INTESTINAL BARRIER FUNCTION IN PIGLETS AND METHODS OF ITS CORRECTION

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Introduction. The intestinal barrier function in piglets is a crucial component for the health of productive animals and the profitability of pig farming. The intestinal barrier protects against pathogenic microorganisms and toxins and is a key factor in the selective absorption of nutrients. A decrease in intestinal barrier function negatively affects both general growth and development indicators of piglets and the overall health status of the organism.

The most critical periods for intestinal health in the life of piglets are the neonatal period and the first weeks after weaning. While colostral immunoglobulins protect the digestive system of piglets immediately after birth, the intestinal barrier function must be supported by additional means during the post-weaning phase.

Various groups of preparations are used to correct the intestinal barrier function: pro- and prebiotics, bacteriophages, phytobiotics, enzyme preparations, and organic acids. Monoglycerides of fatty acids have several positive characteristics that distinguish them from the aforementioned means, including antimicrobial properties through effects on microorganism membranes, modulation of the immune system by affecting inflammatory cytokines, stimulation of intestinal villi growth, fat emulsification which improves absorption, and safety. Considering these properties, this study tested a combined preparation of monoglycerides with fatty acids, which have recently begun to be used on farms in Ukraine as an alternative to antibiotics.

Objective. The aim of this study was to investigate the effect of fatty acid monoglycerides on the barrier function of the jejunum and ileum in piglets at 42, 56, and 77 days of age after 7, 21, and 42 days of administering the monoglyceride and fatty acid with daily feed.

Materials and Methods. The study was conducted under farm conditions in the Dnipropetrovsk region. The monoglyceride and fatty acid preparation was added to the feed on a continuous basis. The preparation was administered for 42 days post-weaning, from 35 to 77 days of age. Weaning occurred on the 33rd day of life. The experimental group consisted of 75 piglets, while the control group had 64 piglets. Throughout the study, we analyzed changes in economic indicators (piglet weight and mortality), collected samples for microbiological studies of the intestinal microbiome, conducted biochemical and morphological blood studies of piglets, histological examination of intestinal morphology, and used PCR and Western blot methods to evaluate the expression and content of specific cell adhesion molecules and cytokine production (occludin and IFN-α, TNF-α, respectively).

Results. The results showed that the use of the monoglyceride and fatty acid preparation contributed to an increase in serum interferon-α content, occludin levels, and improved productive indicators compared to the control group of piglets.

According to the data obtained, the IFN-α content has minimal differences between the groups, with a slight predominance in the experimental group at 56 and 77 days.

The occludin content is significantly higher in the experimental group, especially at 56 and 77 days of piglet life, compared to the control group, indicating improved intestinal barrier function in the experimental animals.

The level of TNF-α in the control group is systematically higher at all time points, suggesting more pronounced inflammatory processes in these animals.

Weighing results at the beginning and end of the rearing period showed that the average weight of piglets in the experimental group at 86 days of life was 34.91 kg, while in the control group, it was 32.48 kg. The difference is 2.43 kg or 6.96%.

Conclusion. The intestinal barrier function in piglets plays a critically important role in maintaining organism homeostasis. To evaluate the effectiveness of preparations, it is promising to use a combined strategy for determining specific molecular markers of barrier function, the state of the intestinal microbiome, morphological indicators of the intestinal epithelium, immune response markers, and productive indicators.

ISOTONIC PROTEIN FORMULATION INHIBITS PEDV PROLIFERATION IN PIGLETS VIA MODULATION OF ENTEROCYTE JUNCTIONS AND INTERFERON PRODUCTION

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Abstract. The porcine epidemic diarrhea virus (PEDV) not only causes large economic losses in the swine industry, as the causative agent of PED, but also poses a risk to other animals and human due to cross-species transmission. Piglets are particularly susceptible to PEDV infection, which disrupts intestinal epithelium morphology and barrier integrity as well as nutrient absorption. PEDV is one of the most important swine viruses that has emerged or re-emerged, posing a significant threat to the global pork industry. In particular, the highly pathogenic PEDV strain, which began to spread in China in 2013, emerged in the United States and then spread to Asian countries such as Korea, Taiwan, and Japan almost simultaneously, causing PED epidemics nationwide. Therefore, the search of anti-PEDV strategies remains exceedingly actual task. Recent data demonstrated the inhibiting effect of milk small extracellular vesicles against PEDV infection in IPEC-J2 and Vero cells. Taking into the account that IPS contains milk substances, observed in our study PEDV suppression can be caused by similar anti-viral mechanisms.By supporting innate immunity and intestinal function, isotonic protein solutions (IPSs) may help in restoring the morphology and function of enterocytes after PEDV infection. To this end, the present study evaluated the effects of supplementing (or not) the drinking water of 14-days-old PEDV-infected piglets with an IPS on: the content of E-cadherin, fibronectin (two structural proteins), and interferon-alpha (IFN-α, an antiviral cytokine); the activity of metalloproteinase 9 (MMP-9, an enzyme that degrades the extracellular matrix); and the content of PEDV DNA in the rectum of piglets. The IPS-supplemented group evidenced a less abrupt decrease in E-cadherin and fibronectin and a modulation of IFN-α production and MMP-9 activity. At day 21 post infection, no PEDV DNA was detected in the rectum of piglets supplemented with the IPS. Overall, these results indicate that IPS supplementation is a viable intervention to rehabilitate the intestinal barrier integrity and function and to modulate the immune response. This is possibly done by providing amino acids that promote the metabolism of structural proteins. IPS supplementation is therefore a valid intervention to mitigate the damage inflicted by PEDV on the intestine.

Considering the results obtained here, IPS supplementation is a valid strategy to protect intestinal barrier function and ameliorate PEDV symptoms. It improves the metabolic activity of enterocytes, which enhances intercellular adhesion (E-cadherin) and ECM structure (fibronectin), reduces the MMP-induced cleaving of the ECM, and modulates IFN-α production for improved resistance to the cell damage caused by PEDV infection.