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Physiological Changes In The Hematological And Hemostatic Characteristics Of Weakened Calves And Piglets Of The Milk Supply During The Use Of A Biostimulator.

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ABSTRACT

The success of the functioning of the hemostasis system in many respects provides the liquid properties of blood and regulates the level of its flow to the organs and tissues of the body throughout life. The process of transition from the newborn phase to the dairy nutritional phase in calves and piglets is an important step in their individual development and requires adequate activity of adaptive mechanisms, including all elements of the hemostasis system. Rational use of a powerful biological stimulant in weakened calves and piglets affects the performance of their blood, including the rheological properties of the formed elements and hemostasis, and is accompanied by positive changes in all body systems, ensuring a rapid and complete restoration of the animals to their age. The use of gamavit promotes in weakened calves and piglets during the dairy nutrition phase a gradual increase in platelet and plasma hemostasis with balance with increasing hemostatic vascular activity. These changes are smooth and balanced. The achieved changes in hemostasis in both species of productive animals on the background of gamavit contribute to the optimal adaptation of their body to environmental factors, accelerating the processes of their growth and development.

Keywords: calves, piglets, blood, hemostasis, phase of dairy feeding, gamavit.

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INTRODUCTION

The course of ontogenesis in productive animals is largely due to the age-related dynamics of the hemostatic properties of their blood, which significantly affects the process of implementing the animal's hereditary program [1-5]. The success of the functioning of the hemostasis system in many respects provides the liquid properties of blood and regulates the level of its flow to the organs and tissues of the body throughout life [6,7,8].

The transition to milk consumption in calves and piglets is an important stage in their individual development [9,10] and requires adequate activity of adaptive mechanisms, including all elements of the hemostasis system [11,12]. The onset of milk in the calf and piglet in the gastrointestinal tract affects blood indices [13,14], including the rheological properties of the formed elements and hemostasis, and is accompanied by adequate changes in all body systems [15], contributing to the adaptation of animals to existing nutritional conditions [16,17].

Previous studies have shown a large role of platelets [18], the vascular wall [19] and the coagulation system [20], which are closely functionally related to each other and determine the aggregative state of the blood [21-25] in ensuring the functional status of the organism [26,27] cattle and pigs. To smooth the coming changes in their organisms, to ensure the maximum optimum functioning of hemostasis is possible through the use of dietary supplements [28], including gamavita [29,30], which previously showed its greater biological activity. However, despite the significance of this problem, the effect of gamavit on the age-related aspects of the development of hemostasis activity in weakened calves and piglets in the dairy feed has not been studied enough, which needs to be carefully assessed.

In connection with the aforesaid, in the present work the goal was set: to trace the physiological features of platelet, vascular and coagulative hemostasis in weakened calves and piglets of the dairy diet against the background of the use of gamavit.

MATERIALS AND METHODS

Research was conducted in strict accordance with ethical principles established by the European Convent on protection of the vertebrata used for experimental and other scientific purposes (adopted in Strasbourg March 18, 1986, and confirmed in Strasbourg June 15, 2006).

35 weakened calves were taken under observation, who were examined and examined during the dairy nutrition phase 3 times: at 11, 20 and 30 days of life. Also, 38 weakened piglets of dairy food were examined at 6, 15 and 20 days of life. All animals received a dietary supplement gamavit 0.03 ml / kg intramuscularly once a day, in the morning during the dairy feeding phase. The data from literature [31,32] are taken as control values.

The state of platelet hemostasis in animals was assessed by platelet aggregation (AP) [13] using as inducers ADP (0.5×10^{-4} M), collagen (1:2 dilution of the main suspension), thrombin (0.125 units/ml), ristomycin (0.8 mg/ml), H_2O_2 (7.3×10^{-3} M), adrenaline (5.0×10^{-6} M) with a standardized number of platelets in the studied plasma 200×10^9 platelets.

The level of arachidonic acid metabolism in animal platelets and the functional activity of their cyclooxygenase and thromboxane synthetase were determined in three transfer samples with the registration of platelet aggregation on a photoelectrocolorimeter.

The functionality of vascular hemostasis was determined by its antiaggregation activity recorded by AP before and after temporary venous occlusion with all inductors and their combinations by calculating the index of antiaggregatory activity of the vessel wall during the division of the duration of AP against the background of venous stagnation at the time of AP appearance without it [13].

The functional activity of antithrombin III in the observed animals was detected before and after temporary venous occlusion with calculation of the index of anticoagulant activity of the vascular wall by dividing the activity of antithrombin III against the background of venous occlusion by its activity without it.

The level of vascular wall control over plasma fibrinolytic ability was assessed by the dynamics of spontaneous euglobulin lysis before and after temporary venous occlusion using the vascular wall fibrinolytic activity index calculated by dividing the time of euglobulin lysis before occlusion by the lysis time after it.

Features of coagulation hemostasis were recorded by the functional ability of coagulation factors (I, II, V, VII, VIII, IX, X, XI, XII), the duration of the activated partial thromboplastin time, prothrombin and thrombin time by standard methods.

The results of the study are processed using the criterion (td) of student.

RESULTS OF THE RESEARCH

In the blood of weakened dairy-fed calves fed gamavit, normal platelet counts were recorded. On the 11th day of life in these calves, the time of AP development under the influence of collagen was 40.7 ± 0.16 s, shortening by 30 days of life to 36.5 ± 0.17 s. Similar AP dynamics in the observed animals was observed under the influence of ADP (on the 30th day 40.3 ± 0.08 s) and ristomycin (on the 30th day 52.5 ± 0.29 s), thrombin developed somewhat slowly (on the 30th day 53.6 ± 0.42 s) and adrenaline (on the 30th day 94.5 ± 0.18 s) AP.

In weakened piglets in the dairy feeding phase, treated with gamavit, normal platelet count was also noted. On the 6th day of life in the observed piglets, the time of AP development under the influence of collagen was 42.4 ± 0.14 s, experiencing a smooth tendency to accelerate to 20 days of life (38.6 ± 0.13 s). Similar AP dynamics in the observed piglets was noted under the influence of ADP (on the 20th day 38.6 ± 0.09 s) and ristomycin (on the 20th day 41.7 ± 0.12 s), thrombin developed somewhat slowly (on the 20th day 59.6 ± 0.15 s) and adrenaline (on the 20th day 98.6 ± 0.22 s) AP, developing by the end of the dairy nutrition phase later than in calves on the 30th day of life.

A serious mechanism that accelerates the process of AP in dairy cattle fed young cattle gamavit is the increased intensity of arachidonic acid exchange in blood plates found in it with increasing thromboxane formation, as indirectly judged by AP in a simple transfer test (on the 30th day on day 35.6 ± 0.08 %). This dynamics was provided by an episode of the enhancement of the activity of both enzymes of its transformation in platelets - cyclooxygenase and thromboxane synthetase, returning to the end by the end of the milk supply phase. The degree of AP recovery in the collagen-aspirin test, which indirectly evaluates the activity of cyclooxygenase in platelets, increased by 30 days to 80.5 ± 0.17 %. The intensity of AP recovery in a collagen-imidazole sample, which indirectly determines the functional activity of thromboxane synthetase in the blood plates, increased in calves by 30 days (35.0 ± 0.09 %).

In weakened dairy food piglets treated with gamavit, a smooth increase in the intensity of arachidonic acid metabolism in blood plates was also found, which could be indirectly judged by platelet aggregation in a simple transfer test (on the 20th day 34.8 ± 0.19 %). This smooth dynamics was provided by a gradual increase in the activity of both enzymes of its conversion in platelets - cyclooxygenase and thromboxane synthetase. The degree of AP recovery in the collagen-aspirin test, which indirectly evaluates the activity of cyclooxygenase in platelets, increased by the 20th day to 70.4 ± 0.18 %. The intensity of the recovery of platelet aggregation in a collagen-imidazole sample, which indirectly determines the functional activity of thromboxane synthetase in the blood plates, increased in piglets by day 20 (45.8 ± 0.11 %).

In weakened dairy-fed calves who received gamavit as a dietary supplement, there was only a slight increase in control of the vascular wall over AP, sufficient to contain it. The highest index of antiaggregation activity of the vessel wall was recorded with ADP. A slightly lower level of anti-aggregation index of the vessel wall was detected with collagen and adrenaline. The index of antiaggregation activity of the vessel wall for thrombin and ristomycin in absolute values was slightly lower, but also increased by 30 days of life. The index of antiaggregatory activity of the vessel wall with the combination of inductors also turned out to be rather high and experienced compensatory gain in the same periods.

In weakened piglets that received gamavit during the dairy nutrition phase, there was a tendency towards a physiologically smooth increase in vascular wall control over AP. The highest index of antiaggregation activity of the vessel wall was recorded with ADP. A slightly lower level of anti-aggregation activity of the vessel wall was detected with collagen and adrenaline. The index of antiaggregatory activity of

the vessel wall for thrombin and ristomycin was slightly lower in absolute values. The antiaggregation index of the vessel wall with the combination of inductors also turned out to be quite high and experienced a tendency to gain during the observation.

An increase in endotheliocyte production of one of the main anticoagulants, antithrombin III, was established in calves of dairy food fed gamavit (the index of anticoagulant activity of the vascular wall by 30 days was 1.34 ± 0.18). In addition, an increase in the intensity of secretion of plasminogen tissue activators was detected in animals at these times, which was detected during the creation of temporary ischemia of the venous wall at 30 days of life.

A smooth increase in the production of antithrombin III by endotheliocytes was found in milk-fed piglets against the background of gamavit (the index of the anticoagulant activity of the vascular wall by 20 days was 1.39 ± 0.19). In addition, in piglets during this phase, a gradual increase in the intensity of secretion of tissue plasminogen activators was found (by 9.6%), detected during the creation of a temporary ischemia of the venous wall.

The observed initially weakened calves throughout the milk supply phase showed a persistent pattern in the dynamics of the activity of coagulation factors. So, on the 11th day of life in calves fed gamavit, a low activity of coagulation factors was recorded. On the 30th day of life, they had a slight tendency to increase the content of fibrinogen and factors II, VII, IX, X, XI, XII against the background of stability of factors V and VIII.

In piglets fed gamavit during the dairy nutrition phase, an increase in the activity of coagulation factors was also observed, but less pronounced than in calves. So, on the 6th day of life, these piglets recorded a low activity of coagulation factors. On the 20th day of life, they had some increase in the content of fibrinogen and factors II, VII, IX, X, XI, XII against the background of stability of factors V and VIII.

Evaluation of coagulation tests in weakened calves fed gamavit during the milk nutrition phase revealed their regular dynamics reflecting changes in the content of individual coagulation factors in their plasma. So, by 30 days, the acceleration of the activated partial thromboplastin time to 37.8 ± 0.15 s, the prothrombin time to 14.6 ± 0.20 s, and the thrombin time accelerated by 10.5% and their subsequent deceleration by the end of the phase was established.

Monitoring of coagulation tests in the observed piglets of milk nutrition revealed their dynamics, reflecting changes in the content of individual coagulation factors in their plasma. Thus, by the 20th day, the acceleration of the activated partial thromboplastin time was established to 43.6 ± 0.29 s, the prothrombin time to 16.4 ± 0.16 s, and the thrombin time accelerated by 9.8%.

DISCUSSION

The system of hemostasis is physiologically very significant, integrating the organism [33, 34]. The rheological properties of blood [35, 36] and, thus, the homeostasis of the organism [37, 38] largely depend on its optimal activity during the whole ontogenesis. At the same time, despite the great biological significance of the activity of platelet, vascular and coagulative hemostasis and the subtle mechanisms for its implementation in weakened calves and piglets fed gamavit during the milk nutrition phase, are not well understood.

The detection of the ability to aggregate platelets under the influence of a number of inductors and a large number of their physiological combinations made it possible to establish from 11 to 30 days of life in calves treated with gamavit, a smooth increase in the level of sensitivity of platelets to them to physiological values. At the same time, in piglets between 6 and 20 days of life against the background of gamavit, the acceleration of AP was also smooth and less pronounced. It has been found that the adhesion ability of the blood plates in both species of animals is experiencing a similar dynamics against the background of gamavit, probably due to a physiological increase in the concentration in their blood of von Willebrand factor - a platelet adhesion cofactor [41,42], which apparently coincides with an increase in the number of receptors to it - (GPIb) on the surface of the blood platelets [43-45]. The increase in the sensitivity of platelets in various calf agonists and their combinations in gaamavite calves by 30 days of age and their similar but less pronounced smooth increase in piglets is probably associated with different intensities in the expression of

fibrinogen receptors (GPIIb-IIIa) [46,47] stimulation of phospholipases A₂ and C [48,49], the level of thromboxane formation [50,51] in the blood plates during early ontogenesis [52,53].

Found increasing the antiaggregatory activity of the vascular walls more pronounced in calves less active in pigs is due to coming at them in the background gamavit increased synthesis of prostacyclin and NO [54,55], which provides the necessary level of the microcirculation [56] in the tissues of the growing animal in response to the processes in platelets [57,58].

A significant role in ensuring the atrombogenic properties of the vascular wall in calves and piglets treated with gamavit during the milk supply phase belongs to the optimal severity of its anticoagulant and fibrinolytic properties, which is probably due to a sufficient degree of expression of the corresponding genes in the vascular endothelium [59,60].

The non-expression of co-ogulation plasma activity in the observed calves and piglets during the milk supply phase was associated with increased activity of factors I, II, VII, IX, XI, and XII that implement both coagulation pathways [61], which was confirmed by some acceleration of the activated partial thromboplastin time, prothrombin and thrombin time.

CONCLUSION

The transition to milk consumption in calves and piglets is an important stage in their individual development and requires an adequate activity of adaptive mechanisms, including all elements of the hemostasis system. In the present work, the physiological features of platelet, vascular, and coagulation hemostasis in weakened calves and milk-fed piglets were identified against the background of gamavit in them. The use of this biostimulator caused in weakened calves and piglets of dairy nutrition to optimize their overall physiological status and the hemostasis system indicators taken into account.

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