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The Severity of the Disaggregation Function of Blood Vessels in Piglets of Plant Nutrition

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ABSTRACT

It becomes clear that to ensure homeostasis in piglets during their early ontogenesis, the functional parameters of platelets and vascular walls are of great importance. The level of their hemostatic capabilities in piglets of any age provides the level of functional readiness of primary hemostasis, the degree of perfusion of blood through tissues and the severity of anabolism in them. These circumstances give reason to believe that the severity of platelet aggregation and vascular disaggregation capabilities and their ratio during their growth and development very significantly affect the dynamics of body weight of piglets, that is, on economically important signs. In the blood of piglets during the phase of plant nutrition, the study found a decrease in peroxidation due to the strengthening of the antioxidant properties of their plasma. At the same time, at the end of early ontogeny, piglets showed low platelet activity and pronounced vascular disaggregation capabilities. The dynamics of platelet aggregation capabilities found in piglets during the phase of plant nutrition was fully compensated by changes in the severity of the disaggregation function of the walls of their vessels..

KEY WORDS: PIGLETS, EARLY ONTOGENESIS, PHASE OF PLANT NUTRITION, BLOOD VESSELS, PLATELETS, AGGREGATION, DISAGGREGATION.

INTRODUCTION

Modern pig farming is a high – tech agricultural industry can in the short term to provide the population with protein food in many countries (Maksimov et al., 2018). It provided for a large growth rate of pigs, their high fertility. For this reason, the pig is a highly profitable industry, attractive for investment. The increase in population around the world poses to agriculture the task of increasing the volume of high-quality protein products that can be achieved is largely due to additional intensification of pig production, based on introduction in practice of new knowledge on the physiology of piglets. More relevant in this regard are the data on dynamics in pigs especially hematological and hemostatic parameters in the course of their growth and development (Tkacheva and Zavalishina, 2018). A very important part of hemostasis, including in growing piglets, considered to be the walls of blood vessels and platelets (Zavalishina, 2018a; Zavalishina, 2018b).

Their hemostatic properties determined in these animals the work of the entire primary hemostasis and intensity of microcirculation in all organs (Bikbulatova, 2018a; Zavalishina, 2018c), creating conditions for anabolism output on the adult level for all parameters (Zavalishina, 2018d). Apparently, the activity of platelet aggregation

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and disaggregative influences on it of the vessels at the final stage of early ontogenesis is associated with the growth intensity of piglets, and hence affects the development of their productive parameters (Korepanova et al., 2015). However, the severity of the ability of platelets to aggregate and disaggregative capabilities of the vessel walls in healthy piglets at the end of the early ontogeny remain poorly studied. In the work goal: to consider the characteristics of platelet aggregation and disaggregative influences from the vessels in piglets during the phase of plant food.

Table 1. Indicators of primary hemostasis in piglets of plant nutrition.

Indicators	Age of piglets, n=32, M±m				
	41 days	90 days	150 days	200 days	230 days
Platelet aggregation s with ADP,	34.1 ±0.12	32.2±0.10	30.1±0.14 p<0.05	28.2±0.10 p<0.01	25.7±0.08 p<0.01
Vascular wall anti-aggregation index with ADP	1.49±0.07	1.53±0.07	1.57±0.06	1.61±0.07	1.66±0.04 p<0.05
Platelet aggregation with collagen, s	23.6±0.08	21.5±0.12	20.0±0.15 p<0.05	18.7±0.06 p<0.01	15.9±0.07 p<0.01
Collagen vascular wall anti-aggregation index	1.51±0.04	1.53±0.05	1.56±0.08	1.60±0.07	1.65±0.03 p<0.05
Platelet aggregation with thrombin, s	49.0±0.10	47.2±0.14	44.3±0.05 p<0.05	41.3±0.11 p<0.01	38.4±0.04 p<0.01
Vascular wall antiaggregation index with thrombin	1.53±0.08	1.55±0.08	1.58±0.17	1.62±0.05	1.67±0.06 p<0.05
Platelet aggregation with ristomycin, s	34.9±0.14	32.1±0.06	29.8±0.19 p<0.05	26.9±0.14 p<0.01	24.3±0.09 p<0.01
Vascular wall antiaggregation index with ristomycin	1.54±0.02	1.57±0.05	1.61±0.08	1.64±0.06	1.69±0.05 p<0.05
Platelet aggregation with H_2O_2, s	36.5±0.13	34.0±0.18	31.6±0.10 p<0.05	28.2±0.08 p<0.01	25.5±0.12 p<0.01
Vascular wall anti-aggregation activity index with H_2O_2,	1.53±0.07	1.55±0.06	1.58±0.06	1.63±0.10	1.68±0.03 p<0.05
Platelet aggregation with adrenaline, s	85.6±0.15	83.2±0.18	78.5±0.17 p<0.05	75.2±0.13 p<0.05	71.4±0.10 p<0.01
Adrenaline vascular wall anti-aggregation index	1.56±0.08	1.58±0.07	1.61±0.05	1.64±0.06	1.70±0.09 p<0.05
Platelet count in aggregates, %	8.7±0.09	9.0±0.06	9.4±0.10 p<0.05	9.8±0.05 p<0.05	11.5±0.03 p<0.01
The number of small aggregates of 2-3 platelets per 100 free-lying platelets	4.2±0.09	4.5±0.05	4.9±0.08 p<0.05	5.5±0.04 p<0.01	6.1±0.05 p<0.01
The number of medium and large aggregates of 4 or more platelets, per 100 free-lying platelets	0.26±0.05	0.28±0.03	0.31±0.05 p<0.01	0.34±0.07 p<0.01	0.37±0.03 p<0.01

MATERIAL AND METHODS

The work was carried out in accordance with the ethical standards outlined in the European Convention for the Protection of Vertebrates Used for Any Scientific Purpose. This convention was adopted in Strasbourg on March 18, 1986 and reaffirmed in Strasbourg on June 15, 2006. For the study, 32 pigs of large white breed aged plant nutrition were taken under observation. All animals were observed daily throughout the study period. They were examined using the following list of methods 5 times: at the age of 41 days, at the age of 90 days, at the age of 150 days, at the age of 200 days, and at the age of 230 days of life.The piglets taken into the work recorded blood concentrations of acyl hydroperoxides and products capable of reacting with thiobarbituric acid using a set of reagents manufactured by Agat-Med (Russia). The amount of plasma antioxidant activity was found out in the piglets taken into work (Barkagan and Momot, 2008).

Using the method of visual assessment of the development of platelet aggregation (AP) (Shitikova, 2000), a standard set of inductors was used in their standard plasma

concentration, which was previously strictly adjusted to the standard level of platelets in it. To assess the disaggregation properties of blood vessels, the value of the index of antiplatelet activity of the vascular wall was calculated. This was accomplished by dividing the value of AP in plasma, which was taken under conditions of temporary venous occlusion of a vein, by AP in plasma obtained without applying a tourniquet to a vein (Shitikova, 2000). The intensity of platelet aggregation occurring in blood in vivo was recorded using phase contrast studies (Shitikova, 2008). The data obtained in the study, processed by the standard criterion (td) of student.

RESULTS

During the age in question, piglets had a gradual decrease in the concentration of acyl hydroperoxides from 1.38±0.016 D233/1 ml to 1.23±0.019 D233/1 ml and products capable of reacting with thiobarbituric acid from 3.25±0.031 mmol/l to 2.99±0.022 μmol/l, respectively. The found changes are based on the increase in the observed plasma level of plasma protection from 36.2±0.19% to 39.8±0.11%. During the phase of plant nutrition in the examined piglets, a gradual acceleration of antibodies was recorded. Most rapidly, their AP occurred in response to the addition of collagen (table1). Slightly slower than AP occurred under the influence of ADP, ristomycin and H_2O_2. The use of thrombin and adrenaline as an inducer led to the development of their antibodies at an even later date.

During the observation period, piglets showed an increase in the values of the indices of the antiaggregatory activity of the vascular wall with respect to all applied inducers (table 1). The maximum value was the index of anti-aggregation activity of the vascular wall with adrenaline due to the most pronounced inhibition of antibodies caused by this inducer in plasma obtained from blood after application of the cuff to the vessel. Slightly lower in the observed animals was this index for H_2O_2 and ristomycin. Even lower is this indicator in terms of collagen (at the end of observation 1.65±0.03), in terms of ADP (at the end of observation 1.66±0.03) and in terms of thrombin (at the end of observation 1.67±0.06).

During the phase of plant nutrition in the blood of piglets, an increase was found in the number of aggregates having a small size by 45.2%, as well as aggregates with a medium and large size by 42.3%. During their observation, the number of platelets in the aggregates up to the level of 11.5±0.09% also increased in their blood (table 1).Thus, in piglets, the normal course of the last phase of early ontogenesis increases the power of the disaggregation effects of blood vessels on platelets, which should be considered as a serious mechanism for providing homeostasis in the whole body by ensuring the normal functioning of the primary hemostasis.

The final phase of early ontogenesis in pigs is marked by the process of steady maturation of organs with the achievement of adequate adaptation to existing conditions (Bekenev, 2012). In this period, piglets are preparing all cells for adulthood and all internal organs are strengthened (Vorobyeva et al., 2018). A blood system and its subsystem, hemostasis, are considered to be a particularly significant system that preserves the optimum functioning of the body (Zavalishina, 2018e). The work of the latter goes through several processes and implements preservation of blood flow during hemocirculation and thrombosis after vascular damage (Zavalishina, 2020a). The depression of the severity of plasma peroxidation found in the examined piglets ensured the morphological integrity of platelets, thereby limiting their activity. This is very strongly determined by the gradual production of thromboxane in their platelets. This leads to better hemocirculation in all tissues, adequate to the needs of the body at the end of early ontogenesis (Zavalishina, 2018f; Karpov et al., 2020).

The activation of the adhesive properties of platelets in animals revealed during the study during the observation period was due to an increase in the density of collagen receptors on them. The presence of amplification of this process was confirmed in piglets by the development of AP acceleration with collagen inducer (Zaitsev, 2019). Also, in piglets during the course of the observation, platelet adhesion increased, which was largely due to the intensification of the generation of von Willebrand factor molecules in the vessels, which interacts with platelets by connecting with specific platelet receptors (Zavalishina, 2018g; Solovyova et al., 2020).

Strengthening of the adhesive properties of platelets occurred in piglets along with an increase in their aggregation. An increase in the severity of the results of the interaction of platelets with strong inducers of platelet aggregation was manifested due to the stimulation of the phosphoinositol mechanism of the flow of hemostatic manifestations of platelets, the enhancement of the enzymatic properties of phospholipases and the increase in the severity of phospholation of actin and myosin in platelets (Zavalishina, 2020b). The acceleration of the onset of platelet aggregation in response to the action of weak inducers was due to the growth of glycoprotein molecules on the platelet membranes, acting as their receptors (Kiperman, 2010) and the enhancement of platelet enzymes of the thromboxane synthesis system (Zavalishina, 2018h; Krapivina and Kryazhev, 2020).

The study in piglets throughout the observation found increase disaggregative manifestation from the vessels, which was associated with the increased generation in their walls physiologic antiplatelet agents. Due to the upcoming changes of the examined animals developed a biological balance between the degree of aggregation and disaggregation process in the blood. Increase in blood of pigs during the observation of the level of substances antiplatelet agents weakened the implementation of the reception and intracellular mechanisms clumping of platelets. It had its basis in piglets of maintaining a strict ratio of output intensity in the blood of substances with proaggregant and antiplatelet properties, which is very

important for hemostasis (Bikbulatova, 2018b).

For surveillance in pigs found increased aggregation of platelets under conditions of blood flow, which was confirmed by its status in animals in vivo. It is sufficient in the blood of observed pigs were provided increased with the age of numerical values of the index antiaggregatory activity of their vessels adequate increase of platelet aggregation (Zavalishina, 2018i). Optimum of their relation proves the adequacy of the disaggregative effects of vessels on increasing with age in piglets platelet activity during hemocirculation (Zavalishina, 2018j). It is clear that it is a powerful adaptation mechanism for restricting growing pigs at the end of their growth excessive platelet activity, and ensure they have the normal flow of hemocirculation (Lazareva, 2005; Zavalishina, 2018k). Developing a clear correlation proaggregation and antiaggregation processes have observed piglets confirms that they have stability in morphological terms, the endothelial layer of the vessels engaged in the synthesis of substances, limiting activity of platelets (Momot, 2006; Zavalishina, 2018l).

CONCLUSION

A clear balance of vascular and platelet activity in mammals is considered extremely important for hemostasis. The adequacy of platelet processes in growing animals in it directly ensures the functioning of primary hemostasis and supports blood circulation in organs. There is no doubt that these processes strongly affect anabolism at the end of early ontogenesis. In the work done, in piglets at the last stage of their organism formation, a clear correlation of platelet activity and increasing level of antiaggregational properties of blood vessels was recorded. This dynamics was the basis for maintaining the optimum blood rheology in any vessels. The detected platelet activation in piglets during the observation period is fully functionally balanced by an increase in hemostatic manifestations of blood vessels. Maintaining a balance between the level of platelet activity and vascular control over it during the final stage of early ontogenesis should be considered extremely important for the normal growth of piglets to an economically preferred level.

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