

на 15,8-25,0%, на 60-й и 90-й день эксперимента в группе подопытных несушек. Уровень триглицеролов снизился у подопытных несушек на 12,8-13,3%, а холестерина снизился так же в пределах 4,7-6,1%. Концентрация глюкозы в крови подопытной птицы в течение эксперимента была больше на 7,2-8,4% по сравнению с контрольной группой несушек.

Ключевые слова: *наноахелаты, селен, цинк, общие липиды, триглицеролы, холестерол, глюкоза, куры-несушки.*

CHANGE OF TOTAL LIPIDS, TRIGLYCEROL, CHOLESTEROL AND GLUCOSE CONTENT IN THE BLOOD OF LAYING HENS UNDER THE INFLUENCE OF NANO-AQUACHELATES OF SELENIUM, ZINC AND VITAMIN E

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The results of the study of the influence of selenium, zinc and vitamin E aqua chelates on lipid and carbohydrate metabolism in laying hens are reflected in the article. In the studies carried out on the layers of the breed, Lohman Brown examined the effect of the addition of selenium nanochemistry solutions at a dose of 30 ml / kg, zinc 30 ml / kg, along with vitamin E - 40 mg / kg of feed. The experiment lasted for 90 days, the use of the above-mentioned drugs caused changes in the content of the studied parameters, namely: a significant increase in the content of total serum lipids on the 60th and 90th day of the experiment in the experimental groups by 15.8-25.0% , and the level of triacylglycerol decreased in experimental layers by 12.8-13.3%. The study of cholesterol levels during the experiment revealed only a tendency to decrease within 4,7-6,1%. The concentration of glucose in the blood of the experimental layers during the experiment was significantly higher in the experiment by 7.2-8.4% compared to the control group of the layers.

Key words: *laying hens, blood, lipids, nano-aquachelates, selenium, zinc, vitamin E.*

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STRUCTURALLY-FUNCTIONAL CHARACTERISTICS OF PROTEIN PLASMOLEMS OF ENTEROCYTES JEJUNUM OF CATTLE IN THE FETAL PERIOD OF ONTOGENESIS

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In accordance with the stated aim, a theoretical generalization and a new solution to the scientific problem are revealed, which is revealed in new scientific data on the characteristics of the structural components of the mucous membrane of the cavity of cattle fetus, the dynamics of cytometric indices of epithelial cells with a curved border of the cavity of structural proteins of the plasmolema of intestinal epithelial cells and age-related changes in the activity of hydrolytic and transport enzymes on the apical basolateral membranes and intestinal cells fetus of cattle. For

the first time, the polypeptide composition of Fc- γ -receptors of the cell envelope of enterocytes in the fruiting period of ontogenesis was identified, the regularities of formation of modulation of Fc- γ -receptor expression were studied and their localization on plasmolemma of cattle enterocytes was established.

Key words: *fetus, cattle, jejunum, enterocyte polypeptides, apical membrane, basolateral membrane, Fc- γ -receptor proteins, transport enzymes, hydrolytic enzymes.*

Introduction. The research of the patterns of development of digestive organs in productive animals during prenatal ontogeny creates the preconditions for ensuring the appropriate level of their vitality at birth [1]. At the same time, determination of physiological and biochemical criteria for the functioning of the organism in the uterine period is impossible without taking into account the morphological and biochemical aspects of their growth and development [2]. In this regard, the study of age-related structural differentiation of the jejunum mucous membrane of the cattle in the fetal period of ontogenesis will allow to determine the intensity of its morpho-functional transformations and will allow to form an appropriate idea of the specificity of prenatal formation of membrane digestion and absorption as a basis hemo- and amniotrophic nutrition to postnatal digestion, which will allow to reveal the pathogenesis of gastrointestinal disorders in newborn animals under conditions of intensive anthropogenic factors [106]. At the same time, information about the regularities of the structural and functional organization of the plasma membranes of intestinal mucous membranes in the period of pre-natal development is fragmentary and non-numerical today, and the data on the determination of the activity of hydrolytic enzymes of apical and basolateral membranes the cattle fetus are almost absent. The research of the expression of the activity of the membrane enzymes of enterocytes will allow to determine both the general patterns of their formation in prenatal ontogenesis, and the peculiarities of the formation of individual units responsible for the development of potential opportunities for interaction with biologically active components of colostrum. Fc- γ receptors provide the supply of immune complexes to competent cells, which in turn form specific clones of lymphocytes and stimulate the development of the immune system [3]. They are widely represented in mammalian cells of different histotypes, in particular in the yolk sac, placental syncytiotrophoblast, in the postnatal period of ontogenesis in the small intestine, capillary endothelium, hepatocytes, renal proximal tubules, respiratory epithelium [4] and epithelium [5]. For today, the localization of Fc- γ receptors in intestinal cells has been sufficiently studied and the mechanisms of transfer of immunoglobulins through the placenta of rodents and humans to the fetus and small intestine in newborn mammals (including cattle) have been elucidated [6–8]. At the same time, there is no information on the distribution of Fc γ R and their involvement in the activation of immune mechanisms in the cattle fetal period. In connection with the above scientifically it is important to investigate the expression features of cattle plasmolemma proteins in the cattle during the fetal period of ontogenesis, in particular, the patterns of expression of the Fc- γ -receptors of the enterocyte plasma membrane of jejunum intestine of cattle fetus. The results of the

study of the peculiarities of structural and functional transformations of the plasmolema proteins of the bovine intestine in the fetal period of ontogenesis will allow to develop scientifically sound safe methods of immunocorrection and prevention, which will contribute to the increase of vitality and the maximum level of realization of the genetic potential of animal productivity.

The goal of this research - is to determine the features of structural and functional transformations of the enterocytes plasmolemma proteins of the cattle in the fetal period of ontogenesis.

Materials and methods of research. The experimental part of the work was carried out on the basis of the meat processing enterprise “Yuvileinyi” of Dnipropetrovsk region. A total of 80 cattle (Holstein breed), two to nine months old, with an average weight of 0,6-39 kg obtained from clinically healthy cows, were used in the slaughtering. The age of the fetus was determined by the weight and length of the body, as well as the development of skin derivatives according to A.P. Studentsovym. Laboratory studies were conducted in the problematic research laboratory of physiology and functional morphology of productive animals of the State Scientific University of Ukraine and the problematic laboratory of internal diseases of animals of the National University of Life and Environmental Sciences of Ukraine, Kyiv. After euthanasia of the fetus, the abdominal section was dissected and the jejunum was isolated. Separation of the mesentery determined the length and middle of the intestine, removed the contents, and then selected part (30% of the total length from the middle portion of the organ), which was used to obtain isolated enterocytes. In the experiments we used a section of the intestine in the early fetal period (two, three and four months) with an average length of 0.8 m; in the late fetal period (five, six, seven, eight and nine months) 1.7 m, which was turned out of the mucous membrane outside or cut lengthwise and divided into small segments of 1.5–3 cm and washed thoroughly (4–5 times) with cold (4–6 ° C) medium of the following composition: 120 mM NaCl and 1 mM HEPES, the pH was 7,4 with the help of dry Trice. The method of cutting the intestine into fetus from two to four months of age was used instead of rotation due to its small diameter. The basis for the selection of intestinal cells was the chemical (citrate/EDTA) method (Tomchuk V.A. Usatiuk P.V. Tsvilikhovskyi M.I. Melnychuk D.O., 1994), on the basis of which an author's modification of the method was developed (Patent utility model No. 118136 Ukraine. Method of producing isolated enterocytes of cattle fetus). The quality of the obtained epithelial cells was evaluated by morphological and functional parameters. To obtain apical and basolateral membranes from the suspension of isolated jejunum enterocytes of cattle fetus used the basic method of differential centrifugation (Tsvilikhovskyi M.I. Usatiuk P.V. Melnychuk D.O., 1988) in our modification (Patent for utility model No. 118133 Method of fractionation of plasma membranes of isolated enterocytes). The amount of total protein in membrane preparations was determined by the Lowry method in Miller modification (Miller, 1964). The activity of alkaline phosphatase (KF 3.1.3.1.) Was determined in the apical and basolateral membranes by the Garena-Leventhal method, γ -glutamyltransferase (KF 2.3.2.2.), Lactase (KF 3.2.1.23.), Na⁺, K⁺-ATPase (KF 3.6.3.9), Ca²⁺, Mg²⁺-ATPase (KF 3.6.1.3) and Mg²⁺-ATPase (KF 3.6.3.2) according

to Boldyrev's recommendations (Boldyrev A.P., 1977). Studies on the content and composition of the structural proteins of plasmolemic enterocytes were performed by polyacrylamide gel electrophoresis of 1 mm thickness (Laemmli, 1970). Immunospecific detection of IgG-Fc- γ receptor (Fc γ R) complexes was performed by immunoblotting (Towbin H., 1988). Experimental studies have been conducted to comply with the requirements of 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 for Animal Experiments" (Kyiv, 2001). The obtained digital data were statistically processed: the arithmetic mean (M) was determined; its error (m). The probability of differences of the mean values was established by Student's criterion. Changes in indicators were considered significant at $p < 0.05$ (including $p < 0.01$ and $p < 0.001$).

Results. In the early fetal period of ontogenesis, the thickness of the entire intestinal wall was found to be $331.7 \pm 6.88 \mu\text{m}$. In two-month fetus genesis of the mucous membrane occurs simultaneously, accompanied by changes in its relief and sizes of villi. At this time, the intestinal villi, both in height and width, are almost identical. At the apex of the villi the epithelium becomes single-row prismatic, and in the region of the base and lateral surface remains multi-row. With age (up to three months old), small epithelial-connective tissue growths completely transform into true villi (first generation). This is indicated by an increase in the diameter of the empty intestine, which occurs due to the rectification of the mucous membrane and the disappearance of the temporal villi. During the early fetal period, the thickness of the wall of the gut and mucous membrane is increased more than twice, its own mucous membrane is formed, the height and the width of the villi increase. In the late fetal period, the thickness of the wall of the empty intestine and its mucous membrane increases moderately, and the height of the villi also increases. By the age of seven months the fetus, the mucous membrane and intestinal wall gradually become thicker, mainly due to the development of its own plate. Then the height and width of the villi does not actually change. Until the last month of uterine development, the width of the intestinal wall continues to increase significantly and the villi lengthen. The linear dependence of the growth of the thickness of the intestinal wall, its mucous membrane and its own mucous plate in the late fetal period was established. Moreover, the development of the villi is asynchronous, with significant variations in height and width. The dependence of the cell sizes and their nuclei on the specific function that they perform in separate areas of villi and crypts is proved. It should be noted that during the fetal period in the area of the base of the villi and crypts, the volume of nuclei increased 1.21 and 1.42 times, respectively, while in the area of the apex and lateral surface of the villi decreased by 1.46 and 1, respectively, 22 times respectively. According to the results of studies in the apical membrane in the early fetal period, 27 and 25 protein fractions were detected in the jejunum enterocyte plasmolemas of the cattle in the apical and basolateral membranes, respectively. In the apical membranes of enterocytes of two-month-old

cattle, 25 protein fractions with a molecular weight of 9.6 to 205 kDa were detected. In addition, if high molecular weight fractions of polypeptides with a molecular weight of 250 kDa and 300 kDa emerge from the age of three months of calf embryos. In addition, 23 protein fractions with a molecular weight of 9.6 to 120 kDa were detected in basolateral membranes of enterocytes of bi-monthly fetus. It is interesting to note that there are no polypeptide fractions with a molecular weight of 22.5 kDa, 37 kDa, 155 kDa, and 170–185 kDa, which are present in the apical membranes, but there are proteins with a molecular mass of 19 kDa, 24 kDa, and 66 kDa. In the early fetal period, dynamic changes occur in the polypeptide composition of the apical and basolateral membranes of enterocytes, characterized not only by changes in their ratio but also by redistribution between the poles of these cells. In the basolateral membrane of enterocytes from the four-month-old embryos, the content of low-molecular-weight protein fractions decreases, and high-molecular polypeptides with a molecular weight of 155 kDa appear. In the late fetal period, 31 and 27 protein fractions of molecular weight from 9.6 kDa to 300 kDa, respectively, were found in the plasmalemma of the enteric cell enterocytes in the apical and basolateral membranes. A feature of the apical membrane of enterocytes at this stage is the presence of proteins with a molecular mass of 80 kDa and 95 kDa, which are absent in the membranes of the fetus of four months of age. At the same time, the content of low molecular weight protein fractions and the increase of polypeptides with a molecular weight of more than 100 kDa decrease in enterocyte membranes. Fractions of polypeptides with molecular weights of 24 kDa and 66 kDa emerge from the age of seven months of embryonic development. In the late fetal period, 25 protein fractions with a molecular weight of 9.6 to 155 kDa were detected in the basolateral membranes of five month old fetus enterocytes. At this time there is a decrease in the content of low molecular weight protein fractions (3.3 times; $p \leq 0.001$) and an increase in the proportion of high molecular weight. In addition, proteins with a molecular weight of 9.6–14.2 kDa disappear from the age of seven months, and proteins of the molecular weight of 300 kDa and 170–185 kDa from the six-month age. In the apical membrane of enterocytes of nine months of age, the content of proteins with a small molecular weight (from 21 kDa to 33 kDa) is predominant in comparison with basolateral, whereas in the basolateral membrane, much heavier proteins (from 35 kDa to 300 kDa) dominate. A higher ($p \leq 0.05$ – 0.001) protein content with a molecular weight of 17 kDa, 21 kDa, 22.5 kDa, 24 kDa, 26 kDa, 29 kDa, 31 kDa, 33 kDa, and 46 kDa was established in the apical membrane, and in the basolateral membrane of polypeptides - 15.5 kDa, 35 kDa, 39 kDa, 43 kDa, 52 kDa, 63 kDa, 66 kDa, 87 kDa, 100 kDa, 155 kDa, 170–185 and 300 kDa. In the late fetal period, significant changes in the protein composition of the apical and basal membranes of enterocytes occur, characterized by their dynamic distribution between the poles of enterocytes with a predominance at nine months of age, with larger masses on the basolateral membrane and with a smaller basal membrane. The activity of transport ATPases of the plasma membrane of the bovine jejunum enterocytes in the early fetal period of ontogenesis gradually decreases in both morpho-functional regions of the plasmalemma with the higher activity of these enzymes on the basolateral membrane. The highest activity of Na^+ , K^+ -ATPases in

both membrane fields is observed in two-month ages fetus. Comparing the activity of the enzyme between the individual sites, the plasma membrane is set at high altitude, it remains in the base part of the membrane lower on the apical course throughout the early period of the fetal period, with each incision being obligatory. The dynamic activity of the Ca^{2+} , Mg^{2+} -ATPase of the usually investigated periodic period is similar to that of the Na^+ , K^+ -ATPase, with known support for active action in the two-month ages fetus. Present, the activity of Ca^{2+} , Mg^{2+} -ATPase at the baseline meteorization when compared to the apical membrane of the usually average period was an average time of 2.2 times. The activity of Mg^{2+} -ATPase on the membrane of enterocytes has lower activity of other ATPases in the same period and in a larger placement on both sites of the plasmolemma. The localization activity of Mg^{2+} -ATPase prevails on average by 21% over the baseline weathering. The peculiarities of the dynamics of the activity of transport ATPases of the plasma membrane of small intestine enterocytes of the cattle at the beginning of the fetal period is determined by the steady tendency to decrease them on both macrodomains of the plasmalemma in all experimental enzymes against the background of their higher content in basolateral cells. The dynamics of the activity of hydrolytic enzymes of bovine enteric plasma enterocytes in the early fetal period of ontogenesis is characterized by a redistribution of their polar activity, which may be related to the genetically determined processes of morpho-functional transformation and differentiation of membranes by metabolic mutations. The highest activity of alkaline phosphatase in the apical membrane of enterocytes is observed in three-month-old fetus. Subsequently, the activity of this enzyme significantly decreased significantly at the age of five months by 3.3 times ($p < 0.001$), by seven months by 4.1 times ($p < 0.001$), and by 8 times at the end of the late fetal period ($p < 0.001$). compared to the three-month fetus. In contrast, the dynamics of alkaline phosphatase activity on the basolateral membrane is less variable. The peak of the enzyme specific activity (2.8 times) occurs in five months. When comparing the activity of this enzyme between the individual sections of the plasma membrane, its higher activity in the basolateral membrane during the whole fetal period is established. In the subsequent to seven and nine months of age, the activity of this enzyme gradually decreases respectively by 1.7 and 2 times (compared to five months). The dynamics of lactase activity in the basolateral membrane is similar to its activity in the apical membrane. Comparing the activity of lactase between individual macrodomains of the plasmalemma, it was found that its activity is significantly higher in the apical membrane compared to the basolateral membrane during the entire fetal period. So at the age of three months this ratio was 3.4; five months - 2.8; seven months - 2 months, and nine months - 6.8 due to a sharp decrease in the activity of this enzyme in the basolateral membrane by the end of the fertile period. The most active activity of γ -glutamyltransferase is observed in the three-month fetus both in the apical membrane and in the basic therapy of the membrane. At the same time, the activity of this enzyme in the apical membrane is uniformly placed on placement (in the case when in the past there remain male winds 1.4 times, in the seven-month period - 1.6 times, in the deficit - 2.1 times with decreasing with three-month planes). In baseline therapy, the membrane dynamics that produce γ -glutamyltransferases up to seven months are similar to the dynamic

apical areas, but there is a fetus periodic progression that decreases 5.5-fold with decreasing three-month age. The results of immunoblotting showed the overall convergence of the composition of Fc- γ receptors extracted from the apical and basolateral membranes of the jejunum enterocytes of the bovine intestine in the fetal period of ontogenesis. Proteins that bind IgG upon incubation of nitrocellulose after transferring to it the pAGE-separated membrane proteins were represented by polypeptide zones with molecular weights of 120 kDa, 87 kDa, 72 kDa, and 43 kDa. Dynamics analysis of the Fc- γ plasmolemma macroscopes showed that the total concentration of IgG receptors on the apical membranes was significantly achieved in five-month numbers of 1.3 times, in seven-month fetuses at 2.2 months (compared to the constant content of Fc- γ -receptor proteins). compared to three-month flat ones). Subsequently, at nine months fetus, the content of receptors is rapidly reduced by almost three times ($p < 0.001$) (compared to the 7 changing planes) and in fact still remain the old planes for 3 minimum years. The main membrane contains the highest content of Fc- γ - receptors, which work in 5 male fetuses. At present, 1.7 and 2.8 people ($p < 0.001$) (compared to such planes) should be used continuously for seven and disinfected appropriately concentrated protein product receptors. Comparing the content of Fc- γ receptors between different polar parts of plasma membrane enterocytes reveals that they are usually in the main periodic period of their concentration higher at the baseline level, lower at the apical level (at three months of age by 42%, at five months by 77%, at nine months by 16% for the reduction of the fruits of the seven months, where their localization prevails on the apical membrane (by 67%). At the same time, quantitative analysis of individual polypeptide zones revealed a significant increase in the content of Fc- γ -receptor proteins with a molecular weight of 87 kDa extracted from the apical membrane of enterocytes from the third to the seventh month of the fetal period. In contrast to the apical membrane, no significant changes in the content of the receptor protein with this molecular weight were detected in the basolateral membrane protein fraction. The highest content of 72 kDa Fc- γ receptors was observed in the apical membrane fractions of five- and seven-month-old fetus. Unlike the apical membrane, fractions of the basolateral membrane had a maximum concentration of this protein at three and five months of age. Particularly noteworthy is the fact that equally directed reduction of the content of Fc- γ -receptor proteins with molecular weight - 87 kDa, 72 kDa and 43 kDa in the fetus of nine months of age on the apical membrane and on the basolateral membrane of enterocytes. The dynamics of changes in the content of individual polypeptide zones with molecular weights of 120 kDa, 87 kDa, 72 kDa, and 43 kDa in general coincided with the dynamics for the total content of Fc- γ receptor proteins, which may be due to the affinity of the genes encoding these polypeptides, and general physicochemical properties of proteins of this family. The peculiarities of structural and functional transformations of the plasmolemic proteins of the cattle jejunum`s enterocytes in the fetal period of ontogenesis were established. For the first time quantitative characterization of structural components of the jejunum mucous membrane of cattle fetus is investigated, the dynamics of cytometric indices of epithelial cells with a striped border of the cavity of cattle fetus and the level of structural proteins of the plasmolyne of the intestine during the intestinal period of

the intestine are determined. Changes in the activity of hydrolytic enzymes and transport enzymes on the apical and basolateral membranes and intestinal cells of cattle. The conducted researches were able to identify the polypeptide composition of Fc- γ -receptors of the cell envelope of enterocytes in the fertile period of ontogenesis, to investigate the regularities of formation and modulation of the expression of Fc- γ -receptors and to establish their localization on the plasmalemma of enterocytes of cadaveric fetus.

Conclusions. Age-related structural differentiation of the hollow mucosa in cattle during the fetal period of ontogeny is determined by the intense morpho-functional transformation of the components that ensure the formation of postnatal digestion and colostrum immunity. Protein composition of the apical and basolateral membranes of the uterine enterocytes in the early fetal period is characterized by: a) in the apical and basolateral membranes (at different stages of research), respectively, 27 and 25 protein fractions; b) polypeptide fractions with molecular weights of 22.5 kDa, 37 kDa, 155 kDa, and 170–185 kDa are absent in the apical membranes, which are absent in the basolateral, and conversely, in the basolateral membranes, proteins with a molecular mass of 19 kDa, 24 kDa, and 66 are available kDa.

The activity of transport ATPases of the plasma membrane of the bovine jejunum enterocytes in the early fetal period of ontogeny gradually decreases at both morpho-functional regions of the plasmalemma with higher activity of these enzymes on the basolateral membrane. Immunoblotting revealed Fc- γ -receptor proteins of the apical and basolateral membranes of the hollow enterocytes with molecular weights of 120 kDa, 87 kDa, 72 kDa, and 43 kDa. Expression of 120 kDa, 87 kDa, and 72 kDa molecular weight polypeptides that exhibit Fc- γ -binding activity is characterized by their predominance on the basolateral membrane by the middle of the fetal period.

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СТРУКТУРНО-ФУНКЦІОНАЛЬНА ХАРАКТЕРИСТИКА БІЛКІВ ПЛАЗМОЛЕМ ЕНТЕРОЦИТІВ КОРІВ В ФЕТАЛЬНИЙ ПЕРІОД ОНТОГЕНЕЗУ

Масюк Д.

Відповідно до заявленої мети розкрито теоретичне узагальнення та нове рішення проблеми щодо характеристик структурних компонентів слизової оболонки порожнини великої рогатої худоби, динаміки цитометричних показників епітеліальних клітин із зігнутим кордоном порожнини структурних білків плазмолемі клітин епітелію кишечника та віковими змінами активності гідролітичних та транспортних ферментів на верхівкових базальтеральних оболонках та кишкових клітинах плоду великої рогатої худоби. Вперше виявлено поліпептидний склад Fc-γ-рецепторів клітинної оболонки ентероцитів у період плодоношення онтогенезу, вивчено закономірності формування модуляції експресії Fc-γ-рецепторів та їх локалізацію на плазмо лемі. Встановлено ентероцити великої рогатої худоби.

Ключові слова: плід, велика рогата худоба, ентероцитарні поліпептиди, верхівкової мембрани, базолатеральна мембрана, білки Fc-γ-рецепторів, транспортні ферменти, гідролітичні ферменти.

СТРУКТУРНО-ФУНКЦИОНАЛЬНАЯ ХАРАКТЕРИСТИКА БЕЛКОВ ПЛАЗМОЛ ЭНТЕРОЦИТОВ КОРОВ В ФЕТАЛЬНЫЙ ПЕРИОД ОНТОГЕНЕЗА

Масюк Д.

В соответствии с поставленной целью проведено теоретическое обобщение и новое решение научной проблемы, выявлены данные о характеристиках структурных компонентов слизистой оболочки полости плода крупного рогатого скота, динамики цитометрии, индексы эпителиальных клеток с изогнутой границей полости структурных белков плазмолемы кишечных эпителиальных клеток и возрастные изменения активности гидролитических и транспортных ферментов на апикальных базолатеральных мембранах и клетках кишечника плода крупного рогатого скота. Впервые выявлена полипептидная композиция Fc-γ-рецепторов клеточной оболочки энтероцитов в период плодоношения онтогенеза, изучены закономерности формирования модуляции экспрессии Fc-γ-рецепторов и их локализация на плазмолемме. энтероциты крупного рогатого скота.

Ключевые слова: плод, крупный рогатый скот, полипептиды энтероцитов, апикальная мембрана, базолатеральная мембрана, Fc-γ-рецепторные белки.