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Physiological Reaction Of Hemostasis In Piglets Caught In Unfavorable Environmental Conditions For The Inclusion Of The Lipipital Preparation Lipovitam-Beta In Their Diet.

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ABSTRACT

A modern source of vitamins for food animals is Lipovitam Beta. It is a liposome filled with a biologically active drug, which ensures its maximum absorption by body tissues. Objective: to evaluate the effect of Lipovit-beta on the hemostasis system in piglets undergoing hypothermia. A total of 48 piglets at the age of 2.5 months, a large white breed, which as a result of a breakdown of the heating system experienced hypothermia for 2 hours, were examined. These animals are randomly divided into experimental and control groups. In the experimental group (24 heads), Lipovita-beta was administered at the rate of 1 capsule (0.17 g) per 1 kg of body weight 1 time per 3 days during the first 30 days after supercooling. The control group 1 is represented by 24 piglets, which after supercooling are kept in standard conditions. In all animals, the main indicators of hemostasis were assessed at the end and after 30 days. The control group 2 is represented by 32 completely healthy piglets contained in the standard conditions of the pigsty. The use of Lipivitama-beta has led to a significant decrease in spontaneous and stimulated platelet aggregation in patients who have had hypothermia. Against the background of feeding Lipivits-beta, these piglets showed a weakening of plasma hemostasis, which improved microcirculation in their tissues. In piglets of the control group 1, an increase in platelet aggregation and an increase in hemocoagulation were noted. This inevitably worsened their hemorheological blood counts and weakened the metabolism in their tissues. After hypothermia in piglets, hemostasis activation develops, which worsens microcirculation processes and may be one of the factors inhibiting growth. The use of Lipovitam-beta in piglets that suffered hypothermia led to a decrease in plasma hemostasis and platelet hemostatic properties, which had a positive effect on microcirculation in their tissues.
Keywords: piglets, hypothermia, Lipovitam-beta, hemocoagulation, platelets.

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INTRODUCTION

Modern pig-breeding is one of the most significant branches of agriculture, providing the population of many countries of the world with full-fledged food products - lard and meat [1,2]. Currently, the world is tasked with its intensification due to the accelerated rearing of its young and its maximum preservation through the use of advanced technologies for its feeding and maintenance [3]. Gradually, science comes to an understanding of great importance in ensuring the viability and productivity of pigs at any age, the state of one of its integrating systems - blood [4,5]. Its hemostatic properties largely determine the degree of tissue perfusion, and, consequently, the level of anabolism in an animal's body and its productive characteristics at any age [5, 6]. In view of the great physiological significance and vulnerability of hemostasis, it begins to be more and more actively studied under normal and adverse conditions [7].

One of the proven methods that cause the body to intensify anabolic processes and, thereby, to enhance the phenotypic manifestation of genetically determined traits despite negative environmental factors [8,9], is the use of various biologically significant effects [10,11] and biologically active substances [12]. These include an increase in physical activity [13], as well as the use of vitamins, the need for some of them in pigs at any age is very high and at the expense of the diet can sometimes not be fully covered [5]. As one of the modern sources of vitamins for piglets, Lipovits-beta is now beginning to be considered, which, being created on the basis of liposomes, is able to provide the maximum absorption of vitamins by the cells of their body [14].

It is recognized that blood is the most labile indicator of the functional state of the body, quickly responding to the receipt of various ingredients [15,16]. The more under their influence increases the body's metabolism, the more pronounced will be changes in the blood [17,18]. In addition, the blood, changing its composition and hemostatic properties, can itself affect the functional state of the whole organism [19,20]. In this regard, it seemed justified to assess the influence of Lipovit-beta on physiological significant hemostasis indicators in piglets caught in adverse environmental conditions.

Objective: to evaluate the effect of Lipovitam-beta on the hemostatic system parameters in piglets who have experienced an adverse environmental factor.

MATERIALS AND METHODS

The study included 48 healthy piglets at the age of 2.5 months of the large white breed contained in pig farms of the Samara region of Russia. Pigs were taken under observation on the day of an accidental occurrence due to an unplanned emergency shutdown of heating in a pigsty for 2 hours with a decrease in temperature in it to 10°C. The diet of the piglets taken in the study was standard. The animals that experienced hypothermia were randomly divided into experimental and control groups. The experimental group consisted of 24 pigs, who additionally received Lipovitam beta (Biodom, Russia) at the rate of 1 capsule (0.17 g) per 1 kg of body weight of the animal during its mixing with the feed. The drug was given 1 time in 3 days for 30 days after hypothermia. The control group 1 consisted of 24 pigs who had undergone hypothermia, were in similar conditions and received the same diet. All piglets in both of these groups were examined twice: immediately after supercooling and 30 days after it. The control group 2 consisted of 32 piglets completely healthy and unaffected by the external environment.

All piglets examined the blood levels of fibrinogen according to the modified Claus method [21]. Assessment of the level of plasminogen was determined they have a kinetic method on the device FP-901 ("LabSystems", Finland) with a chromogenic substrate ("Dade Behring ", Germany). The concentration of soluble fibrin-monomer complexes was determined by vizual-tion method using reagents of the company Technology standard (Russia) [21]. Activated partial thromboplastin time were investigated using the coagulometer "HumaClot" ("HUMAN GmbH ", Germany) with a set of reagent HemoStat aPTT-EL. The determination of the international normalized ratio was performed according to Quick's method [21]. Platelet aggregation was studied on two-channel laser analyzer of platelet aggregation ("Biola", Russia) turbidimetrically method. As inducer of aggregation applied 0.5 mm solution of adenosine diphosphate (ADP) [22].

Statistical processing of the obtained results was performed using student's t-test.

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RESULTS

Evaluation of the state of hemostasis in all piglets who experienced hypothermia showed its activation and did not reveal significant differences in the values of the determined indicators of platelet activity, coagulation and fibrinolytic systems (table). Their functional activity before the start of observation in both groups of these animals was significantly different from the values in the control group 2.

Table. Dynamics of hemostasis in observed piglets

Indicators	Lipovitam-beta, n=24		Control 1, n=24		Control 2, n=32
	Exodus	The end of the observation	Exodus	The end of the observation	
International normalized attitude	1.15±0.12*	1.21±0.10	1.14±0.09*	1.11±0.17*	1.22±0.09
Activated partial thromboplastin time, s	30.2±0.82*	37.0±0.54	29.7±1.12*	26.0±0.71*	37.1±0.69
Fibrinogen, g/l	3.2±0.22*	2.6±0.14	3.1±0.28*	3.7±0.40**	2.5±0.23
Soluble fibrin-monomer complex, mg/dl	3.1±0.27*	2.5±0.20	3.0±0.30*	3.8±0.32**	2.6±0.82
Plasminogen, %	89.0±0.67*	95.1±0.42	90.1±0.81*	86.8±0.81**	94.0±0.057
Spontaneous platelet aggregation, units	1.17±0.12*	1.02±0.08	1.16±0.15*	1.30±0.16**	1.01±0.10
Platelet aggregation 0.5 µM ADP, units	2.32±0.19*	2.01±0.24	2.29±0.15*	2.89±0.27**	2.00±0.21

Legend: the reliability of differences of indicators from the level of control 2 * - $p < 0.05$, ** - $p < 0.01$.

By the end of the observation period, a significant inhibition of activated partial thromboplastin time (by 22.5%) was observed in the group of piglets treated with Lipovits-beta, a tendency towards an increase in the international normalized ratio (5.2%) and plasminogen (6.8%), decrease in concentrations of fibrinogen (23.1%) and soluble fibrin-monomer complexes (24.0%), approaching control group 2. In control group 1, after 30 days of observation, an acceleration of the activated partial thromboplastin time (14.3%) was detected, propensity to reduced The values of the international normalized ratio (2.7%) and the level of plasminogen activity (4.8%) with an increase in blood fibrinogen (19.3%) and soluble fibrin-monomer complexes (26.7%), moving away from the level of control 2.

After 30 days, the piglets of the experimental group showed a spontaneous decrease in platelet aggregation by 14.7%, stimulated - by 15.4%. In the control group 1, the spontaneous and ADP - induced platelet aggregation increased significantly, exceeding the initial values by 12.1% and 26.2%, respectively, and moved away from the control level 2. At the same time, the differences in platelet aggregation in the control group 1 by the end of observation amounted to spontaneous 27.4% ($p<0.01$), for stimulated - 43.8% ($p<0.01$).

DISCUSSION

Being strictly genetically programmed, all signs of a living organism [23,24] can change the degree of their phenotypic manifestation depending on the influence of environmental factors [25]. In this regard, there is a high relevance for continuing the in-depth study of various aspects of the physiology of living organisms [26] in negative environmental conditions [27,28] with due regard for the various consequences of their influence [29]. Additional research on the physiology of piglets and pigs can provide a solid basis for further improving the technology of their housing and feeding [1,3]. As a result of the summation of the knowledge

obtained in the course of these studies and their subsequent practical application, intensification of pig breeding is possible [2,5].

In previous studies, it was shown on various biological objects that hemostasis [30,31] very sensitively responds to various environmental effects, especially to adverse factors [32] in the form of the formation of various dysfunctions [33] and severe pathology [34,35]. It is also known that the suppression of lipid peroxidation and the elimination of vitamin deficiencies can have a multifaceted beneficial effect on a living organism [36,37]. It was noted that against this background, a rational weakening of the activity of many components of the hemostasis system [38,39] and the improvement of the rheological parameters of the blood [40,41] are developing. It is with these changes that hematological indicators are associated with the improvement of microcirculation processes and the intensification of metabolic processes against the background of various effects on the body, which are based on antioxidant effects [42].

As a result of the observation on the background of the use of Lipovitam-beta in piglets who have experienced an episode of hypothermia, a weakening of the activity of hemostasis was noted. At the same time, in control 1, the results showed an inverse pattern, which, by the end of the observation, provided for the reliability of the differences in the indicators taken into account in both groups of animals that had experienced hypothermia.

The results obtained suggest that additional ingestion of a piglet after supercooling a balanced vitamin complex weakens the process of hemocoagulation along both ways of its implementation [21]. Apparently, this is due to the weakening of the functional properties of most of the clotting factors involved in it. Obviously, a decrease in the generation of thromboplastin and a decrease in contact activation of factor XII also developed in the blood of these animals. The addition of Lipovit-beta to animal feed also led to a decrease in blood fibrinogen and soluble fibrin-monomer complexes, which indicated the inhibition of its polymerization process, which was actively restrained by the necessary degree of activated fibrinolysis system. In piglets of control 1, opposite phenomena were noted, contributing to the enhancement of all stages of hemocoagulation and a decrease in the activity of fibrinolysis.

Considering the literature data, it can be considered that the use of Lipovit-beta stimulates the antioxidant defense of the body [43,44], which always reduces the ability of platelets to spontaneous and stimulated aggregation [45,46]. There is reason to believe that the addition of this drug to animals increases their level of cyclic adenosine monophosphate in platelets and reduces the formation of thromboxane A_2. The evolving situation prevents the formation of platelet aggregates in the lumen of the vascular bed [47,48]. The tendency noted in animals of the control of 1 cows to increase the aggregation capacity of platelets was apparently associated with a decrease in their cyclic adenosine monophosphate [49] and an increase in the synthesis of thromboxane A_2 in them [50,51], naturally leading to an increase in the blood of these animals dynamic aggregates of blood platelets [52,53,54].

At present, an opinion is gradually being formed on the close relationship between the somatic status and the level of the productive properties of animals with the state of their hematological parameters [55,56]. In the study, a part of early ontogenesis was traced and therefore it is somewhat premature to draw conclusions about the effect of feeding Lipovits-beta on the whole process of piglet development in early ontogenesis under adverse conditions with an attempt to explain the results from the standpoint of the dynamics of hemostasis activity. At the same time, the found opportunities to optimize the state of hemostasis disturbed by adverse environmental effects with the help of a liposomal multivitamin complex can serve as an impetus for a more detailed and in-depth study of aspects of this issue taking into account the productivity of pigs with a more physiologically favorable state of hemostatic parameters [57]. There is every reason to think that a link between the restoration of hemostasis activity and the increase in piglet productivity can be found in future studies.

CONCLUSION

As a result of hypothermia, piglets develop hemostasis activation, which adversely affects the microcirculation in their tissues and may be one of the factors that gradually inhibit growth. The use of such piglets Lipovitam-beta can lead to a decrease in the functional activity of plasma hemostasis and a weakening

of the aggregation ability of platelets, which can positively affect the microcirculation and the dynamics of their economically beneficial properties.

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