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Functional Features Of Platelets In Newborn Calves Ayrshire Breed.

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ABSTRACT

The evaluation of blood parameters and especially of the elements of hemostasis in productive animals has a serious practical significance for modern practical biology. These parameters are closely related to their somatic characteristics and processes of functioning of the whole organism. The elucidation of their values makes it possible to work out the age norms of these indicators and clearly identify the onset of the onset of hemostasis. In view of the high productivity of Ayrshire cattle and the patient importance of platelet activity in his young, it was decided to evaluate his ability to aggregate blood platelets. Objective: to establish the features of platelet aggregation in healthy newborn calves of Ayrshire breed. 74 newborn calves of Ayrshire breed were examined using hematological methods. The most active platelet aggregation was observed on adenosine diphosphate, which turned out to be maximal at the end of the observation. Collagen and ristomitsinovaya aggregation was less pronounced and similar direction, which indirectly pointed to the low availability of collagen for blood and a small concentration of von Willebrand factor in it. The disaggregation potential of platelets in response to all tested inductors in newborn calves tended to increase. Low platelet activity in calves of this breed at the beginning of ontogenesis provides optimal conditions for the blood supply to their growing and ripening organs.

Keywords: platelets, aggregation, calves, newborn, Ayrshire breed.

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INTRODUCTION

The beginning of postnatal ontogenesis is inextricably linked with the dynamics of systems that regulate and integrate living organisms, including blood [1,2,3]. It is physiologically extremely important its biological subsystem, providing, on the one hand, the preservation of its liquid state, and on the other, prevention and relief of bleeding is hemostasis [4,5,6].

The optimum physiology of the animal is provided by a number of different components, of which platelets are very significant, which also affect hemocoagulation [7, 8]. The efficiency of the blood supply to the tissues and the prevention of various pathological conditions in all parts of the body [9, 10] largely depend on their functional perfection.

Estimation of blood parameters and especially hemostasis elements in newborn animals, as shown, is closely related to their somatic characteristics [11], the functioning of the entire maternal organism [12], as well as platelet activity during pregnancy and early lactation [13 ,14].

Given the high milk production of Ayrshire cattle and the great importance of platelet activity, for the optimum physiological status of productive animals and the growth rate of its young, it was decided to evaluate the activity of blood plates in newborn calves of this breed.

Objective: to establish the features of platelet aggregation in healthy newborn calves of Ayrshire breed.

MATERIALS AND METHODS

The 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 in March 18, 1986, and confirmed in Strasbourg in June 15, 2006) and approved by the local ethic committee of Federal State Budgetary Educational Institution of Higher Education "Vologda State Dairy Farming Academy by N.V. Vereshchagin" (Record №12 dated December 3, 2015), the local ethic committee of All-Russian SII of Physiology, Biochemistry and Animals' feeding (Record №11, dated December 4, 2015) and the local ethic committee of Russian State Social University (Record №16, dated December 7, 2015).

The study was performed on 74 newborn calves of the Ayrshire breed in the Plemsavod Maysky, Vologda District, Vologda Region (Russia). Animals were examined 5 times: 1-2 days, 3-4 days, 5-6 days, 7-8 days and 9-10 days of life. Only healthy physiologically mature animals were taken under observation.

In all calves, in the morning hours, blood was taken from the jugular vein to study the platelet parameters. The sampling was carried out in a plastic tube containing 3.8% sodium citrate solution, in the ratio of blood volumes and sodium citrate - 9:1.

The number of platelets, their average volume and thrombocrit (an indicator characterizing the percentage of platelet mass in the blood volume) was determined by an electronic-automatic method on a hematological analyzer VS-3000 PLUS.

The ability of platelets to aggregate was determined by a quantitative method using KFK-2 photoelectric colorimeter using ADP, collagen and ristomycin in standard concentrations as inducers. Platelet aggregation was assessed by a totaling platelet aggregation index (SIPA), an aggregation rate (SA) and a platelet disaggregation index (IPD).

The results obtained in the course of the research were processed using the Microsoft Excel program and presented as $M \pm m$. Comparison of data between themselves was carried out using Student's t-test.

RESULTS OF THE RESEARCH

General platelet counts in the examined calves (platelet count, average volume and thrombocritus) were within the normal range and did not experience changes during the observation period (Table 1).

Table 1. General platelet characteristics in newborn Ayrshire calves

Indicators	Age calves, n=74, M±m				
	1-2 day	3-4 day	5-6 day	7-8 day	9-10 day
Quantity of platelets, thousand/mcl	380.6±6.18	382.0±7.54	378.4±4.22	375.4±5.70	378.0±6.09
Average platelet count, fl	7.2±0.14	7.3±0.18	7.2±0.15	7.3±0.20	7.3±0.15
Thrombocyte, %	0.27±0.06	0.27±0.03	0.27±0.05	0.27±0.04	0.27±0.03

Note: the reliability of the dynamics of the indicators is not detected.

As a result of the study of platelet aggregation activity in newborn calves of Ayrshire breed, a tendency towards its increase was revealed (Table 2).

Table 2. Platelet aggregation activity in newborn Ayrshire calves

Indicators	Age calves, n=74, M±m				
	1-2 day	3-4 day	5-6 day	7-8 day	9-10 day
Inductor of aggregation ADP					
SIPA, %	13.10±1.22	13.42±1.34	13.90±0.95	14.20±1.07	14.90±1.20
SA, min	0.017±0.008	0.018±0.006	0.020±0.005	0.020±0.007	0.021±0.008
IPD, %	9.60±0.62	9.70±0.70	9.80±0.54	9.95±0.72	10.12±0.63
Inductor of aggregation collagen					
SIPA, %	5.75±0.36	5.87±0.38	6.07±0.42	6.15±0.47	6.20±0.38
SA, min	0.0045±0.006	0.0046±0.007	0.0048±0.004	0.0048±0.005	0.0051±0.004
IPD, %	2.37±0.20	2.40±0.19	2.40±0.25	2.42±0.16	2.44±0.19
Inductor of aggregation ristomycin					
SIPA, %	7.27±0.20	7.35±0.25	7.41±0.18	7.46±0.16	7.50±0.22
SA, min	0.0050±0.004	0.0052±0.007	0.0055±0.006	0.0057±0.007	0.0060±0.005
IPD, %	2.05±0.05	2.07±0.06	2.06±0.09	2.06±0.07	2.08±0.11

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

In the course of the studies carried out in Ayrshire calves during the neonatal period, a tendency was revealed towards an increase in the recorded parameters of platelet aggregation. The highest response of platelets is marked on ADP. At the same time, SIPA with ADP during the first 10 days of life had a tendency for calves to grow, reaching 14.90±1.20% by the end of observation. In response to SIPA collagen, the animals also gradually increased to 6.20±0.38% during the colostrum phase. This indicated a tendency to increase the sensitivity of platelets to inducers of aggregation during the observation of Ayrshire calves and the intensification of the secretory process from platelets during their activation. The activity of platelet aggregation under the action of ristomycin in Ayrshire calves during the colostrum phase also tended to increase - SIAT at the beginning was 7.27±0.20%, and by its end it reached 7.50±0.22%.

During colostrum nutrition, the rate of formation of aggregates in Ayrshire calves in response to ADP tended to increase to 0.021±0.008 minutes. Similar dynamics experienced SA under the action of collagen and ristomycin, amid calves by the end of the observation, 0.0051 ± 0.004 min and 0.0060 ± 0.005 min, respectively.

The assessment of the platelet disaggregation index, which shows the stability of the emerging aggrigents, made it possible to find out that the most stable were the aggregates formed in response to ristomycin - the amount of IPD with it during the newborn, having a slight tendency to grow, reached only

2.08±0.11%. Aggregates formed in calves under the action of ADP and collagen throughout the colostrum were less stable: IDT gradually increased with both inductors, reaching 2.44±0.19% with collagen, and with ADF 10.12±0.63%.

The large amount of knowledge on the physiology of hemostasis collected so far allows us to consider this system as particularly important in maintaining the functional optimum of the organism [15,16]. Hemostasis activity is heterogeneous in different parts of the vascular bed [17]. In functionally active organs at the moment, a certain hemostatic level is established, which differs from the general blood flow, which is connected with the mosaic structure of the hemostasis system in different parts of the vascular bed [18,19].

Recent studies have significantly expanded the understanding of the factors affecting platelet aggregation, as well as the preservation of blood in a liquid state [20]. These processes are well studied in many conditions in humans and animals [21,22]. However, a large number of aspects of the platelet component of hemostasis in cattle at different ages and in many environmental conditions are still very poorly investigated. Their breed characteristics, in particular, the Ayrshire breed, including during the most potentially productive and significant period - in the neonatal phase [23], remain unclear.

It is recognized that during the entire neonatal period, the body of calves intensively undergo anabolic, physiologically necessary processes, which causes certain changes in the work of all organs and body systems [24,25]. It is during this period that all tissues are most susceptible to the influence of unfavorable environmental factors and need the maximum inflow of blood to them and its good liquid properties [26,27].

Performed studies on newborn calves of the Ayrshire breed revealed that the number of platelets and their average volume do not go beyond the limits of generally accepted standard values [28,29]. At the same time, the aggregation activity of platelets in them during the phase of the colostric feeding gradually increases [30]. The most active platelets respond to the action of ADP. With increasing age, SIPA with this inducer increases in newborn calves of this breed. At the same time, in response to collagen and ristomycin, SIPA reaches lower values. This indirectly indicates a low availability of collagen during the phase of colostrum with a low content of von Willebrand factor in their blood [31,32]. It is able to interact simultaneously with ristomycin and platelet membrane glycoproteins Ib and IIb / IIIa, providing interaction between platelet aggregating agents [33,34]. In the observed animals during the neonatal phase, the rate of aggregation in response to all tested inductors tended to increase, which indicated an increase in the number of corresponding receptors on platelet membranes [35,36].

The severity of the disaggregation potential of platelets during the phase of colostrum nutrition in response to all agonists increased to a similar degree [37]. This phenomenon can also be explained by receptor rearrangements on platelet membranes and the dynamics of platelet activity of their activation mechanisms (synthesis of thromboxane, phosphatidic acid and platelet activating factor) [38,39].

Assessing the data obtained in the examined animals, it can be concluded that during the dairy feeding of Ayrshire calves an increase in the adhesive-aggregation activity of platelets occurs, most pronounced towards its end [40]. Considering that growth and development in calves for a rather long time occur simultaneously, it becomes clear that both of these processes have a strong influence on the adhesive – aggregation activity of platelets [41].

CONCLUSION

In the course of the study revealed the dynamics of platelet aggregation in newborn calves of Ayrshire breed. The low ability of platelets to aggregate in animals of this breed at the beginning of growth and development of optimal conditions for the blood supply to all organs and tissues, laying the foundation for high productivity.

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