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Physiological Features Of Coagulation In Calves Of Plant Nutrition.

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ABSTRACT

A very important mechanism of hemostasis in all mammals, including productive animals, is hemocoagulation. Her condition during the growth and development of calves is of enormous physiological importance. The dynamics of the activity of the coagulating system of blood plasma in the phase of plant nutrition in calves should be considered as an important component of the physiological maintenance of homeostasis in the final maturation of the animal's body. The functional adequacy of the plasma clotting capacity provides adaptation to the external environment of the body systems through the maintenance of liquid blood properties, contributes to the completion of the individual calf development program. It was found that in healthy calves of plant nutrition there is a regular dynamic of the functional state of the activity of elements of coagulation hemostasis, which ensures the optimal rheology of blood necessary for the growth and development of the organism. The evolving increase in the activity of the blood clotting mechanisms helps the calf to adapt to the phase of plant nutrition, ensuring the final transition to nutrition with plant foods.

Keywords: blood coagulation, clotting factors, calves, phase of plant nutrition, development.

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INTRODUCTION

Modern science desperately needs further development and strengthening of its actual base [1,2,3]. The main customer of this is the society [4,5], which needs more and more food products [6,7]. To provide the population with sufficient amount of food is largely capable of livestock [8]. Intensify it is possible by actively using physiological information about the activity of vital body systems [9,10]. These include blood [11] and a hemostasis system [12], which ensures the preservation of blood in the liquid state and the rapid formation of a thrombus in the event of damage to the vessel wall [13,14].

A very important mechanism of hemostasis in all mammals [15,16], including productive animals [17], is hemocoagulation. Her condition during the growth and development of calves is of enormous physiological importance. The dynamics of the activity of the coagulating system of blood plasma in the phase of plant nutrition in calves is an important component of the physiological maintenance of homeostasis in the final maturation of the animal's body [18]. The functional adequacy of the plasma clotting ability provides, in many respects, adaptation to the external environment of the body systems through the maintenance of liquid blood properties, contributes to the completion of the individual calf development program [19,20]. At the same time, many aspects of the age-related changes in the activity of the coagulation system in healthy calves in the phase of plant nutrition have not yet been studied sufficiently.

The goal of the research is formulated: to evaluate the dynamics of the physiological state of the coagulating system of blood plasma in healthy calves at the beginning of the phase of plant 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 39 healthy calves of plant nutrition at the age of 91 days. The complex of examinations consisted of determining the activity of peroxide oxidation of plasma lipids by the content of acyl hydroperoxides, thiobarbituric acid-active products by the Agat-Med company (Russia) and the antioxidant activity of the liquid part of the blood. Each level of the monitored calf was evaluated for the level of coagulation factors (I, II, V, VII, VIII, IX, X, XI, XII), duration of activated partial thromboplastin time, prothrombin and thrombin time.

All calves were examined in the phase of plant nutrition 4 times: 91 days, 6 months, 9 months and 12 months of life. The statistical processing of the results was carried out by Student's t-test.

RESULTS OF THE STUDY

Since the beginning of the phase of plant nutrition in healthy calves, there has been a gradual increase in the level of antioxidant plasma activity (from $33.9 \pm 0.09\%$ to $36.5 \pm 0.10\%$ by 12 months of life), which led to a decrease in the activity of lipid peroxidation. Thus, the level of primary products of peroxide oxidation of lipid acyl hydroperoxides in the period under evaluation decreased to $1.21 \pm 0.14 D_{233}/1 \text{ ml}$, totaling 15.7%, with a decrease in the content of secondary products of free radical lipid oxidation-thiobarbituric acid-active compounds by 7,8% to the level of $3,18 \pm 0,12 \mu\text{mol/l}$.

All healthy calves included in the study evaluated the activity of coagulation factors throughout the estimated period of the phase of plant nutrition. In the dynamics of activity of coagulation factors, they found a statistically significant regularity (Table 1).

On 91 days of life in calves, the low activity of all coagulation factors was noted. Subsequently, during the entire period of observation in animals, a gradual increase in the content of factors I, II, VII, IX, X, XI and XII was detected with an unreliable fluctuation in the blood content of V and VIII factors, which remained practically unchanged from 3 months to 12 months of the animal's life.

The activity of coagulation tests in healthy calves during the phase of plant nutrition of early ontogeny reflected the patterns of activity dynamics of coagulation system factors in this phase of early ontogeny (Table 1). Thus, in assessing the age-related dynamics of activated partial thromboplastin time, its gradual acceleration over the estimated period was 11.3%. Prothrombin time, somewhat delayed at the beginning of the phase, by 12 months has reached 13.2±0.05 s. Thrombin time, reflecting the intensity of the transition of fibrinogen to fibrin, from 91 days in total to 12 months. Life in calves was accelerated by 19.3%, amounting to 12.4±0.08 s by the end of the observation.

Thus, in the first 9 months of the phase of plant nutrition in calves, there is a significant increase in the plasma clotting system, which is undoubtedly an important element in the adaptation of animals to food only by plant-based feeds, helping them to pass the hemostasis to the level required for further growth and development of the body.

Table 1. Dynamics of activity of hemocoagulation in calves of plant nutrition

Registered parameters	Phase of plant nutrition, n=39, M±m				Average value, n=39, M±m
	91 day of life	6 months of life	9 months of life	12 months of life	
Coagulation factor I, g/l	3.5±0.16	3.6±0.12	3.8±0.02 p<0.05	4.0±0.08 p<0.05	3.7±0.10
Coagulation factor II, %	89.0±0.12	90.9±0.14 p<0.05	92.1±0.09 p<0.05	94.3±0.05 p<0.05	91.6±0.10
Coagulation factor V, %	84.0±0.03	84.2±0.10	83.9±0.05	84.1±0.08	84.1±0.07
Coagulation factor VII, %	75.5±0.02	76.7±0.06 p<0.05	77.5±0.07 p<0.05	78.9±0.04 p<0.05	77.2±0.05
Coagulation factor VIII, %	86.6±0.15	86.7±0.10	87.2±0.14	86.8±0.19	86.9±0.15
Coagulation factor IX, %	88.1±0.20	89.7±0.17 p<0.05	90.6±0.09 p<0.05	92.0±0.10 p<0.05	90.1±0.14
Coagulation factor X, %	63.2±0.07	65.1±0.10 p<0.05	66.7±0.07 p<0.05	67.9±0.08 p<0.05	65.7±0.08
Coagulation factor XI, %	94.8±0.05	96.0±0.07 p<0.05	97.8±0.12 p<0.05	99.5±0.18 p<0.05	97.0±0.11
Coagulation factor XII, %	92.7±0.12	93.6±0.14 p<0.05	95.1±0.05 p<0.05	98.9±0.16 p<0.05	95.1±0.12
Activated partial thromboplastin time, s	38.5±0.16	37.1±0.02 p<0.05	36.2±0.10 p<0.05	34.6±0.07 p<0.05	36.6±0.09
Prothrombin time, s	16.1±0.10	15.2±0.04 p<0.05	14.3±0.06 p<0.05	13.2±0.05 p<0.05	14.7±0.06
Thrombin time, s	14.8±0.05	14.0±0.06 p<0.05	13.1±0.12 p<0.05	12.4±0.08 p<0.05	13.6±0.08

Legend: p - reliability of ontogenetic dynamics of the indicators being evaluated.

DISCUSSION

In calves without deviations in the state of health, vegetative nutrition, a gradual weakening of lipid peroxidation is registered due to the enhancement of antioxidant protection of the plasm during the whole period of observation with a certain dynamics of plasma hemostasis activity [21,22], which is undoubtedly a consequence of the organism's adaptation process calf to feed exclusively vegetable feed, various unfavorable environmental factors and the process of final maturation of the internal organs of the calf, providing a norm rheological state of blood, and thus, an adequate supply of nutrients and oxygen to animal tissues [23]. The dynamics of the activity of the clotting system, which largely controls the aggregate state of the blood

[24], is undoubted. is associated with fluctuations in the activity of lipid peroxidation at the optimal level with a possible increase in the influence of environmental factors [25]. The gradual acceleration of the prothrombin time of blood coagulation reflects an increase in the mechanisms of activation of plasma hemostasis along the external pathway and is largely associated with an increase in the intensity of formation and activity triggering the process of clotting of thromboplastin in plant nutrition of calves [26]. The registration of these phenomena provides the level of liquid blood properties necessary for the final phase of early ontogeny and the optimal degree of perfusion of the internal organs [27], which largely maintains the necessary level of metabolism in calf tissues, contributing to its further growth and development [28].

During the initial phase of the phase of plant nutrition, referring to the first year of life, the calves retain the same content of blood in the V, VIII factors with a significant increase in the activity of other coagulation factors [29]. In this connection, the activated partial thromboplastin time, reflecting the activity of the internal coagulation pathway, prothrombin time, revealing the activity of its external pathway and its terminal stage, estimated by thrombin time, is accelerated [30]. It is obvious that the established dynamics of blood clotting activity is an indispensable element of the organism's transition to the beginning of consumption of only plant foods [31].

The dynamics of plasma coagulation activity provides the level of liquid blood properties necessary for the end of early ontogeny and the optimal degree of perfusion of internal organs, which contributes to the necessary level of metabolism in calf tissues for its further growth and development [32,33].

Thus, calves of plant nutrition develop a gradual increase in the functional activity of the clotting system, providing an adequate level of its response to environmental factors, contributing to the overall adaptation process of the organism in early ontogeny.

CONCLUSION

In healthy calves of plant nutrition there is a regular dynamics of the functional state of the activity of elements of coagulation hemostasis, which provides the optimal rheology of blood necessary for the growth and development of the organism. Increasing the activity of blood clotting mechanisms helps the animal to adapt to the phase of plant nutrition, ensuring the final transition to nutrition with plant foods.

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