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Functional Features Of Vascular Hemostasis In Calves Of Dairy Nutrition.

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ABSTRACT

Being the bloodstream of the whole body of the calf, the vessels are inextricably linked with all its systems and organs, largely controlling the course of ontogenesis. Synthetic processes in the cellular elements of blood vessels largely determine the state of hemostasis as a whole due to the formation of substances with antiaggregatory, anticoagulative and fibrinolytic activity in them, which regulate the fluid properties of blood and the adequacy of microcirculation in the tissues of growing young. The examination of 32 healthy calves of the dairy nutrition of the black-and-white breed established the constancy of the content of acyl hydroperoxides and thiobarbituric acid in their blood - active compounds with a slight tendency to increase the activity of the plasma antioxidant potential. Against the background of a low level of endotheliocytemia in healthy dairy feeding calves, a tendency towards an increase in the indexes of antiaggregatory activity of the vascular wall with all tested inducers and their combinations was found. Endotheliocytes of dairy feed calves were characterized by increased production of antithrombin III, providing the necessary level of anticoagulants of vascular origin in their blood. At the same time, the secretion of tissue plasminogen activators detected during the creation of temporary ischemia of the venous wall in calves from 11 to 30 days of life had a general tendency to increase. It can be considered that the increase in antiaggregation, anticoagulation and fibrinolytic activity of the vascular wall observed in calves during the milk nutrition phase is an important component of adaptation at this stage of ontogenesis.

Keywords: calves, dairy nutrition phase, hemostasis, vascular wall, lipid peroxidation.

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INTRODUCTION

Being the bloodstream of the whole body of the calf, its vessels are inextricably linked with all its systems and organs, largely controlling the course of ontogenesis [1-5]. Synthetic processes in the cellular elements of blood vessels largely determine the state of hemostasis as a whole [6,7] due to the formation in them of substances with antiaggregatory [8,9], anticoagulant [10,11] and fibrinolytic activity [12], regulating the fluid properties of blood and the adequacy of microcirculation in the tissues of growing young [13,14]. In this regard, hemostatic abilities of the vascular wall in the dairy nutrition phase [15] are of great biological importance, since its functional activity largely determines the processes of calf adaptation in preparation for the transition to feeding on plant foods [16,17], laying the foundation for productive qualities animal [18,19]. At the same time, the severity of vascular wall control over the processes of hemostasis in calves of the milk diet has been studied very poorly [20,21]. Until now, its antiaggregation, anticoagulant and fibrinolytic properties have not been determined in milk calves [22]. Taking into account the existing gaps in the system of modern scientific views, the present study was planned and conducted, the purpose of which is to evaluate the hemostatic ability of the walls of blood vessels in healthy calves during the dairy nutrition phase.

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) and approved by the local ethic committee of Russian State Social University (Record №12 dated December 3, 2015).

The study included 32 healthy calves of dairy food of black and motley and Simmental breeds. Their examination and examination were carried out 5 times: on the 11th day, the 15th day, the 20th day, the 25th day and the 30th day of life.

In all animals, the activity of plasma lipid peroxidation (LPO) was determined by the content of acyl hydroperoxides (AHP) and thiobarbituric acid-active products using the Agat-Med kit with the evaluation of the antioxidant activity (AOA) of the liquid part of blood. The severity of endotheliocytemia was recorded in the blood of all calves. Anti-aggregation activity of the vessel walls was determined in a sample with a temporary venous occlusion based on a visual micromethod for recording platelet aggregation (AP) with ADP (0.5×10^{-4} M), collagen (dilution 1:2 of the main suspension), thrombin (0.125 units/ml), ristomitsinom (0.8 mg/ml) and adrenaline (5.0×10^{-6} M), and with their combinations - ADP + adrenaline, ADP + collagen and collagen + adrenaline in the same concentrations with a standardized platelet count in the investigated plasma (200×10^{9} platelets) before and after temporary venous occlusion with the calculation of the index a tiagregatsionnoy activity of the vascular wall (IAAVW) by dividing the duration AP amid venous stasis at the time of occurrence of AT without it.

The anticoagulant capacity of the vessels of calves was estimated by the index of the anticoagulant activity of the vessel wall (IACAVW), which was calculated by dividing the activity of antithrombin III (AT III) in plasma after a temporary venous occlusion by its activity before it.

The degree of control of the vascular wall over the blood fibrinolytic activity was recorded by calculating the fibrinolytic activity index of the vascular wall (IEAVW) by dividing the time of euglobulin lysis to a temporary venous occlusion by the time of lysis after it.

The obtained scientific results are processed by the criterion (td) of Student.

RESULTS AND DISCUSSION

In the plasma of the observed calves during the milk supply phase, insignificant fluctuations were observed in the number of primary LPO – AHP products and secondary - thiobarbituric acid –active compounds, on average, they have 1.51±0.14 D_{233}/1 ml and 3.53±0.15 µmol/l, respectively. The registered low severity of the peroxidation process was possible as a result of their high plasma antioxidant potential, which tends to increase from 32.4±0.23% at the beginning of the phase to 32.8±0.15% at its end.

For calves of milk nutrition, a high integrity of the endothelial lining was typical, as indicated by a low level of endotheliocytemia (1.5±0.04 cells/μl on the 11th day of life and 1.7±0.06 cells / μl on the 30th day).

In the observed healthy calves during the dairy nutrition phase, a gradual increase in the IAAVW was recorded with all the inductors used and their combinations. The highest IAAVW was noted for ADP due to the maximum slowing down of AP with this agonist in the sample with temporary venous occlusion. The IAAVW level with adrenaline and collagen was slightly lower. Even lower was IAAVW with thrombin (1.53±0.06 on average) and ristomycin (1.53±0.04 on average), the magnitudes of which also increased during the milk-feeding phase. The indexes of vascular wall aggregation activity with simultaneous use of two inductors, although they were lower in absolute values, also tended to increase from the 11th to the 30th day of the life of calves, which indicated an increase in production in the wall of the vessel in milk-calves of antiplatelet agents.

In the blood of healthy calves from the 11th to the 30th day of life, there was a tendency for AT III to increase by 6.4%. At the same time, it was characteristic of them to increase the production of anticoagulants in endotheliocytes, which provided a tendency for AT III to increase in vascular origin (IACAVW increased by 2.3% during the phase).

In all cases, a clear tendency towards a reduction in the time of spontaneous euglobulin lysis, totaling 4.6%, was found in the observed animals. At the same time, in calves during the dairy nutrition phase, the secretion of tissue plasminogen activators, triggered by temporary ischemia of the venous wall, also had a slight tendency to increase (IEAVW during the phase increased by 2.1%).

Following the neonatal phase, the phase of dairy feeding in calves is an important stage of ontogenesis, largely determining the processes of adaptation of the organism [23] to changing environmental conditions and preparing it to begin feeding on plant foods [24,25]. A large role in this process is played by the state of an extensive system of blood vessels [26], which binds together the organism of a growing animal [27,28]. Being polyfunctional, the vascular wall through a number of mechanisms is closely connected with all systems and organs [29], largely determining the fluid properties of blood [30] due to the synthesis in it of factors regulating platelet aggregation [31], coagulation processes [32] and fibrinolysis [33].

Non-expressed activity of POL in plasma in calves of dairy nutrition, providing low alteration of endotheliocytes, which promoted the formation of hemostatically significant substances in them [34,35].

In healthy calves during the dairy nutrition phase, strengthening of the control of the vascular wall over the adhesive ability of the blood plates has been established, at least through two mechanisms [36,37]. The first is the increase in depressive effects from the vascular wall on the density of collagen receptor glycoproteins Ia - IIa and VI on the platelet membrane [38,39], as judged by the prolongation of AP with collagen against the background of temporary venous occlusion [40,41]. The second mechanism of weakening the adhesion of platelets in calves during the milk supply phase is associated with a decrease in the synthesis in the von Willebrand factor vessels, which is a cofactor of this process [42,43].Under conditions of a gradual increase in the synthesis of the vascular wall of physiological antiplatelet agents, gradual weakening of the fixation of strong aggregation agonists (collagen and thrombin) with their own receptors on the platelet membrane [44] was observed, which significantly inhibits the phospholipase C activity in the blood plates, inhibiting the phosphoinositol activation of platelets [40] in the blood plates, inhibiting phospholipase C activity, inhibiting phosphoinositol activation of platelets. and phospholation of the contractile system proteins [46]. As a result of gradual enhancement of the synthesis of prostacyclin and nitric oxide in the vessel wall during the milk supply phase, the effect of weak aggregation inducers (ADP and adrenaline) on the platelets is weakened [47], which is realized by lowering the expression of fibrinogen receptors (GPIIв-IIIa) and weakening the functional activity of phospholipase A_2, which limits the release of arachidonic acid from platelet membrane phospholipids [48].

The increase in the antiaggregation capacity of the vascular wall in calves during the dairy nutrition phase, detected by the combined use of aggregation inducers, indicated a pronounced increase in the synthesis of disaggregating substances in it [49-50].

A prominent role in maintaining an adequate total atrombogenic capacity of the vascular wall in calves of the milk diet belongs to the increased formation of anticoagulant and fibrinolytic substances in it, which primarily include the physiological anticoagulant – AT III and tissue plasminogen activator [51-53].

CONCLUSION

The increase in the antiaggregation capacity of the vascular wall in calves during the dairy nutrition phase, detected by the combined use of aggregation inducers, is based on a pronounced increase in the synthesis of disaggregating substances in it. A prominent role in maintaining an adequate total atrombogenic capacity of the vascular wall in calves of the milk diet belongs to the increased formation of anticoagulant and fibrinolytic substances in it, which include the physiological anticoagulant - antithrombin III and tissue plasminogen activator. An increase in the antiaggregation, anticoagulant and fibrinolytic activity of the vascular wall is noted in calves during the dairy nutrition phase, contributing to the necessary adaptation of the animal at this stage of ontogenesis.

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