accuracy of printers, it has become possible to provide pharmaceutical companies with the most customized drug delivery devices for various ways of drugs administration. To conclude, 3DP is more convenient, less expensive, and is better for personalized medicine.

There are many various 3D printing technologies in the production of personalized medicines. Nowadays the most used method is fused deposition modeling (FDM) which is used to create implants, pills, and other objects. This process requires melting of polymers and then shaping them as wanted or needed. On the other hand, there is a so called inkjet printing that requires heating of ink fluid which is then being sprayed in different shapes. When completely dried, it provides a solid dosage form ready to be used by patients. Another innovative technology is called Zip Dose and is required for producing oral medicines that disintegrate within seconds. These forms are the most appropriate for patients that find it hard or even impossible to swallow medicines.

As an example of a modern company that is specialized in 3DP technologies, FabRx is a modern biotechnical company that has started the use of 3DP techniques in order to manufacture patient-centric products. With the use of a completely new technology called Printlets, they are able to create drugs with flexible dosages, shapes, sizes, and active pharmaceutical ingredients. In 2020, FabRx invented the world's first medicine dedicated 3D printer M3DIMAKER which is meant for the small-ranged production of modifiable pharmaceutical products to make a truly personalized attitude towards patients.

Discussing the future of 3DP, it is justified to use innovative technology in hospitals and pharmacies for both individuals and various groups of people with special needs. Moreover, these personalized medicines can be fabricated in situ at a pharmacy or even at home by the patient himself.

Conclusions. To sum up, 3DP is one of the nanotechnologies necessary in the medical and pharmaceutical fields to personalize them and find special approach to each patient. Also, with the introduction of 3DP in the medical field, the time required to produce medical products can be reduced from many days to several hours. Thus, it will allow us to quicker release certain pharmaceutical products onto the market. In addition, because of minor waste of raw materials, it may cause a significant decrease in production costs, which will increase the accessibility to the needed before unaffordable medicines for people with difficult financial situations.

CHOICE OF BASIS IN THE DEVELOPMENT OF A SOFT DRUG FOR SKIN WITH A PROBIOTIC COMPONENT

Soloviova A.V, Kaliuzhnaia O.S.
National University of Pharmacy, Kharkiv, Ukraine
soloviova.alina@gmail.com

Introduction. The skin is a complex barrier organ consisting of a symbiotic relationship between microbial communities and host tissue through complex signals provided by innate and adaptive immune systems. The skin is constantly exposed to various endogenous and exogenous factors - physical, chemical, bacterial and fungal, which affect this balanced system, potentially leading to inflammatory skin conditions, including infections, allergies or autoimmune diseases. Creating effective means of correction and/or maintenance of human normoflora to maintain a healthy skin microbiome is an urgent task today. Moreover, the violation of the skin microbiome can be a consequence of infectious and inflammatory dermatoses and their treatment with antimicrobials, and the cause, as the reduction of the microbiome of this ecosystem normally leads to the activation of

opportunistic pathogens and, consequently, to infectious disease. And treatment of dermatoses exclusively with antimicrobial and anti-inflammatory drugs leads to long-term, often ineffective, treatment with frequent relapses. Therefore, the creation of a soft dosage form containing strains of probiotic cultures to restore the normal microbiocenosis of the skin and the simultaneous prevention or treatment of dermatological inflammatory and infectious diseases is promising.

The use of probiotic cultures as an active component of living cells determines the specificity of the created tool, and puts forward a number of requirements for the preparation of the dosage form. The basis and parameters of production of living biotherapeutic drugs, first of all, should ensure the viability of cells and the preservation of their probiotic activity.

Purpose of the research. The aim of this study was to determine the possibility of co-administration as part of a mild preparation for cutaneous application of a probiotic component with selected components of the base.

Materials and methods. The main active ingredient of the drug is lactobacilli, which are currently the most common, including probiotic products for skin care. The introduction of the probiotic component in the composition of the base of the mild drug for dermal application was carried out in the form of biomass of the drug "Lactobacterin dry", which is a microbial mass of living, antagonistically active strains *L. fermentum* 90T- C4, or *L. fermentum* 39, or *L. plantarum* 8P-A3, or *L.plantarum* 38, yophilized in the culture medium with the addition of a protective medium. Acrylates, which are stable, inexpensive, and technologically convenient, were used as gelling agents: Sepiplus 400, Carbopol 934 and Aristoflex AVC. Determination of the number of lactobacilli cells was performed by surface seeding.

Obtained results. To study the effect of the components of the base on lactobacilli, they were cultured in 100 ml of liquid nutrient medium MRS with the addition of each of the studied components. After 48 h of cultivation at room temperature (37±1) °C in each sample, the number of live microorganisms expressed in CFU was determined by surface seeding and compared with the control. As a control used a culture of lactobacilli grown under the same conditions with the same initial inoculation dose, but without the addition of the test component.

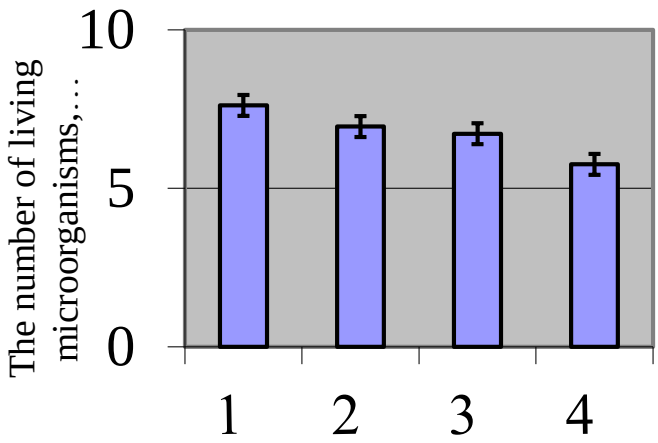

Fig. 1 - Dependence of lactobacilli viability on the type of gelling agent:
1 – control; 2 – Aristoflex AVC; 3 – Sepiplus 400; 4 – Carbopol 934

The results are shown in Fig. 1 indicate a certain decrease in the viability of lactobacilli when cultured with selected gelling agents compared to the control. These data correlate with information on limiting the introduction of lyophilized biomass into hydrophilic bases due to hydration of lyophilized biomass and cell proliferation in the composition of the tool, which, in turn, will contribute to the instability of the dosage form. In addition, it should be borne in mind that some

hydrophilic bases have a hyperosmolar effect.

But in the development of soft preparations for dermal use for the treatment of dermatological diseases should take into account the main pathogenetic factors whose interaction contributes to the manifestation of infectious and inflammatory diseases of the skin, including acne: sebaceous gland production, changes in keratinization, colonization of *P. acnes* follicles and the release of inflammatory mediators. That is, in such dermatological diseases, the increase in the amount of sebum, in which the skin surface becomes oily, calls into question the use of ointment or cream bases, the components of which are oily substances. This can lead to overload of fatty components of already oily skin, pH shift to the alkaline side, clogging of pores and lack of positive effect of the active components of the drug. In addition, the use of hydrophobic bases raises another problem - how easily microorganisms can be released from the oil base applied to the skin and thus become metabolically active, sufficient to provide the necessary probiotic effects.

Thus, we still settled on a mild dosage form in the form of a gel, and the introduction of the probiotic component was carried out through the oil phase, thereby stabilizing the lactobacilli. Thus, when using hydrophilic bases, the creation of an oil phase, in which lactobacilli are incorporated, will protect cells from the action of moisture and hyperosmolar action of the components of the bases. Vegetable oil was used as the oil phase, in which lyophilized biomass pre-dissolved in polysorbate-80 was introduced. The study of cell viability of such a combination is shown in Fig. 2.

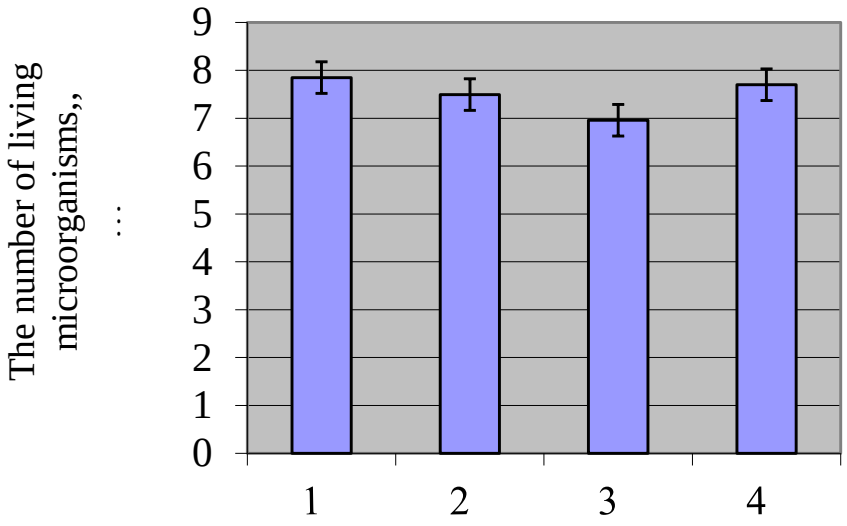

Fig. 2 - Dependence of cell viability on the type of gelling agent in which lactobacilli were introduced through the oil phase:
1 – control; 2 – Aristoflex AVC; 3 – Sepiplus 400; 4 – Carbopol 934

The results are shown in Fig. 2 indicate a slight decrease in the number of cells when cultured with selected gelling agents, in which lactobacilli were introduced through the oil phase.

Conclusions. Thus, the obtained results prove the prospects of introducing biomass of lactobacilli through the oil phase into the gel base.