

## EVALUATION OF THE QUALITY OF CHEESES PRODUCTION INTENDED FOR COMMERCIALIZATION THROUGH THE USE AND COMPETITIVENESS OF SOME STARTER CULTURES OF MICROORGANISMS

Artur GOLBAN<sup>1</sup>, Rita GOLBAN<sup>2</sup>

<sup>1</sup>Commercial Bank `Victoriabank` Joint Stock Company, 141, 31 August 1989 Street, Chisinau, MD-2004, Republic of Moldova, E-mail: aaartgolb@gmail.com

<sup>2</sup>The Technical University of Moldova, 168, Stefan cel Mare Boulevard, Chisinau, Republic of Moldova, E-mail: golbanrita@gmail.com

*Corresponding author:* aaartgolb@gmail.com

### *Abstract*

*The aim of the scientific investigation study was to evaluate the quality of cheeses production by involving some starter cultures of microorganisms and to evaluate the study of the cells of the fermentation microbial populations according to their qualitative aspects and their competitiveness. Mesophilic, thermophilic and mixed lactic starter cultures and their contribution to fermentation processes in manufactured cheeses were studied. Also, in the scientific article was analysed the value chain of cheeses and the necessary conditions for running a successful cheeses business in the rural environment. The article describes also the problems agricultural farmers are facing towards commercialization the cheeses. The starter cultures were used as materials for elaboration of the article, in the same time were used tests for the research of the process of fermentation. The main results of the research demonstrated that the use of the economic performance of the can be achieved using starter microbial cultures in the process of production of cheeses. The conclusions of the research are that at the process of cheeses fermentation a big contribution play mesophilic, thermophilic and mixed lactic starter cultures.*

*Key words:* consumption, organic products, Romania

### INTRODUCTION

The competitiveness of dairy products depends of raw milk quality, quality management in milk processing and commercialization [10, 11, 12].

The progress recorded in the use of microorganisms at the industrial level has always aimed at obtaining high-performing starter cultures, with improved properties suitable for the purpose for which they were created. The general concepts of starter cultures were initially used only for lactic acid bacteria. Over time, its use has expanded to all cultures selected through exogenous involvement at different stages of the technological process, these being called complementary or secondary starter cultures. The improvement and coordination of the activity of selected microorganisms, used in the form of starter cultures and able to coexist with the indigenous milk microbiota, much

more adapted to the technological conditions, has currently allowed both the modernization and the continuous diversification of cheese assortments [1, 3, 5].

The evaluation and establishment of the composition of the starter culture takes into account both the specific characteristics of the finished product and the requirements of the consumers, therefore the starter cultures of lactic bacteria are designed in such a way as to meet all the objectives aimed at the processing of milk and the quality of cheeses [2, 4, 6].

Some bibliographic studies reveal the importance of the thermophilic cheese starter, which is considered to perform excellently at high temperatures. That is why they are used in the production of cheeses with Italian extract. This is "Mozzarella", which is distinguished by an unforgettable taste and the love of consumers [8, 13, 14].

At the present moment, the importance of the involvement of obtaining and using high-performance starter cultures has led to the orientation of their production by specialized multinational companies, which permanently orientate their research and production in accordance with the requirements of food producers. Therefore, it is considered that it would be ideal for the cheese producer to permanently use the same starter cultures in order to eliminate technological or qualitative variations. In practice, however, in view of the sensitivity of crops to beech attack, crops are rotated. For these reasons, starter crop producers pay special attention to the quality of starter crops in order to obtain high-performing strains that can be used permanently without rotation [7, 9].

For these reasons, the main objectives of these researches are the evaluation of the quality of cheese making by involving starter cultures of microorganisms and the evaluation of the study of the cells of the fermentation microbial populations according to their qualitative aspects and competitiveness.

## MATERIALS AND METHODS

The experimental part of the work was carried out in the microbiology laboratory of the Faculty of Veterinary Medicine. As material, starter cultures of various categories used in the manufacture of cheeses were researched. Tests were used to investigate the study of cells of fermentation microbial populations by quantitative and qualitative aspects.

## RESULTS AND DISCUSSIONS

The average annual consumption of cheeses in Moldova is 4,000-5,000 tons.

The most wanted cheeses by the population from Moldova are „Rossiyskiy” (Russian), „Goladnskiy” (Dutch) and on the third place comes „Poshekhonskiy”. Also moldovans prefer „Edam” and „Gouda”, but the share of these cheeses are insignificant.

In Moldova, cheeses are imported from Ukraine and EU (75% of all cheeses). In the same time, in the last years, was registered an

increase of cheeses export in Moldova from Belarus.

The biggest producers from Moldova of cheeses are: Lactis JSC and Lactalis Alba.

Lactis JSC is a big company where 280 people work which produces 17 types of cheeses. The company opened more than 90 milk collection points in vilages from more than 7 districts from Moldova.

Lactalis Alba LLC imports mostly cheeses from France, but alsoe produces cheeses in the factory located in Soroca. French entrepreneurs registered investments in this company more tha 17 mln USD. It is a big company with more than 220 employees.

In Moldova also produces cheeses the following factories: MilkMark, JSC Cahul („Estonskiy” - Estonian), JLC Group.

According to Statista.com, it is expected that in 2023 the revenues in the cheeses segment to constitute 282.10 mln USD. During 2023-2027, it is expected that the market to grow annually by 3.79%. By 2027, it is expected that the volume of cheeses segment to constitute 19.09 m kg.

The study of the economic characteristics of the starter cultures regarding their involvement in the manufacture of cheeses shows us the data of Table 1.

Evaluating some properties of the starter cultures we were guided by the importance of some categories of commercial starter cultures and the ways of their use in the practice of manufacturing cheeses with an efficiency higher economic.

The importance of this study is of interest for the acquisition and use of starter crops as well as the orientation of their production by various specialized producers, who permanently orientate their research and production in accordance with the requirements of food producers.

Therefore the successive multiplication of microbial cells until they achieve the levels that ensure the necessary concentration to start lactic fermentation are provided by the methods of obtaining starter production cultures. Over time the methods of obtaining the inoculum have evolved simultaneously with the modernization of the technologies of production.

Analyzing figure 1 gave us the possibility to deduce some interpretations of differentiation in the result of the investigation of the homofermentative and heterofermentative mesophilic starter cultures.

The lactic microbial species *Lactococcus lactis* and *Lactobacillus cremoris* recorded

various quantitative behaviors regarding the number of lactic microbial cells with fermentative activity. The values in Figure 1 reveal a higher number of lactic cells of the species *Lactococcus lactis* constituting 22/28 cells compared to the species *Lactococcus cremoris*, which registered 18/14 lactic cells.

Table 1. The analysis of economic characteristics related to the starter cultures used in production of cheeses

No.	Characteristics	Starter cultures		
		Mesophilic	Termophiles	Mixed
1	Production cost	medium	medium	medium
2	Technological restrictions	small	big	big
3	Conservation costs	small	medium	medium
4	Time required to obtain starter cultures	72 hour	48 hours	48 hours
5	Crop diversity and market availability	good	good	good

Source: elaborated by the authors.

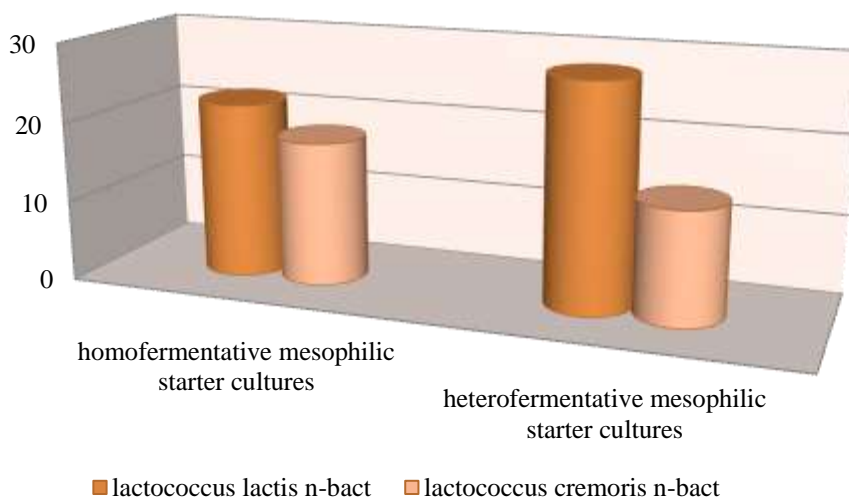


Fig. 1. Evaluation of the fermentation evolution study of mesophilic starter cultures used in cheese making (Number)

Source: elaborated by the authors.

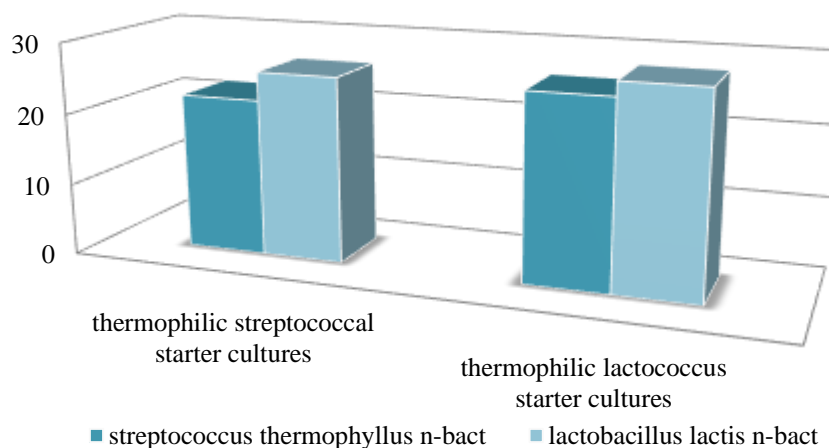


Fig. 2. The analysis of the evolution of fermentation of thermophilic starter cultures and their impact on production of cheeses (Number)

Source: elaborated by the authors.

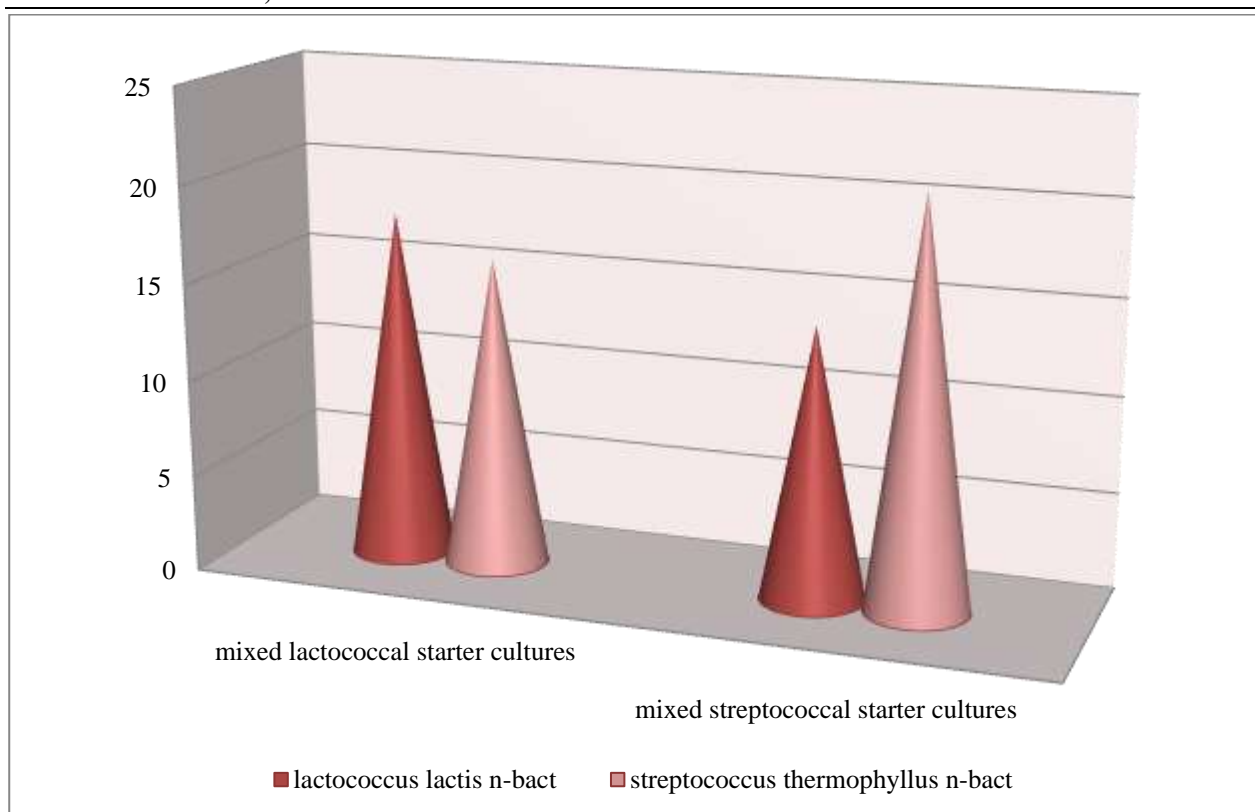


Fig. 3. The study of mixed starter cultures and their impact on the fermentation evolution in the process of producing cheeses (Number)

Source: elaborated by the authors.

These differentiations of fermentation processes by means of starter cultures is not only a means to provide, maintain or improve the keeping qualities of the product but also presents the fermentation process in cheeses with a strong impact on its quality and acceptability.

Scientific studies confirm that during the fermentation process the primary nutrients from milk, such as high-quality protein compounds, calcium, phosphorus and vitamins of the B complex, remain available and give high nutritional value to the fermented dairy product. But, more importantly, these fermented dairy products can exceed the limit of nutritional properties by becoming functional if the fermentation process is optimally managed. The aroma, viscosity, microbial and chemical characteristics can be affected by the size of the inoculum added to the milk, by the presence of agitation during fermentation or other such aspects.

Important indices of the thermophilic starter cultures are shown in Figure 2, according to

which were determined some aspects of the starter cultures with the implication of lactic species *Streptococcus thermophyllus* and *Lactobacillus lactis*, where the recorded number of lactic bacteria of these thermophilic cultures constituted 22/26 microbial cells at bacterioscopy in the *Streptococcus thermophyllus* species and 26/28 lactic microbial cells in the *Lactobacillus lactis* species.

According to the obtained results, was registered the highest number of *Lactobacillus lactis* species, these results being caused by a more intense development and acceleration of the fermentation processes in cheese making with the active participation of the thermophilic starter cultures of microorganisms.

According to our analysis, we can conclude that thermophilic starter cultures in this investigation conditions presented a fermentative metabolism which is well-determined and with high importance to the process.

Analyzing the Figure 3, we can reveal the number of microorganisms at bacterioscopy of the mixed species *Lactococcus lactis*, which compared to the species *Streptococcus lactis*, constituted 18/14 microbial cells and *Streptococcus thermophilus*, which revealed values of 16/21 lactic fermentation germs involved in the microbiological biotechnological processes of cheese manufacturing.

All microbiological indicators showed a high microbiological innocuousness, a fact due to strict compliance with hygiene requirements.

From the results presented above, we deduce that the lactose present in the raw material milk was consumed during the fermentation process by the inoculated lactic bacteria.

Based on the studies carried out, the starter cultures have a high importance in the process of production cheeses.

These characteristic researches are of public interest and allow us to make remarks, that mesophilic, thermophilic and mixed starter lactic cultures where the bacterial species *Lactococcus lactis* predominate are characterized by the presence in the area of the specific imprint of amino acids, nucleic acids, polysaccharides, proteins and esters, which contribute to the fermentation processes in manufactured cheeses. The presence of these compounds is in accordance with the data from the specialized literature, some of them being characteristics of cell walls and membranes and others are found in cells as reserve compounds.

## CONCLUSIONS

Based on the results, the following conclusions were drawn:

-The management of the company which produces cheeses, in order to achieve economic growth, is very important to analyze and take decisions related to the use of starter microbial cultures which will determine increase of productivity and competitiveness,  
-In the process of producing cheeses, the mesophilic starter cultures registered relevant values of homofermentative and heterofermentative microbial species.

- A well-defined fermentative metabolism was registered at the thermophilic starter cultures, characteristic to the number of fermentation bacteria.

-The fermentation processes in production of cheeses are highly influenced by mesophilic, thermophilic and mixed lactic starter cultures, playing a significant role in the production volume growth of the company.

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