squalane and probiotic cultures to normalize the microflora of the skin is a promising aspect in the creation of dermatological remedies.

Aim. The aim of this work is to determine the possibility of combined use in complex dermatological cosmetic agent squalane with strains of probiotic cultures of lactobacilli.

Materials and methods. In the work cultures provided by the Institute of Microbiology and Virology named by J.K. Zabolotniy – *Lactobacillus plantarum* – B-2693, *Lactobacillus acidophilus* B-7016, *Lactobacillus fermentum* – B-2693 and squalane "100% Plant Derived Squalan" trademark "The Ordinary" were used.

To identify the possibility of combined use of squalane and lactobacilli, biotechnological studies were performed by the method of co-cultivation in liquid nutrient medium with subsequent seeding in Petri dishes. Sowing doses of inoculum were standardized to $1 \cdot 10^6$ CFU/cm^3. The cultivation was carried out for 48 h, temperature of (37±1)^{o}C. For each lactobacilli stain were performed separated experiment. As a control was used the liquid nutrient medium with pure cultures. Quantitative accounting of lactobacilli was performed by counting colonies (Koch method).

Results and discussion. According to the results of an experiment of the co-cultivation of squalane with strains of lactobacilli and counting microorganisms, could be concluded that the number of lactobacilli with squalane was not less than in control. This leads to the conclusion about the possibility of the joint use of squalane and lactobacterium as part of a complex dermatological cosmetic product.

Conclusions. Squalene has a number of advantages for skin tissues, but it is not stable and can cause inflammation, so it is advisable to use dermatological cosmetics with its analogue – squalane. The current success of squalene and its analogs shows the promise of further clinical trials for use in skin products. Another promising issue is the use of probiotic cultures in skin care and treatment products. In this work, experiments conducted on the co-cultivation of squalane and strains of lactobacilli proved the possibility of using them in one complex dermatological cosmetic product.

CHARACTERISTICS OF CLASSICAL PROPIONIC ACID BACTERIA

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Introduction. It is known that the correction of the intestinal microflora and, therefore, the prevention of various diseases, is possible by the use of lactic acid products prepared using homo-enzymatic lactic acid bacteria. The usage of propionic bacteria for this purpose has not been practiced until recently due to their inability to actively ferment milk, but when combined with propionic bacteria and bifidobacteria, this problem can be solved.

Aim. The purpose of the study is to characterize classical propionic acid bacteria for determining the possibility of expanding their application.

Materials and methods. We used the descriptive research method: were analyzed literary and Internet sources.

Results and discussion. Propionic acid bacteria can be called living fossils: they appeared at least three billion years ago, when life was born on Earth. In those days, the surface temperature of the planet was much higher than it is now; the other was the composition of the atmosphere: a lot of methane, ammonia, carbon dioxide, hydrogen, hydrogen sulfide, water vapor, complete absence of oxygen. Such conditions have determined the properties of modern propionic acid bacteria (*Propionibacterium*) – heat resistance, anaerobic, hydrogen sulfide tolerance, which is toxic to most living organisms.

When oxygen appeared in the earth's atmosphere, the propionic acid bacteria also adapted to the aerobic environment. Moreover, they are even able to extract a small energy benefit from contact with

oxygen because they have a respiratory chain. However, the main form of their "communication" with oxygen is to neutralize it by flavin respiration, during which oxygen is spent on the oxidation of the recovered flavoproteins.

Propionic acid bacteria (*Propionibacterium*) were first described in the late 19th century by E. Von Freudenreich and Sigurd Orla-Jensen during the study of propionic fermentation in Emmental cheese. Cheeses, milk and dairy products have become the main sources of excretion of pure cultures of propionic bacteria. The main habitat of classical propionic acid bacteria - hard rennet cheeses and more than 60% of strains isolated from Emmental cheese, are *Propionibacterium freudenreichii* and *Propionibacterium shermanii*. It is worth noting that in addition to the classic, so-called "milk" propionibacteria, there are skin types.

Propionic acid bacteria are initiators of propionic fermentation, ferment glucose, lactose and other carbohydrates, as well as some alcohols with the formation of propionic and acetic acids and CO_2.

Leaven containing propionic acid bacteria have long been used in cheese making: drawing ("peephole"), as well as the taste and aroma of Swiss cheese are largely associated with propionic acid fermentation.

Of great interest in scientific and practical terms are lactic acid and bifidobacteria as probiotics, i.e. microorganisms that colonize the intestinal epithelium. However, propionic bacteria can be significantly more beneficial to human health as transient probiotics. The presence of probiotic significant properties in certain strains of propionic acid bacteria allows them to be used as transient probiotics, which are known to preserve viability and exhibit metabolic activity, moving along the gastrointestinal tract for about 20 hours.

In general, probiotics fall into three functional categories: antimicrobial, immunomodulatory and metabolic. All these qualities are present in the "arsenal" of classic propionic acid bacteria.

The list of probiotic characteristics of propionic acid bacteria should be increased, first of all, at the expense of the antimutagenic, reacting and protective properties revealed in them. In practice, the probiotic properties of propionic acid bacteria are associated with: modulation of the microbiota and metabolic activity in the gut, modulation of intestinal peristalsis and absorption, influence on inflammation of the gut, modulation of the immune system, and potential reduction of risk factors.

The resistance of lactic propionic bacteria to technological stress should lead to their continued use in various fermented probiotic products.

An important probiotic value of the properties of *P. freudenreichii* strains is that unlike lactic acid bacteria, they are able to produce a number of useful nutraceutical compounds, while exhibiting low growth needs (for the cultivation of a glucose-mineral medium with only two vitamins are sufficient).

Exometabolites of propionic acid bacteria are vitamins B (riboflavin, pyridoxine, nicotinic and folic acids), antimicrobial factors, linoleic acid conjugates, exoenzymes and antimutagenic factors, as well as bifidogenic factors - stimulants of growth.

The biosynthesis of large amounts of corinoids – the intracellular compounds of the vitamin B12 group - is a known metabolic feature of propionic acid bacteria, which is essential both for the animal (human) and for the body gastrointestinal microbiota. That is why propionic bacteria are used as producers for microbiological synthesis of vitamin B12.

The ability of lactic acid bacteria to enhance the adhesion of propionic acid bacteria on the inner surface of the gastrointestinal tract is known. Therefore, the formation of a community of bacteria of probiotics in the gastrointestinal tract is not excluded. The strain of *P. freudenreichii*, whose physiology has long been studied by many researchers, has shown biocompatibility (lack of mutual inhibition of growth) with lactic acid probiotics such as *Lactobacillus casei* and *L. acidophilus*.

A probiotic property of a number of the strains under study is also the pronounced antioxidant activity, as well as, for example, the ability to cause the death of tumor cells of the rectum and stomach.

Unlike other probiotics, propionic acid bacteria have been found to produce a significant synthesis of corinoids, heme-containing antioxidant enzymes: catalase, peroxidase, and superoxide dismutase (SOD). It is known that lactic propionic bacteria are resistant to bile acids, withstand low pH

(2.0) acidity of the stomach, inhibit the activity of β-glucuronidase, azareductase and nitroreductase – enzymes that are formed by intestinal microflora and are absorbed.

Conclusion. Thus, by analyzing current sources regarding the possibilities of using propionic acid bacteria for the treatment and prevention of various human diseases, we can distinguish the following effects of propionic acid bacteria: antibacterial, anticancer, immunostimulating, bifidogenic and total probiotic. Data from many studies show the relevance and potential of using propionic acid bacteria in combination with other probiotic strains to create probiotic agents for therapeutic and prophylactic action.

DEVELOPMENT OF COMPOSITION AND TECHNOLOGY OF BIOPRODUCT BASED ON PROPIONIC ACID BACTERIA AND PLANT RAW MATERIALS

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Introduction. Probiotics have been the subject of intense research focusing mainly on bifidobacteria and lactic acid bacteria. However, there is evidence that lactic propionic bacteria have simply unique and often more significant probiotic properties, whose potential resources are underestimated so far.

In this regard, the use of propionic bacteria in the manufacture of functional fermented beverages is of great interest. Propionic acid bacteria have immunomodulatory, anti-inflammatory, anti-stress and antimutagenic properties, have a bifidogenic effect.

Propionic acid bacteria increase the nutritional value of products as a result of the synthesis of B vitamins, especially the most important for human and animal health and the highly deficient B12.

It is known that the correction of intestinal microflora and, therefore, the prevention of various diseases, traditionally seek the use of lactic acid products prepared with homo-enzymatic lactic acid bacteria.

The use of propionic bacteria for this purpose has not been practiced until recently due to their inability to actively ferment milk, but when combined with propionic bacteria and bifidobacteria, this problem can be solved.

In addition, the combined use of these two types of probiotic cultures causes: the supply of bifidobacteria useful for their growth of bifidogenic substances that synthesize propionic acid bacteria, and bifidobacteria create the initial conditions for milk fermentation due to active acid formation.

That is, the use of propionic acid bacteria as a probiotic component in functional fermented beverages is promising for the development of effective therapeutic and prophylactic products.

Aim. The choice of a rational ratio of propionic acid bacteria and bifidobacteria in the composition of therapeutic and prophylactic.

Materials and methods. *Propionibacterium freudenreichii* (*Propionibacterium freudenreichii subsp. Shermanii*) was selected as the main probiotic component.

Dry lyophilized biomass of propionic acid bacteria has good solubility, increased hydrophilicity (85%), which indicates its good quality. Biomass has a significant number of viable cells of propionic acid bacteria $8 \cdot 10^9$ in 0.1 g. As an herbal component, we have chosen cranberry juice, which has many therapeutic effects. As the probiotic culture we have chosen bifido-containing leaven.

The work used classical microbiological methods for working with cultures of probiotics and technological methods for obtaining fermented beverage.

The identification of the cultured microorganisms was carried out by the method of "Gram staining".