

experiment, with the highest values on day 34. This indicates an improvement in the intestinal barrier function, which can reduce the risk of pathogen penetration and improve the overall health of the chicks. E-cadherin expression also noticeably increased in the experimental group, particularly on day 20. The increased levels of this protein indicate improved cellular adhesion and epithelial layer integrity, which helps protect against infections. The beneficial impact of fatty acids confirms their potential benefit for enhancing bird immunity and productivity.

Conclusion. The obtained results demonstrated the importance of using molecular biological methods, particularly RT-PCR, for assessing the intestinal barrier function in broiler chickens. The study results indicate a significant impact of fatty acid preparations on the expression of markers such as occludin and E-cadherin. Considering that intercellular adhesion proteins play a key role in maintaining the integrity and functionality of the intestinal barrier, the obtained data suggest the prospect of using the developed strategy for assessing intestinal health and, accordingly, productive animals. Thus, the results confirm the potential benefits of including fatty acids in the diet of broiler chickens to enhance their immunity and productivity. This comprehensive approach to evaluating intestinal barrier function and using modern molecular biology methods allows obtaining data on chick health and feeding correction.

INDICATORS OF PROTEIN METABOLISM OF BLOOD AND MODULATION OF THE BARRIER FUNCTION OF THE PIGLET'S INTESTINE BY THE ACTION OF AN ISOTONIC PROTEIN MIXTURE

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Relevance. The main task in modern pig breeding is to obtain the maximum number of piglets per sow per year. On average, 2.2-2.3 farrowings per year can be obtained from a sow, but the number of piglets born to a sow varies from farm to farm. The number of piglets born per sow in Ukraine on average ranges from 13.5 to 17.5 heads, based on 12-16 working nipples per sow. Improving the viability of newborn piglets in the early postnatal period of ontogeny is a priority for any pork producer. The safety of piglets in the lactation period in Ukraine is on average 85-90% of the piglets born. The main losses of piglets occur in the first week of life associated with a lack of colostrum, milk, impaired intestinal barrier function and the manifestation of diarrhea due to a complex of pathogens of viral-bacterial etiology (Rota A, C, E. Coli, Cl. perfringens A, C). In the first week after birth, piglets face the most severe stress associated with zooveterinary treatments (removal of canines, docking of tails, tagging, castration, injections of iron-containing drugs, antibiotics, coccidiostats)

Therefore, new strategies to prevent the development of infections by initiating the protective mechanisms of innate immunity and intestinal barrier function are very relevant. The use of additives that can increase the resistance of the intestines to external damage is an important strategy in modern animal husbandry. The barrier function of the intestine is provided by proteins involved in the intercellular adhesion of the epithelial layers of the intestine. Weakening of the

barrier function of the intestine leads to the entry of microorganisms and toxins into the cells of the intestinal system. Such an invasion provokes cell damage and increases the risk of infectious diseases. Modulation of immune status and integrative properties of piglet intestinal epithelial layers are considered important components of a strategy that can support growth performance and gut health in piglets.

Therefore, the purpose of the study was to determine the peculiarities of the dynamics of blood protein metabolism indicators and modulation of the content of fibronectin, E-cadherin and interferon-alpha in the small intestine of piglets under the action of an isotonic protein mixture.

Materials and methods. The work was carried out at the Department of Physiology, Animal Biochemistry and Laboratory Diagnostics of DSAEU. Laboratory studies were carried out on the basis of the Research Center for Biosafety and Environmental Control of Resources of the AIC "Biosafety-Center" of DSAEU. The experiment was carried out on piglets of Danish genetics in the conditions of the pig complex of AgroInd LLC. To conduct the study, 2 groups of piglets (experimental and control) of 2-day-old age ($n = 65$) were formed, which were in the same pigsty in separate pens with identical growing conditions according to the company's protocol. The experimental group, in addition to the diet from 3 to 8 days of life, was fed an isotonic protein mixture at a dose of 0.5 liters per nest during the day. To study the indicators of protein metabolism of blood (total protein, albumin, globulins, AST, ALT) and molecular markers of barrier function (fibronectin, E-cadherin, interferon-alpha) of the intestinal system, 5 piglets were selected from each group at 9, 21 and 35 days of age and subjected to euthanasia. Blood serum and duodenal fragments (3-5 cm) were taken from piglets. The material was stored for the study in frozen form at a temperature of -18°C to -22°C .

Serum biochemical parameters were studied using the automatic biochemical analyzer Miura (Italy) and commercial systems manufactured by Cormay (Poland) and Spinreact (Spain). The level of globulins was determined calculatedly. To study the content of molecular markers, the Western-blot method was used using monoclonal antibodies and enhanced chemiluminescence: E-cadherin, fibronectin, interferon-alpha.

The experimental studies were carried out in compliance with the requirements of the Law of Ukraine No. 3447-IV of 21.02.06 "On the Protection of Animals from Cruelty" and are consistent with the basic principles of the "European Convention for the Protection of Vertebrate Animals Used for Experimental and Scientific Purposes" (Strasbourg, 1986), the Declaration "On the Humane Treatment of Animals" (Helsinki, 2000) and the National Congress on Bioethics "General Ethical Principles of Animal Experimentation" (Kyiv, 2001).

The obtained numerical data were processed statistically: the arithmetic mean (M) and its error (m) were determined. The probability of differences in mean values was established by the Student's criterion. Changes in indicators were considered significant by $p \leq 0.05$ (including $p \leq 0.01$ and $p \leq 0.001$). The correlation coefficient (r) was calculated using the Pearson method using the Microsoft Office Excel 2019 application software package.

Results. In the blood serum of piglets, age-related fluctuations in the level of total protein and its main fractions were observed within physiological values. In particular, in control animals, a decrease in protein content was observed with age, which was accompanied by an increase in the concentration of albumin and a decrease in the content of globulins. Probably, such changes are explained by an increase in the synthetic activity of the liver with age, as well as the breakdown of colostral antibodies, as indicated by the works of Polo et al. (2012), Kaneko et al. (2016). The use of an isotonic protein mixture led to an increase in the content of serum proteins due to albumins and globulins. In our opinion, the first can be explained by the better assimilation of plastic material for the construction of blood proteins from the composition of the supplement. On the other hand, higher globulin levels are probably associated with a longer circulation period of colostral antibodies (due to less antigen supply due to improved intestinal barrier).

The activity of aminotransferases was higher in piglets of the experimental group of 9 days of age, which can be explained by the assimilation of amino acids from the isotonic-protein mixture and their subsequent metabolism in hepatocytes. At the same time, at 35 days of age, ALT was

significantly lower in piglets of the experimental group, which may indicate a lower level of enzyme elimination from the liver (Kaneko et al., 2016).

There was a significant increase in the content of fibronectin by 51% in the experimental group on the 9th day of life compared to piglets of the control group. A significant increase in cadherin E content was higher by 48% in the experimental group on days 9 and 35 of the experiment. The content of interferon alfa was significantly higher by 54% only in piglets of the experimental group on the 35th day of the experiment.

The survival of piglets in the experimental group was higher on the 9th day of life + 9.0%, on the 21st day of life + 6.0%, on the 35th day of life + 13.0%. The weight of piglets in the experimental group was higher on the 9th day of life + 0.140 kg, on the 21st day of life + 0.800 kg, on the 35th day of life + 0.880 kg

Conclusions. The use of an isotonic-protein mixture in the early postnatal period of piglets' life significantly improves the biochemical parameters of blood serum, and molecular markers of the barrier function of the intestinal system, has a positive effect on the productive and physiological indicators of experimental piglets. Therefore, the use of functional feed additives to support intestinal health in piglets can be a promising component of a comprehensive strategy for the development of modern pig production.

NOVEL APPROACH IN DNA VACCINE DEVELOPMENT AGAINST PORCINE CIRCOVIRUS TYPE 2

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Porcine circovirus type 2 (PCV2) is an important viral pathogen in pig populations. However, commercial vaccines cannot provide complete protection with induced humoral immunity only against disease development. DNA vaccine is a candidate of great potential because it can induce both arms of the immune system, humoral and cellular immune responses.

Belonging to the family Circoviridae, porcine circovirus type 2 (PCV2) has the smallest, single-stranded circular DNA genome (1767-1768 bp). PCV2 is associated with a number of diseases in pigs collectively known as PCV-associated disease (PCVAD). In the late 1990s, a pathogenic circovirus designated PCV2 was isolated, which is different from the known nonpathogenic PCV type 1 (PCV1). PCV2 is ubiquitous and can be detected in both diseased and clinically healthy pigs. Infection induces varying degrees of lymphoid depletion and immune suppression, demonstrated by experimentally infected pigs with PCV2 infectious DNA clones. Generally, PCV2 alone is limited in its ability to induce full spectrum of clinical disease; however, it is an essential pathogen in the development of PCVAD. It is known that many factors have contributed to the pathogenicity of PCV2.

Currently, commercial vaccines against PCV2 in the US have either recombinant proteins or inactivated PCV1-2 chimeric virus which is constructed by replacing the ORF2 gene in PCV1 with the corresponding gene. They induce only humoral immunity which is effective in reducing the level of PCV2 viremia and preventing the development of severe PCVAD even with the presence of