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THE IMPORTANCE OF AGRICULTURAL PRODUCTION AND VARIATION OF BACTERIAL MICROFLOWER ON THE QUALITY OF POULTRY MEAT IN VARIOUS MARKETING CONDITIONS

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Abstract

The scientific research reflected in this investigation had the purpose to study the importance of agricultural production and the variation of bacterial microflora on the quality of certain categories of poultry meat in different commercial conditions. In the scientific paper were analysed the indices of the volume of agricultural production in different categories of households during the last period and highlighted the aspects of its increase and decrease. In the same time, by laboratory microbiological methods were evaluated the results of the saprophytic and pathogenic microflora of three categories of poultry meat under various commercialization conditions. The results of the study confirmed that all categories of commercialized poultry meat showed an insignificant number of coccic microorganisms both in the surface layers and in the depth of the meat, which corresponds with the commercialization requirements and is acceptable in human food.

Key words**:** *agricultural production, bacterial microflora, bacterial colonies, poultry meat, marketplace*

INTRODUCTION

Poultry is an important source of protein in the normal growth and development of the human body. On average, the man consumes 30 tons of food during his lifetime, under various versions of the diet. Generally speaking, they are a mixture of chemicals, which constitute four main categories: nutrients, natural toxins, contaminants and additives. According to bibliographic studies, a food is safe when its consumption does not alter or affect the health of the consumer [6, 13].

Microorganisms have a special role by modifying the organoleptic and nutritional properties of meat, which by its chemical composition is a very favorable nutritional environment for their development. In order to prevent their development, it is important to know the microbial species, the conditions in which they develop and the risk of triggering some food poisoning infections [5].

Due to its chemical composition, varied and rich in the main groups of nutrients necessary to the organism (proteins, fats, carbohydrates, minerals and vitamins), poultry meat contributes to its normal functioning and to maintaining good health [16].

The fact that poultry is the most complete food is reflected in over a hundred nutrients necessary for human life, which it contains: proteins, vitamins, minerals, enzymes and other substances [2, 4].

The microorganisms that act unfavorably on food are: bacteria that cause food poisoning (*Salmonella*, *Escherichia*, *Staphylococcus*, etc.), molds that causes rotting (*Penicillium*, *Aspergillus*, *Mucor*) and yeast that cause fermentation. The meat registers in particular processes of bacterial spoilage of putrefaction and rotting and is a valuable food product that represents a very good environment for microorganisms, benefiting from a pH = 6.4-6.5, easily assimilable substances (glycogen and lactic acid) and nitrogen-assimilable substances [14].

The essential link in food safety consists of the following categories of basic operations: protection of food from harmful contamination, preventing the development and spread of harmful contamination. Also, we may add efficient removal of contamination and contaminants [8, 15].

Therefore, considering the analyzed bibliographic studies and the practical investigations performed in the microbiological laboratory, the aim of the presented paper is to study the importance of agricultural production and variation of bacterial microflora on the quality of certain categories of poultry in various commercialization conditions.

MATERIALS AND METHODS

The scientific researches were performed in the microbiology laboratory of the Faculty of Veterinary Medicine of the State Agrarian University of Moldova.
As a research material were used 3 categories of poultry commercialized in Chisinau, namely: Central Square from Chisinau, supermarket and house meat.
For this purpose, was studied the superficial and in-depth microflora of these 3 categories of poultry meat. To research food microflora were used laboratory microbiological methods.
In the same time, as research methods were used: comparative analysis, logical analysis, analysis and synthesis, graphical method, induction and deduction. The statistical data was used from National Bureau of Statistics of the Republic of Moldova.

RESULTS AND DISCUSSIONS

Global agricultural production in households of all categories, according to the National Bureau of Statistics in 2020 was 72.9 % compared to 2019, which represent a decrease by 27.3%.
The decrease in global agricultural production (by 27.1%) was determined by the decrease of vegetable production by 35.9% (which caused the reduction of the general index of global agricultural production by 26.1%) and animal production - by 3.8% (-0.1%) (Fig.1).
In households of all categories of agricultural producers on January,1st, 2020, compared to the same date of the previous year there was registered a decrease in livestock of all species, except for the number of bovines and swines, where the number increased, respectively, by 2, 6% and by 11, 7%.

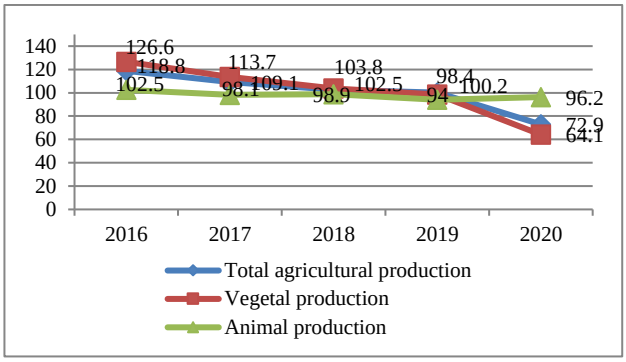

Fig. 1. Indices of the volume of agricultural production in households of all categories, 2016-2019 (previous year = 100)
Source: elaborated by authors based on [1].

The livestock of poultry on January, 1st, 2020 constituted 3,891.2 thousand capita, which represent a decrease compared to previous year by 12.7% (Figure 2).

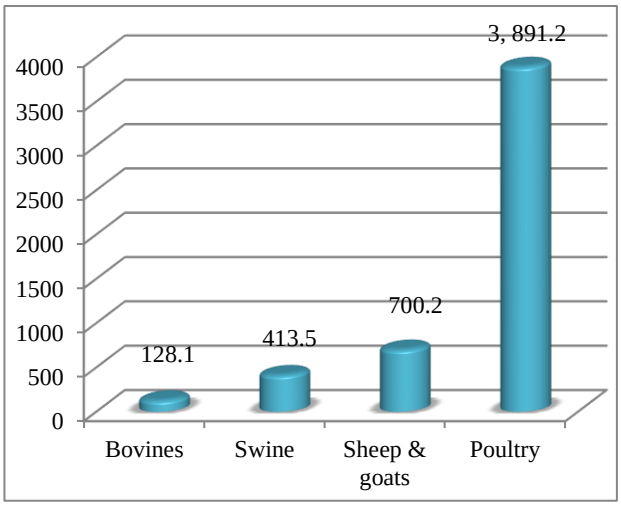

Fig. 2. The livestock of animals in all categories of producers as of January, 1st, 2020, (thousand capita)
Source: elaborated by authors based on [1].

The status of the zootechnical sector continues to be mainly determined by the situation in populations' households, in which on January, 1st, 2020, was concentrated 85.6% of the total number of cattle, out of which: cows - 94.4%, 44.8% of swines, 97.2% of sheep and goats and is produced the most of the animal production (bovines and birds - 54.1%, milk production - 93.6%, egg production - 57.7%).
Analysing the data from Figure 3 regarding the meat production, we can reveal that in

Republic of Moldova in 2018 was produced 122 thousand tons of meat, which represent a decrease compared to 2016, by 15.8 thousand tons when this indicator constituted 137.8 thousand tons and an increase compared to 2017 by 4.5 thousand tons. From total produced meat, the poultry meat constituted 45.2 thousand tons, being surpassed by pork meat, which constituted 65.9 thousand tons. After poultry meat, on the third place regarding production of meat, is placed beef, with 8.1 thousand tons (BNS, 2019).

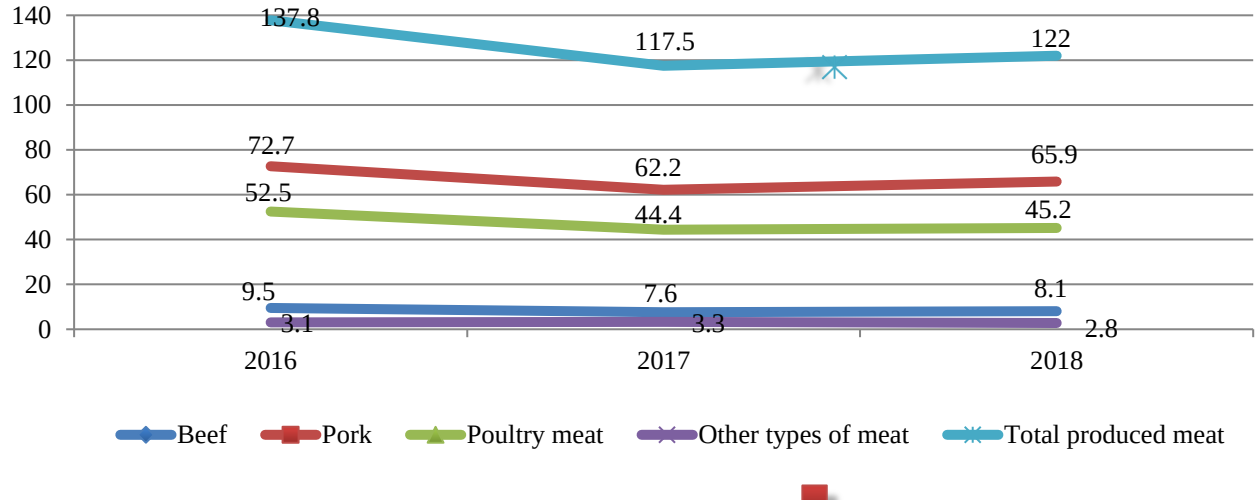

Fig. 3. The meat production during 2016-2018 in Republic of Moldova, thousand tons
Source: elaborated by authors based on [1].

Scientific researches were focused on studying the bacterial microflora of different categories of poultry meat sold in the industrial network from Chisinau municipality. The investigation of the microbiological aspects of this product was performed using the laboratory bacteriological methods. According to bibliographic sources, it is known that the microbiological study of meat investigation divides the commercialized meat in three categories: fresh meat, where the microflora is up to 10 cocci on microscopic visualization; meat with dubious freshness, where the bacterial microflora constitutes up to 30 cocci under microscopy and outdated meat, where the bacterial microflora constitutes more than 30 cocci, or some stick shape bacteria are also present.

The microbiological results of poultry meat commercialized at the central square in Chisinau and in supermarket reflect different aspects of the recorded indices, representing the quantitative bacterial microbiological aspects of the number of bacterial colonies and the number of microorganisms in the microscopic research fields.

The data from Figure 4 reveal 64 bacterial colonies in the superficial microflora of poultry meat sold at the central square, compared to the number of colonies of meat sold in the supermarket shown in Figure 5, which constituted a number of 5 colonies in the supermarket meat on the superficial microflora.

Regarding the number of colonies on the nutrient agar medium of the profound bacterial microflora, the data of figure 5 shows important aspects in the poultry meat sold in the supermarket, where a smaller number of microbial colonies was found constituting 1 colony, compared to the data of Figure 4, where the number of bacterial colonies of meat sold in the central square was 28 colonies.

These data confirm that the poultry meat sold in the supermarket is fresh, compared to the meat commercialized in the central square which is outdated.

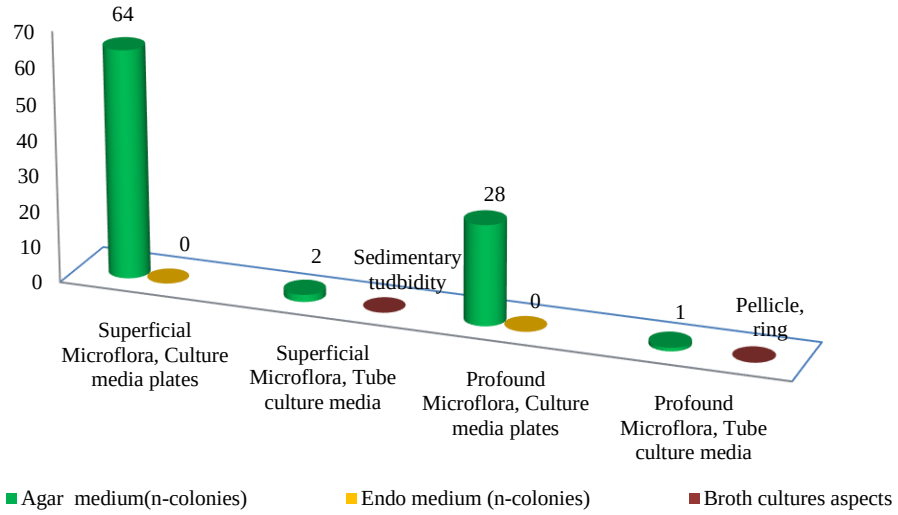

Fig. 4. Quantitative aspects of the bacterial microflora on the poultry meat culture media sold at the central square in Chisinau
Source: elaborated by authors.

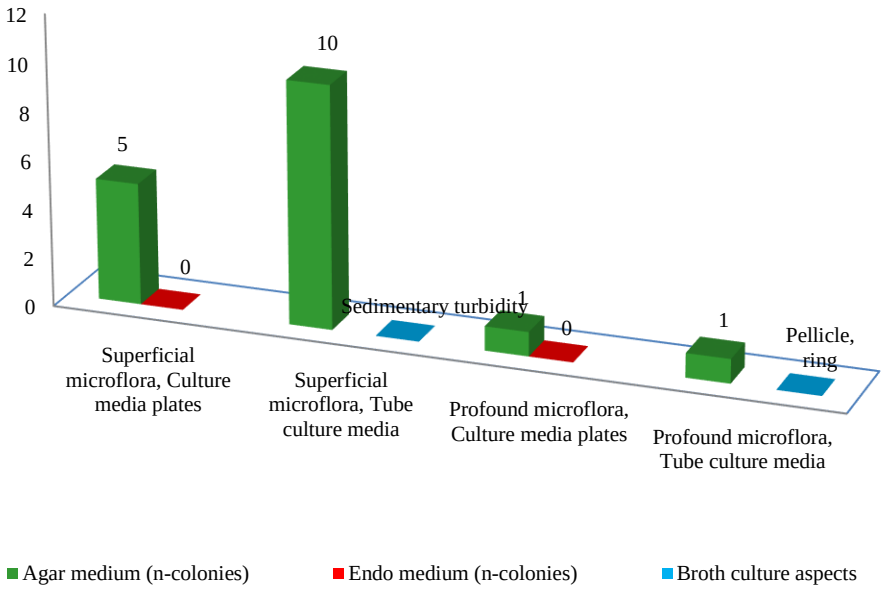

Fig. 5. Quantitative aspects of bacterial microflora on culture media of poultry meat sold in the supermarket
Source: elaborated by authors.

Regarding the passages on the special culture medium Endo in order to identify pathogenic microorganisms (E.coli, Salmonella) in poultry meat of all commercialization categories were not recorded the development of microbial colonies, which indicates that pathogenic microorganisms are absent in the poultry meat. Aspects of the development of microorganisms in poultry meat in the liquid broth medium are highlighted by the development of microorganisms in the form of turbidity, sediment, surface film, ring, in most cases the liquid medium is transpicuous. At the same time, important characteristics are highlighted on the agar medium in tubes, which denotes quantitative indices comprising the number of colonies best determined in the poultry meat sold in the supermarket, the superficial microflora constituting 10 colonies, compared to meat commercialized in the central square, where were determined 2 colonies. Regarding the profound bacterial microflora in both categories of commercialized poultry meat, the number of

colonies was insignificant, constituting 1 colony in both cases. These aspects confirm that both poultry meat sold in the central square and meat sold in the supermarket can be used in human nutrition. Important results during the microbiological investigations were highlighted in the house poultry meat which was commercialized, registering a superficial microflora of the number of colonies on the agar medium in number of 2, compared to the meat commercialized in the supermarket and in the central square, where this number of colonies was higher insignificantly.

The profound microflora in the researched poultry meat determined only one colony, which indicates that the bacterial microflora is insignificantly present, can be used safely as food and compared to the bacterial microflora of poultry commercialized in the central square and in the supermarket, do not present danger and meets the microbiological requirements (Table 1).

Table 1. Quantitative aspects of bacterial microflora on house poultry meat culture media

Samples	Culture media plates		Tube culture media	
	Agar (n-colonies)	Endo medium (n-colonies)	Agar (n-colonies)	Broth culture aspects
Superficial microflora meat	2	0	3	Turbidity
Profound microflora meat	1	0	1	Pellicle, ring

Source: elaborated by authors.

Important microbiological indices regarding the bacterial microflora of poultry meat are revealed in Tables 2 and 3.

Table 2. Quantitative aspects of bacterial microflora on smears of poultry meat commercialized on the central square

Smear (Gram coloration)	Number of microorganisms/ microscopic field	Morphological bacterial aspects
Superficial microflora meat	35	Cocci, Gram positive
Profound microflora meat	10	Cocci, Gram positive

Source: elaborated by authors.

Thus, the scientific researches were focused on bacterioscopic investigations, on performing bacterial smears from poultry meat samples and coloring according to the Gram method.

The detailed analysis of Tables 2 and 3 shows that in the poultry meat purchased from the central square the superficial microflora constituted 35 bacteria, compared to the meat from supermarkets - 9 bacteria. The number of bacteria determined in the profound poultry meat in the supermarket - 6 bacteria, compared to the results of the investigation of poultry meat in the central square, which constituted 10 bacteria. Therefore, these quantitative aspects of micro-organisms in poultry meat indicate that the poultry meat in supermarket is fresh, compared to the poultry meat procured from the central square (with outdated freshness).

The number of bacteria in profound meat on smears determined the following results in supermarkets - 6 bacteria, compared to the investigations of poultry meat in the central square - 10 bacteria on the microscopic fields. Therefore, these quantitative aspects of micro-organisms in poultry meat indicate that poultry meat in supermarkets is fresh, compared to poultry meat traded on the central square, which has outdated freshness.

Table 3. Quantitative aspects of bacterial microflora on smears of poultry meat commercialized in supermarket

Smear (Gram coloration)	Number of microorganisms/ microscopic field	Morphological bacterial aspects
Superficial microflora meat	9	Cocci, Gram positive
Profound microflora meat	6	Cocci, Gram positive

Source: elaborated by authors.

The bacterial microflora of the quantitative aspects of poultry meat on the smears investigated and the results are presented in Table 4.

It was determined the superficial microflora consisting of 4 cocci bacteria, compared to the superficial microflora of meat sold at the central square and supermarket, where this number of bacteria was 35 and 9 bacteria.

Table 4. Quantitative aspects of bacterial microflora on smears of house poultry meat

Smear (Gram coloration)	Number of microorganisms/ microscopic field	Morphological bacterial aspects
Superficial microflora meat	4	Cocci, Gram positive
Profound microflora meat	2	Cocci, Gram positive

Source: elaborated by authors.

Regarding the results of the profound microflora, the results from table 4 determined 2 cocci bacteria, compared to the categories of meat sold at the central square and supermarket, which constituted 10 and 6 cocci bacteria.

Therefore, based on the results of the previously investigations, we confirm according to the microbiological requirements, that the freshest commercialized poultry meat is house meat, where the number of bacteria is in all cases of microbiological investigation the lowest, compared to other categories of meat, which also meet the microbiological requirements and can be used in nutrition.

As a result of research on the microscopy of smears of poultry meat, Gram coloration, the morphological aspects of cocci germs are detached, which were presented on the microscopic field by spherical bacteria, Gram positive, constituting a normal microflora of meat.

Bacteriological and bacterioscopic investigations of poultry meat of different commercialization categories according to the investigations show that all categories of poultry meat by their dietary and nutritional value, are favorable and beneficial to be used in nutrition.

High importance is the house poultry meat, which in our microbiological research study confirmed that it is the most fresh meat after conducting the microbiological examination, which confirms that this category of meat is contaminated with a smaller number of saprophytic microorganisms represented by Gram-positive cocci.

Regarding the aspects of investigating the presence of pathogenic microorganisms determined by passages on the special Endo culture medium for the detection of E.coli germs, Salmonella, which frequently cause food poisoning, in poultry meat of the 3 commercialization categories were not recorded the development of pathogenic microbial colonies, which reveals that pathogenic microorganisms are absent in the examined poultry meat.

In this sense, in the process of production and commercialization the poultry meat, it is necessary to continuously carry out actions to improve the quality of production through quality management.

The quality management designates the responsibilities of all levels of management of enterprises, which need to be managed by the highest level of management. According to Kelada, "*the quality management represents the entire activities which have the purpose of realization the objectives by using optimally the resources of the enterprises*" [11].

These activities include: *planification, organization, coordination, control* and ensuring the quality [7, 12, 9, 10].

Kelada considers that each enterprise has to realize the following objectives: economical, social, technical, commercial which are performed using operational objectives.

Following the discussions above, Juran considers that quality is "*the ability to meet the needs or the extent to which the product successfully meets consumer expectations*" [10].

In opinion of Ishikawa, quality is "the opposite of the adverse influences (losses) caused to society by the provision of a product / service"[7].

Feigenbaum A. V. considers that "*Quality is the only important force that contributes and leads to the economic growth of companies in international markets"* [3].

Through the quality management, the enterprise has the purpose to obtain such products which satisfy a necessity or correspond to an well determined objective, which satisfy the customers expectations, which are in compliance with the standards, with the applicable specifications and with the requirements of the society, which respect the

requirements regarding protecting the nature and which are offered at competitive prices and obtained in conditions of profit.

According to bibliographic scientific studies, we remark with certainty that the rules of hygiene and good practice in the food industry are aimed at protecting food against contamination, effective temperature control to prevent and disseminate contamination. Therefore, the essential tools of food safety in food processing units or those that sell them are food safety microbiological investigations. In this context, based on the presented analyzes, we mention the importance of the functionality of the non-pathogenic saprophytic bacterial microflora available in the poultry we researched, which represents a normal bacterial microflora. At the same time, this research in food microbiology is of particular interest, because it allows us to deduce that the poultry food frequently sold in the retail network is qualitative and is acceptable and meets the commercialization requirements.

CONCLUSIONS

From this research, teh following conclusions were drawn:

-The poultry meat of all categories which is commercialized in Republic of Moldova on different markets (supermarkets, central square) has shown an insignificant number of cocci microorganisms both in the superficial layers and in the profoundness of the meat, and meets the commercialization requirements and is acceptable in human nutrition.

-Quantitative aspects of the number of microbial colonies in the commercialized poultry meat determined fresh house meat and meat commercialized in supermarkets - 2/1 and 5/1 colonies; aged meat sold at the central square - 64/28 microbial colonies

-Quantitative aspects of the bacterial microflora of poultry commercialized meat, revealed on smears the category of fresh traded house and supermarket meat - 4/2 and 9/6 cocci bacteria and 35/10 bacteria detected in poultry meat commercialized in the central square.

-Poultry and supermarket meat commercialized in the retail network are fresher according to microbiological research indicators, showing non-pathogenic saprophytic microflora.

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