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Functional Features of Platelet Secretion in Piglets During Early Ontogenesis

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Physiologically, the secretion is considered to be a very important element of the platelet hemostasis system. Its functional state seriously determines the activity of primary hemostasis and microcirculation parameters in the capillaries, and, consequently, the course of metabolic processes throughout the body. It is known that the success of the entire hemostasis, as well as the activity of the processes in the development of the vessels of the body of productive animals, depends on the level of secretory activity of platelets. Of particular physiological significance are its features during early ontogenesis, when the body grows, matures and reaches its optimum productive qualities. For this reason, additional study of the secretory potential of platelets during the first year of life is of great importance for the physiology of the blood of piglets. These studies can help in finding approaches to the continuation of further intensification of pig production. In the work carried out, it was found that the ability of platelets to secrete increases in piglets during early ontogenesis. The main mechanism of this process should be considered as an increase in platelets of basal amount and self-assembly of actin and myosin. These changes are amplified at the physiological level in piglets due to the increase in the content of adenosine phosphate in platelet granules and the severity of its secretion under the influence of aggregation inducers. The increased activity of platelet secretion in piglets during the first year of life contributes to maintaining their microcirculation processes in the tissues at the level of their body's needs for nutrients and oxygen.

Keywords: Piglets, Early ontogenesis, Platelets, Aggregation, Adhesion, Secretion.

Optimum vitality of the body at any age by a range of mechanisms that support homeostasis[1,2]. A huge role is played by the system of homeostasis, which continuously keeps the blood in the vessels in the liquid state[3,4], and damage in various forms is strictly a local blood clot to stop the bleeding[5]. Balanced functioning of all components of hemostasis maintains blood volume and high viability of the organism[6,7]. The hemostatic system largely determines the rheological characteristics of blood, primarily in the capillaries, adjusting the intensity of the trophic tissue in the body[8,9].

The preservation of normal activity of hemostasis maintains the necessary level of viability of all productive animals throughout their development[10]. It is therefore very important

to conduct a detailed study of different aspects of the physiology of hemostasis. This information can seriously help in the intensification of their breeding and finding approaches to foster their economic implementation. In addition, this information can help in maintaining a functional optimum of their body under any adverse environmental conditions[11,12].

Great functional importance in the whole system of hemostasis are thrombocytes. Manifestations of their hemostatic properties seriously determine the perfusion of small vessels, and, consequently, the intensity of metabolism in the tissues of the body[13]. Very important for primary hemostasis can be considered secretory properties of platelets, because of their severity depends on the degree of involvement in the hemostatic process intact platelets and, consequently, the adequacy of primary hemostasis and optimum rheology of blood in the capillaries[14,15]. In this regard, it is important to assess the secretory properties of platelets during growth and development of young productive animals, including pigs, being economically very important sources of meat in many countries[16]. In this regard, the work the aim was to clarify the age dynamics of the secretory characteristics of platelets in piglets during early ontogenesis.

MATERIALS AND METHODS

This study was carried out in full compliance with all ethical principles established in the decisions of the European Convention for the Protection of Vertebrates, used for experimental and other scientific purposes (adopted in Strasbourg on March 18, 1986 and confirmed in Strasbourg on June 15, 2006). It was approved by the local ethical committee of the Vologda State Academy of Dairy Farming. N. V. Vereshchagin (Minutes No. 12 of December 2, 2016), the Local Ethics Committee of the All-Russian Research Institute of Physiology, Biochemistry and Livestock (Minutes No. 11 of December 5, 2016) and the Local Ethics Committee of the Russian State Social University (Minutes ¹16 of December 7, 2016).

The study was performed on piglets of optimal functional status of the large white breed: for 38 newborns, 35 dairy feeds, 37 dairy-plant feeds and 32 plant feeds. All animals taken in the study were obtained from completely healthy sows with 2-3 farrow.

Taken from the piglets taken, blood was taken from the tail vein. Then, the traditional method was used to wash and resuspend platelets with an assessment of the concentrations of acyl hydroperoxides and malonic dialdehyde in them, using the thiobarbituric acid reduction reaction[17].

The observed animals in intact and thrombin-activated platelets determined the content of actin and myosin, as well as the level of ADP and the severity of its secretion[18]. All obtained digital results of the study were processed by applying Student's criterion.

RESULTS

During the first year of life in pigs, a gradual weakening of peroxidation processes in platelets was observed. This was indicated by a gradual decrease in the concentration in the platelets of pigletsacylhydroperoxides (total 22.9%) and malondialdehyde (total 38.6%).

The amount of actin in intact platelets in newborn piglets averaged 26.2 ± 0.10% of the total protein in the platelet. At an older age, it gradually grew, reaching by the end of the first year of life 34.1 ± 0.10% of the total protein in the platelet (Table 1). The intensity of additional education of actin on the background of platelet aggregation under the influence of a strong inducer during the first year of life in the observed piglets also gradually grew by a total of 17.8%.

In the first phase of ontogenesis, the level of myosin in piglets intact platelets was also low, accounting for 10.9 ± 0.09% of the total protein content in the platelet, reaching 18.3±0.09% of the total protein content of the platelet by 12 months. In the conditions of development of platelet aggregation in response to a strong inducer in piglets during all four phases of early ontogenesis, a gradual increase in this indicator in the amount of 12.6% was observed.

In the blood plates of piglets, the content of ADP gradually increased during the first year of life. So, during the phase of colostrum nutrition, this indicator was the smallest in animals, then gradually increased in total by 29.4%. This was accompanied by their increased activity of its

Table 1. Indicators of platelets in piglets during early ontogenesis

Parameters	Newborn phase, n=38, M±m	Milk phase, n=35, M±m	Milk and vegetable nutrition phase, n=37, M ± m	Phase of plant nutrition, n=32, M±m
Acyl hydroperoxide platelets, $D_{233}/10^9$ platelets	2.31±0.011	2.17±0.007	2.02±0.011 p<0.05	1.88±0.009 p<0.01
Malonicdialdehydeplatelets, nmol/10^9platelets	0.61±0.011	0.57±0.009	0.52±0.011 p<0.05	0.44±0.009 p<0.01
The content of actin in intact platelets, % of the total protein content in the platelet	26.2±0.10	27.5±0.09	29.8±0.12 p<0.05	34.1±0.10 p<0.01
The content of actin in platelets on the background of thrombin-aggregation,% of the total protein content in platelet	60.2±0.11	61.5±0.12	65.2±0.13 p<0.05	70.9±0.12 p<0.01
The content of myosin in intact platelets, % of the total protein content in the platelet	10.9±0.09	11.9±0.09	14.5±0.10 p<0.05	18.3±0.09 p<0.01
The content of myosin in platelets on the background of thrombin-aggregation,% of the total protein content in platelet	70.6±0.08	72.4±0.10	74.9±0.14 p<0.05	79.5±0.13 p<0.01
The content of ADP in platelets, mmol/10^9 platelets	3.06±0.07	3.23±0.09	3.52±0.07 p<0.05	3.96±0.08 p<0.01
The degree of secretion of ADP from platelets on the background of stimulation,%	32.9±0.11	37.7±0.09	43.0±0.10 p<0.05	50.4±0.15 p<0.01

Legend: p - the reliability of the dynamics of the indicators taken into account relative to the level of the neonatal phase

secretion (by 53.2%) in response to the stimulation of platelets by a strong inducer of their aggregation.

DISCUSSION

Given the high biological significance of the platelet hemostasis system and especially their secretory activity, there is still a high relevance for continuing the accumulation of knowledge in physiology[19]. Of great importance for practice is the study of the ontogenetic dynamics of the secretory properties of platelets in productive animals and especially pigs[20]. They are the most important strategic source of meat products in many countries of the world. In view of the fact that their main productive qualities are formed in early ontogenesis, it is of great interest to study the parameters of platelet secretion, which can affect the metabolism in various tissues[21,22].

The level of secretory features of piglet platelets is largely ensured by the growth of the basal amount of actin and myosin in platelets and the intensification of self-assembly of their molecules under conditions of platelet aggregation in response to the inductor in the environment[23,24].

The increased enhancement of platelet secretion in piglets of early ontogenesis, apparently, was caused by increased activity of the actin-myosin complex and an increase in the accumulation of adenosine phosphates in platelet granules[25]. This process was facilitated by the weakening with age in piglets of the first year of life processes of lipid peroxidation in the structures of platelets. In addition, the peroxidation activity, which decreases as the age increases, apparently, provides for the accumulation in platelets of active G-proteins that transmit the signal from the receptor to the inside of the cell[26,27]. The situation developing in the observed piglets contributed to an increase in the activity of a very functionally significant hemostatic mechanism of platelets - secretion[28,29]. An increase in the activity of the secretory process in their platelets may indicate improvement in piglets of the mechanisms of primary hemostasis

with age, which ensures a high degree of adaptation of their organism to the conditions of existence during the first year of life[30].

CONCLUSION

In piglets during the first year of life, there is an increase in the secretory activity of their platelets. Important mechanisms that ensure its activation should be considered an increase in the number of actin and myosin in platelets with age and the intensification of their self-assembly under the influence of physiological stimulating effects on platelets. The growth of platelet secretion activity in piglets in early ontogenesis is also ensured by an increase in the number of ADP in their dense platelet granules and an increase in their release rate against the background of platelet activation by the inducer of the aggregation process.

REFERENCES

1. Belozerova, T.B. and Agronina, N.I. Independent Quality Estimation of Social Services: Rendering to Patients and Invalids. *Prensa Med Argent*, **103** : 4 (2017) doi: 10.4172/lpma.1000255
2. Agronina, N.I. and Belozerova, T.B. Rendering Social Services Assessment by Social Service Organizations in Belgorod and Kursk Regions in Russia. *Prensa Med Argent*, **103** : 4 (2017) doi: 10.4172/lpma.1000256
3. Bikbulatova, A.A. and Andreeva, E.G. Dynamics of Platelet Activity in 5-6-Year Old Children with Scoliosis Against the Background of Daily Medicinal-Prophylactic Clothes' Wearing for Half A Year. *Biomed Pharmacol J*,**10(3)** (2017). http://biomedpharmajournal.org/?p=16546
4. Medvedev, I.N. Vascular-platelet interaction in pregnant cows. *Bulg. J. Agric. Sci*,**23(2)**:310-314 (2017)
5. Belozerova, T.B. and Agronina, N.I. The Development of the Social Service System in Russia. *Prensa Med Argent*, **103** : 4 (2017). doi: 10.4172/lpma.1000257
6. Bikbulatova, A.A. Dynamics of Locomotor Apparatus' Indices of Preschoolers with Scoliosis of I-II Degree Against the Background of Medicinal Physical Training. *Biomed Pharmacol J*,**10(3)** (2017) http://biomedpharmajournal.org/?p=16762
7. Sizov, A.A. Investigation mistakes in investigation of crimes of foreign citizens, committed in the territory of Russia. *Biosciences Biotechnology Research Asia*, **12(1)**. http://www.biotech-asia.org/?p=5452> (2015)
8. Maksimov, V.I., Parakhnevich, A.V., Parakhnevich, A.À., Glagoleva, T.I. and Kutafina, N.V. Rheological Properties of Erythrocytes of Healthy Piglets during the Transition from Dairy to Vegetable Nutrition. *Annual Research & Review in Biology*, **16(4)** : 1-7 (2017) doi: 10.9734/ARRB/2017/35865
9. Maksimov, V.I., Parakhnevich, A.V., Parakhnevich, A.À., Glagoleva, T.I. and Kutafina, N.V. Erythrocytes' Microrheological Features of Piglets during the Phase of Dairy-vegetable Nutrition after Damage or Common Supercooling. *Annual Research & Review in Biology*, **16(3)** : 1-8 (2017) doi: 10.9734/ARRB/2017/35864
10. Maksimov, V.I., Parakhnevich, A.V., Parakhnevich A.À., Glagoleva, T.I. and Kutafina, N.V. Physiological Reaction of Erythrocytes' Micro Rheological Peculiarities in Milk Fed Piglets after the Negative Impact of the Environment. *Annual Research & Review in Biology*,**17(1)**: 1-8 (2017) doi: 10.9734/ARRB/2017/35867
11. Maksimov, V.I., Parakhnevich, A.V., Parakhnevich, A.À., Glagoleva, T.I. and Kutafina, N.V. Rheological Properties of Erythrocytes of Healthy Piglets during the Transition from Dairy to Vegetable Nutrition. *Annual Research & Review in Biology*, **16(4)** : 1-7 (2017) doi: 10.9734/ARRB/2017/35865
12. Medvedev, I.N. Correction of primary hemostasis in patients suffering from arterial hypertension with metabolic syndrome. *Klinicheskaiameditsina*, **85(3)**: 29-33 (2007)
13. Medvedev, I.N. and Danilenko, O.A. Complex correction of vascular hemostasis in patients with arterial hypertension, metabolic syndrome, and recent ocular vessel occlusion. *Russian Journal of Cardiology*, **4** : 15-19 (2010)
14. Oshurkova, Ju.L. andGlagoleva, T.I.Physiological Activity of Platelet Aggregation in Calves of Vegetable Feeding. *Biomedical & Pharmacology Journal*,**10(3)** : 1395-1400 (2017)
15. Kutafina, N.V. Platelet Parameters of Holstein Newborn Calves. *Annual Research & Review in Biology*, **15(2)** : 1-8 (2017) doi: 10.9734/ARRB/2017/35214
16. Maksimov, V.I., Parakhnevich, A.V., Parakhnevich, A.À., Glagoleva, T.I. and Kutafina, N.V. Erythrocytes' Microrheological Features of Piglets during the Phase of Dairy-vegetable Nutrition after Damage or Common Supercooling. *Annual Research & Review in Biology*, **16(3)** : 1-8 (2017) doi: 10.9734/ARRB/2017/35864
17. Volchegorskij IA, Dolgushin II, Kolesnikov

OL, CejlikmanVJe. Experimental modeling and laboratory assessment of adaptive reactions of the organism. Cheljabinsk, 2000:167.

18. Ermolaeva, T.A. The program for the differential diagnosis of thrombocytopathy. *Hematology and Transfusiology*, **42(4)** : 33-36. (1997)
19. Medvedev, I.N. Platelet functional activity in clinically healthy elderly. *Advances in gerontology*, **29(4)** : 633-638 (2016)
20. Maksimov, V.I., Parakhnevich, A.V., Parakhnevich A.À., Glagoleva, T.I. and Kutafina, N.V. Physiological Reaction of Erythrocytes' Micro Rheological Peculiarities in Milk Fed Piglets after the Negative Impact of the Environment. *Annual Research & Review in Biology*,**17(1)**: 1-8 (2017) doi: 10.9734/ARRB/2017/35867
21. Vorobyeva, NV. Physiological Reaction of Erythrocytes' Microrheological Properties on Hypodynamia in Persons of the Second Mature Age. *Annual Research & Review in Biology*,**20(2)** : 1-9 (2017)doi: 10.9734/ARRB/2017/37718
22. Medvedev, I.N. Neuropsychologicalchanges in cognitive function during the transition of the elderly in old. *Advances in gerontology*, **28(3)**: 479-483 (2015)
23. Bikbulatova, A.A., Andreeva, E.G. and Medvedev, I.N. Platelets' Functional Peculiarities in Persons of the Second Mature Age with Spinal Column Osteochondrosis of the Second Degree. *Annual Research & Review in Biology*, **21(1)** : 1-9 (2017) doi: 10.9734/ARRB/2017/37795
24. Medvedev, I.N. The Impact of Durable and Regular Training in Handto-hand Fighting Section on Aggregative Platelet Activity of Persons at the First Mature Age. *Annual Research & Review in Biology*, **15(2)** : 1-6 (2017) doi: 10.9734/ARRB/2017/35048
25. Medvedev, I.N. Physiological Dynamics of Platelets' Activity in Aged Rats. Annual Research & Review in Biology, **18(2)** : 1-6 (2017) doi: 10.9734/ARRB/2017/36821
26. Mikhaylova, I.V. and Makhov, A.S. Introducing chess education in Russian school system: Theoretical and practical aspects. *Teoriya i PraktikaFizicheskoyKultury*, **5** : 53-55. (2018)
27. Medvedev, I.N. and Skoryatina, I.A. Erythrocyte aggregation in patients with arterial hypertension and dyslipidemia treated with pravastatin. *Klinicheskaiameditsina*, 92(11) :34-38. (2014)
28. Mikhaylova, I.V., Makhov, A.S., Seselkin, A.I. and Alifirov, A.I. Chess in Russian inclusive education system: Problems and prospects. *Teoriya i PraktikaFizicheskoyKultury*, **3** : 97-99. (2018)
29. Medvedev, I.N. and Skoryatina, I.A. Pravastatin in correction of vessel wall antiplatelet control over the blood cells in patients with arterial hypertension and dyslipidemia. *Cardiovascular therary and prevention*, **13(6)** :18-22. (2014)
30. Oshurkova, Ju.L., Medvedev, I.N. and Fomina, L.L. Platelets' Aggregative Properties of Ireshire Calves in the Phase of Dairy-vegetable Nutrition. *Annual Research & Review in Biology*, **16(4)** : 1-6 (2017) doi: 10.9734/ARRB/2017/35868