ANIMAL SCIENCE AND FOOD TECHNOLOGY

Journal homepage: https://animalscience.com.ua/en
Animal Science and Food Technology, 13(4), 39-49
Received: 20.09.2022 Revised: 22.10.2022 Accepted: 01.11.2022

UDC 006.83:637.52:598.261.7
DOI: 10.31548/animal.13(4).2022.39-49

The quality of quail meat cans depending on storage conditions and time of consumption

Vasile Macari*
Doctor of Biological Sciences, Professor
State Agrarian University of Moldova
2049, 42 Mircesti Str., Chisinau, Moldova
https://orcid.org/0000-0002-8072-4150

Natalia Pavlicenco
Doctor of Biological Sciences, Professor
State Agrarian University of Moldova
2049, 42 Mircesti Str., Chisinau, Moldova
https://orcid.org/0000-0003-1954-8167

Ana Rotaru
PhD in Veterinary Sciences, Professor
State Agrarian University of Moldova
2049, 42 Mircesti Str., Chisinau, Moldova
https://orcid.org/0000-0003-3637-1607

Gheorghe Pistol
PhD in Veterinary Sciences
State Agrarian University of Moldova
2049, 42 Mircesti Str., Chisinau, Moldova
https://orcid.org/0000-0002-3271-2534

Marin Alexandruc
PhD in Veterinary Sciences
State Agrarian University of Moldova
2049, 42 Mircesti Str., Chisinau, Moldova
https://orcid.org/0000-0001-9290-8507

Valentyna Israelian
PhD in Technical Sciences, Associate Professor
National University of Life and Environmental Sciences of Ukraine
15, Heroiv Oborony str., 03041, Kyiv, Ukraine
https://orcid.org/0000-0002-7242-3227

Suggested Citation:
Macari, V., Pavlicenco, N., Rotaru, A., Pistol, G., Alexandruc, M., & Israelian, V. (2022). The quality of quail meat cans depending on storage conditions and time of consumption. *Animal Science and Food Technology*, 13(4), 39-49.

**Corresponding author*

Abstract. Physicochemical and biochemical changes may occur in products of animal origin under the influence of internal and external factors, depending on the storage conditions. For the products made from the meat raw materials of various origins, it is important to know the optimal duration and modes of storage, which will preserve the optimal indicators of product quality and safety. The study aimed to determine the effect of different temperature regimes during storage on the quality and safety indicators of canned quail meat. Three series of experiments were conducted on the canned quail meat. In the first experiment, the quality indicators of the freshly prepared product were evaluated. In the second and third experiments, the parameters of the product were determined after aging for one year at temperatures of 2-4°C and 18-20°C. Organoleptic properties and physico-chemical and microbiological parameters were evaluated in the canned goods. The following methods of research were used: during the organoleptic assessment, it was considered the following properties: appearance, color, cross-section, smell, taste; fat content – by the Soxhlet method; hydrogen index (pH) – by the potentiometric method; microbiological indicators – by the horizontal method of counting colonies of microorganisms. It was found that the storage temperature did not affect the bacteriological indicators of the samples, which indicates the high quality of sterilization and excludes biological influence on the quality of canned goods. It has been established that, regardless of the storage temperature, the organoleptic indicators of canned food 12 months after production meet the state standard and the manufacturer's requirements, and they do not differ significantly. After one year of storage, the physico-chemical indicators of canned quail meat are within the limits of indicators established by the standard, regardless of the storage temperature. At the same time, certain changes were detected in the canned goods, which depended on the temperature conditions of storage. Considering the trends in physico-chemical parameters, the desired storage temperature for canned quail meat is 2-4°C, although the increase in temperature to 18-20°C does not lead to significant changes and it is permissible. Research is scientifically based on establishing the safety and quality of canned minced quail meat during long-term storage conditions, to create and produce high-quality and safe food products, which in turn allows for expanding the assortment of canned meat raw materials

Keywords: bones, collagen, peroxide index, sterilization, the bloat of cans

Introduction

In modern society, special attention is paid to proper nutrition, balanced in nutritious and safe substances. Nutritionists and food industry professionals are concerned about the issue of functional nutrition. The quality and safety of foodstuffs depend on the quality of the raw and auxiliary materials used, the conditions of processing, and storage. It is known that during the technological flow and the period of storage, there are permanent physico-chemical and biochemical changes, which lead more or less to the loss of nutritional and hygienic quality (Ostachowicz *et al.*, 2019).

Food storage is an important stage of the technical and economic circuit. During the storage of products, qualitative changes may occur, the intensity and meaning of which depend on the interaction between internal and external factors of the products. The prevention of these changes requires constant monitoring of the storage regime and action, and if necessary, to ensure and maintain a balance between action and mutual dependence on internal and external factors of the products (Umaraw *et al.*, 2020). The most important physical changes are mainly related to the fluctuating action of the air parameters, respectively the relative temperature and relative humidity. The influence of these parameters is the basis for both physical changes and all other types of changes (Riabovol & Bal-Prylypko, 2021).

The quality of canned quail meat is of particular interest, depending on the storage conditions and the term of consumption, having a high nutritional value; they can be consumed in its pure form, without any additional preparation. These products can be stored for a certain time, in conditions of adequate microclimate, constituting the supplement of the basic food for all categories of consumers (Abdel-Atty *et al.*, 2020).

The technology of manufacturing canned meat using the method of sterilization is primarily aimed at obtaining safe products, free from microorganisms that can lead to spoilage of the product and poisoning of consumers. Currently, this problem remains relevant. In particular, in the studies conducted in Egypt, the *Clostridium perfringens* was isolated from 28% of canned meat samples from beef and poultry (Bal-Prylypko *et al.*, 2022). This indicates the possibility of bacterial contamination due to violations during the receipt and storage of meat raw materials and technological requirements for the production of product, which affects changes in the canned meat during storage.

As a result of the long-term storage of sterilized canned meat, changes occur, which are associated with corrosion of the outer and inner surface of cans and changes in the sensory and physicochemical properties of the product. In particular, it was detected the color changes, accumulation of greenish-blue crystals, an unpleasant smell, the smell of stale meat, and a bitter aftertaste (Stojanovic *et al.*, 2021). An increase in the content of Fe in the product is also noted (Rashid & Khidhir, 2021), which leads to a deterioration of sensory evaluation due to a pronounced metallic aftertaste. The effect on canned products is determined not only by the duration, but also by the temperature of storage. In the example of canned tuna, which was stored for 120 days at temperatures of 5°C, 15°C, and 25°C, a connection was established (Sabow, 2021) between elevated storage temperatures and an increase in pH (up to 8.5 at

25°C) with the content of total volatile base nitrogen, free fatty acids, and thiobarbituric acids. During the storage of canned quail meat, chemical changes related to the fatty acid profile of fats can be expected, since this product contains a significant amount of unsaturated fatty acids. It has been found (Bal-Prylypko *et al*., 2016) that in some parts of the quail carcass, more than one-third of all fatty acids are oleic acids.

The purpose of the study is to determine the influence of temperature parameters on the quality and organoleptic indicators of the canned quail meat during the storage process. To fulfill the goal, the following tasks were defined: to conduct a literature search on the sterilization regimes of canned goods and the influence of microorganisms on the quality of ready-made canned goods during the storage, and to investigate the organoleptic, physico-chemical and microbiological indicators of product quality depending on the temperature and storage period.

Materials and Methods

The research was conducted on the canned stuffed quail meat produced in the Republic of Moldova. The first stage of the research consisted of evaluating the quality indicators of the freshly prepared product. In the second and third stages, it was conducted the studies of the complex characteristics of the quality of finished products after the aging for one year at temperatures of 2-4°C and 18-20°C; in particular, organoleptic, physico-chemical and microbiological parameters were determined.

There were 3 series of research on this product between 25.11.2020-13.10.2021 with the aim of researching the quality of canned quail meat depending on the storage conditions and the term of consumption and safety of the product. The assessment of quality of the researched product and the changes that took place under the influence of storage conditions, namely the temperature at 2 regimes (2-4°C and 18-20°C) and the term of consumption were made within the Institute Publica "Centrul Republican de Diagnostic Veterinary". Six samples of the investigated material were taken. All assessed quality indices and indices indicating changes in the quality depending on the storage conditions and shelf life of the product were analyzed by the national regulatory requirements in force and the company standard for this product. The organoleptic evaluation of the finished product was carried out according to DSTU 4823.2:2007. The main quality indicators were considered during the evaluation: appearance, color, cross-section, smell, and taste. Determination of physicochemical parameters, namely: hydrogen index (pH) – by the potentiometric method according to DSTU ISO 2917-2001 (2003), the mass fraction of the total fat content was determined by the Soxhlet method according to DSTU 8380:2015 (2017), sodium chloride content in canned meat was carried out according to DSTU 4939:2008. The determination of microbiological changes in canned goods was evaluated by the horizontal method using the quantitative counting of colonies of microorganisms following DSTU 8446:2015 (2017), and ISO 11290-1:2017 (2017). According to DSTU 7992:2015 (2017), DSTU 7963:2015 (2017), the sampling and determining the quality and safety of food products, packaging and labeling were carried out according to the rules and methods of analysis established by the current legislation for this type of product.

Results and Discussion

The evaluation of quality of the canned quail meat, depending on the storage conditions and the consumption term, was started with the sensory (organoleptic) analysis of the investigated product. Sensory analysis is very important when considering the quality of the end product (Fu & Chen, 2019). In the Table 1, there are the results of the organoleptic indices investigated in the first series of research.

Table 1. *The values of the organoleptic indices of canned quail meat*

Parameter analyzed	Test methods	Obtained results
Canned meat. Quail meat	DSTU 4823.2:2007, PS- CSA-PRO-01	Glass jar, tightly closed, uncombed. They can have pieces of meat, without tendons, bones and connective tissue. The meat is not juicy, rough, or uncooked, it does not crumble when removing from the jar. The color of the flesh is yellowish-cream, without spots. The unheated broth is clear light yellow. Pleasant odor, characteristic of the product, with the aroma of spices, without foreign odor. Pleasant taste, suitable for salting, and moderately spicy, without foreign taste

Source: (2009)

The results in the Table 1 regarding the organoleptic characteristics of the product investigated in the first series of research correspond to all the requirements presented in the company standard for this product and the National Legislation (GD No. 624 of 19.09.20 on the approval of the Quality Requirements for preparations and products meat), and no deviations from the norm regarding organoleptic indices have been detected. In the second series of research – the researched product was kept at a temperature of 2-4°C for 1 year. The organoleptic indices of the canned quail meat are shown below in the Table 2.

Table 2. *Organoleptic indices of the canned quail meat in the second series of research*

Sample name	Obtained results	Normative requirements	Test methods
Canned meat Quail meat	Glass jar, tightly closed, uncombed. Canned meat pieces, compactly placed, without tendons, bones and connective tissue. The meat is not juicy, rough, or uncooked, it does not crumble when removing from the jar. The color of the flesh is yellowish-cream, without spots. The unheated broth is clear light yellow. Pleasant odor, characteristic of the product, with the aroma of spices, without foreign odor. Pleasant taste, suitable for salt, without foreign taste	SF MD 41213475-002: 2019 (2019)	DSTU 4823.2:2007, PS- CSA-PRO-01

Table 2 clearly shows that the organoleptic indices of the investigated product (in the second series of research, which was kept at a temperature of 2-4°C, for 1 year) correspond to all the requirements presented in the company standard.

It is important to note that in the third series of research, the analyzed product has been kept at a temperature of 18-20°C for 1 year. Organoleptic indices in this series of research are given below in the Table 3.

Table 3. *Organoleptic indices of the canned quail meat in the third series of research*

Sample name	Obtained results	Normative requirements	Test methods
Canned meat Quail meat	Glass jar, tightly closed, uncombed. Canned meat pieces, compactly placed, without tendons, bones and connective tissue. The meat is not juicy, rough, or uncooked, it does not crumble when removing from the jar. The color of the flesh is yellowish-cream, without spots. The unheated broth is clear light yellow. Pleasant odor, characteristic of the product, with a slight aroma of spices, no foreign odor. Pleasant taste, suitable for salt, without foreign taste	SF MD 41213475-002: 2019 (2019)	DSTU 4823.2:2007, PS- CSA-PRO-01

From the data presented in Table 3, it can be stated that the organoleptic indices investigated in the product under study (in the third series of research, which was kept at a temperature of 18-20°C for 1 year) correspond to all the requirements presented in the company standard. At the same time, the assessment of product quality and safety has been determined by several specific aspects of the food products, which are carried out (determined) in laboratory conditions by physico-chemical indices of the canned stewed meat, namely:

- pH;
- mass fraction of salt, %; max
- mass fraction of fat, %,
- mass fraction of proteins, %;
- peroxide index ½ O mmol/kg;
- acidity index, mg KOH mg/g;
- bone mass fraction, %; MAX
- mass fraction of meat, %; min
- mass fraction of jelly sauce, %; MAX
- hydroxyproline content, %;
- mass fraction of proteins, %; min.

Performing the physico-chemical analysis of the canned quail meat studied during the three (3) series of research and compared with the requirements of the company standard, a wide range of results have been obtained, which are presented in the Figure 1.

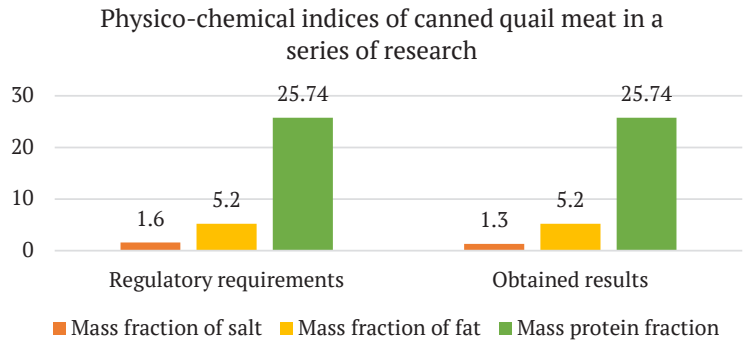

Figure 1. Physico-chemical indices of the stewed canned quail meat with regulatory requirements (1st research series)

According to the standard, the mass fraction of salt, %, max in the stewed canned quail meat amounted to 1.3%, which corresponds to the normative requirements. The mass fraction of fat, %, max in the canned quail meat is 5.2%, and the mass fraction of protein, %, max 25.74%, which corresponds to the requirements and rules in force. The results of the physico-chemical parameters obtained in the second series of investigations after keeping the researched product for 12 months at a temperature of 2-4°C are presented in the Figure 2-4.

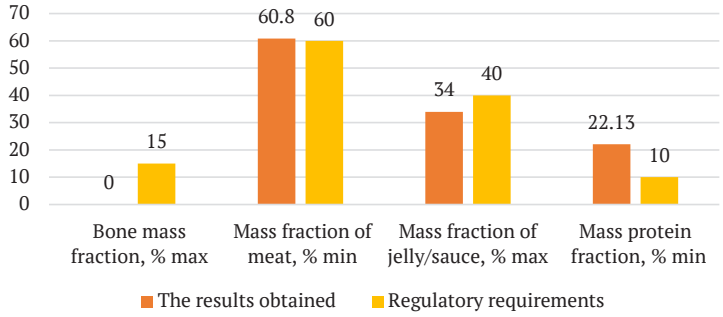

Figure 2. Test results after storage of the product for 12 months at 2-4°C following regulatory requirements

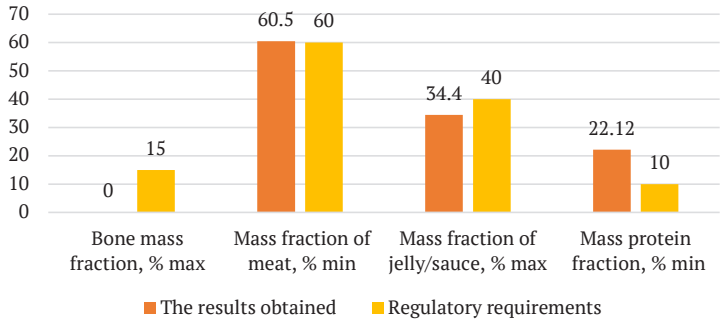

Figure 3. Test results after storage of the product for 12 months at 18-20°C following regulatory requirements

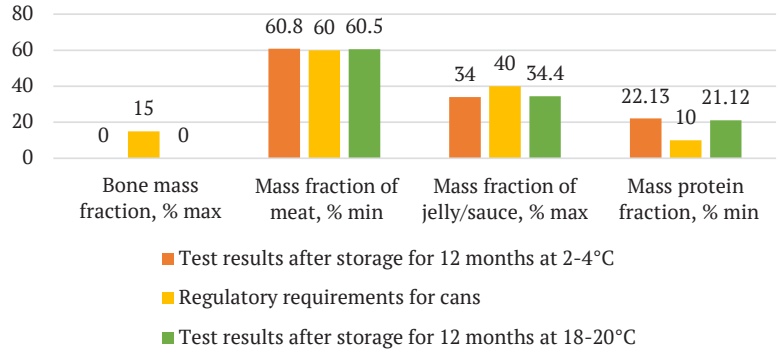

Figure 4. Test results after storage of the product for 12 months at 2-4°C and 18-20°C according to regulatory requirements

The pH is the degree of acidity or alkalinity of a food. Foods naturally contain organic acids. These acids are essential in preserving the taste, color, luster and quality of food. Due to improper sterilization, thermostable microorganisms are not destroyed during this technological process, and at a certain pH value, they can develop during storage, which can cause biological bloat of cans.

Results of pH examination after storage of the product for 12 months at 2-4°C and 18-20°C are presented in the Figure 5.

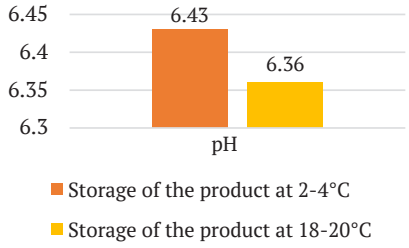

Figure 5. Results of pH examination after storage of the product for 12 months at 2-4°C and 18-20°C

After analyzing the obtained results (Fig. 5), it has been established that the pH of the product stored at 2-4°C is 6.43, and the pH of the product stored at 18-20°C is more acidic and has a value of 6.36. According to the results of conducted research, it has been established that the pH value also depends on the storage temperature of canned quail meat, but its value has decreased insignificantly (by 0.07). Nevertheless, this change did not affect the product's quality, as evidenced through the sensory qualities of the product (Pleasant taste, corresponding to the given product, without foreign taste).

However, during the storage of meat products, oxidation processes of fats can take place. These are the most important factors that determine the loss of quality and implicitly of flavor, texture, nutritional value and color: the lipid oxidation products acting as a substrate for protein oxidation. Oxidation products affect the product's quality, including the organoleptic aspects – rancid odor (Mushtruk *et al.*, 2022).

Results of the examination of the peroxide index and acidity index after storage of the product for 12 months at 2-4°C and 18-20°C are presented in the Figure 6.

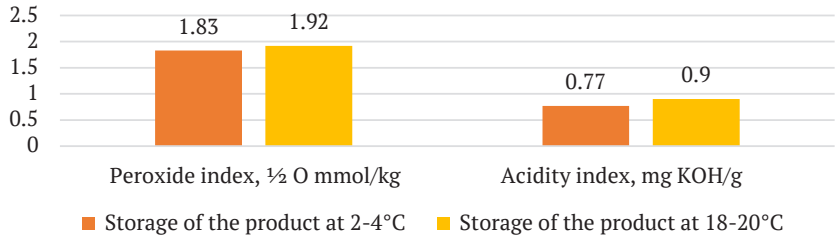

Figure 6. Results of examination of peroxide index and acidity index after storage of the product for 12 months at 2-4°C and 18-20°C

The peroxide index shows the oxidation degree of the product. Thus, analyzing the Figure 6, it can be concluded that the peroxide index of the product stored at 2-4°C is 1.83 and the peroxide index of the product stored at 18-20°C increased by 0.9 to 1.92. Thus, the high storage temperature contributed to the product's oxidation.

The acidity index is a parameter that shows the degree of fats' rancidity. Therefore, analyzing the figure 6, it has been found that the product stored at 2-4°C has an acidity index of 0.77 mg KOH/g, and the product stored at 18-20°C has significantly increased the acidity index, by reaching 0.9 mg KOH/g. Therefore, the temperature influences the value of acidity index in the investigated product. Thus, during the storage period of meat products, the oxidation of fats in products was practically minimal, which was proven by the low value of peroxide and acidity index and the insignificant variation of their values over time, values that did not negatively influence the appearance, aroma and color; it has been confirmed the stability of organoleptic indices during storage of the product, even at different temperatures.

Determination of the hydroxyproline content in the canned meat is a commonly used parameter for assessing the meat quality (Punia *et al.*, 2020).

The hydroxyproline content obtained in the meat products under research is 0.12%, which indicates a good quality of the canned food and demonstrates the use of quality raw material; this fact is confirmed by the meat content of 60.0-60.8% and zero value (0%) of bone content. The mass fraction of bones is an index that reflects the percentage of bones in a certain amount of bone-in meat. This is a parameter used to assess the quality of meat. The mass fraction of bones significantly influences the change of product during storage, because the bones contain a large amount of collagen, which shows the fact that the product will degrade more rapidly during storage.

Results of examination of the mass fraction of bones, meat, jelly/sauce and protein after the product's storage for 12 months at 2-4°C and 18-20°C are presented in the Figure 7.

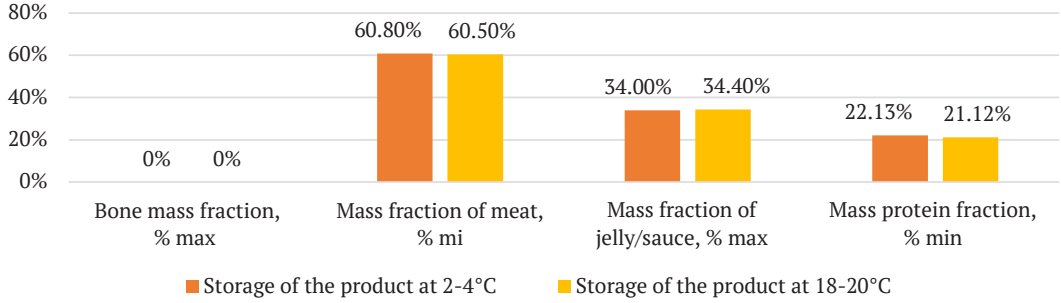

Figure 7. Results of examination of the mass fraction of bones, meat, jelly/sauce and protein after storage of the product for 12 months at 2-4 °C and 18-20 °C

The mass fraction of meat is an important index that shows the quality of canned quail meat. According to the study, analyzing the Figure 7, it has been found that the mass fraction of meat represents 60.8% for the product stored at 2-4°C, and the mass fraction of meat decreased insignificantly by 0.3%, reaching the mark of 60.5% for the product stored at 18-20°C.

The mass fraction of jelly/sauce is an indicator of quality, especially for the canned meat. After conducting the analysis, the Figure 7 shows that the mass fraction of jelly/sauce is 34.0% for the product stored at a temperature of 2-4°C, and the mass fraction of jelly/sauce has increased, by reaching the value of 34.4% for the product stored at a temperature of 18-20°C. Thus, the high temperature directly influences the formation of jelly and meat sauce.

The mass fraction of protein in a meat product restores its quality, as the value of meat mainly consists of the protein. In the course of the study, it has found that the mass fraction of protein is 22.13% for the product stored at 2-4°C, the mass fraction of protein has decreased significantly by 1.01%, reaching the mark of 21.12% for the product stored at 18-20°C (Figure 7).

After analyzing the obtained results, it is possible to conclude the following: all the physicochemical properties of canned quail meat are within the parameters set by the standard, and their value may vary depending on the storage conditions and the period of consumption, depending on the storage temperature that does not affect the quality of the product (Barreira *et al.*, 2019). It should be noted that the most important requirement of the food is its compliance with the rules of microbiological indices (Bal-Prylypko & Nikolayenko, 2018). It is pointed out in the cited sources that the microbiological safety of consumer is an important issue in ensuring the complete sterility of these types of cans (Creydt & Fischer, 2019), Holembovska *et al.*, 2021).

The microbiological indices analyzed in the researched canned quail meat (III research series) are presented in the Tables 4, 5, and 6, respectively.

Table 4. *Microbiological indices of the stewed canned quail meat in the first research series*

Analyzed parameter	Test methods	Normative requirements	Obtained results
Listeria monocytogenes in 25 g	ISO 11290-1:2017 [14]	Not Admitted	Not detected
Industrial sterility	DSTU 8446:2015 [13]	Not Admitted	Mesophilic aerobic viable microorganisms in 0.1 g were not detected. Viable mesophilic anaerobic microorganisms in 0.1 g were not detected. It corresponds to the industrial sterility

Table 5. *Microbiological indices of the stewed canned quail meat in the second series of research*

Sample name	Obtained results	Normative requirements	Test method
Listeria monocytogenes in 25 g	Not detected	Not Admitted	ISO 11290-1:2017 [14]
Industrial sterility	Mesophilic aerobic viable microorganisms in 1.0 g were not detected. Viable mesophilic anaerobic microorganisms in 1.0 g were not detected. It corresponds to the industrial sterility	Not Admitted	DSTU 8446:2015 [13]

Table 6. *Microbiological indices of the stewed canned quail meat in the third research series*

Sample name	Obtained results	Normative requirements	Test method
Listeria monocytogenes in 25 g	Not detected	Not Admitted	ISO 11290-1:2017 [14]
Industrial sterility	Mesophilic aerobic viable microorganisms in 1.0 g were not detected. Viable mesophilic anaerobic microorganisms in 1.0 g were not detected. It corresponds to the industrial sterility	Not Admitted	DSTU 8446:2015 [13]

Analyzing the data obtained from the laboratory expertise of microbiological indices (*Listeria monocytogenes*) and Industrial Sterility in all series of research, it is clear that the product is safe and meets the requirements in force. Mesophilic aerobic viable microorganisms in 1.0 g and Mesophilic anaerobic viable microorganisms in 1.0 g were not detected, Listeria monocytogenes in 25 g was not detected; moreover, their presence is not even allowed according to the company standard and GD no. 221/2009 "Rules on microbiological criteria for food", (Cherednichenko *et al.*, 2020), (Costachescu *et al.*, 2018).

The production of canned meat from quail is one of the methods of preserving meat, which allows keeping stocks of highly nutritious, high-quality and safe meat products ready

for consumption for a considerable period. In the studies (Suchenko *et al.*, 2017), it is stated that the biochemical processes occur due to the development of residual anaerobic microflora as a result of non-compliance with sterilization regimes or insufficient time for its implementation. All this leads to the rapid spoilage of the product.

Significant attention is paid to the safety of raw materials included in the canned products. M. Nikolaienko & L. Bal-Prylypko, (2020) have identified the dangerous factors in the production of stewed meat. The researchers have established that the risks of biological origin exist in every technological operation. O.M. Bergilevich, V.V. Kasyanchuk (2018) and O.A. Hitska (2018) note that the control of manufacturing process and especially the storage of canned meat should be risk-oriented and should be carried out at all stages of the production and circulation.

This requires a scientific-based assessment of risks, especially microbiological ones, which arise during the storage of canned meat (Roşca *et al.*, 2018; Zheplinska *et al.*, 2021).

The author of scientific work (Sofos, 2014) has conducted a study of various types of hazards that can be in the composition of meat products, and which can include chemical substances and biological agents (bacteria, viruses and parasites, and abnormal prions, as well as various mechanical impurities). According to the author, it follows that the formation of microorganisms in meat and meat products is a normal process, since various types of microorganisms are present in the animals and their environment. The presence of microbes and their growth is the reason of rapid spoilage of products and decrease in the safety. The quality and safety of meat and meat products must be maintained by an integrated preventive approach at all stages during production, including producers, processors, distributors, sellers, catering establishments, as well as consumers (Sofos, 2014).

The team of authors (Šopík *et al.*, 2022) have conducted a series of experimental studies regarding the development of indicators that have a significant impact on changes in the quality of food products and safety of the selected canned (Szeged goulash, canned chicken meat, pork pate, canned tuna) and dehydrated (goulash) food products during two years of storage. Experiments were conducted at four different temperature regimes. Storage temperatures have been chosen to reflect the following climate zones: arctic (-18°C), temperate (5°C), subtropical (25°C) and tropical (40°C), where such food is likely to be stored during humanitarian and military missions. The authors proposed methods for determining the number of microorganisms, depending on the storage temperature, and methods for determining the dry matter, fat and proteins. According to the results of experiments, it was observed an increase in the level of ammonia in all food products during 24-month storage, and the loss of individual amino acids during storage reached the mark from 5% regarding the calculated content of amino acids in a month "0" up to 15%. At storage temperatures above the freezing point, the indicators of hardness decreased with an increase in the storage temperature. Furthermore, at temperatures -18°C, the hardness development measured as the "rate of decline" was significantly higher compared to the absolute values (Šopík *et al.*, 2022).

Based on the above information, it has been proven that the researched products are of high quality, harmless, and safe for the consumer's health, as well as meet the requirements of industrial sterility and hygiene.

Conclusions

The stewed canned quail meat under research has demonstrated qualitative characteristics suitable for the manufacture for public consumption, complying with all the requirements and norms of the company standard and the requirements of the National Legislation (GD No. 624/2020) for this type of product.

Organoleptic parameters, such as color, taste and smell, which have been investigated for the canned quail meat depending on the storage conditions and shelf life, have demonstrated characteristics that correspond to the requirements of this product throughout the storage period at different temperatures.

The investigated physical-chemical parameters showed the following results: insignificant variation of the Ph values did not significantly influence the product's quality, this was also confirmed by the stability of the sensory indices, taste and smell throughout the storage period at different temperatures; temperature influences the value of peroxide index and the acidity index when storing canned quail meat, but their low values and insignificant variation during storage did not affect the quality of the product, the smell and taste remained stable and they were not identified as foreign smell and taste; as the temperature increases, the mass fraction of meat decreases, this is explained by the fact that the jelly, sauce and fat in the composition of meat decompose or melt. Thus, the mass fraction of meat in the canned quail influences the quality of product stored at different temperatures; as the storage temperature of the product increases, the content of jelly/sauce in the cans increases, which is explained by its decomposition from the meat. Therefore, the mass fraction of jelly/sauce in the canned quail meat stored at different temperatures influences the product's quality; however, as the temperature of product increases, the mass fraction of protein in the product decreases. The variation of storage temperature of the product has a great influence on the mass fraction of protein and the quality of canned quail meat, as protein is the most important substance in meat.

Microbiological indices and industrial sterility are the aspect that reflects safety and harmlessness of the food produced for the public consumption. According to the results of microbiological examination of the researched cans, no viable aerobic and anaerobic microorganisms have been detected in 1.0 g of the product, which confirms the quality and safety of the investigated product.

The prospects for further research are related to the calculation of nutritional value, determination of stages of

organising the supply, and quality control of the canned food, which includes the selection of control points according to the system of risk analysis, dangerous factors and control of critical points of HACCP, as well as the optimization of production processes and determination of rational equipment parameters for the production of canned meat from land and waterfowl.

References

[1] Abdel-Atty, N.S., Khalafalla, F.A., & Barakat, D.A. (2020). Bacteriological quality of canned meat marketed in Egypt. *Benha Veterinary Medical Journal*, 39(1), 154-158. https://doi.org/ 10.21608/bvmj.2020.40633.1258.

[2] Bal-Prylypko, L.V, & Nikolayenko, M.S. (2018). An integrated system of management of quality and safety of food products. *Scientific Bulletin of the National University of Bioresources and Nature Management of Ukraine*, 10(5-6), 68-76.

[3] Bal-Prylypko, L., Yancheva, M., Paska, M., Ryabovol, M., Nikolaenko, M., Israelian, V., Pylypchuk, O., Tverezovska, N., Kushnir, Y., & Nazarenko, M. (2022). The study of the intensification of technological parameters of the sausage production process. *Potravinarstvo Slovak Journal of Food Sciences*, 16, 27-41. https://doi.org/10.5219/1712.

[4] Bal-Prylypko, L.V., Patyka, N.V., Leonova, B.I., Starkova, E.R., & Brona, A.I. (2016). Trends, achievements, and prospects of biotechnology in the food industry. *Microbiological Journal*, 78(3), 99-111. https://doi.org/10.15407/microbiolj78.03.099.

[5] Barreira, J.C., Nunes, M.A., Da Silva, B.V., Pimentel, F.B., Costa, A.S., Alvarez-Ortí, M., & Oliveira, M.B.P. (2019). Almond cold-pressed oil by-product as an ingredient for cookies with potential health benefits: Chemical and sensory evaluation. *Food Science and Human Wellness*, 8(3), 292-298. https://doi.org/10.1016/j.fshw.2019.07.002.

[6] Bergilevich, O.M., & Kasyanchuk, V.V. (2018). *Theoretical and experimental substantiation of microbiological risk assessment Cronobacter spp. (Enterobacter sakazakii).* Sumy: Sumy State University.

[7] Cherednichenko, O., Bal-Prylypko, L., Paska, M., & Nikolaenko, M. (2021). The expediency of the creation of technology for production of meat products of long term of storage of the combined structure. *IOP Conference Series: Earth and Environmental Science*, 723(3), article number 032086. https://doi.org/10.1088/1755-1315/723/3/032086.

[8] Costăchescu, D., Boişteanu, P.C., Costachescu, E., & Hoha, G. (2018). Physico-chemical and sensory characteristics of quail meat, meat line. *Animal Husbandry and Agricultural Biotechnology,* 52(2), 31-37. https://doi.org/10.37897/rjs.2020.2.6.

[9] Creydt, M., & Fischer, M. (2019). Blockchain and more – Algorithm-driven food traceability. *Food Control*, 105, 45-51. https://doi.org/10.1016/j.foodcont.2019.05.019.

[10] DSTU 4823.2:2007 "Meat products. Organoleptic evaluation of quality indicators". (2009). Kyiv: State Standard of Ukraine. Retrieved from http://online.budstandart.com/ua/catalog/doc-page?id_doc=83084.

[11] DSTU 4939:2008 "Fruit and vegetable processing products, canned meat and vegetable meat. Methods for determination of chloride content". (2009). Kyiv: State Standard of Ukraine. Retrieved from http://online.budstandart.com/ua/catalog/doc-page.html?id_doc=83279.

[12] DSTU 7050:2009 "Canned meat. Liver pates. General technical conditions". (2010). Kyiv: State Standard of Ukraine. Retrieved from http://online.budstandart.com/ua/catalog/doc-page?id_doc=87123.

[13] DSTU 7963:2015 "Food products. Preparation of samples for microbiological analysis". (2017). Kyiv: State Standard of Ukraine. Retrieved from http://online.budstandart.com/ua/catalog/doc-page?id_doc=80966.

[14] DSTU 7992:2015 "Meat and meat raw materials. Methods of sampling and organoleptic evaluation of freshness". (2017). Kyiv: State Standard of Ukraine. Retrieved from http://online.budstandart.com/ua/catalog/doc-page?id_doc=81075.

[15] DSTU 8380:2015 "Meat and meat products. The method of measuring the mass fraction of fat". (2017). Kyiv: State Standard of Ukraine. Retrieved from http://online.budstandart.com/ua/catalog/doc-page.html?id_doc=71564.

[16] DSTU 8446:2015 "Food products. Methods for determination of the number of mesophilic aerobic and facultative anaerobic microorganisms". (2017). Kyiv: State Standard of Ukraine. Retrieved from http://online.budstandart.com/ua/catalog/doc-page?id_doc=84583.

[17] DSTU ISO 2917-2001. "Meat and meat products. Determination of pH (Control method)". (2003). Kyiv: State Standard of Ukraine. Retrieved from http://online.budstandart.com/ua/catalog/doc-page?id_doc=89528.

[18] Fu, X., & Chen, J. (2019). A review of hyperspectral imaging for chicken meat safety and quality evaluation: Application, hardware, and software. *Comprehensive Reviews in Food Science and Food Safety*, 18(2), 535-547. https://doi.org/10.1111/1541-4337.12428.

[19] Hitska, O.A. (2018). Risk-based food safety system: Analysis of international and national legislation. *Collection of Scientific Works of the Kharkiv State Veterinary Academy: Problems of Zooengineering and Veterinary Medicine,* 35(3), 102-107.

[20] Holembovska, N., Tyshchenko, L., Slobodyanyuk, N., Israelian, V., Kryzhova, Y., Ivaniuta, A., Pylypchuk, O., Menchynska, A., Shtonda, O., & Nosevych, D. (2021). The use of aromatic root vegetables in the technology of freshwater fish preserves. *Potravinarstvo Slovak Journal of Food Sciences*, 15, 296-305. https://doi.org/10.5219/1581.

[21] ISO 11290-1:2017 "Microbiology of the food chain – Horizontal method for detecting and enumerating Listeria monocytogenes and *Listeria spp.* Part 1: Detection method". (2017). Geneva: International Organization for Standardization.

[22] Mushtruk, M., Bal-Prylypko, L., Slobodyanyuk, N., Boyko, Y., & Nikolaienko, M. (2022). Design of reactors with mechanical mixers in biodiesel production. In *Lecture notes in mechanical engineering* (pp. 197-207). Cham: Springer. https://doi.org/10.1007/978-3-031-06044-1_19.
[23] Nikolaienko, M., & Bal-Prylypko, L. (2020). Development of an integrated food quality management system. *Potravinarstvo Slovak Journal of Food Sciences*, 14, 862-873. https://doi.org/10.5219/1434.
[24] Ostachowicz, W., Soman, R., & Malinowski, P. (2019). Optimization of sensor placement for structural health monitoring: A review. *Structural Health Monitoring*, 18(3), 963-988. https://doi.org/10.1177/1475921719825601.
[25] PS-CSA-PRO-01 "Company standard. Canned meat. Quail pat". Quality management systems – Requirements.
[26] Punia, S., Sandhu, K.S., Dhull, S.B., Siroha, A.K., Purewal, S.S., Kaur, M., & Kidwai, M.K. (2020). Oat starch: Physico-chemical, morphological, rheological characteristics and its applications – A review. *International Journal of Biological Macromolecules*, 154, 493-498. https://doi.org/10.1016/j.ijbiomac.2020.03.083.
[27] Rashid, N.J., & Khidhir, Z.K. (2021). Impact of different storage temperatures on canned meat. Characteristics. *Euphrates Journal of Agriculture Science*, 13(3), 28-37.
[28] Riabovol, M., & Bal-Prylypko, L. (2021). Justification and development of sausage technology with health properties. *Animal Science and Food Technology*, 12(1), 39-47. https://doi.org/10.31548/animal2021.01.039.
[29] Roşca, I., Rubţov, S., Sandulachi, L., & Ciobanu, C. (2018). Functional bakery products with added rosehip powder. *Meridian Engineering*, 1, 85-88.
[30] Sabow, A.B. (2020). Carcass characteristics, physicochemical attributes, and fatty acid and amino acid compositions of meat obtained from different Japanese quail strains. *Tropical Animal Health and Production*, 52(1), 131-140. https://doi.org/10.1007/s11250-019-01991-2.
[31] SF MD 41213475-002:2019 "Company standard. Canned meat. Quail pate".
[32] Słowiński, M., Miazek, J., Dasiewicz, K., & Chmiel, M. (2021). The effect of the addition of fiber preparations on the color of medium-grounded pasteurized and sterilized model canned meat products. *Molecules*, 26(8), article number 2247. https://doi.org/10.3390/molecules26082247.
[33] Stojanović, B., Vasilev, D., Stojanović, Z., Parunović, N., Janković, S., Stanojević, S., Balaban, M., & Antić, V. (2021). Determination of sensory properties and levels of trace elements during storage of canned meat products. *Journal of Food Processing and Preservation*, 45(3), article number 15278. https://doi.org/10.1111/jfpp.15278.
[34] Zheplinska, M., Mushtruk, M., & Salavor, O. (2021). Cavitational Impact on Electrical Conductivity in the Beet Processing Industry. Lecture Notes in Mechanical Engineering, 755-762. https://doi.org/10.1007/978-3-030-68014-5_73.
[35] Umaraw, P., Munekata, P.E., Verma, A.K., Barba, F.J., Singh, V.P., Kumar, P., & Lorenzo, J.M. (2020). Edible films/coating with tailored properties for active packaging of meat, fish, and derived products. *Trends in Food Science & Technology*, 98, 10-24. https://doi.org/10.1016/j.tifs.2020.01.032.
[36] Yu, P., Low, M.Y., & Zhou, W. (2018). Design of experiments and regression modeling in food flavor and sensory analysis: A review. *Trends in Food Science & Technology*, 71, 202-215. https://doi.org/10.1016/j.tifs.2017.11.013.
[37] Sukhenko, Y., Mushtruk, M., Vasyliv, V., Sukhenko, V., & Dudchenko, V. (2019). Production of Pumpkin Pectin Paste. *Lecture Notes in Mechanical Engineering*, 805–812. Springer International Publishing. https://doi.org/10.1007/978-3-030-22365-6_80.
[38] Sofos, J. N. (2014). Safety of Food and Beverages: Meat and Meat Products. *Encyclopedia of Food Safety*, 268-279. https://doi.org/10.1016/b978-0-12-378612-8.00282-1
[39] Šopík, T., Lazárková, Z., Salek, R. N., Talár, J., urevdorj, K., Buňková, L., Foltin, P., Jančová, P., Novotný, M., Gál, R., & Buňka, F. (2022). Changes in the Quality Attributes of Selected Long-Life Food at Four Different Temperatures Over Prolonged Storage. *Foods*, 11(14), 2004. https://doi.org/10.3390/foods11142004.

Якість консервів з перепелиного м'яса залежно від умов та часу зберігання

Василе Макарі
Доктор біологічних наук, професор
Державний аграрний університет Молдови
2049, вул. Мірчешті, 42, м. Кишинів, Молдова
https://orcid.org/0000-0002-8072-4150

Наталія Павліченко
Доктор біологічних наук, професор
Державний аграрний університет Молдови
2049, вул. Мірчешті, 42, м. Кишинів, Молдова
https://orcid.org/0000-0003-1954-8167

Ана Ротару
Кандидат ветеринарних наук, професор
Державний аграрний університет Молдови
2049, вул. Мірчешті, 42, м. Кишинів, Молдова
https://orcid.org/0000-0003-3637-1607

Георге Пістол
Кандидат ветеринарних наук
Державний аграрний університет Молдови
2049, вул. Мірчешті, 42, м. Кишинів, Молдова
https://orcid.org/0000-0002-3271-2534

Марін Александрук
Кандидат ветеринарних наук
Державний аграрний університет Молдови
2049, вул. Мірчешті, 42, м. Кишинів, Молдова
https://orcid.org/0000-0001-9290-8507

Валентина Миколаївна Ісраелян
Кандидат технічних наук, доцент
Національний університет біоресурсів та природокористування України
03041, вул. Героїв Оборони, 15, м. Київ, Україна
https://orcid.org/0000-0002-7242-3227

Анотація. Під впливом внутрішніх і зовнішніх факторів залежно від умов зберігання, в продуктах тваринного походження можуть відбуватися фізико-хімічні та біохімічні зміни. Для продуктів виготовлених з м'ясної сировини різного походження важливо знати оптимальні тривалість і режими зберігання, за яких зберігатимуться оптимальні показники якості та безпечності продукту. Метою дослідження було визначити вплив різних температурних режимів під час зберігання на показники якості і безпечності консервів з м'яса перепелів. Проводили три серії дослідів на консервах з м'яса перепелів. В першому досліді оцінювали якісні показники свіжоприготовленого продукту. В другому і третьому дослідах визначали показники продукту після витримки протягом одного року за температури 2-4 °С і 18-20 °С. В консервах оцінювали органолептичні властивості, фізико-хімічні та мікробіологічні показники. Використовували такі методи досліджень: при органолептичній оцінці враховувалися: зовнішній вигляд, колір, вид на розрізі, запах, смак; вміст жиру – методом Сокслета; водневий показник (pH) – потенціометричним методом; мікробіологічні показники – шляхом горизонтального методу підрахунку колоній мікроорганізмів. Виявлено, що температура зберігання не вплинула на бактеріологічні показники зразків, що свідчить про високу якість стерилізації і виключає біологічний вплив на якість консервів. Було встановлено, що незалежно від температури зберігання органолептичні показники консервів через 12 місяців після виготовлення відповідають державному стандарту та вимогам виробника і суттєво не відрізняються. Через рік зберігання фізико-хімічні показники консервів з м'яса перепелів не залежно від температури витримування знаходяться в межах встановлених стандартом показників. У той же час в консервах було виявлено окремі зміни, які залежали від температурних режимів зберігання. З урахуванням тенденцій у фізико-хімічних показниках, бажана температура зберігання консервів з м'яса перепелів становить 2-4 °С, хоча підвищення температурних режимів до 18-20 °С не призводить до суттєвих змін і є допустимою. Дослідження є науково обґрунтованими щодо встановлення безпечності та якості фаршевих консервів з перепелиного м'яса під час тривалих умов зберігання, з метою створення і виробництва якісних і безпечних продуктів харчування, що в свою чергу дозволяє розширити асортимент консервів із м'ясної сировини

Ключові слова: кістки, колаген, перекисний індекс, стерилізація, бомбаж банок