

Lactococcus lactis – an important probiotic of a healthy digestive system

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Abstract

The scientific investigations revealed in this investigation has the purpose the identification of the microbial culture of Lactococcus lactis, considered as a probiotic in the aspects of consumption different milk products as well as the mechanisms of action of probiotics. There were realized bacterioscopic and bacteriological researches by performing microbial preparations and passages on culture media, using different simple and complex methods of investigation, in order to determine the presence and diversity of the saprophytes and pathogens microorganisms. Simultaneously, there were evaluated the aspects of development the culture of Lactococcus lactis on simple and complex identification mediums, the morphology of microorganisms on images natively visualized smears and microbial colonies. It is revealed the importance of this microorganism on the beneficial effects of the human and animal body, representing one of the most important microorganisms from the milk industry, being considered as a probiotic which expresses the balancing of the intestinal flora. In this aspect was proved, that bacteria Lactococcus lactis represents not only the safest and free of risks probiotic which helps the digestion, but also the simplest and natural solution to maintain the health and increase the longevity.

Key words: Lactococcus lactis, Colonies, Sowings, Culture mediums.

Introduction

Lactococcus lactis bacteria is considered to be a probiotic, because of its benefic effects. The benefic effects are expressed through the balancing of the intestinal flora, acting against the harmful bacteria from the intestine and preventing the formation of free radicals in the organism. A multitude of infections can be prevented, if it is maintained an equilibrium of the intestinal flora and also if benefic bacteria are provided to the human and animal organism, such as the Latococcus probiotic [1; 5].

According to the scientific investigations, in the last years attempts are made to completely remove antibiotics from the animal feed, from prophylaxis and even from the therapy of some infections, especially digestive. Instead of antibiotics that often destroy both pathogenic and normal flora, without selectivity, or sometimes only destroy normal flora, the pathogen being more resistant, it is indicated the use of probiotics containing bacteria from Lactobacillus and Streptococcus genres– for probiotics containing vegetative forms of bacteria and Bacillus subtilis for probiotics used to increase the bacterial spores. Some probiotics may contain only yeasts or mixes of different genres and yeasts [3; 6].

It is remarkable that probiotics have a direct impact on the digestive system. Thus, the form in which they are ingested in the body is very important, because if their structure is changed too much, they can have adverse effects. It is important to replace the probiotics naturally, and the lactococcus bacterium that reaches the body, to have the possibility to produce proteins for a good functioning of the digestive system [2; 4].

For centuries it has been state, that by the consumption of acidic dairy products health improves, which would increase human longevity. Because the lactococcus bacteria can produce lactic acid, it is one of the most important microorganisms from the dairy industry. It is used for

the production of milk, kefir, yoghurt, cheese and butter. It is also used for fermenting many vegetables, such as pickles, where lactococcus bacteria has a special role.

There are currently numerous studies and data about the practical results of the use of probiotics in animals feed, confirming the advantages of using them. As possible benefits of using probiotics, we can mention improving digestion and stimulating growth, preventing and controlling enteritis, as well as respiratory, bacterial, viral and tumoral diseases [7].

From this point of view, the main objective of this study is to identify the bacterium *Lactococcus lactis* by the characteristics of microbiological aspects and to reveal the importance of this microorganism as a probiotic in the beneficial effects of the human and animal organism, representing the secret of a healthy digestive system.

Material and method

For performing the investigations were used diary products. The investigations were realized in the laboratory of microbiology and immunology of the Faculty of Veterinary Medicine of the State Agrarian University of Moldova.

In order to identify the micro-organisms from the food product, there were performed bacterioscopic investigations by performing smears, by simple method of coloring using the methylene blue dye, fixing to the spirit flame, microscopy, objective 90, immersion.

Bacteriological investigations were carried out by performing the passages on Petri plate culture media and in tubes, using the simple agar nutrient media, broth and differentiation: Endo Levin.

The plates were incubated thermostat at 37 °C during 24-48 hours. Later, were visualized the developmental characteristics of microbial cultures were studied by studying microbial colonies (edges, color, consistency, relief, etc.). There were highlighted, the character of the development of microorganisms in broth liquid medium, by visualization the microorganisms development characteristics in liquid media (turbidity, sediment, consistency, smell, etc.). From the identified primary cultures characteristic to *Lactococcus lactis* bacteria, there were performed repeated passages in order to identify pure cultures simultaneously, following the same scheme by performing smears and seedings.

Results and discussions

The detailed analysis of the conducted researches allowed us to isolate under laboratory conditions by bacteriostomy and bacteriology investigations the *Lactococcus lactis* bacterium.

The determinations carried out on the samples examined by bacterioscopy allowed us to reveal under the results determined by performing smears from native samples and from microbial cultures. The smears were carried out on sterile blades, degreased by bacteriological ansa near the flame of the burning spirit lamp. A drop of milk evenly spread into a thin layer on the blade. After drying the smear at room temperature, the smears were fixed by physical method to the flame of the spirit lamp, colored with the methylene blue dye and examined on the microscope immersion system. On the examined preparations, the microorganism presents spherical form, Gram-positive, unsporulated, unciliated, chain-shaped germs.

The action mechanism of the *Lactococcus lactis* bacterium is expressed by its action in the digestive tract (gastrointestinal tract). As long as it is situated here, the body takes advantage of its beneficial effects over a long period of time. When the *Lactococcus lactis* bacterium is added in the composition of milk, it creates energy molecules (ATP) from latose using enzymes. The lactic acid is a product of ATP. The lactic acid prevents the proliferation of microbes. Because of these

facts, *Lactococcus lactis* bacterium is a natural solution for maintaining our health, being found especially in the digestive tract and vagina. Nisin is produced from milk with the help of *Lactococcus* bacteria. Also known as bacteriocin, it is a polycyclic peptide. It is made up of 34 amino acids and is commonly used in the food industry due to its antibacterial properties.

Table 1. The effects of probiotics consumption from acid dairy products

Type of effect	How it influences the health
Physiological effects	Antagonist effects on pathogens. Production of bacteriocins
Action on the digestive system	Prevention of intestinal disturbances. Stimulation of intestinal immunity
Alterations of intestinal microflora.	Recovery of intestinal microflora.
Effects on diarrheal disease.	Prevention and treatment of some types of diarrheal diseases.
Systemic effects	Enhancement of immunity. Reducing the blood pressure. Reducing the incidence of some types of cancer. Reducing the cholesterol.

Nisin is capable to stop the bacteria proliferation. Therefore, the *Lactococcus* bacterium is very effective in treating various gastrointestinal affections. Recently, *Lactococcus* bacterium became popular because it is the first live genetically modified organism used in the treatment of different diseases. Not only that this bacterium does not present risks, but is also recommended, because beside the fact that it produces lactic acid, it also generates the Nisin, very effective against microbes or pathogens. The performed bacteriological investigations confirms the isolation and identification of the *Lactobacillus lactis* culture in the kefir food product. The sowings were performed by bacteriological ansa on the culture media of agar, broth, Endo, Levine, next to the spirit lamp, after which they were incubated in the thermostat (Figure 1).

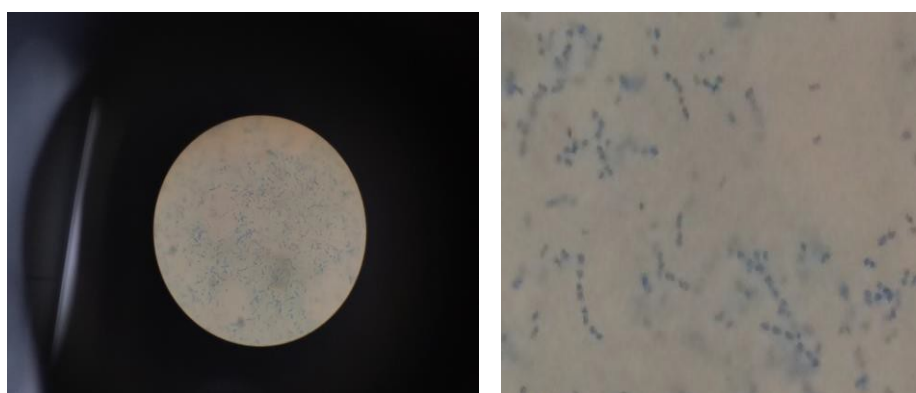


Figure 1. The *Lactococcus lactis* microscopy

The colonies of microorganisms were visualized in simple broth and agar mediums. On these mediums, lactic bacteria presented microbial cultures by forming a deposit with floconous aspect, slightly abundant, the medium remaining clear (Figure 2). On the agar medium, the characteristic

cultures presented round shapes of "S" type, with edges and smooth surface, being small, regular, semi-transparent, unpigmented.

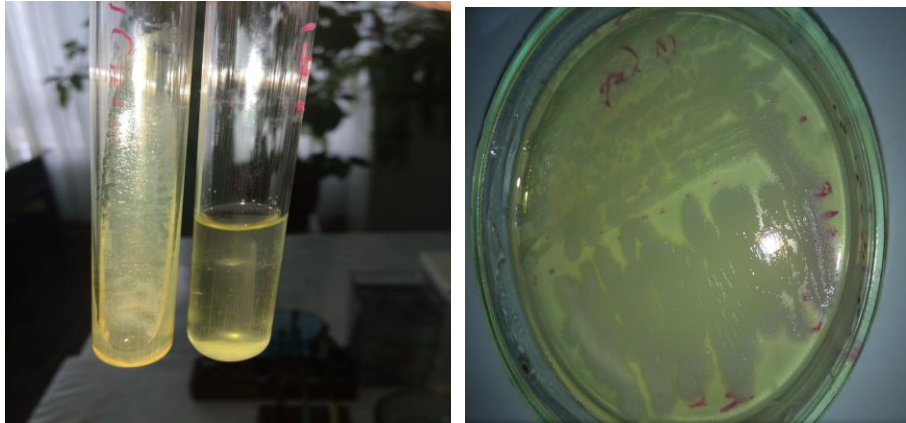


Figure 2. Cultivation of *Lactococcus lactis*

In this aspect the bibliographic researches reveal, that the acid dairy products are obtained by fermenting milk under the action of lactic bacteria cultures, these are fermenting lactose with the formation of lactic acid, which determines the increase of the acidity of milk; causing its coagulation. The acid dairy products, by lactic acid which is contained in them, prevent the development of harmful microflora in the intestines, helping to prevent and even to treat gastrointestinal diseases.

Table 2. Microorganisms used as probiotics

Genus	Species and subspecies
Lactobacillus	Lactobacillus acidophilus, L.plantarum, L.casei, L.delbrueckii, L.fermentum
Lactococcus	Lactococcus lactis subsp.lactis, L.lactis subsp.cremoris.
Bifidobacterium	Bifidobacterium bifidum, B.longum, B.breve
Streptococcus	Streptococcus thermophilus
Enterococcus	Enterococcus faecalis; E.faecium

In the same time, under the action of lactic bacteria, the proteic substances from milk, suffer chemical transformations being decomposed into simpler substances becoming soft, easily digested by the body and thus easily assimilable. Therefore, these products are characterized by a special nutritional value, containing all the nutritive elements of milk in an easily assimilable form. Acid dairy products are also characterized by their quality to conserve longer than milk which is an important economic advantage.

It should be noted that the lactic acid bacteria, which reach the intestine are developing and creating a beneficial medium for the organism health, because their development does not allow the development of other types of bacteria with diverse degrees of pathogenicity. Lactic acid bacteria may also be called „digestive tract sanitars”.

The immunity of the organism depends in high proportion, of 50-60%, on the health condition of the colon.

The recent researches has shown that certain components of acidic dairy products, namely conjugated linoleic acid, dairy sphingolipids and probiotic cultures and metabolites can reduce the risk of colon cancer. In vitro studies and on experimental animals have highlighted the internal mechanisms by which these components of acidic dairy products ensures protection against colon carcinogenesis.

Human clinical studies, including recent studies on the use of rations rich in acidic dairy diet products ensures support for reducing colon cancer when the diet is rich in such products. At the same time, the administration of bifidobacteria ensures the production of antibodies for the experimental animals.

We consider this information useful because *Lactococcus* is a digestive bacterium that can not survive outside the intestinal tract. It has been shown that the bacterium *Lactococcus lactis* is not only the safest and risk-free probiotic that helps digestion, but also the simplest and most natural solution for good health. It is no coincidence that fermented foods are consumed for hundreds of years, which means that the bacterium *Lactococcus lactis* is in our body for centuries. Unfortunately, it is very difficult to find a dietary supplement that can replace probiotics in our body.

Conclusions

1. In the process of growth and development of the animal organism, the most commonly used bacterial strains for the preparation of probiotics are: *L. lactis*, *Lactobacillus acidophilus*, *L. bulgaricus*, *L. casei*, *Bifidobacterium* etc.
2. The benefic action of *Lactococcus lactis* for the animal or human organism is the mechanism of action on the reduction of pathogenic microorganisms, the production of useful substances (amino acids, vitamins, enzymes, etc.), the neutralization of toxins (*E. coli* enterotoxins) and stimulation of organism immunity.
3. In order to manifest its maximum efficiency, it is recommended that probiotics to be administrated to animals immediately after birth, during periods of stress, and also immediately or simultaneously with the mass therapeutic treatments.

References

1. Carp-Cărare C., 2015. Bacteriologie specială. Iași: Editura Ion Ionescu de la Brad, 177 p.
2. Banu C., 2010. Tratat de industrie alimentară. Editura ASAB, pp.68-69.
3. Dan V., 2001. Microbiologia alimentelor. Galați: Editura Alma, 52 p.
4. Dobrea M., 2014. Biotehnologii alimentare. Vol. I. București: Editura Printech.191 p.
5. Golban R., 2015. Microbiologie alimentară. Curs de prelegeri, UASM, Chișinău: uasm.moodle.md,142 p.
6. Golban R., 2000. Microflora laptelui și produselor din lapte. Îndrumări metodice cu privire la lucrările de laborator și lucrul de sinestător pentru studenții specialităților 2601 „Medicină veterinară” și 2701 „Zootehnie”. Chișinău, pp 7-10.
7. Savu C., coord.,2013. Controlul de laborator al alimentelor de origine animală. București: Editura Transversal. 406 p.