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Improvement of Preventive Measures in Iron-Deficiency Anemia of Piglets in the Conditions of a Clinical Experiment.

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ABSTRACT

Experiments on the use of natural bentonites for the prevention of iron-deficiency anemia of suckling piglets born from sows, which for 30–40 days (depending on the period of gestation) received natural aluminosilicates (1.5% of dry matter of ration), showed that their use has a beneficial effect on the processes of erythro- and hematopoiesis. The importance of the combined action of ferroglucinum on the background of the prophylactic effect of bentonites on the piglets' organism during ontogenesis is confirmed by the difference in the indicators between the groups by the end of the research, which was 19.7% for erythrocytes, 42.8% for hemoglobin, 11.8% for iron and 13.3% for copper.

Keywords: sows, piglets, anemia, bentonites, ferroglucinum, prevention, erythropoiesis

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INTRODUCTION

Feed rations are not always balanced in terms of macro- and microelements that leads to mineral metabolism disorders in the body of animals and birds, as well as to a decrease in resistance and, as a consequence, the occurrence of various diseases [4,5].

As the source that compensates the deficiency of minerals in the body can successfully serve natural aluminosilicate minerals, which, acting as an active donor of macro- and microelements (due to cationic exchange and structural formula), not only normalize mineral metabolism, but also intensify the course of all redox processes in the organisms of animals. At the same time, the high bioavailability of the mineral component of bentonite clays allows, to a certain extent, to prevent anemia in young animals [3,6,7,8].

Speaking about the occurrence of an anemic condition in piglets after birth, it is impossible not to take into account an important biological feature in the blood formation processes of this species of animals. In the embryonic period, hemopoiesis in pigs occurs mainly in liver. At the same time, erythro- and myelopoietic tissues develop, giving rise to hemocytoblasts, normoblasts and non-nuclear erythrocytes. This period of hemopoiesis refers to the stage of extramedullary blood formation. Then the blood formation gradually moves to the bone marrow – a period of medullary blood formation begins. Intensive growth of piglets in the first weeks of life is far ahead of the formation of blood-forming organs and the perfection of their functional activity, therefore, hematopoietic processes do not provide sufficient red blood cell production, as a result of which anemia develops. In addition, the poor digestibility of milk proteins in young piglets due to the lack of hydrochloric acid in the gastric juice causes a decrease in hemoglobin synthesis and is another reason for the development of anemia. These reasons determine the use of ferrodextran preparations in farms for the prevention of anemia [1,2].

METHODOLOGY OF RESEARCH

The experiment was carried out on gestating sows (n = 60) and the offspring obtained from them. After farrow, four groups of newborn piglets were formed. Experimental groups (1, 2) were formed from piglets (n = 53 and n = 52), whose sows for 30-40 days (depending on the period of gestation) received bentonites in addition to the basic ration (1.5% of the dry matter of the ration). The control groups (3 – negative control (n = 51) and 4 – positive control (n = 53) included piglets born from sows who did not receive natural minerals during pregnancy. At the same time, animals from 2nd experimental and 4th control groups on the third day after birth were intramuscular injected with ferroglucinum at a dose of 3 ml. Piglets of the 1st and 3rd groups did not receive iron-containing preparations (Table 1).

Table 1: Scheme of the experiment

Groups	Number of animals	Characteristics of groups
1 experimental	53	Piglets born from sows prophylactically receiving bentonite in the period of gestation
2 experimental	52	Piglets born from sows prophylactically receiving bentonite + intramuscular injection of ferroglucinum (3 ml) during gestation
3 control	51	Pigs born from sows who are on the main ration during the period of gestation
4 control	53	Piglets born from sows who are on the main ration during the period of gestation + intramuscular injection of ferroglucinum (3 ml)

Baseline (background) data were determined in 10 piglets of each group on the 2nd day after birth (before the introduction of the ferrodextran preparation), and then on the 14th and 21st days of the experiment.

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The hematological parameters of the blood of animals were carried out on an automatic hematological analyzer for the *in vitro* diagnostics of ORPHEE Company – Mythic 18 (the country of origin is Switzerland).

Biochemical studies were carried out on a Vitalab Flexor Junior biochemical analyzer (the country of origin is the Netherlands) with the help of ELITech Clinical Systems kits.

Statistical processing of the obtained results was carried out using special software packages. The study of quantitative features was carried out by comparing the average values of two sample sets with the definition of Student's t-test and significance level (p).

RESULTS

The results of the research revealed that the background hematological parameters of animals after birth gave evidence to the normal physiological state of the body in relation to anemia.

However, the levels of red blood cells and hemoglobin in the experimental groups at the time of birth of the piglets differed from these indicators of the control groups. The difference in red blood cells, on average, was 14.2-16.5%, in hemoglobin the difference was 14.8-17.2%, respectively.

But already in the second week of life piglets of the 1st and 3rd groups, which did not receive ferroglucinum injection at the age of three days, showed a simultaneous decrease in the level of hemoglobin and in the number of red blood cells associated with slowing of hemopoiesis. However, in the 1st experimental group, the piglets of which were born from sows that consumed 1.5% bentonite during the period of gestation, the decrease in the level of red blood cells and hemoglobin was not as intense as in 3rd group of piglets whose sows were exclusively on the feeding ration. At the same time, the decrease in the number of the red blood cells in the 1st group was 6.8% versus 10.2% in the 3rd group relative to background indicators, and the hemoglobin concentration in these groups decreased by 13.5% and 22.7%, respectively. The difference remained at the level of 4.0% for red blood cells and 9.2% for hemoglobin.

However, these indicators were kept, on average, up to 14 days, and then signs of the disease increased. This means that the use of bentonites to sows in the period of gestation affects the degree of anemia in the offspring only up to a certain age, and then an anemic condition develops in experimental piglets, similarly to the animals of the control group.

Paying attention to the hematological parameters of the blood of piglets, the concentration in their serum of such microelements as iron and copper should be taken into account. Tracking the dynamics of changes in these elements, we found out that in the experimental groups of animals (1 and 2), the amount of iron was, on average, 15.8 µmol / l, in contrast to the control groups (3 and 4), in which this indicator was in within 13.25 µmol / l. In percentage terms, the difference between the groups was 17.6-20.6%. In terms of copper, these indicators were following: 12.0 µmol / l versus 10.05 µmol / l or 18.6–20.2%, respectively (Table 2).

Table 2: Dynamics of changes in serum iron and copper in piglets over the period of experiment (M±m; n=40)

Age, days	Iron, µmol / l	Copper, µmol / l
1 experimental		
2	15.53±1.4	11.9±2.0
14	11.8±1.6*	11.2±1.2
21	9.34±0.85	9.54±1.0
2 experimental		
2	16.04±2.3	12.1±1.6
14	18.2±2.4*	10.5±0.9
21	15.1±1.7	10.2±0.88*
3 control		

2	13.2±0.67	9.9±1.1
14	8.44±0.5	7.8±0.42
21	6.15±0.23	7.11±0.8
4 control		
2	13.3±1.2	10.2±2.3
14	15.7±2.5	9.4±0.67
21	13.5±1.4	9.0±0.82

* significance level – p≤0,05

Subsequently, in the groups that did not use ferroglucinum, a sharp decrease in the level of serum iron was observed: in the 1st group the decrease was in 1.32 times (14th day of the experiment) and in 1.66 times (21st day), in the 3rd group the decrease was in 1.6 times and 2.14 times respectively.

The decrease in the concentration of copper was not as significant and amounted to 6.2% and 25.9% for the experimental group and 26.9% and 39.2% for the control group. However, at the time of birth the amount of copper in the blood of piglets of the 2nd experimental group was 18.7% higher than that the same indicator of control animals. In this case, bentonite had a pronounced effect on the content of copper in blood and its deposition in liver of newborn piglets.

The results of research indicate the insufficiency of the prophylactic action of ferroglucinum after a single parenteral application to new-born piglets of the 4th group. And if at the age of two weeks, hemoglobin and iron levels reached their peak values, by 21st day their level had decreased by 7.3% and 16.3%, respectively.

In the 2nd experimental group the situation was different from the control indicators. An increase in hematopoiesis processes was observed, characterized by an increase in the number of red blood cells (by 4.5%) and hemoglobin concentration (by 6.1%). The correlation between the level of hemoglobin in blood and the amount of serum iron was manifested by a decrease, first of all, in the concentration of iron, followed by a decrease in the level of hemoglobin. And although in the 2nd group there was a decrease in serum iron level by 21st day by 20.5% relative to the values of the age of two weeks, the increase in hematopoiesis indicates that the body of piglets more actively uses the deposited iron to build hemoglobin.

The importance of the combined action of ferroglucinum on the background of the prophylactic effect of bentonites on piglets during the ontogenesis is confirmed by the difference in the indicators between 1st and 2nd experimental groups by the end of the study, which was 19.7% for the red blood cells, 42.8% for hemoglobin, 11.8% for iron and 13.3% for copper.

CONCLUSION

Thus, the use of bentonites to gestating sows from the second half of gestation has a pronounced effect on the body of piglets during the prenatal period, normalizing and maintaining the morphological and biochemical composition of blood, activating blood formation and replenishing iron and copper deficiency in the organism. The use of ferrodextran preparations for such piglets fully provides a preventive effect regarding the incidence of anemia.

REFERENCES

[1] Biryukov M.A. Iron-deficiency anemia in piglets: prevention. Russian cattle breeding. 2014; 1: 27.
[2] Okolyshev S. Iron-deficiency anemia of pigs. Russian cattle breeding. 2013; 1: 17.
[3] Antipov VA, Semenenko MP, Fontanetsky AS, Matyushevsky LA. Prospects for the use of natural aluminosilicate minerals veterinary. Veterinary Medicine. 2007; 8: 54.
[4] Semenenko MP, Kuzminova EV, Tyapkina EV, Rodin IA. Modern View on the Use of Natural Bentonites in the Prevention of Gastroenteric Pathology of Piglets. RJPBCS. 2018; 9(6): 1513-1517.
[5] Semenenko MP, Kuzminova EV, Koshchaev AG. Mechanisms of biological activity of bentonites and possibilities of their use in veterinary medicine. Advances in Agricultural and Biological Sciences. 2015; 2: 3-10.

[6] Semenenko MP, Kuzminova EV, Koschaev AG. Realization of the bioresource potential of the broiler chickens when using the natural bentonites. Advances in Agricultural and Biological Sciences. 2017; 3(1): 19-24.
[7] Semenenko MP. Pharmacology and the use of bentonites in veterinary medicine: dissertation of doctor of Vet. Science. FSEI HPE "Kuban State Agrarian University". Krasnodar, 2008, 348 p.
[8] Semenenko MP, Antipov VA, Kuzminova EV, Troshin AN, Tyapkina EV, Fersunin AV. Use of natural bentonites in livestock and veterinary medicine. Krasnodar, 2014, 51 p.