of chilled and frozen meat depends, above all, on microflora in raw meat, but also on the manner and time of storage, the method of transport and the proper storage of meat [13].

When storing frozen meat, there is no delay of hydrolytic changes in the protein system, and even at a temperature of (-18) °C there are signs of deep hydrolysis of proteins. Quite intensive hydrolytic decomposition of fats also occurs at relatively low storage temperatures. In the case of long-term storage products, which include frozen products, the deterioration in quality is caused by slow chemical reactions, and the result is, for example, a decrease in nutritional value [14].

The practice of long-term reserving of meat shows that for beef the shelf life is 18 months at a temperature of (-18) °C and 24 months at a temperature of (-25) °C, for pork – 12 months both at a temperature of (-18) °C and at a temperature (-25) °C. For the most part, the given expiration dates of these meats coincide with the norms of the national standards of Ukraine, but the said norms do not provide for the possibility of storing meat for 24 months. At the same time, the above parameter is confirmed by the long-term practice of storing frozen meat in long-term storage freezers and the data given in [15] (Table 2).

Table 1 – Biochemical parameters of butter after storage at a temperature of -25 ± 3 °C [12]

Parameters	Storage time, months			
	Control	3	24.	30
Titrated acidity, °T	15,9±0,8	15,9±0,7	16,7±0,8	20,00±0,9
Acid fat phase, °K	1,79±0,08	1,80±0,09	2,00±0,1	2,37±0,1

Table 2 – Shelf life of the frozen meat, months [15]

Kind of meat	Temperature (-12) °C	Temperature (-18) °C	Temperature (-24) °C
Beef carcasses*	8	15	24
Veal carcasses*	6	12	15
Pork carcasses*	6	10	15

* Carcasses are unwrapped or wrapped with the sackcloth

Concluded. So it can be concluded that specialized organizations of the state reserve system, which are equipped with properly equipped refrigerators and storage facilities, can carry out long-term storage of butter and meats for periods exceeding those specified in the national standards. It is possible to develop of standards defining the terms and conditions of long-term storage of foods in the conditions of enterprises of the state reserve system, equipped with appropriate refrigerating chambers and warehouses. Another possible solution to the existing problem is the introduction to the current standards of provisions regarding special requirements for long-term storage of foods in the state reserve, these involved in solving the issues of the food security.

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Питання продовольчої та харчової безпеки за тривалого зберігання м'ясних і молочних продуктів

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Стан, коли всі люди в будь-який час мають фізичний та економічний доступ до безпечної та корисної їжі, достатньої для задоволення їх фізіологічних потреб і необхідних для активного та здорового способу життя, називається продовольчою безпекою. Основними її складовими є: доступність як ступінь фактичної або потенційної доступності продовольства для певної групи населення впродовж певного періоду; доступність, як ступінь

спроможності населення впродовж певного періоду отримувати харчові продукти у своє розпорядження; споживання, як забезпечення населення достатньою кількістю поживних продуктів харчування впродовж певного періоду. Поняття продовольчої безпеки, поряд з економічними аспектами, охоплює низку технічних компонентів: харчову та поживну цінність продуктів, інші фізико-хімічні характеристики, придатність до транспортування та короткочасного або тривалого зберігання. Технічне регулювання – це правове регулювання відносин у сфері визначення та виконання обов'язкових вимог до характеристик продукції або суміжних процесів і методів виробництва. Основними напрямками врахування вимог продовольчої безпеки в технічному регулюванні є норми раціонального споживання, державні продовольчі ресурси, безпечність харчових продуктів та окремі показники їх якості. Визначено основні напрями основ продовольчої безпеки в межах технічного регулювання та стандартизації, а також алгоритм доцільного залучення основ продовольчої безпеки до нормативних норм. Врахування принципів продовольчої безпеки в технічному регулюванні може бути здійснено розро-

бленням нормативних документів, які містять норми щодо тривалого зберігання, внесення змін до чинних нормативних документів, до сфери дії яких належать окремі харчові продукти, з відповідними розділами, а також розробленням документів, що нормалізує, за необхідності, спеціальні методи дослідження продуктів тривалого зберігання, наприклад, вершкового масла та замороженого м'яса. Зазначається, що спеціалізовані холодильні та складські приміщення можуть здійснювати довготривале зберігання вершкового масла та м'яса на терміни, що перевищують встановлені національними стандартами. Можливим є розроблення стандартів, що визначають терміни та умови тривалого зберігання харчових продуктів в умовах підприємств системи державного резерву. Іншим способом розв'язання проблеми є долучення до чинних норм положень про особливі вимоги щодо тривалого зберігання харчових продуктів у державному резерві, які пов'язані з вирішенням питань продовольчої безпеки.

Ключові слова: продовольча безпека, тривале зберігання, безпечність харчових продуктів, стандарти, масло, заморожене м'ясо, технічне регулювання.



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