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Physiological Features Of Hemostasis In Piglets Who Have Experienced The Effects Of Unfavorable Environmental Factors.

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ABSTRACT

Adverse environmental effects can adversely affect the activity of hemostasis. However, the degree of its dynamics is not known in all cases. Objective: to evaluate changes in the activity of the hemostasis system in piglets who undergo 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. The control group is represented by 32 completely healthy piglets contained in the standard conditions of the pigsty. Those undergoing hypothermia showed increased spontaneous and stimulated platelet aggregation. These piglets showed an increase in plasma hemostasis and weakening of fibrinolysis, which disrupted microcirculation in their tissues. This inevitably worsened their hemorheological blood counts and weakened the metabolism in their tissues. It becomes clear that after hypothermia in piglets, hemostasis activation develops, which interferes with microcirculation processes and may be one of the factors inhibiting growth. This situation dictates the need to find approaches to the correction of plasma hemostasis activity and platelet hemostatic properties in the piglets that have suffered from hypothermia, which should positively influence the microcirculation in their tissues.

Keywords: piglets, hypothermia, hemostasis, hemocoagulation, platelets.

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INTRODUCTION

Currently, pig breeding is one of the most significant branches of agriculture, providing the population of many countries of the world with full-fledged food [1,2]. A serious problem now is its intensification through the accelerated rearing of young stock and the maximum possible preservation of it 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]. It is recognized that blood is the most labile indicator of the functional state of the body, quickly responding to various influences [6,7]. The more under their influence changes the metabolism in the body, the more pronounced will be changes in the blood [8,9]. In addition, blood is capable of changing its composition and hemostatic properties and itself affect the functional state of the whole organism [10,11]. Its hemostatic properties largely determine the degree of tissue perfusion [12], and, consequently, the level of anabolism in an animal's body and its productive characteristics at any age [13,14]. In view of the great physiological significance and vulnerability of hemostasis, it begins to be more and more actively studied in normal and adverse conditions [15].

It is noticed that the body reacts sensitively by changes in the intensity of metabolic processes and thus change the phenotype of genetically determined basics of life [16,17]. These include various biologically significant effects [18,19] and biologically active substances, changing physical activity and dietary habits [20].

Objective: to assess the change in the activity of the hemostatic system in piglets that experienced the impact of an unfavorable factor of the environment.

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. Piglets were taken under observation on the day of an unplanned emergency shutdown of heating in the pigsty for 2 hours, accidentally arising as the temperature in it was lowered to 10 ° C. These piglets formed an experimental group. The control group consisted of 32 piglets completely healthy and unaffected by the external environment. The diet of the piglets taken in the study was standard.

All piglets were examined for blood levels of fibrinogen using a modified Claus method [21]. Plasminogen level assessment was determined by their kinetic method on an FP-901 instrument (LabSystems, Finland) with chromogenic substrates (Dade Behring, Germany). The concentration of soluble fibrin-monomer complexes was determined by a visual method using reagents from Tekhnolog-Standart (Russia) [21]. Activated partial thromboplastin time was studied on a HumaClot coagulometer (HUMAN GmbH, Germany) with a HemoStat aPTT-EL reagent kit. The definition of the international normalized relationship was carried out according to the method of Quick [21]. Platelet aggregation ability was studied on a two-channel laser platelet aggregation analyzer (Biola, Russia) using a turbodimetric method. A 0.5 μM solution of adenosine diphosphate (ADP) was used as an inducer of aggregation [22].

Statistical processing of the results was carried out using Student's t-test.

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 (see table). Their functional activity in these animals was significantly different from the values in the control group.

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Table. Hemostasis in the observed piglets

Indicators	Experienced group, n=48	Control group, n=32
International normalized attitude	1.14±0.11*	1.22±0.09
Activated partial thromboplastin time, s	29.9±0.97**	37.1±0.69
Fibrinogen, g/l	3.2±0.25**	2.5±0.23
Soluble fibrin-monomer complex, mg/dl	3.1±0.29*	2.6±0.82
Plasminogen, %	89.6±0.74	94.0±0.057
Spontaneous platelet aggregation, units	1.17±0.13*	1.01±0.10
Platelet aggregation 0.5 µM ADP, units	2.31±0.17*	2.00±0.21

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

In the experimental group of piglets, there was a significant acceleration of the activated partial thromboplastin time (by 24.1%), a decrease in the international normalized ratio (7.0%) and plasminogen level (4.9%), an increase in fibrinogen concentrations (28.0%) and soluble fibrin-monomer complexes (19.2%). This was accompanied by the acceleration of spontaneous (15.8%) and induced (15.5%) platelet aggregation in the overcooling piglets.

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 a change in the activity of lipid peroxidation is capable of exerting a diverse influence on a living organism [36,37]. It was noted that against this background, the dynamics of the activity of many components of the hemostasis system [38,39] and the change in the rheological parameters of blood [40,41] develop. It is with these changes that hematological parameters are associated with the processes of microcirculation and metabolic processes against the background of various effects on the body, which are based on antioxidant effects [42].

As a result of hypothermia in piglets, hemostasis increased activity. The results obtained suggest that this is connected with the strengthening of the hemocoagulation process along both ways of its realization. Apparently, this is caused by the enhancement in these animals of the functional properties of most of the clotting factors involved in it. Obviously, the excessive generation of thromboplastin and the weakening of contact activation of factor XII develop in the blood of these animals. This situation may also be associated with an increase in their blood fibrinogen and soluble fibrin-monomer complexes. These changes indicated an acceleration of the process of its polymerization, which was weakly restrained by a weakened system of fibrinolysis.

Considering the literature data, it can be considered that the weakening of the body's antioxidant defense [43,44] always enhances the ability of platelets to spontaneous and stimulated aggregation [45,46]. There is reason to believe that the basis for this in animals is a decrease in the level of cyclic adenosine monophosphate in platelets and an increase in the formation of thromboxane A_2 [47, 48]. The current situation stimulates the formation of platelet aggregates in the lumen of the vascular bed [49,50].

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 [51,52]. In this study, only a fragment of early ontogenesis was traced and therefore it is somewhat premature to conclude about the effect of short-term hypothermia on all subsequent development of pigs with an attempt to explain the results from the standpoint of the dynamics of hemostasis activity [53]. At the same time, the found disturbances in the state of hemostasis, caused by the adverse environmental effects of the 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 [54]. There is every reason to think that there is a clear connection between the activity of hemostasis and the state of productivity of piglets [55,56].

CONCLUSION

As a result of hypothermia, hemostasis activation develops in piglets, which negatively affects blood hemocirculation. In such pigs, there is an increase in the functional activity of plasma hemostasis, a weakening of fibrinolysis and an increase in the aggregation ability of platelets, which has a very negative effect on the microcirculation in their tissues, worsening the severity of their gains.

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