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Research Article

Physiological features of antiaggregatory vascular control of platelets in calves of dairy nutrition

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ABSTRACT

Objective:evaluate vascular antiaggregation potential for platelets in dairy-fed calves.

Material and methods:Under the supervision there were 32 healthy calves of dairy food of black and motley breed, which were examined and examined 5 times: on the 11, 15, 20, 25 and the 30 day of life. The severity of endotheliocytemia was recorded in the blood of all calves using the Goryaev chamber. In the work, platelet aggregation with ADP, collagen, thrombin and ristomycin and adrenaline and also with their combinations - ADP and adrenaline, ADP and collagen and collagen and adrenaline in the same concentrations in plasma rich in platelets, standardized in their number to 200×10^9 platelets per liter of obtained blood taken after temporary venous occlusion and without it. The index of antiaggregatory activity of the vascular wall was calculated by dividing the duration of platelet aggregation in plasma, taken against the background of artificial venous stasis, by the amount of time that platelet aggregation occurred in plasma taken without it. The results are processed by the criterion (td) Student.

Results:The activity of synthesis in the walls of blood vessels of calves of dairy nutrition of substances with antiaggregatory activity largely determines the state of their entire homeostasis in the body, regulates the fluid properties of blood and microcirculation processes in growing tissues. During the dairy nutrition phase, when preparing for the transition to nutrition with vegetable feed, the success of the microcirculation is especially important, including at this age the foundations of the productive qualities of the animal are largely laid. In calves during the dairy nutrition phase, a gradual increase in the control of the vascular wall over the adhesion ability of the platelets was established through an increase in depressive effects from the vascular wall on the density level of collagen receptors on the platelet membranes and as a result of a decrease in the synthesis in vessels of von Willebrand factor, which is a cofactor of this process.

Conclusion:In calf platelets during the dairy nutrition phase, there was a decrease in sensitivity to strong and weak aggregation inductors, largely due to a decrease in the expression level of fibrinogen receptors on their membranes and weakening of platelet phospholipase A_2 and C as a result of the effects of vascular disaggregants. This was indicated by the found tendency to an increase in the indexes of the antiaggregatory activity of the vascular wall with all tested inducers and their combinations.

Keywords: Calves, Phase of dairy nutrition, Antiaggregatory properties, Vascular wall, Vascular endothelium.

INTRODUCTION

Cattle breeding in the modern world is a very intensively developing branch of agriculture. [1,2] It owes its dynamics to successfully conducted studies in the physiology of cattle of different ages in different countries.[3,4] It has been established that the blood system[5,6], its biochemical[5] and rheological properties[6,7] are of great importance for the ontogeny of these productive animals. It was found that a low level of aggregation of blood corpuscles and intensive formation of substances with antiaggregation activity in the vessel wall are optimal for ensuring hemostasis[8] and microcirculation processes in tissues.[9] At the same time, platelet aggregation and vascular control over it[10] are very sensitive to various dysfunctions[11,12] and disorders of the general state of animals at any age.[13] At the same time, the phase of dairy nutrition in productive animals is a very physiologically important

stage, since it is connected with their preparation for the transition to feeding on plant foods. It becomes clear that the success of vascular control over platelet aggregation in calves at this age, and, consequently, the optimum microcirculation, are necessary for maximum deployment of the program of their future productive qualities.[14,15] Given the insufficient study of vascular control over platelets in calves of the first month of life, the goal of the paper is to evaluate the antiaggregation potential of vessels in relation to platelets in calves of the milk diet.

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).

Under the supervision there were 32 healthy calves of dairy nutrition of black and motley breed, which were examined and examined 5 times: at 11, 15, 20, 25 and 30 days of life. The severity of endotheliocytemia was recorded in the blood of all calves using the Goryaev chamber. In the work, platelet aggregation (AP) with ADP (0.5×10^{-4} M), collagen (1: 2 dilution of the main suspension), thrombin (0.125 units/ml), and ristomycin (0.8 mg/ml) and adrenaline (5.0×10^{-6} M), and also with their combinations - ADP and adrenaline, ADP and collagen and collagen and adrenaline in the same concentrations in plasma rich in platelets, standardized in their number to 200×10^{9} platelets per liter of obtained blood taken after temporary venous occlusion and without it. The index of the antiaggregatory activity of the vascular wall (IAAVW) was calculated by dividing the duration of AP in plasma taken against the background of artificial venous stasis by the amount of time that AP appeared in plasma taken without it. The results are processed by the criterion (td) student.

RESULTS

A low level of endotheliocytemia was found in milk calves (1.5±0.04 cells/μl on the 11th day of life and 1.7±0.06 cells/μl on the 30th day), which indicated the high integrity of the endothelial lining of their vessels.

For healthy calves during the dairy nutrition phase, a gradual increase in IAAVW with all the inductors used and their combinations was found (table).

Table. Antiaggregatory activity of vessels in calves of dairy food

Registered indicators	Age calves, n=32, M±m				
	11 day of life	15 day of life	20 day of life	25 dayof life	30 day of life
The index of antiaggregatory activity of the vascular wall with ADP	1.75±0.10	1.76±0.03	1.77±0.05	1.78±0.04	1.79±0.05
The index of antiaggregatory activity of the vascular wall with collagen	1.61±0.04	1.62±0.02	1.63±0.04	1.64±0.05	1.64±0.04
The index of antiaggregatory activity of the vascular wall with thrombin	1.52±0.04	1.53±0.07	1.53±0.08	1.54±0.05	1.55±0.04
The index of antiaggregatory activity of the vascular wall with ristomycin	1.52±0.02	1.53±0.04	1.53±0.07	1.54±0.02	1.55±0.04
The index of antiaggregatory activity of the vascular wall with adrenaline	1.65±0.11	1.65±0.05	1.66±0.07	1.67±0.03	1.68±0.08
The index of antiaggregatory activity of the vascular wall with ADP and adrenaline	1.43±0.08	1.44±0.02	1.44±0.07	1.45±0.03	1.46±0.06
The index of antiaggregatory activity of the vascular wall with ADP and collagen	1.36±0.03	1.37±0.04	1.37±0.02	1.38±0.01	1.39±0.03
The index of antiaggregatory activity of the vascular wall with adrenaline and collagen	1.48±0.03	1.49±0.06	1.49±0.05	1.50±0.02	1.51±0.07

Note: the reliability of the dynamics of the indicators taken into account was not revealed.

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. IAAVW with adrenaline and collagen was slightly lower. Even lower was IAAVW with thrombin, which reached 1.55±0.04 and ristomycin, which amounted to 1.55±0.04. Their value also increased during the milk supply phase. The indexes of the aggregation activity of the vascular wall with the simultaneous use of two inductors, although they were lower in absolute values, also experienced a tendency to increase between 11 and 30 days of calf life. It also allowed for an increase in the production of antiplatelet agents in the vessel walls.

DISCUSSION

A large role in the process of adaptation of the organism of young mammals to changing environmental conditions is played by the state of the blood system, which binds together the organism of a growing animal.[16,17] Its aggregative state is under constant control of the vascular wall[18] and can vary in many states.[19] Vascular control over the fluid properties of blood is associated with the synthesis in the vascular endothelium of factors that weaken platelet aggregation.[20] In the course of the study, it was found that in healthy calves during the dairy nutrition phase there is an increase in the control of the vascular wall over the adhesion of the blood platelets. They combined this with a decrease in the activity of platelet collagen receptor glycoproteins Ia-IIa and VI and a decrease in the synthesis in the von Willebrand factor vessels, which is a cofactor of this process.[21] In addition, for calves of dairy nutrition under conditions of a gradual increase in the synthesis in the vascular walls of the physiological antiplatelet level, weak fixation of strong aggregation agonists (collagen and thrombin) with their own receptors on the platelet membrane is characteristic. This leads to a weakening in the blood platelets of phospholipase C activity, inhibition of the phosphoinositol pathway activation of platelets and a decrease in the level of phosphorylation of proteins of the contractile system.[22] In the calves during the milk supply phase, vascular aggregation of platelet aggregation in response to weak aggregation inducers (ADP and adrenaline) was also noted. This is largely due to a decrease in the expression of fibrinogen receptors (GPIIb-IIIa) on the surface of platelets and a decrease in the functional activity of platelet phospholipase A_2 in response to an increase in the release of blood vessels of prostacyclin and nitric oxide and a decrease in the functional activity of platelet phospholipase A_2.[23]

CONCLUSION

During the dairy nutrition phase, the animal is preparing for the transition to the consumption of vegetable feed. A major role in this is played by the state of microcirculation, which provides the basis for the implementation of the hereditary animal program. In the work carried out, it was found out that calves during the dairy nutrition phase develop a gradual strengthening of the control of the vascular wall over the adhesive ability of the blood plates through the increase of depressive influences from the vascular wall on the density of receptors on the platelet membranes to the induction aggregators. In platelets of calves at this age, there was a weakening of sensitivity to strong and weak inducers of aggregation. This is largely due to a decrease in the expression of fibrinogen receptors on their membranes and a decrease in the activity of platelet phospholipases A_2 and C as a result of the effects of vascular deaggregants.

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