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## Physiological Indicators Of Platelets In Ayrshire Calves During The Dairy Feeding Phase.

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### ABSTRACT

The processes of growth and development of productive animals are inextricably linked to the dynamics of systems that regulate and integrate living organisms, including blood. 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. In this regard, the assessment of blood parameters and especially of the elements of hemostasis in productive animals has great practical significance for biology. They 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 beginning of the onset of hemostasis. Due to the high productivity of Ayrshire cattle and the patient importance of platelet activity in its young, it was decided to evaluate the aggregation of platelets. Objective: to establish the features of platelet activity in healthy Ayrshire calves during the dairy nutrition phase. A survey of 65 calves feeding the Ayrshire breed using hematological methods of research. The most active platelet aggregation was observed on adenosine diphosphate, which turned out to be maximum by the end of observation. Collagen and ristomitsinovaya aggregation was less pronounced and similar direction, which indirectly indicated the low availability of collagen and a small concentration of von Willebrand factor in it. The disaggregation potential of platelets in response to all tested inductors in calves of the milk feed tended to increase. Low platelet activity in animals of this breed during growth and development provides optimal conditions for the blood supply to growing and ripening organs.

**Keywords:** platelets, calves, dairy food, Ayrshire breed.

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## INTRODUCTION

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

The functioning of hemostasis is provided by a number of different components [7,8], of which platelets [9,10] are very significant, having an effect on blood coagulation [11,12]. The efficiency of the blood supply to the tissues and the prevention of various pathological conditions throughout the body largely depend on their functional perfection [13, 14,15].

Of great practical importance for biology is the evaluation of blood parameters and especially of the elements of hemostasis in productive animals. It is known that they are closely related to their somatic characteristics [16,17] and the functioning of the whole organism [18,19]. This allows you to develop age-related norms of the indicators taken into account [20,21] and to identify the beginning of the onset of hemostasiopathy in certain states [22,23]. These studies are especially important in highly productive breeds of farm animals [24,25].

In view of the high productivity of Ayrshire cattle and the fact that platelet activity is very important for the optimality of the status of any animals and their productivity, it was decided to evaluate the activity of the blood platelets in its young.

Objective: to establish the features of platelet activity in healthy Ayrshire calves during the dairy nutrition phase.

## 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 65 calves of the Ayrshire breed of dairy food in the Plemsavod Maysky, Vologda District, Vologda Region (Russia). Animals were examined 5 times: on the 11th day, on the 15th day, on the 20th day, on the 25th day and on the 30th day of life. Only healthy 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.

Platelet aggregation activity was determined by a quantitative method using KFK-2 photoelectrocolorimeter using aggregation of 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  $M \pm m$ . The comparison between the data was carried out using Student's t-test.

**RESULTS OF THE RESEARCH**

The general indices of the platelets in the examined calves (the number of platelets, their average volume and thrombocritus) were within the normal range and did not experience changes during the observation period (Table 1).

**Table 1. Total platelet characteristics of blood of calves of the Ayrshire dairy breed**

Indicators	Age calves, n=65, M±m				
	11 day	15 day	20 day	25 day	30 day
Quantity of platelets, thousand/mcl	385.9±9.62	345.8±8.33	336.1±5.81	328.6±7.22	314.7±8.01
Average platelet count, fl	7.3±0.18	7.3±0.23	7.2±0.17	7.2±0.27	7.3±0.19
Thrombote, %	0.27±0.05	0.27±0.08	0.27±0.04	0.27±0.07	0.27±0.06

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

As a result of the study of platelet aggregation activity in calves of the Ayrshire dairy food, a tendency towards its increase was observed (Table 2).

**Table 2. Aggregation activity of platelets in calves of the Ayrshire dairy feed**

Indicators	Age calves, n=65, M±m				
	11 day	15 day	20 day	25 day	30 day
Inductor of aggregation ADP					
SIPA, %	14.80±1.45	16.02±2.02	17.00±3.08	17.20±2.62	18.00±2.27
SA, min	0.021±0.007	0.022±0.009	0.024±0.007	0.025±0.008	0.026±0.005
IPD, %	10.10±0.68	9.95±0.73	10.00±0.63	10.05±0.80	10.25±0.75
Inductor of aggregation collagen					
SIPA, %	6.17±0.53	6.32±0.61	6.65±0.50	6.85±0.63	7.01±0.49
SA, min	0.0052±0.005	0.0054±0.003	0.0055±0.006	0.0058±0.004	0.0061±0.006
IPD, %	2.43±0.23	2.48±0.25	2.47±0.28	2.48±0.18	2.50±0.22
Inductor of aggregation ristomicin					
SIPA, %	7.53±0.19	7.65±0.24	7.70±0.29	7.73±0.33	7.80±0.31
SA, min	0.0061±0.005	0.0059±0.008	0.0060±0.007	0.0064±0.005	0.067±0.007
IPD, %	2.07±0.06	2.10±0.09	2.13±0.12	2.11±0.08	2.15±0.10

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 dairy diet, the dynamics of the platelet aggregation indicators taken into account were clarified. The highest response of platelets is marked on ADP. At the same time, SIPA with ADP over the course of the dairy feed tended to increase, reaching 18.00±2.27% by the end. In response to collagen, SIPA in animals during the dairy diet also gradually increased to 7.01±0.49%. This indicated a tendency to an increase in the sensitivity of platelets to inducers of aggregation during the observation of Ayrshire calves with the intensification of the secretory process from platelets during plate activation. The activity of platelet aggregation under the action of ristomicin in Ayrshire calves during the milk supply phase tended to increase — SIPA at the beginning was 7.53±0.19%, reaching 7.80±0.31% by its end.

The rate of formation of aggregates in Ayrshire calves in response to ADP reliably tended to increase during the milk supply from 0.021±0.007 min to 0.026±0.005 min. to its end. Similar dynamics experienced SA under the action of collagen and ristomicin, which in calves at the end of the observation was 0.0061±0.006 min and 0.0067±0.007 min, respectively.

The assessment of the platelet disaggregation index, which shows the stability of the emerging aggregates, made it possible to find out that the most stable were the aggregates formed in response to ristomycin - the value of the IPD with it during plant nutrition, having a tendency to grow, reached minimum values ( $2.15 \pm 0.10\%$ ). The aggregates formed by the action of ADP and collagen throughout the milk supply were less stable: IPD gradually increased with respect to both inductors, reaching  $2.50 \pm 0.22\%$  with collagen and  $10.25 \pm 0.75\%$  with ADP.

## DISCUSSION

The current high level of knowledge about the physiology of hemostasis allows us to consider this system as particularly important in maintaining the functional optimum of the organism [26,27]. Hemostasis activity is heterogeneous in different parts of the vascular bed [28,29]. 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 [30,31].

Recent studies have significantly expanded the understanding of the factors affecting platelet aggregation, as well as the preservation of blood in a liquid state [32]. These processes are well studied in many conditions in humans and animals [33]. However, a large number of aspects of the platelet component of hemostasis in cattle at different ages and in many environmental conditions remain poorly investigated. Their breed characteristics, in particular, the Ayrshire breed, including during the most potentially productive and significant period, in calves in the dairy feeding phase, remain unclear.

It is recognized that anabolic, physiologically necessary processes occur in the body of calves during the entire phase of dairy nutrition, which causes certain changes in the work of all organs and body systems. 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 [34].

The studies performed on Ayrshire calves of the dairy feed revealed that the platelet count and their average volume do not exceed the limits of generally accepted standard values [35]. At the same time, the platelet aggregation activity in them during the milk supply phase gradually increased. Platelets reacted most actively to the action of ADP. With increasing age, SIPA with this inducer has increased. At the same time, in response to collagen and ristomycin, SIPA achieved lower comparable values. This indirectly indicated a low availability of collagen during the milk supply phase with a low content of von Willebrand factor in their blood. It is able to interact simultaneously with ristomycin and platelet membrane glycoproteins Ib and IIb / IIIa, providing interaction between platelet aggregating agents [36]. In the observed animals during the dairy nutrition phase, the rate of aggregation in response to all tested inductors tended to increase, indicating an increase in the number of corresponding receptors on platelet membranes [37].

The severity of platelet disaggregation potential throughout the entire milk supply phase in response to all agonists increased to a similar extent. This phenomenon can also be explained by receptor rearrangements of the platelet membranes and the dynamics in the platelets of their activation mechanisms (synthesis of thromboxane, phosphatidic acid and platelet activating factor).

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. Considering that the growth and development of calves for a rather long time occur simultaneously, it becomes clear that both of these processes affect the adhesive – aggregative activity of platelets. The incomplete information available in the literature that the growth of platelet aggregation properties [38] decreases or increases in calves as they grow [38] can be explained by the breed differences of animals taken in these studies or by making these observations in incomparable environmental conditions [40].

## CONCLUSION

In the course of the study, the dynamics of platelet hemostasis in Ayrshire calves during the milk feeding phase was revealed. Low platelet activity provides optimal conditions for animals of this breed at this age for the blood supply to their growing organs.

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