

MICROBIAL QUALITY OF RABBIT MEAT CARCASSES SOLD ON THE LOCAL AND FOREIGN MARKET

Rita GOLBAN¹, Artur GOLBAN²

¹Technical University of Moldova, 168, Stefan cel Mare Boulevard, Chisinau, Republic of Moldova, MD-2004, E-mail: golbanrita@gmail.com

²Commercial Bank "Victoriabank" Joint Stock Company, Chisinau, 141, 31 August 1989 Street, MD-2004, Republic of Moldova, E-mail: golban.artur@yahoo.com

Corresponding author: golban.artur@yahoo.com

Abstract

The purpose of the scientific investigation study was the microbiological research of the quality of the domestic rabbit carcasses sold in various storage periods and temperatures and the interpretation of the data obtained according to the aspects of the microbiological quantitative values. The quality aspects of the rabbit carcasses were revealed according to the organoleptic and microbiological indices, which confirmed the quality of the rabbit carcasses after the evaluations of the quality indices and their use in the food chain. In the same time, in the scientific article was analysed the local and foreign market of rabbit meat and the main problems faced by rabbit meat producers from the Republic of Moldova.

Key words: rabbit carcass, culture media, organoleptic indices, bacterial microflora, local and foreign market

INTRODUCTION

The quality of agro-food products is very important for assuring food safety and competitiveness of agricultural products [8].

More than this, the products of animal origin play a very important role in human diet and that is why their quality should be controlled for achieving a safe and healthy consumption [6].

From a nutritional point of view, rabbit meat is an important source of energy and nutrients for humans. Due to the balanced chemical composition of substances with high biological value (proteins, fats, minerals and vitamins), superior digestibility and dietary-culinary potential, rabbit meat is an indispensable food in human nutrition. Rabbit meat contains all the essential amino acids, less collagen, myoglobin and elastin than in the meat of other animal species, it has a low calorie and cholesterol content, being particularly important for the human population [4; 15; 16; 10].

At the moment, it is considered that the world production of rabbit meat is estimated at over 1 million tons, and Spain is the third producer. Although rabbit meat is marketed and

consumed worldwide, information on microbiological quality is very scarce regarding spoilage microflora, sensory quality and other physicochemical aspects of this food product [1; 3; 5].

Recent bibliographic studies determine some conceptual aspects about the microbes of rabbit meat and the types of microbiological indices characteristic of its quality [7]. For these reasons, the microbiological examination of this food product is important by identifying the presence or absence of its microbial harmfulness for consumers and the preservation capacity under the given conditions [2; 13; 12].

At the same time, rabbit meat has sanitary and economic significance, with special implications in the current conditions, when the results are generally reflected in very large batches of products. For this, a series of basic conditions are necessary regarding the collection, transport and actual examination of the food samples sent to the laboratory. Therefore, the presence of certain categories of bacteria is manifested by changes in appearance, consistency, smell and taste, sometimes specific, and their detection during the microbiological examination is important

by using the most appropriate methods for isolating the respective germs, which ultimately determine the quality of rabbit meat [7, 14; 11].

For this reason, this study continues our researches regarding meat quality control in relation to bacteriological microflora as we did before on poultry meat [9], and at present, the main objective of this research is to analyse the microbiological flora on the quality of the domestic rabbit carcasses sold in various storage periods and temperatures and to interpret the data obtained according to the microbiological quantitative aspects.

MATERIALS AND METHODS

The experimental part of the work was carried out in the microbiology laboratory of the Faculty of Veterinary Medicine. Rabbit meat carcasses sold in the municipality of Chişinău were investigated as material. The carcasses were subjected to organoleptic investigations and microbiological evaluations. For this purpose, the superficial and deep microflora of rabbit carcasses was studied.

The classic microbiological methods of laboratory conduct were used for researching the microflora of the meat. For research, medium samples of rabbit meat were collected from their carcasses and microbiological quality indicators were determined, the number after bacteriological and bacterioscopic tests in order to assess the quality of rabbit carcasses sold in the Chisinau market.

RESULTS AND DISCUSSIONS

At the global level, the production of rabbit meat increased until 2010, after which registered significant decrease according to FAO and in 2020 the production of rabbit meat constituted 893,631 tons, which is lower than in 2019 with 26,347 tons, when was registered 919,978 tons of rabbit meat.

At the global level, the biggest producers of rabbit meat are: countries from Asia – 67%; European Countries – 22%, Africa – 9.7%, America – 1.6%.

The annual world production of rabbit meat is hundreds of thousands of tons, of which: China produces 700 thousand tons; Italy – 300 thousand tons; Spain and France - 180 thousand tons.

According to the figure 1, we can reveal that the production of rabbit meat in Republic of Moldova during 2016-2020 decreased from 1,135 tons to 602 tons, with 533 tons. The market of the Republic of Moldova, is facing with a deficit of rabbit meat: the economic agents ignore the high-performing technologies maintenance and exploitation of rabbits and use for growth the breeds with low genetic potential.

Microbiological investigations of domestic rabbit carcasses demonstrate our microbiological evaluations in the following tables and figures.

The carcasses taken in the study were evaluated according to the organoleptic indices according to the norms in force. Consistency, taste and smell were determined organoleptically: external appearance, color and cross-sectional appearance - visually, according to GOST 9959.91 "Meat products. General conditions for organoleptic evaluation" [10]. The rabbit meat samples taken in the study were analyzed from an organoleptic point of view in accordance with Government Decision no. 696/2010 regarding the approval of the Technical Regulation "Meat - raw material. Production, import and marketing". The organoleptic properties of the meat were appreciated by the indicators: color, consistency, smell, taste.

The data in Table 1 represent the results of the organoleptic assessment of fresh domestic rabbit carcasses,

Thus, according to the evaluation of the organoleptic indices of the investigated rabbit carcasses, we mention that the structure and organoleptic indices depend on a series of factors, such as: the composition of the muscle tissue, the ratio between the tissues, the processing method, the physiological state, the thermal state of the product, etc.

The results obtained state that the organoleptic indices assessed in the investigated samples correspond to the requirements of the norms in force.

Later, the values of the total number of microorganisms were determined, regarding the microflora of the samples from the rabbit carcasses, both superficially and from deep. In this context, we state that the microflora represents a sanitary indicator and provides data on the state of contamination of the

product. The research was carried out according to the requirements of the Government Decision No. 221 of 16-03-2009 [11] regarding the approval of the Rules regarding microbiological criteria for food products.

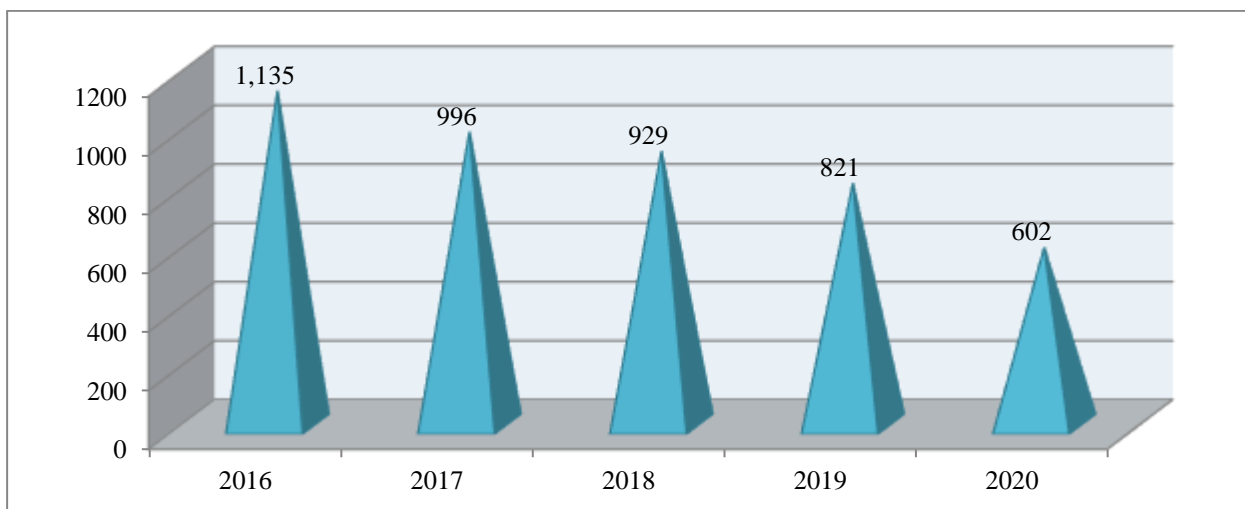


Fig. 1. The production of rabbit meat in Republic of Moldova during 2016-2020, tons
 Source: elaborated by the authors.

Table 1. The study of organoleptic indices of rabbit carcass (according to Government Decision no. 696/2010)

Organoleptic indices	Fresh carcasses
Color	It varies from pale pink to red, depending on the type of muscle
The smell and the taste	Species-specific, determined by the particularities of the feed, sex and species, as well as the content of ammonia and sulfur in the meat
Succulence	Pronounced
Consistency	Normal
Mottling	Pronounced
The parcelling	Medium

Source: elaborated by the authors.

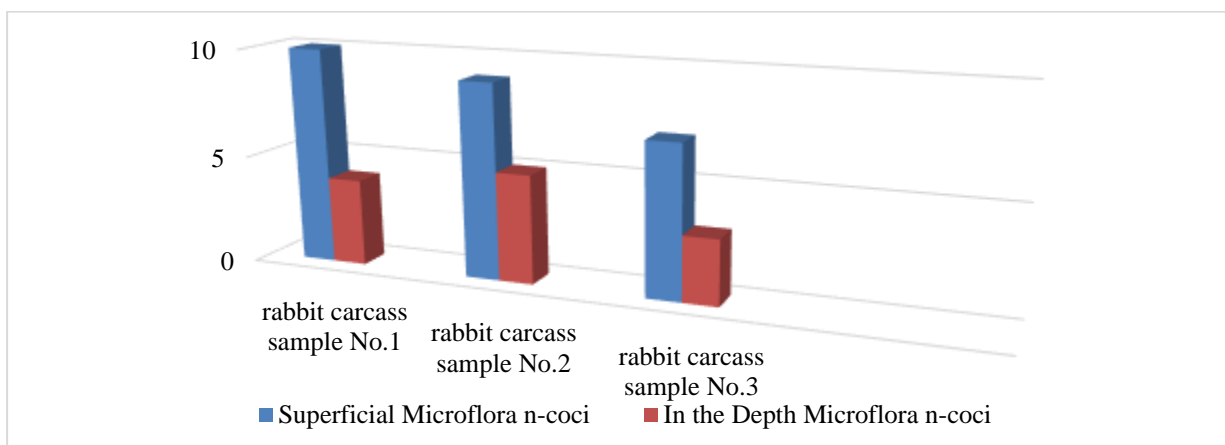


Fig. 2. Indices of bacterioscopic quality of carcass of domestic rabbits
 Source: elaborated by the authors.

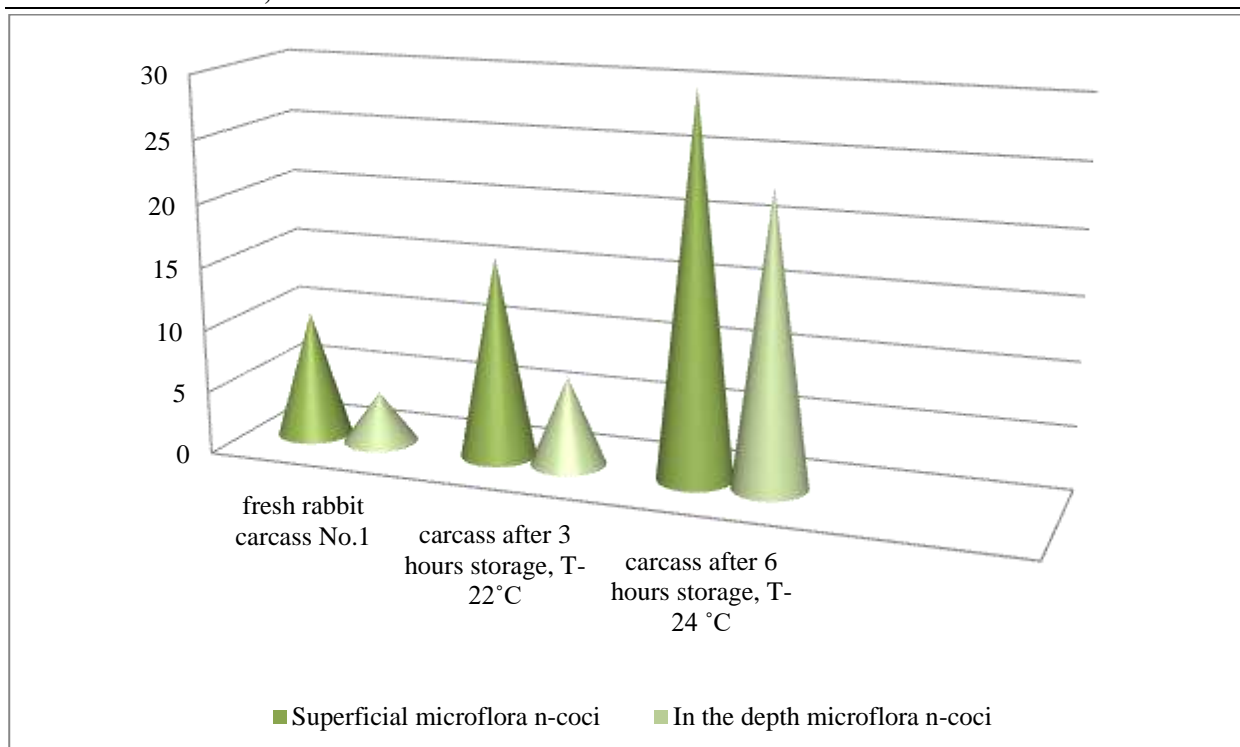


Fig. 3. Indices of the bacterioscopic quality of the carcass of domestic rabbits No. 1 in various periods of storage time and temperature
 Source: elaborated by the authors.

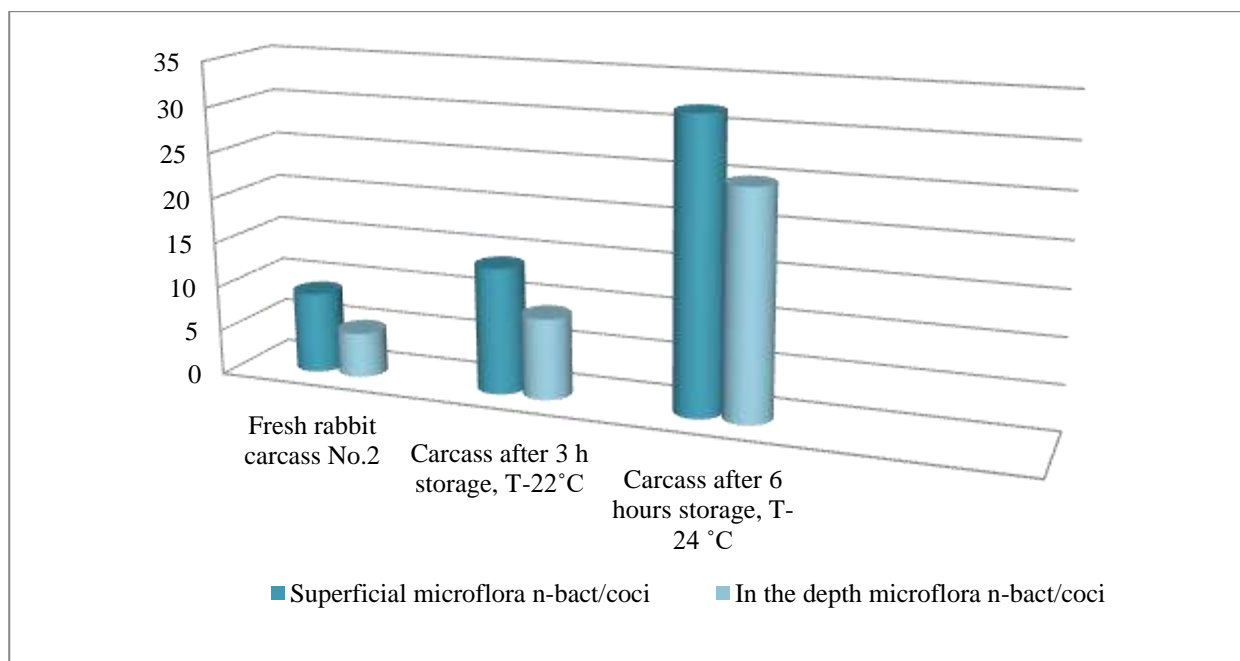


Fig. 4. Indices of the bacterioscopic quality of the carcass of domestic rabbits No. 2 in various periods of storage time and temperature
 Source: elaborated by the authors.

The quality of the rabbit meat investigated according to the bacterioscopic indices regarding the evaluation of all the carcasses constituted the values of the superficial and deep microflora shown in figure 2. Thus, according to the values obtained, the indices

of the superficial microflora of all the carcasses examined were higher, constituting 10; 9 and 7 saprophytic cocci bacteria at bacterioscopy, compared to the microflora indices from the depth with values of 4; 5 and 3 saprophytic cocci cells. Therefore these

values appreciate a less abundant microflora, which denotes normal aspects of development and multiplication of the saprophytic bacterial microflora.

Important aspects of the investigation of the bacterioscopic quality of the carcass of domestic rabbit No. 1 are reproduced in figure 3, where the values of the polluting microorganisms in various periods of storage time and temperature are highlighted.

The indices of Figure 3 denote values of the superficial microflora of the rabbit carcass No. 1 of 10; 16 and 30 cocci bacteria in

various storage periods of 3-6 hours at different temperatures of 22°C and 24°C, compared to the microflora from the depth, where the number of saprophytic microorganisms is lower and is 4; 7 and 23 cocci microbial cells.

Later, important aspects of the investigation of the microflora of rabbit meat are shown in Figures 4 and 5, where the values of cocci microorganisms recorded in carcasses No. 2 and No. 3 constituted comparable indices in various periods of time and temperature.

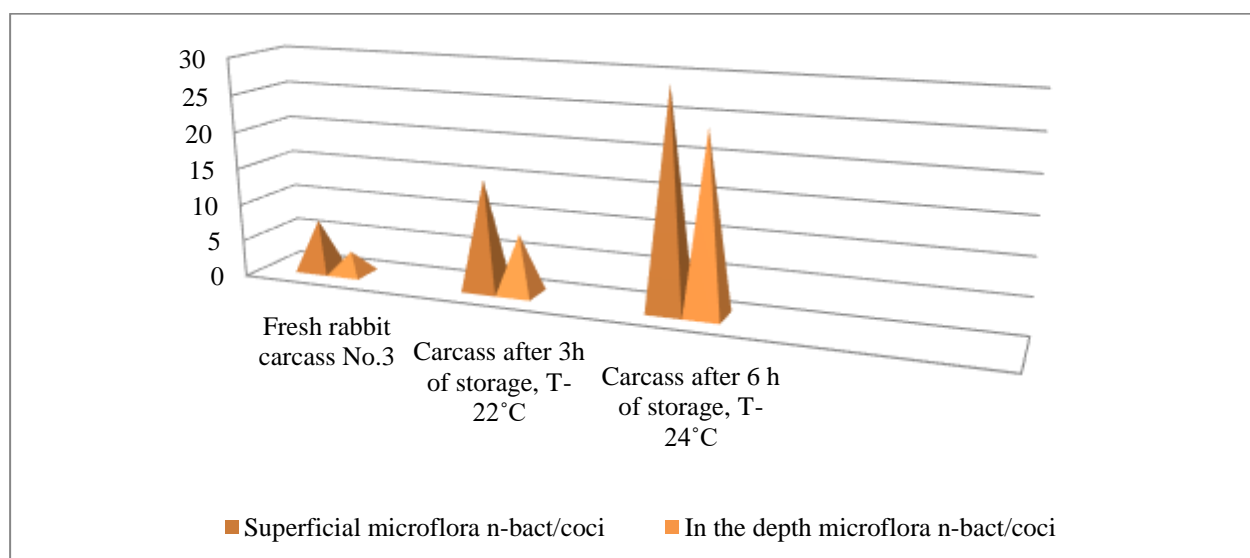


Fig. 5. Indices of the bacterioscopic quality of the carcass of domestic rabbits No. 3 in various periods of storage time and temperature

Source: elaborated by the authors.

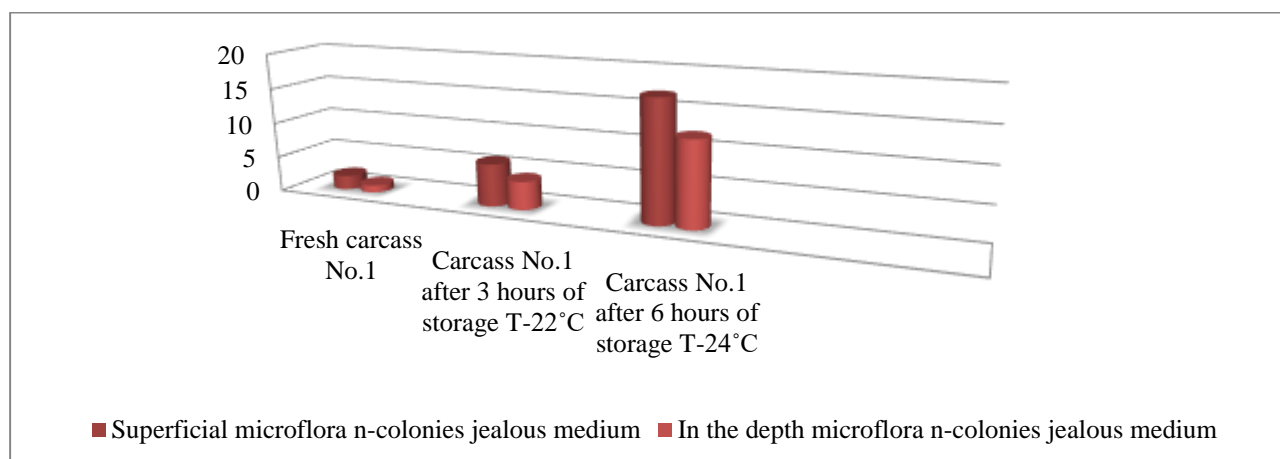


Fig. 6. Indices of the bacteriological quality of the carcass of domestic rabbits No. 1 in various periods of time and temperature

Source: elaborated by the authors.

These microbiological aspects constituted values of 9; 14 and 32 microbial cocci cells and 7; 15 and 29 of the superficial microflora

after 3 and 6 hours of storage at various temperatures compared to the microflora in the depth of the rabbit carcasses, where the

microbiological values were 5; 9 and 25 cocci microbial cells, compared to values of 3; 8 and 24 microorganisms respectively in rabbit carcasses No. 2 and 3 investigated.

At the same time, the microbiological investigations, regarding the quality of the rabbit carcasses, were bacteriologically investigated on various usual jealous culture media and especially: Endo and Levine, aiming at the detection of pathogenic microorganisms of the Salmonella, Escherichia species.

Figures 6, 7 and 8 determine the results of the bacteriological quality indices of the carcasses of domestic rabbit No. 1; No. 2 and No. 3 kept for various periods of time and temperature. Appreciable values can be observed in figure 5 of the rabbit carcasses, where they constituted the investigation of the superficial microflora of the carcass No. 1 on the jealous culture medium 2; 6 and 17 microbial colonies and 1; 4 and 2 microbial colonies when investigating rabbit carcass No. 2.

Pathogenic microorganisms of Salmonella and Escherichia species were not recorded on Endo and Levine media.

Figure 7 regarding the investigations of the bacteriological quality of the carcass of domestic rabbit No. 2 in various periods of time and temperature has relevant indices of

4; 7 and 18 microbial colonies of the superficial microflora and 2; 3 and 8 microbial colonies of the microflora in depth on the usual agar medium, compared to the indices revealed in figure 7, where the indices of the bacteriological quality of house rabbit carcass No. 3 constituted 6; 9 and 21 bacterial colonies regarding the superficial microflora of the carcass and 3; 5 and 10 microbial colonies on the microbial microflora in the depth of the carcass.

Regarding the presence of the microflora of pathogenic microorganisms in these rabbit carcasses No. 2 and No. 3, Salmonella and Escherichia species were not recorded. Thus, meat being a favorable environment for the development of bacteria determines an intense development of the microflora both on the surface and in depth. Therefore, the indicators of the level of microbial load of rabbit carcasses in our opinion, can be influenced by temperature and storage time.

These reports indicate the fact that the temperature of the meat and the environment in which the meat is kept has a major role in ensuring the microbiological and biochemical stability of the meat. As a result of keeping at temperatures of 22⁰C-24⁰C, there are correlated changes in the physico-chemical parameters.

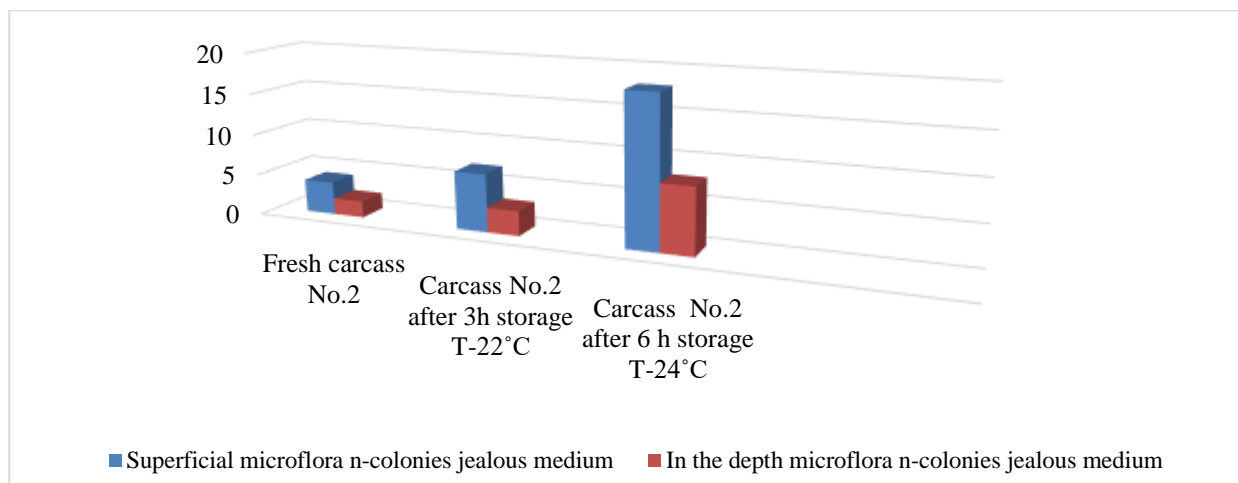


Fig. 7. Indices of the bacteriological quality of the carcass of domestic rabbits No. 2 in various periods of time and temperature

Source: elaborated by the authors.

Analyzing the study values and bibliographic sources regarding the microbiological study of the quality of the meat investigation, we were

guided by some methodologies related to the division of the meat sold in three categories:

- fresh meat, where the microflora constitutes up to 10 cocci when viewed microscopically;
- less fresh meat, where the bacterial microflora constitutes up to 30 cocci per microscopy;
- relatively fresh meat, where the bacterial microflora constitutes more than 30 cocci.

In 2022 the rabbit meat has become more expensive by over ten percent, compared to last year. Thus, one kilogram ended up costing 150 lei. According to the producers, this happens because of the increase in the prices of fuel, but also of veterinary services and products.

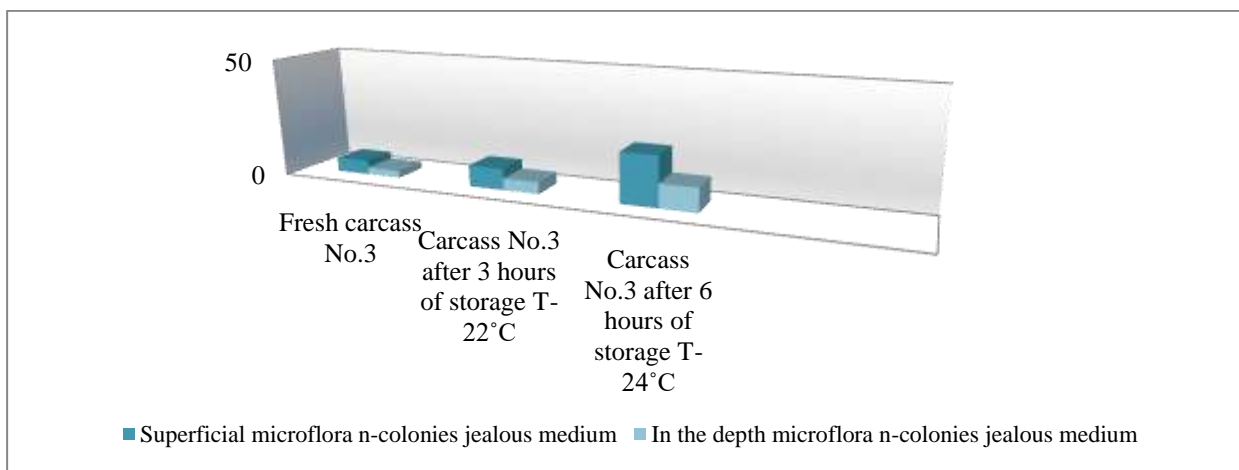


Fig. 8. Indices of the bacteriological quality of the carcass of domestic rabbits No. 3 in various periods of time and temperature

Source: elaborated by the authors.

In the same time, according to the performed investigations rabbits are grown mainly in domestic conditions and not in enterprises well organized and equipped, which determine low level of competitiveness on the market. The rabbit meat producers complaints about the tax burden, which in the country is quite high, being not friendly to the business environment. In Moldova taxes from salaries constitute 45% and the VAT rate on meat is high (20%).

At the end of the research of the microbial indices of the bacterioscopic and bacteriological quality of the carcass of domestic rabbit meat, we appreciate the absence of pathogenic microorganisms spp Salmonella, Escherichia, etc. and the presence of saprophytic microorganisms characteristic of cocci by morphology, which constitute a normal microflora of the meat.



Photo 1. Growing rabbits in domestic conditions in Republic of Moldova

Source: elaborated by the authors.

These results of the investigations allowed us to state that all categories of rabbits meat carcasses correspond to the quality indices and can be used in the food chain.

CONCLUSIONS

The results of this research work led to the following conclusions:

-Rabbit meat presents a favorable food product for the development of biochemical and microbiological processes.

-The quality of the classic microbiological methods of rabbit meat investigation confirms the safety of its use in consumer food.

-The microbiological quality indices of the domestic rabbit carcasses taken in the study indicate their freshness according to Government Decision on microbiological standards no. 221 of 16.03.2009, regarding the microbiological criteria for food products.

-The physical factor of the external environment – temperature, influences the intensity of bacteria development, classifying this food product in the category of meat - less fresh after 6 hours of storage.

-All categories of rabbit meat carcasses correspond to the quality indices and can be used in the food chain.

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