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Early diagnosis of symptoms and effective therapy of hypoglycemia in piglets

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Abstract

The aim of the study was to study the main etiological factors of hypoglycemia in newborn piglets, to establish criteria for a comprehensive diagnosis of the disease, as well as to develop an optimal treatment regimen. The materials obtained in the course of the study are of great importance for the clinical assessment of piglets' health. On the other hand, it expands knowledge in understanding this pathology and allows for effective therapeutic and preventive work in industrial pig breeding complexes.

In the studied group of animals, a significant decrease in blood glucose was recorded to 3.49±0.03 mmol/l on the second day of life and to 2.75±0.03 on the 4th day, when the piglets were in a coma. The indicators of erythrocytes, hemoglobin and iron, which were also reduced by 35%, 57.9% and 57.1%, respectively, indicate that the young have signs of alimentary anemia. As a therapeutic technique, it is effective to use a 15% glucose solution and plant piglets under healthy sows. Due to this, on the 10th day, the blood glucose level of piglets rose to 5.25± 0.04 mmol/l. Of the 90 sick piglets on the farm, 78 recovered, the percentage of young animals was 84.6%.

The greatest effect is observed with the intraperitoneal method of administration of a 15% solution in a dose of 5-10 ml, which increases the percentage of recovery to 92%. For the highest results, it is recommended to use ferran preparations in a dose of 2 ml and nitamine 0.4 ml per 10 kg of weight as additional therapy, as well as warming piglets with infrared lamps.

Key words: glucose, sows, diet, blood, prevention

Introduction

The key tasks facing modern industrial pig farming are to increase pork production and improve its quality. Pig farms achieve these goals by comprehensively improving production, taking into account modern scientific achievements and advanced methods. One of the most important tasks is to reduce the economic losses experienced by livestock and especially pig farming from non-communicable diseases [1]. These diseases account for up to 95% of the total damage, of which 35% are diseases of the respiratory system [2, 3]. Metabolic disorders, in particular, piglet hypoglycemia, occupy a significant place among non-communicable diseases of pigs. It is registered in about 30% of the total number of pig diseases.

Piglet hypoglycemia is a disease manifested by a significant decrease in blood glucose and an increase in non-protein nitrogen (urea, uric acid and its fractions) in it. The main cause of this disease in piglets is insufficient and inadequate feeding of sows, leading to the development of hypogalactia and agalactia in them [4]. Often the disease manifests itself in litters after the second and subsequent farrowing in pigs with mastitis. The cause of the disease may also be the birth of a large number of piglets in the litter, when not all of them can be provided with the mother's milk nipples. Low temperatures and high humidity in the pigsty contribute to the manifestation of hypoglycemia in piglets, leading to large losses of heat from the body, and to maintain thermal equilibrium, animals consume carbohydrate reserves, primarily blood glucose. Its costs are not compensated by sufficient intake of breast milk or by impaired absorption in the intestine with diarrhea in young animals [5, 6].

A decrease in blood glucose quickly leads to a decrease in vitality, and a violation of brain nutrition leads to a comatose state. It is almost always possible to diagnose a concomitant disease ‑anemia in piglets. In most cases, this disease develops in parallel with hypoglycemia [7, 8].

The death rate among sick animals reaches 30-50%, which leads to significant financial losses in farms. Losses from piglet hypoglycemia exceed all damages caused to pig farming by acute infectious diseases combined [9, 10]. In this regard, special attention of the scientific community is paid to the search and development of modern methods for the early diagnosis of hypoglycemia in piglets. As well as the search for drugs and their combinations that have comprehensive preventive and therapeutic potential, allowing for highly effective treatment and reducing the risks of this disease. So the main purpose of this study was to compare glucose solution treatments such as oral, subcutaneous, and intraperitoneal administration.

Materials and methods

The work was carried out from 2019 to 2023, at the Department of Animal Diseases and Veterinary and Sanitary Expertise of the Saratov State University of Genetics, Biotechnology and Engineering named after N.I. Vavilov and in the pig farming of the Saratov region. To accomplish this task, pregnant sows of a large white breed aged up to two years with a live weight not exceeding 180 kg were selected. The animals are kept in standard rooms, feeding is carried out with barley, alfalfa hay, combined silage, as well as additives in the form of feed yeast and table salt. Two groups of 10 piglets were created for the study ‑ the control (healthy) and the experimental (sick). The clinical picture in healthy and sick animals was evaluated according to a generally accepted and widely used method in veterinary practice.

We considered piglets suspicious of hypoglycemia to be animals that in the first days of life showed the following symptoms: pallor of the outer integuments, tips of ears, nose and tail, lethargy, shaky gait and trembling, sometimes convulsions, tachycardia, the sucking reflex is not manifested or weakened. For a more accurate diagnosis of hypoglycemia in piglets, we received blood from the ear for glucose testing on a STATFAX 3300 biochemical analyzer. Also we conducted a morphological blood analysis using the Micro CC 20vet analyzer and a biochemical blood analysis using the BioChem SA.

To determine the therapeutic effectiveness of glucose solution administered in various ways, 92 piglets with signs of the disease were selected. The administration of 15% glucose solution was carried out in three ways: it was administered orally and subcutaneously to 32 piglets and 28 intraperitoneally. All sick and glucose-treated piglets were placed under other sows with milk, and were also warmed under infrared lamps IKZ-250 and received ferran at a dose of 2 ml and nitamine (A, D3, E, C) 0.4 ml per 10 kg of weight. Pathoanatomical autopsies were also performed on nine piglets that had fallen with a clinical picture of the disease.

The obtained material was subjected to statistical processing in the Microsoft Excel program according to the methodology of E. K. Merkuryeva (1980)

Results

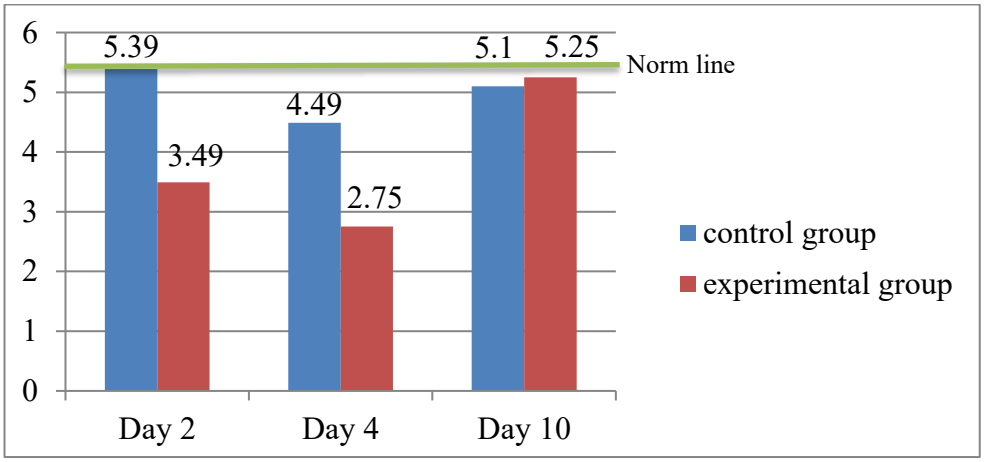
As we have established, the main cause of hypoglycemia in piglets is insufficient and inadequate feeding of sows. The data are presented in Table 1.

Table 1.

Feeding ration of pregnant sows

Type of feed	Daily feeding, kg	Feed unit, kg	digested protein, g	Ca g	P g	Carotene mg	Sugarg	Salt g
Grain of barley	2,0	2,3	170	4,0	7,8	0,6	40	
Alfalfa hay	0,25	0,11	25,25	4,25	0,55	12,25	5	
Combined silo	2,0	0,58	32	1,4	1,0	6,0	-	
Feed yeast	0,1	0,12	41,9	0,8	0,39	1.49	0,14	
Salt	0,04							
In total		3,1	269,15	10,45	9,74	20,34	45,14	40
The norm for sows under 2 years of age		4,1	490	20	16	30	not standar dized	40

Since the direct cause of hypoglycemia is a decrease in blood glucose levels, we took blood samples on the 2nd day of life at the first clinical signs of the disease, as well as from piglets who were in a coma (on the 4th day), and on the 10th day of life after treatment. The data is shown in Figure 1.



	Day 2	Day 4	Day 10
Control group	5,39±0,03	4,49±0,02	5,09±0,04
Experimental group	3,49±0,03	2,25±0,02	5,25±0,04

Figure 1. Blood glucose levels in piglets on the 2nd, 4th and 10th day of the study

In order to study metabolic disorders associated with the development of hypoglycemia and anemia, we conducted morphobiochemical blood tests on the 2nd day of piglets' life (Table 2).

Table 2.

Hematological and biochemical parameters in piglets on the 2nd day of the study

Indicators	Control group	Experimental group	Reference values
Leukocytes ((x10^9 л))	8,21±0,11	16,48±0,6	6-13
Erythrocytes ((x10^{12} л))	6,72±0,34*	4,37±0,8*	6,0-7,5
Hemoglobin (g/dl)	12,22±0,42*	5,67±0,39*	6-15
Hematocrit (%)	40,2±0,27	32,3±0,35	38-45
Total protein (g/l)	48,2±1,37*	78,7±1,61*	45-52
Albumins (g/l)	22,44±1,67	19,56±1,35	19,9-25,0
Globulins (g/l)	27,8±1,33	43,2±1,05	25,0-35,1
Creatinine (mmol/l)	103,3±4,64*	170,9±4,79*	60-167
Total lipids (g/l)	3,18±0,35	2,51±0,15	2,5-4,5
Calcium (mmol/l)	3,01±0,13	2,42±0,4	2,5-3,5
Phosphorus (mmol/l)	2,88±0,19	2,32±0,16	1,5-3,5
Iron (mg%)	175,03±4,74*	75,09±5,65*	160-220
Urea (mmol/l)	3,67±0,45	1,7± 0,42	1,7-2,2

*Results are statistically significant compared to the control P≤0.05

In order to study the pathoanatomical picture of piglet hypoglycemia, we performed autopsies of the corpses of died animals. As a therapy we used a warm 15% glucose solution. It was administered in three ways: inside, subcutaneously and intraperitoneally. Along with this, special attention was paid to the temperature regime for sick piglets - infrared lamps were used. And also the animals were placed under other high-milk sows that did not suffer from mastitis and didn`t suffer from agalactia. In addition, all piglets were injected intramuscularly with ferran at a dose of 2 ml and nitamine (A, D3, E, C) 0.4 ml per 10 kg of weight on the second day after birth. Of the 90 sick piglets on the farm, 78 recovered, 12 heads fell. Consequently, the percentage of safety of young animals is 84.6%. It is worth noting that glucose administered to sick piglets intraperitoneally gave the best effect and the lowest case rate. The results of the study are shown in Table 3.

Table 3.

Results of treatment for hypoglycemia in piglets

	Inside	Subcutaneously	Intraperitoneally
Total	31	31	28
Recovered	25	27	26
Died	6	4	2

We also found out that 15% glucose solution, used as the only therapeutic measure, doesn`t give results, 14 out of 17 piglets fell. In the treatment of animals with hypoglycemia, only the comprehensive measures described above should be used.

Discussion

An analysis of the diet of pregnant sows indicates that it does not meet the feeding standards. The diet, first of all, is not balanced in terms of digestible protein. It lacks feed units, calcium and phosphorus. All this suggests that the deficiency of the components of the diet in the studied farm has an adverse effect on the quality and development of offspring, as well as on the process of milk formation in sows [5,7].

Normally, the blood glucose index in young pigs ranges from 4.88 to 6.6 mmol/l [2]. It can be seen from the figure that piglets have an average of 3.49 ±0.03 mmol/l for 2 days of life at the first signs of the disease.

With the progression of the disease on the 4th day, when the piglets fall into a coma, the blood glucose level drops to 2.25± 0.03 mmol/ l, which is more than twice lower than normal. In piglets treated with glucose and warmed by infrared rays, after being hooked to other sows, the glucose level on the 10th day reaches 5.25±0.04 mmol/l. Their well-being improved markedly after the therapy used: the temperature is within the normal range (about 39.5 ° C), appetite is restored, the condition is lively, the outer integuments are pink.

Other changes in glucose content were obtained in control piglets, from which blood was taken at the same time, but without signs of disease and did not receive glucose. So on the 2nd day of their life, their blood glucose level was 5.39±0.03 mmol/l. On day 4, the glucose content decreases slightly to 4.49 ± 0.02 mmol/l, which is below normal, but no signs of the disease were found. The concentration of glucose in the blood on the 10th day averaged 5.09± 0.04 mmol/l, we considered such piglets to be completely healthy.

It is worth noting that the leukocytes in the experimental group are 78.94% higher than in the control group, the indicators of total protein are reduced by 63.2%, namely γ-globulins (by 55.4%), which indicates an inflammatory process in the piglets' body, as well as a decrease in the functioning of humoral immunity. The indicators of erythrocytes, hemoglobin and iron, which were reduced by 35%, 57.9% and 57.1%, respectively, indicate that piglets have signs of alimentary anemia [3, 8].

In the blood of the studied animals, there is an increased content of creatinine and urea by 39.6% and 53.7%, respectively, due to the discrepancy between the intake of energy substances and their

consumption, leading to an increase in gluconeogenesis. Indicators of piglets' mineral metabolism also do not correspond to the norm, sick animals experience a noticeable lack of nutrients.

On external examination of corpses, a characteristic feature of this disease was the cyanosis of the outer integuments. The tips of the ears, legs, and tail had a dark bluish tinge. Abrasions are visible on the skin of some corpses, which indicates a struggle for the mother's nipple. The visible mucous membranes of the eyes, mouth and anus have a pale pink color with a bluish tinge. The abdominal cavity was opened by incision along a white line from the xiphoid process to the pubic fusion. The peritoneum is smooth, shiny, and bluish in color. The intestines are empty. In some fallen piglets, a small amount of meconium is found, and sometimes milk in the stomach. This suggests that some animals received it in small quantities. But still, an empty stomach was a characteristic feature. The autopsy data indicates that death occurred precisely as a result of starvation of the animals.

Based on the data we obtained, we diagnosed hypoglycemia with signs of alimentary anemia in the studied piglets. Our results are similar to previous studies, which confirms the importance of the therapy [2, 9].

All the aforementioned treatment methods have led to significant results. The percentage of safety of young animals is 84.6%

Conclusion

To prevent the disease of piglets with hypoglycemia, it is necessary to strictly observe the technology of feeding and keeping pregnant sows, as well as to create optimal microclimate parameters for newborn animals. Systematically inform pig farm workers about non-communicable diseases of newborn piglets, pay special attention to spring and summer farrowing, since the disease is seasonal. As a therapeutic technique, it is effective to use a glucose solution and plant piglets under a healthy sow. The greatest effect is observed with the intraperitoneal method of administration of a 15% solution in a dose of 5-10 ml, which increases the percentage of recovery to 92%. For the highest results, it is recommended to use ferran preparations in a dose of 2 ml and nitamine 0.4 ml per 10 kg of weight as additional therapy, as well as warming piglets with infrared lamps.

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