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## Functional Properties Of Anticoagulant And Fibrinolytic Activity Of Blood Plasma In Calves In The Phase Of Milk Nutrition.

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### ABSTRACT

A regular change in the activity of anticoagulant and fibrinolytic systems of blood plasma in the phase of milk nutrition in calves is one of the most important physiological elements of providing homeostasis in the postnatal period. The formation of adequate functional activity of anticoagulant and fibrinolytic systems largely ensures adaptation to the external environment of all body systems. They control the liquid properties of blood, maintaining the level of its fluidity through the vessels and promote the optimal deployment of an individual calf development program, despite possible undesirable effects from the external environment. It was found that in healthy calves of dairy nutrition there is a regular dynamic of the functional state with anticoagulant and fibrinolytic activity in plasma, providing the optimal blood rheology necessary for growth and development of the organism. The increased activity of anti-coagulation mechanisms and fibrinolysis in the blood helps the animal to adapt to the phase of milk nutrition, providing its preparation for feeding with plant foods. Increase in activity of plasma hemostasis should be considered in calves of dairy nutrition as an element of the general adaptation process of the organism in early ontogeny.

**Keywords:** calves, ontogeny, development, phase of milk nutrition, anticoagulation, fibrinolysis.

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## INTRODUCTION

The growth of population on the planet increasingly puts various social issues, including the issue of intensification of food production [1,2,3]. A possible solution to this problem is the practical active use of new information on physiology [4,5], including cattle [6]. As an important direction of obtaining physiological information, studies in the field of various aspects of blood are being considered [7,8]. Particular attention here deserves the mechanisms that support it in the liquid state and retain its optimal rheological and trophic properties [9, 10]. They include anticoagulation and fibrinolysis, which are now actively studied in humans and various biological objects [11,12].

It becomes clear that a regular change in the activity of anticoagulant and fibrinolytic systems of blood plasma in the phase of milk nutrition in calves is one of the most important physiological elements of providing homeostasis in the postnatal period [13]. The formation of adequate functional activity of anticoagulant and fibrinolytic systems largely provides adaptation to the external environment of all body systems, controlling the liquid properties of blood, maintaining the level of its fluidity along the vessels, thereby facilitating the optimal deployment of an individual calf development program, despite possible undesirable effects from the external environment [14]. At the same time, the ontogenetic dynamics of the activity of anticoagulant and fibrinolytic systems in healthy calves in the phase of dairy nutrition have not been studied sufficiently [15].

In this connection, the goal of the study was formulated: to evaluate the ontogenetic dynamics of the physiological state of the anticoagulant and fibrinolytic systems of blood plasma in healthy calves in the phase of milk nutrition.

## 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 calf dairy nutrition on the 11th day of life. The complex of examinations consisted of determining the activity of peroxide oxidation of plasma lipids by the content of acyl hydroperoxides [3], TBC-active products by the Agat-Med company (Russia) and the antioxidant activity of the liquid part of the blood. Each calf under observation was evaluated for the activity of the anticoagulant system of blood plasma by determining the activity of antithrombin III and protein C in plasma.

To determine the activity of fibrinolytic ability of blood plasma in neonatal calves, a method for determining the time of spontaneous euglobulin lysis, the level of plasminogen,  $\alpha_2$  antiplasmin, and the content of fibrin degradation products by the phenanthroline method was used.

Healthy calves were examined during the milk feeding phase 5 times: on 11, 15, 20, 25 and 30 days of life.

Statistical processing of the results was carried out using Student's t-test.

## RESULTS OF THE STUDY

During the whole phase of milk feeding in healthy calves, the level of antioxidant plasma activity was stable (on average  $32.6 \pm 0.21\%$ ) and lipid peroxidation activity. Thus, the level of primary products of lipid peroxidation, acyl hydroperoxides, averaged  $1.48 - 0.02 D_{233} / 1\text{ml}$  with a low content of secondary products of free radical lipid oxidation-thiobarbituric acid-active compounds (an average of  $3.29 \pm 0.02 \mu\text{mol/l}$ ), reliably not differing from the study to the study during the whole phase of the dairy diet.

All healthy calves included in the study evaluated the activity of anticoagulant and fibrinolytic activity of blood throughout the entire phase of the dairy diet. In the dynamics of activity of the components evaluated in calves, a statistically significant pattern was found (Table 1).

**Table 1. Anticoagulation and fibrinolytic activity blood in healthy calves of dairy nutrition**

Registered parameters	Milk phase, n=32, M±m					Average value for the phase of milk nutrition, n=32, M±m
	11 day of life	15 day of life	20 day of life	25 day of life	30 day of life	
The activity of antithrombin III in plasma, %	101.7±0.07	103.6±0.14 p<0.05	105.4±0.12 p<0.05	106.9±0.10 p<0.05	108.2±0.16 p<0.05	105.2±0.13
Protein C, %	76.0±0.10	78.2±0.76 p<0.05	79.4±0.04 p<0.05	81.6±0.06 p<0.05	83.5±0.08 p<0.05	79.7±0.09
Time of spontaneous euglobulin lysis, minutes	178.2±0.34	175.4±0.15 p<0.05	173.0±0.22 p<0.05	172.0±0.18	170.3±0.15 p<0.05	173.8±0.19
Plasminogen, %	122.0±0.05	123.8±0.08 p<0.05	124.6±0.06 p<0.05	126.0±0.05 p<0.05	128.6±0.10 p<0.05	125.0±0.08
α <sub>2</sub> antiplasmin, %	101.3±0.19	100.0±0.14	98.7±0.06 p<0.05	97.3±0.05 p<0.05	96.4±0.09 p<0.05	98.7±0.10
Fibrin degradation products, µg/ml	40.2±0.25	41.3±0.19	41.9±0.20	42.2±0.09	42.8±0.16	41.7±0.20

Legend: p - reliability of the dynamics of the indicators being evaluated during the phase of dairy nutrition.

A small but significant increase in the level of antithrombin III, an average of 105.2±0.13%, was established in the blood of healthy calves of dairy nutrition. Simultaneously, there was a significant increase during the milk feeding phase of protein C level in calves between 11 and 30 days of life from 76.0±0.10% to 83.5±0.08%.

During the phase of dairy nutrition, a significant increase in the level of plasminogen was observed in healthy calves with a significant decrease in the inhibitor of its active form, α<sub>2</sub> antiplasmin, by 5.1% for this phase of early ontogeny. This ensured a small but steady decrease in the time of spontaneous euglobulin lysis with a constant level of fibrin degradation products during the milk feeding phase, which was a marker of optimal adaptation of the organism to the external environment by maintaining fibrinolysis activity at the required level.

Thus, during the whole milk feeding phase, the calves show a significant increase in plasma level of antithrombin III plasminogen, protein C activity and a decrease in α<sub>2</sub> antiplasmin, which is an important element of adaptation of animals to the conditions of extrauterine life, contributing to the transition of hemostasis to the level required for further growth and development of the body and preparation for plant nutrition.

### DISCUSSION

In healthy calves of dairy nutrition, there was a lack of reliable fluctuations in the level of lipid peroxidation and antioxidant protection of the plasma with a certain dynamics of activity of anticoagulation and fibrinolysis [16,17], which undoubtedly allows the calf to adapt to the conditions of extrauterine existence [18,19], providing a normal rheological state of the blood [20], and thus, an adequate influx of nutrients and oxygen to the developing tissues of the animal's body [21,22]. This is an important element in the protection of calves against possible adverse environmental factors [23,24] affecting their body in the phase of milk nutrition [25,26]. The dynamics of the anticoagulation system that controls the aggregate state of blood and the fibrinolysis system that dissolves excess fibrin is largely ensured by the stability of lipid peroxidation at the optimal level with the growing influence of environmental factors [27,28]. Thus, during the milk feeding phase,

the activity of coagulation inhibitors and the level of fibrinolytic agents significantly increase: antithrombin III, protein C and plasminogen increase and the activity of the fibrinolysis inhibitor- $\alpha_2$ -antiplasmin [29] decreases. Obviously, this is a physiological response to the adaptation of the organism, which, upon completion of the neonatal phase, requires an increase in fibrinolysis activity [30, 31]. In view of the fact that the general inhibitor of the contact activation of plasma proteases, plasminogen gradually increases with the level of fibrin degradation products remaining in the blood, one can think about the optimal functioning of the mechanisms of hemostasis adaptation in these conditions without signs of hypocoagulant hemostasis direction at these times, providing optimal microcirculation conditions in hemodynamic adaptation in phase of milk nutrition [32].

Summation of the dynamics of activity of anticoagulation and fibrinolysis provides the level of liquid blood properties necessary for this stage of ontogeny and the optimal degree of perfusion of internal organs, which largely maintains the necessary level of metabolism in calf tissues, contributing to its growth and development [33].

It is obvious that the revealed dynamics of activity of anticoagulation and fibrinolysis of blood is an indispensable element of the organism's preparation for a new diet - the beginning of consumption of plant food.

Thus, calves have a small but significant increase in plasma hemostasis activity, which is probably an element of the general adaptation process of the organism in early ontogeny.

### CONCLUSION

In healthy calves of dairy nutrition, there is a regular dynamics of the functional state with anticoagulant and fibrinolytic activity in plasma, providing the optimal blood rheology necessary for the growth and development of the organism. Increasing the activity of anti-coagulation mechanisms and fibrinolysis in the blood helps the animal to adapt to the phase of dairy nutrition, ensuring its preparation for feeding with plant foods.

### REFERENCES

- [1] Apanasyuk LA, Soldatov AA. (2017) Socio-Psychological Conditions for Optimizing Intercultural Interaction in the Educational Space of the University. *Scientific Notes of Russian State Social University*. 16(5-144) : 143-150. doi: 10.17922/2071-5323- 2017-16-5-143-150.
- [2] Maloletko AN, Yudina TN.(2017) (Un)Making Europe: Capitalism, Solidarities, Subjectivities. *Contemporary problems of social work*. 3 (3-11) : 4-5.
- [3] Pozdnyakova ML, Soldatov AA. (2017) The Essential and Forms of the Approaches to Control the Documents Execution. 3 (1-9): 39-46. doi: 10.17922/2412-5466-2017-3-1-39-46.
- [4] Bikbulatova AA, Andreeva EG, Medvedev IN. (2018) Hematological Features Of Patients With Osteochondrosis Of The Spine. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(3):1089-1095.
- [5] Bikbulatova AA, Karplyuk AV, Medvedev IN. (2018) The Problem Of Vocational Guidance Work With Young People, Who Have Limited Health Opportunities In Modern Russia. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(4):586-590.
- [6] Oshurkova JuL, Medvedev IN, Fomina LL. (2018) Physiological Peculiarities of Platelet-Coagulative Hemostasis in Dead-Wood Cows of Irishire Breed. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(1) : 817-822.
- [7] Bikbulatova AA, Karplyuk AA, Parshin GN, Dzharfar-Zade DA, Serebryakov AG. (2018) Technique for Measuring Vocational Interests and Inclinations in High-School Students with Disabilities. *Psikhologicheskaya nauka i obrazovanie-psychological science and education*. 23(2) : 50-58. doi: 10.17759/pse.2018230206
- [8] Skorjatina IA. (2018) Therapeutic Possibilities Of Rosuvastatin In The Medical Complex In Relation To Disaggregation Vascular Control Over Erythrocytes In Persons With Arterial Hypertension And Dyslipidemia. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(2) : 977-983.

- [9] Medvedev IN. (2018) Peculiarities of vascular control over platelet aggregation in patients with Arterial hypertension of the 3rd degree at metabolic syndrome. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(1) : 258-264.
- [10] Medvedev IN. (2018) Functional Peculiarities Of Platelet Activity In Persons With Arterial Hypertension Of The High Degree Developing Against The Background Of hypodynamia At Metabolic Syndrome. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(1) : 308-314.
- [11] Medvedev IN. (2018) Development of Platelet Dysfunctions at Arterial Hypertension with Dyslipidemia. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(1) : 439-444.
- [12] Medvedev IN. (2018) Physiological Reaction of Erythrocytes' Microrheological Properties in Persons of The Second Mature Age on Prolonged Hypodynamia. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(1):577-582.
- [13] Oshurkova JuL, Medvedev IN, Fomina LL. (2018) Physiological Indices of Platelet-Coagulation Hemostasis in Purebred Irish Cows in The Course of Lactation. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(2):419-426.
- [14] Oshurkova JuL, Medvedev IN, Fomina LL. (2018) Physiological features of platelet aggregation in calves of Ayrshire breed during the phase of plant nutrition. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(2) : 1008-1013.
- [15] Oshurkova JuL, Medvedev IN, Tkacheva ES. (2018) Functional Features Of Platelet Aggregation In Heifers Of The Ayrshire Breed, Which Are Being Prepared For Insemination. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(3) : 1155-1160.
- [16] Medvedev IN. (2018) Activity of Platelets' Aggregation in Patients of The Second Mature Age with Arterial Hypertension of The 3rd degree. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(1) : 651-656.
- [17] Medvedev IN. (2018) Disaggregating Vascular Impacts on Platelets in Patients with Arterial Hypertension Of The 3rd Degree. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(1) : 663-669.
- [18] Medvedev IN. (2018) Physiological Peculiarities of Erythrocytes' Aggregation in Rats Of Elder Ages. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(1) : 716-721.
- [19] Medvedev IN. (2018) Physiological Dynamics of Erythrocytes' Cytoarchitecture In Aged Rats. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(1) : 736-740.
- [20] Medvedev IN. (2018) Dis Aggregative Capabilities of Vascular Wall in Respect of Erythrocytes in Patients with Arterial Hypertension and Dislipidemia. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(1) : 811-816.
- [21] Medvedev IN. (2018) Disaggregative Impacts of Vascular Wall on Platelets of Patients with Arterial Hypertension and Dyslipidemia. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(1) : 857-863.
- [22] Medvedev IN. (2018) Vascular Disaggregative Control Over Neutrophils In Patients With Arterial Hypertension And Dyslipidemia. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(1) : 864-869.
- [23] Medvedev IN. (2018) Aggregation of Thrombocytes in People of Second Adulthood with Arterial Hypertension of the 2 Rd Degree. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(1) : 870-875.
- [24] Makhov AS, Medvedev IN. (2018) General Assessment of The Health Status of Children with Down Syndrome Who Have Low Physical Activity. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(2):427-431.
- [25] Makhov AS, Medvedev IN. (2018) Basics of Prevention and Correction of Asthenic Syndrome in Young Footballers With Down Syndrome. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(2):522-526.
- [26] Medvedev IN. (2018) The Image of The Physical "I" In People with Disabilities with Hemi Paresis as A Result of Hemorrhagic Stroke. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(2) : 527-532.
- [27] Makhov AS, Medvedev IN. (2018) Problems of Physical Rehabilitation of Children with Down Syndrome with Injuries of The Lower Limb. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(2):615-619.
- [28] Medvedev IN. (2018) Correction of the image of the physical "I" in people with disabilities with hemiparesis who underwent a hemorrhagic stroke. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 9(2) : 697-704.



- [29] Makhov AS, Medvedev IN. (2018) Evaluation of the effectiveness of the complex rehabilitation of children with oligophrenia in the degree of imbecility, who underwent fracture of the lower limb. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(2) : 731-736.
- [30] Medvedev IN.(2018) Adaptive Resource Of Disabled Persons With Hemiparesis Who Underwent Hemorrhagic Stroke. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(2): 957-964.
- [31] Medvedev IN. (2018) Vasopathy In Patients With Arterial Hypertension 2 Degrees. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(2) : 965-971.
- [32] Vorobyeva NV, Mal GS, Skripleva EV, Skriplev AV, Skoblikova TV. (2018) The Combined Impact Of Amlodipin And Regular Physical Exercises On Platelet And Inflammatory Markers In Patients With Arterial Hypertension. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(4):1186-1192.
- [33] Skripleva EV, Vorobyeva NV, Kiperman YaV, Kotova OV, Zatsepin VI, Ukolova GB.(2018) The Effect Of Metered Exercise On Platelet Activity In Adolescents. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 9(3):1150-1154.