Furthermore, the impact of NPs can be multidirectional, and some of them are effectively used to neutralize the toxic effects of others. For example, co-administration of ZnO-NPs reduced most of the toxic effects of Ag-NPs and can be used as an alternative agent to minimize reproductive toxicity associated with exposure to Al due to antioxidant, anti-inflammatory, anti-apoptotic activity (Shehata et al., 2021; Yousef et al., 2021; Lokman et al., 2022).

Conclusions. The results of the literature review indicate the presence of a negative effect of Ag-NPs on the sexual function of male rats, which was characterized by a decrease in sperm motility and viability, led to a decrease in testosterone levels and accumulation of silver in the testicles. On the other hand, there are no data on the reproductive toxicity of Au-NPs, and therefore their use in animal reproduction is impossible. Thus, it can be seen that the introduction of precious metals nanoparticles as components of nanobiotechnologies for animal reproduction requires the insertion of a safe dose, size and form-factor of these NPs with a mandatory determination of their impact on sexual function.

APPLICATION OF ISOTONIC PROTEIN PREPARATION PROVIDE THE MAINTENACE INTESTINAL BARRIER IN WEANED PIGLETS

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Relevance. The current limitations on the widespread use of antibiotics in animal husbandry are gaining impact in most countries. Consequently, research of feed additives as substitutes for antibiotics or targeted supportive measures attract significant interest. The primary objective of ensuring sustainable animal husbandry is to evaluate the effectiveness of feed additives on gut health and immune response in productive animals. The mixture of bioactive compounds obtained through yeast hydrolysis is an important component of feed supplements to maintain the health of farming animals. The content of nucleotides, vitamins, amino acids, and polysaccharides in yeast cell walls accounts for the beneficial effects of such a mixture on the activation of metabolic processes, animal growth, and the balance of nutrient consumption with metabolic energy expenditure. However, there is considerable variation in the biological activity of feed additives present in the market of commercial products. Therefore, molecular and cellular effects of feed additives require detailed investigation regarding their efficacy and potential application as alternatives to antibiotics in animal husbandry.

In pig farming, a critical challenge is to support the health of weaned piglets due to weak immune response and barrier functions of the intestine. Under natural conditions, weaning is a gradual process that completes within 10-12 weeks, but in the production process, piglets are often weaned at 3-4 weeks. This abrupt change occurs when the piglet's digestive tract is undergoing rapid expansion and specialization of intestinal epithelial cells, making them extremely vulnerable to infectious agents. Hence, novel strategies to prevent infections by initiating protective mechanisms of innate immunity and intestinal barrier function are highly relevant. The use of

additives that can enhance the resilience of the intestine against external damage is an important strategy in modern animal husbandry. The intestinal barrier function is provided by proteins involved in intercellular adhesion of the intestinal epithelial layers. Weakening of the intestinal barrier function leads to the entry of microorganisms and toxins into the intestinal system cells. Such invasion triggers cell damage and increases the risk of infectious diseases. Feed additives can stimulate animal growth primarily by modulating the gastrointestinal microbiota, supporting barrier function, and innate immune responses. Despite significant progress in the research of biological effects of a wide range of prebiotics, information on the impact of isotonic protein preparations (IPPs) on the intestinal barrier function of weaned piglets remains limited. Modulation of immune status and integrative properties of the piglet's intestinal epithelial layers are considered crucial components of a strategy that can support growth performance and gut health in piglets.

The objective of this study was to investigate the mechanism of action of IPPs on the innate immunity status of the intestine and the intestinal barrier function of weaned piglets.

Materials and Methods. The study carried out in the swine farm of the Dnipro region. Piglets were divided into two groups - control and experimental (n = 10). Both groups of piglets were fed a standard diet. The animals in the experimental group additionally received the commercial product Tonisity PxW (an isotonic product based on natural bioactive compounds) mixed with drinking water for 8 days from the 28th to the 36th day of life. The piglets in the experimental group consumed an average of 850 ml per day of a 0.2% solution of Tonisity PxW. The effects of Tonisity PxW on the intestinal barrier characteristics were evaluated via the measuring the molecular markers including E-cadherin and interferon-α. The content of these molecular markers was determined in the cells of the piglets' small intestine on the 28th and 36th day of life using immunoblotting. The samples of small intestinal tissue were used to assess the level of interferon-α production specifically by the cells of the intestinal. The content of both E-cadherin and interferon-α was detected with immunoblot technique.

Results. The results of immunoblotting showed a moderate stimulation of interferon-α production by the cells of the piglets' intestinal system on the 36th day of life in the experimental group compared to the control. However, no differences in interferon-α content were observed between the groups on the 28th day. The results obtained in our study showed that the PxW preparation can modulate the dynamics of interferon-α production in intestinal cells. Furthermore, the protective effect of PxW may be mediated, at least in part, through the stimulation of interferon-α production in the intestinal system. Comparative analysis of E-cadherin content in piglets' small intestinal samples showed a statistically significant ($P < 0.05$) increase in the level of this epithelial cell adhesion protein in the group of animals consuming the PxW preparation compared to the control group.

The results of the presented study indicate a possible cause-and-effect relationship between the activation of interferon-α production and the content of E-cadherin, where interferon-α activates the synthesis of E-cadherin through mechanisms of gene expression. Firstly, the modulation of E-cadherin content observed in our study indicates an enhancement of intercellular adhesion strength in the epithelial layer. Secondly, the temporal association between the increase in interferon-α production and E-cadherin content suggests that the consumption of the PxW preparation by piglets after weaning has multifactorial effects on supporting innate immunity and intestinal barrier function. Considering that the post-weaning piglet gut is highly vulnerable to infectious challenges, a strategy to support gut health through the comprehensive action of probiotics, nucleic acids, vitamins, limited hydrolyzed peptides, and other functional feed components may be an effective means of preserving the health of weaned piglets.

Conclusions. The isotonic product PxW modulates the production of interferon-α and the content of E-cadherin in weaned piglets, which are indicators of innate immunity and intestinal barrier function. Therefore, the use of functional feed additives to support gut health in weaned piglets may be a promising component of a comprehensive strategy for the development of modern pig farming in conditions where the use of antibiotics is restricted. Furthermore, current strategies to

estimate gut health should be based on the comprehensive analyses of molecular and cellular markers.

ASSESSMENT OF THE FIBRONECTIN ROLE IN THE INTESTINE HEALTH MAINTENANCE OF WEANED PIGLETS

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Relevance. The intestinal barrier protects the organism from the invasion of a wide range of pathogens. Barrier function is a critical component in ensuring the health of the intestinal system in piglets. Intercellular communications formed by tight contacts between specific types of adhesive proteins play a key role in the formation of a protective barrier. These junctions create a continuous and tight branching network between the membranes of neighboring cells, resulting in maximal consolidation of the apical intercellular space. Additionally, cell localization and migratory capabilities are facilitated by the interaction of cell adhesion proteins with components of the extracellular matrix (ECM), which establish specific intercellular adhesion between epithelial cells. One of common ECM component is fibronectin. The dynamic regulation of fibronectin content ensures a wide range of cell-ECM interactions and plays an important role in cell adhesion, migration, and tissue architectural remodeling. Therefore, imbalances in intestinal tissue fibronectin can impair cell-ECM interactions, intercellular signaling pathways, and the functional capacity of the intestinal barrier. Fibronectin molecules consist of two nearly identical subunits with a 250 kDa approximal molecular weight. Each monomer is composed with three types of repeated fibronectin domains that possess specific binding sites for other adhesive proteins, enabling cell-extracellular matrix interactions.

The functioning of the intestinal epithelial layer requires stable intercellular adhesion to ensure barrier function. Decreased fibronectin content may lead to disruption of the integrity of the epithelial layer and initiate the breakdown of the intestinal barrier. Furthermore, the effectiveness of the intestinal barrier can be assessed by both detecting and distributing fibronectin within the intestinal system. Strategies to maintain the barrier function of productive animals as well as their health are based on the application various compounds which can enhance intercellular adhesion power. Recently, biological effects of short-chain fatty acids and monoglycerides (SCFA-M) as cytoprotectors of intestinal barrier function have been actively investigated. An important argument in favor of these compounds is their multifactorial effects on the microbiome, immune response, and interaction of key cellular types in the intestine. Unfortunately, the molecular and cellular mechanisms of SCFA-M effect on the intestinal health of productive animals remain unclear.

The aim of our research was to determine the fibronectin content in the small intestine of piglets and to analyze the potential in fibronectin applying as a molecular marker of the intestinal barrier function.