

**Research Article****Physiological activity of hemostasis parameters in piglets who had an episode of overheating and received catosal****Zaitsev V. V.<sup>1\*</sup>, Mekhanikova M. V.<sup>2</sup>,****Shestakova S. V.<sup>2</sup> and Ryzhakina T. P.<sup>2</sup>**<sup>1</sup>Samara State Agricultural Academy,  
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**ABSTRACT****Introduction:** A modern and strong biostimulator for different species of food animals is catosal. He showed his high biological activity, providing stimulation of various tissues of a living organism.**Objective:** to evaluate the effect of catosal on hemostasis activity in piglets who had an episode of overheating.**Material and methods:** A total of 58 piglets of a large white breed at the age of 2.5 months were examined, which as a result of an unplanned breakdown of the air-conditioning system in a pigsty experienced an episode of overheating for 3 hours. These piglets were randomly divided into two comparable groups - experimental and control 1. Animals of the experimental group (21 heads) were intramuscularly injected with katosal 2.5 ml daily for 5 days, starting the next day after overheating. The control group 1 is represented by 21 piglets. After the episode of overheating, these animals were kept in standard conditions of the pigsty and were not subjected to any effects. In the piglets of the experimental group and the control group 1, a number of hemostasis indicators were determined at the end and after 30 days. In the work carried out, the control group 2 was represented by 32 completely healthy piglets, which were kept in the standard conditions of the pigsty and were examined only once. In work hematologic and statistical methods of research are applied.**Results:** The use of katosal was accompanied in the piglets who experienced overheating by lowering the severity of spontaneous and stimulated platelet aggregation to a physiological level. As a result of the use of catosal in piglets of the experimental group, a decrease in the level of hemocoagulation activity was also noted, which stimulated the blood supply to all their tissues. In animals that formed the control group 1, the growth of platelet aggregation activity and hemocoagulation enhancement was found. These changes had an extremely negative effect on hemorheology and lowered the activity of metabolism in the internal organs. It becomes clear that in piglets who have suffered overheating, in the absence of therapeutic effects, hemostasis is gradually activated. This adversely affects microcirculation and is a serious factor inhibiting the level of gains.**Conclusion:** The use of catosal in piglets that have undergone overheating leads to a decrease in the activity of hemocoagulation and the functional parameters of platelets to the optimum level, which positively affects the microcirculation processes in their organs.**Key words:** Piglets, Overheating, Catosal, Platelets, Hemocoagulation.\*Correspondent author: Zaitsev Vladimir Vladimirovich, Tel +79102700994, E-mail: [ilmedv1@yandex.ru](mailto:ilmedv1@yandex.ru)

## INTRODUCTION

Currently, pig breeding is a very intensively developing branch of agriculture. It provides the population of a large part of the countries of the world with full-fledged food products - lard and meat.<sup>1,2</sup> The process of its intensification is currently carried out by applying approaches to accelerating the rearing of pigs and providing conditions for maximum preservation of their livestock.<sup>3</sup> This effect is sought to result from the application of new approaches to the treatment, feeding and optimization of conditions of detention.<sup>4,5</sup>

Modern science is beginning to more clearly link the level of viability and severity of productivity of pigs with functional indicators of the blood system.<sup>6,7</sup> It is recognized that its hemostatic indicators very strongly determine the level of tissue perfusion and thus the level of anabolism in the body of an animal, and hence its productive characteristics.<sup>8,9</sup> Due to its high physiological significance and high vulnerability of hemostasis indicators, it is increasingly being studied in standard and modal conditions.<sup>10,11</sup>

A very effective way of stimulating in the body the activation of anabolic processes and activating the phenotypic manifestation of hereditarily certain traits despite the negative influence of environmental factors<sup>12,13</sup> is the use of enhanced feeding<sup>14</sup> and stimulating compounds.<sup>15</sup> The use of the latter is possible when added to food, as well as in the injection form, which is very widely used in pigs to improve their productive qualities.<sup>16</sup> One of the conducted modern biostimulants for productive animals is katozal, which is able to enhance vital processes in the blood and internal organs.<sup>17</sup>

It is believed that blood counts have a great lability and can be considered as a sensitive indicator of various functional states of the body. In addition, blood parameters are able to quickly respond to the use of various bioregulators<sup>18,19</sup>, which allows to judge their effectiveness. It is noticed that according to their dynamics one can judge the degree of activation of metabolism in the whole organism.<sup>20,21</sup> At the same time, the blood can change not only its biochemical parameters, but

also hemostatic parameters. This provides a significant regulation of the functional characteristics of the whole organism.<sup>22,23</sup> For this reason, it seems very important to determine the effects of various biostimulants on the functional parameters of hemostasis in piglets that have experienced adverse environmental effects. In this regard, the goal was set in the work: to evaluate the effect of catosal on hemostasis activity in piglets who had an episode of overheating.

## MATERIALS AND METHODS

The studies were conducted in strict accordance with the ethical principles established by the European Convention for the Protection of Vertebrate Animals used for experimental and other scientific purposes (adopted in Strasbourg on March 18, 1986 and confirmed in Strasbourg on June 15, 2006).

74 healthy pigs of large white breed aged 2.5 months were taken under observation. They were kept in pig farms located in the Samara region of Russia. Some of these piglets (42 heads) experienced unplanned overheating due to being in a medium for 10 hours in an environment 10° C above the optimum. This change in environment occurred due to an emergency breakdown of the air conditioning system in the pigsty during the summer period. The diet of the examined piglets was traditional. Piglets that have undergone overheating were randomly divided into experimental and control group 1 groups.

The experimental group consisted of 21 pigs. From the next day after overheating, all of them received a cathosal produced by Bayer HealthCare LLC (USA) 2.5 ml per day intramuscularly for 5 days.

The control group 1 consisted of 21 pigs. After overheating, animals in this group were under standard conditions and received a similar diet. Animals in both of these groups were examined twice: the first time - immediately after overheating and 10 days after it. The control group 2 consisted of 32 pigs, which were completely healthy and had never before been

exposed to the negative influences of environmental factors.

In the blood of all animals, the amount of fibrinogen was estimated by the Klaus method. The level of plasminogen activity in them was determined using the kinetic method on an FP-901 device (LabSystems, Finland) using a chromogenic substrate (Dade Behring, Germany). The content of soluble fibrin-monomer complexes in the blood was detected using the visual method, using reagents from Tekhnolog-standart (Russia). The magnitude of the activated partial thromboplastin time was estimated using a HumaClotcoagulometer (HUMAN GmbH, Germany) using the HemoStataPTT-EL reagent kit. An evaluation of the international normalized attitude was carried out according to the method of Quick. The state of platelet aggregation properties was

assessed using a turbodimetric method using a two-channel laser platelet aggregation analyzer (Biola, Russia). The aggregation inducer in the study performed was a 0.5  $\mu\text{M}$  adenosine diphosphate solution (ADP).

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

## RESULTS

The above assessment of the activity of hemostasis parameters in experienced piglets who had an episode of overheating revealed its enhancement in terms of platelet and coagulation mechanisms and the weakening of the fibrinolytic system (see table). In these pigs, the functional activity of their hemostasis in the outcome was significantly different from its state in the control group 2.

**Table.** Hemostasis parameters in the examined piglets

Indicators	Catosal, n=21		Controll, n=21		Control2, n=32
	exodus	End of observation	exodus	End of observation	
Level of international normalized attitude	1.14±0.14*	1.22±0.12	1.12±0.07*	1.13±0.16*	1.22±0.09
The value of activated partial thromboplastin time, seconds	30.4±0.79*	37.2±0.63	30.8±1.03*	26.3±0.84*	37.1±0.69
Fibrinogenlevel, g/l	3.4±0.18*	2.5±0.15	3.2±0.22*	3.6±0.32**	2.5±0.23
The amount of soluble fibrin-monomer complexes, mg/dl	3.3±0.19*	2.4±0.17	3.1±0.26*	3.9±0.19**	2.6±0.82
Plasminogenactivity, %	86.5±0.32*	94.8±0.54	85.2±0.32*	84.4±0.20*	94.0±0.57
The level of spontaneous aggregation of platelets, units	1.20±0.16*	1.60±0.09	1.24±0.18*	1.33±0.10**	1.01±0.10
Platelet aggregation activity with 0.5 $\mu\text{M}$ ADP, units	2.46±0.15*	2.00±0.23	2.38±0.16*	2.94±0.32**	2.00±0.21

Legend: the statistical significance of differences in performance from the level of the control group 2: \* -  $p < 0.05$ , \*\* -  $p < 0.01$ .

By the end of the observation of the piglets that received catosal, an increase in the value of the activated partial thromboplastin time (22.4%) was revealed, the trend towards an increase in the international normalized ratio (7.0%) and plasminogen activity (9.6%) with a decrease in fibrinogen (36.0%) and the concentration of soluble fibrin-monomeric complexes (37.5%). By the end of the observation, all these indicators reached the level of the control group 2. In piglets of the control group 1, after 10 days of observation, the development of accelerated activated partial thromboplastin time (17.1%) developed, the propensity to increase the value of the international normalized ratio (0.9%) and propensity to decrease plasminogen activity (0.9%) with an increase in fibrinogen level in their blood (12.5%) and an increase in soluble fibrin-monomer complexes (25.8%), which indicated an increase in hemostasis activity in the control group 1 compared to with Indicators of control group 2.

After 10 days, the piglets that made up the experimental group showed a weakening of platelet aggregation advancing spontaneously by 20.0%, developing as a result of stimulation - by 23.0%. In the control group 1, platelet aggregation spontaneous and ADP-induced increased, exceeding the initial values by 17.2% and 23.5%, respectively. The differences in platelet aggregation activity in the experimental piglets and animals of the control group 1 reached 33.0% for the spontaneous process ( $p < 0.01$ ) and 47.0% for the stimulated process ( $p < 0.01$ ) for the spontaneous process.

## DISCUSSION

Modern pig breeding has a great need to continue considering the scope of knowledge on the physiology of piglets.<sup>24</sup> Still relevant is the study of various aspects of the functioning of internal organs in piglets, which is realized under the influence of external factors on the organism. Conducting research on the features of the functioning of the body of piglets is required for modern science and practice to continue the development of effective

approaches to further increase their level of productivity and preserve the optimum health.<sup>25</sup> The ongoing studies on the physiology of pigs and pigs have not yet allowed to gather scientific data on the physiology of their integrative systems, including blood, with satisfactory completeness. For this reason, there is a need to evaluate the mechanisms of blood functioning in piglets that are in different environmental conditions.<sup>26,27</sup>

It has long been observed that during early ontogenesis in pigs, fluctuations of many functional characteristics are very characteristic against the background of the influence of external influences that can adversely affect various systems of the animals. Their action often violates individual blood parameters and hemocirculation processes in the capillaries. These changes are of great biological importance, as they regulate the level of the body's provision of gases and nutrients. It also affects the course of the main physiological processes in the body associated with the fluid characteristics of the blood.<sup>28,29</sup>

It was previously noted that in the ontogeny of animals there is a relationship between age and blood parameters that can influence the course of the vital processes of any animal species.<sup>30,31</sup>

In this connection, the continuation of a detailed elucidation of many aspects of the physiology of organisms of productive animals<sup>32</sup> under conditions of negative environmental influences<sup>33,34</sup> and the elucidation of the possible consequences of their exposure<sup>35</sup> is of great importance. In this regard, further physiological studies in pigs and pigs are designed to create a reliable basis for improving approaches to their recovery and feeding.<sup>36,37</sup> As a result of a comprehensive reflection and summation of the results of these studies and their subsequent application in practice, it is possible to achieve an intensification of pig breeding.<sup>38,39</sup>

It is known that in mammals environmental factors can affect hemostasis.<sup>40</sup> It is possible that in the case of exposure to adverse factors<sup>41</sup>, various dysfunctions often occur<sup>42</sup> and pathology is often formed.<sup>43,44</sup> It is recognized that the weakening of lipid peroxidation and the

appearance of biologically active substances in the blood often have a very beneficial effect on animals, stimulating their growth.<sup>45,46</sup> It was also noted that under these conditions the activity of individual components of hemostasis can be weakened<sup>47</sup>, having a beneficial effect on the rheological parameters of blood<sup>48</sup>. It is customary to associate with these changes in blood parameters the optimization of microcirculation and metabolism processes during various stimulating effects on the animals' organism<sup>49</sup>.

In the course of the work, the piglets who underwent an episode of overheating, while using katosal, found a decrease in hemostasis activity to the level of the norm. At the same time, in the control group 1, negative dynamics was revealed, which led to the end of observation in them to the development of significant, functionally unfavorable changes in hemostasis indicators peculiar to the state of prepathology.

The study showed that the intake of a piglet that had undergone brief overheating, the biostimulator of the catosal weakens the course of hemocoagulation along both its mechanism.<sup>50</sup> Obviously, this is associated with a decrease in the level of activity of the main number of coagulation factors in these animals.<sup>51</sup> Apparently, thromboplastin synthesis weakens in the blood of these piglets and the severity of contact activation of factor XII decreases. In addition, the introduction of katosal into the body of the observed piglets was able to reduce the amount of fibrinogen and fibrin-monomeric complexes in their blood. In animals that formed the control 1 group, the opposite changes were found, leading to increased hemocoagulation and inhibition of fibrinolysis.

It is clear that the use of katosal increases the level of antioxidant protection of the body<sup>52</sup>, which always weakens the ability of platelets to spontaneous and stimulated aggregation.<sup>53</sup> It can be thought that the use of this drug in piglets leads to an increase in the level of cyclic adenosine monophosphate in their platelets and weakens the synthesis of thromboxane A<sub>2</sub>. These changes inhibit the formation of platelet

aggregates under conditions of hemocirculation *in vivo*.<sup>54</sup> The piglets that formed the control group 1 have an increase in platelet aggregation properties, which is obviously associated with a weakening in them of the formation of cyclic adenosine monophosphate<sup>55</sup> and activation of thromboxane A<sub>2</sub> synthesis<sup>56</sup>, regularly increasing the number of free-circulating platelet aggregates in the blood of such pigs.<sup>57</sup>

Modern researchers are of the opinion that there is a connection with the state of somatic status, which determines the productive qualities of animals and the activity of their hemostatic parameters.<sup>58</sup> In the study, a small part of the early ontogenesis of pigs was traced and for this reason, based on the data obtained, it was early to draw conclusions about the effect of catosal on the development of growing pigs who were in unfavorable conditions, explaining the results by the dynamics of hemostasis activity. At the same time, the revealed possibility of optimizing the activity of hemostasis, changed under the influence of unfavorable environmental factors, with the help of a biostimulator may be an impetus for further detailed clarification of various aspects of this issue and the relationship between the level of piglet productivity and hemostasis activity.<sup>55</sup>

## CONCLUSION

There is no doubt that blood is an accurate and sensitive marker of the functional state of the body. She actively responds to ingestion of any substances. The more actively under their action the metabolism is activated in the body, the stronger the changes in blood counts will be. This is fully true for hemostatic parameters, which are able to strongly influence the general condition of the animal. It seemed quite justified to assess the effect of catosal on hemostasis parameters in piglets who experienced an episode of adverse effects from the external environment - an episode of overheating. In response to this adverse effect, hemostasis was activated in piglets, which always negatively affects the microcirculation in the internal organs and significantly slows down the growth. The use of catosal in these piglets

was able to reduce the functional activity of hemocoagulation and platelet aggregation, which should activate their microcirculation and the severity of their dynamics of productively significant qualities.

#### CONFLICT OF INTEREST

No conflict of interest is declared.

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