Physiological and biochemical status of newborn piglets

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Abstract. The flow rate in newborn piglets of all types of metabolism strongly determines the intensity of their growth and development. At the same time, many of their normative indicators in newborn piglets in the conditions of central Russia remain not fully understood. In piglets kept in Central Russia, during the neonatal period, the level of total protein rapidly increased due to an increase in the albumin and globulin fractions. This was accompanied by an increase in their blood urea, reflecting the intensification of protein metabolism. In piglets, an increase in glucose and triglyceride levels with a decrease in cholesterol concentration was noted in the blood during the first 5 days. During the neonatal period, the observed piglets showed an increase in the activity of alkaline phosphatase and gamma-glutamyl transferase. This was accompanied by a decrease in the activity of transaminases in their blood and the stability of the functional activity of lactate dehydrogenase and creatine kinase. The detected concentrations of the metabolites taken into account and the found activity of the registered enzymes can be considered as normative for newborn piglets kept in central Russia.

1. Introduction
Maintaining optimal physiological status of a livestock of pigs – a very important point for the intensification of modern pig farming. A special place in the health of their livestock has a phase newborns [1,2]. Modern science considers this period one of the most important critical stages of individual development during which very actively implementing all of the adaptation processes in the body related to the transition to extrauterine life and the beginning of the functioning of all organs outside the mother’s body [3,4].

In newborn piglets intensively flow all kinds of metabolism [5]. This provides them with high growth rates, exceeding those in many other productive animals [6]. Important role this plays in piglets the high content in their blood mass biologically active substances, which are metabolites and bioregulators vital processes in the organism [7,8]. For this reason, the blood of newborn piglets is considered as an important object for monitoring their condition, as by registering the concentration of the contained substances may accurately assess the current status of the animal and predict its future dynamics.

Assessment of the impact of adverse environmental factors on the organism of farm animals including piglets is considered as one of the fundamental questions of modern practical physiology [9]. For this reason it is important to further accumulation of information on physiological and biochemical parameters of piglets at the beginning of their ontogeny. Knowledge of their characteristics can help to
better understand the conditions necessary for the successful flow of processes of life support, growth and development of the body until they reach the economic level required. The aim of the study was to evaluate physiological and biochemical characteristics of blood of piglets during their neonatal phase under standard conditions pigsty, located in Central Russia.

2. Materials and methods
The work was carried out in full accordance with generally accepted ethical standards for the treatment of vertebrate animals during scientific research. The study was conducted in the conditions of the Russian pig complex on the basis of Vladimirskoye pig farm of the Ryazan region. For the study, a group of completely healthy newborn piglets of a large white breed with a total of 31 heads was formed. The processes of feeding and keeping piglets were carried out standardly according to generally accepted technologies.

All piglets were evaluated indicators of physiological and biochemical status during the neonatal phase from the first day of life to the fifth day of life. Blood for the study was taken from the pigs from the tail vein in all cases in the morning. Their blood was determined by the content of total protein, albumin, urea, cholesterol, triglycerides, glucose, as well as the enzymatic activity of aspartate aminotransferase, gamma-glutamyl transferase, alanine aminotransferase, alkaline phosphatase, lactate dehydrogenase and creatine kinase [10] by conventional methods.

The obtained digital values were processed by the method of variation statistics. Assessment of the reliability of differences of the considered indicators was carried out using the student criterion. Significance of differences in indicators was recorded at p<0.05.

3. Study results and discussion
The dynamics of the physiological development of piglets is manifested in adequate changes in the level of metabolites and the activity of many enzymes, ensuring their active growth, development and progressive process of functional maturation of all organs. In the course of the study, they revealed significant changes in the quantitative blood levels of piglets of metabolites of various types of metabolism and the dynamics of the activity of a number of enzymes (Table 1).

| Parameters                  | Age of piglets (day of life), M±m |
|-----------------------------|-----------------------------------|
| Total protein, g/l          | 60.0±0.36 62.3±0.30 63.5±0.28 65.2±0.37* 69.9±0.39** |
| Albumins, g/l               | 29.6±0.24 31.7±0.35 32.2±0.29* 33.4±0.27* 33.9±0.36* |
| Urea, mmol/l                | 2.52±0.47 2.57±0.24 2.62±0.33 2.67±0.28 2.92±0.25* |
| Alkaline phosphatase, ncat/l| 11512.7±2.33 12503.6±2.48* 12712.4±2.54* 12923.0±2.26* 13265.7±2.05** |
| Cholesterol, mmol/l         | 3.62±0.31 3.12±0.17* 2.88±0.42** 2.77±0.51** 2.65±0.44** |
| Triglycerides mmol/l        | 0.18±0.05 0.22±0.06** 0.26±0.03** 0.27±0.04** 0.29±0.05** |
| Glucose, mmol/l             | 3.3±0.20 3.5±0.18 3.8±0.22* 4.1±0.23** 4.3±0.26** |
It was revealed that in the blood of newborn piglets at the daily age, the level of total protein is low and amounts to 60.0±0.36 g/l. Subsequently, with each day of life, its amount in the blood of animals gradually increased and by the end of the phase of colostrum nutrition a total increase of 16.5% (p<0.01). The increase in the level of total protein in the blood of piglets during the first 5 days of life should be associated, first of all, with the intensive absorption of immunoglobulins from their stomach and intestines coming from sows colostrum. Moreover, in newborn piglets on the first day of ontogenesis, the concentration of albumin in the blood was 29.6 ± 0.24 g/l, gradually increasing in the subsequent follow-up. In total, its growth during the observation period was 14.5% (p<0.05).

The amount of urea in the blood of newborn piglets in the daily age reached 2.52 ± 0.47 mmol/l. Subsequently, its level in the blood of piglets increased by the end of the observation to 2.92±0.25 mmol/l. The increase in this metabolite by 15.9% indicated an increase in their protein metabolism at this age.

In the course of the study of newborn piglets has also increased carbohydrate metabolism. This was noted a statistically significant increase of glucose in their blood, in total amounting to 30.3%.

Have observed in the study, piglets were marked by the dynamics of physiological and biochemical parameters of lipid metabolism, reflecting the changes during the earliest life stage of the animals (table 1). The amount of cholesterol in the blood of piglets at birth was the highest and amounted to 3,62±0.31 mmol/l In subsequent periods of observation the level of cholesterol in their blood gradually decreased and by the end of observation inferior to 38.2% (p<0.01) level in the daily age.

In blood of the examined piglets minimum values of triglycerides noted in the daily age (0.18±0.05 mmol/l). Then with each day life, their concentration gradually increased (a total of 61.1%) and a five-day age was 0.29±0.05 mmol/l (p<0.01). The dynamics of the oppressed in lipid metabolism reflect the beginning of intense fat metabolism, which is essential to ensure the conditions for growth and development of animals [11,12].

An assessment of the physiological and biochemical characteristics of the activity of blood enzymes in piglets during the neonatal phase revealed their regular biological dynamics (Table 1).

By the end of the neonatal phase, the activity of alkaline phosphatase increased in the blood of piglets. A statistically significant increase in the activity of this enzyme by 15.2% was observed in comparison with the first days of animal life (p<0.01). A gradual increase in alkaline phosphatase activity in the blood of newborn piglets confirmed their activation of carbohydrate metabolism [13,14]. The ongoing
increase in the carbohydrate component of metabolism should be considered very significant for the maturation of mechanisms in the immune system [15]. In this regard, it can be assumed that the onset of the development of the immune system in piglets after birth is manifested by a moderate increase in the activity of this enzyme in their blood [16,17].

The level of activity of the enzymes alanine aminotransferase and aspartateaminotransferase in the first days of life in newborn piglets was the highest and accounted for 289.7±1.12 ncat/l and 1017.2±3.12 ncat/l, respectively. To the second day, their level decreased by 11.3% (p<0.05) and 2.5%, respectively. During the entire follow-up transaminase activity in the blood of the animals gradually decreased. Compared to the first day of life, their levels in total decreased by 31.4% and 12.6%, respectively. The decrease of transaminases and increase in the concentration of total protein in the blood of piglets during the neonatal should be associated with the logical reinforcement they velocimetery mechanisms of the liver and establish a clear balance of the processes of transamination and deamination [18,19]. It is known that the dynamics of the functional properties of transaminases is always connected with processes of growth and development of the organism as a whole and especially its muscular system [20,21]. This gives grounds to consider them as important markers of the dynamics of the development of the meat productivity of calves of all farm animals [22,23].

The activity of lactate dehydrogenase in the blood of newborn piglets on the first day of life was quite high – 26.2±0.16 ncat/l and remained subsequently stable until the end of the observation. The severity levels of creatine kinase in the blood of newborn piglets has varied slightly and by the end of observation was 2621.3±2.52 ncat/l observed in a study of newborn piglets on the first day of life the activity of gamma-glutamyltransferase was of 301.2±0.91 ncat/l. Then its level gradually increased to a five-day age increased by 26.2%(p<0.01), reaching the level of 381.6±0.68 ncat/l. peculiarities of enzymatic activity in the examined piglets should be associated with the development of their processes of adaptation [24,25], caused by changes in genetic expression and changes in this background protein synthesis in the liver, muscle, and bone marrow [26].

4. Conclusion
The beginning of the early ontogeny in piglets is associated with a lot of adaptive changes in their body, reflected in the current phase of the newborn at the level of different indices of blood. In this regard, pigs are extremely important to monitor parameters of protein, fat and carbohydrate metabolism with the enzymes it implementing them with the first days of life. They can quickly assess the General physiological and biochemical status of animals and to conduct timely preventive and therapeutic measures. Found in the current study, the changes of the parameters of the main types of metabolism and key enzymes in piglets reflect their current optimal physical status and can be considered as normative for further researches in farms of Central Russia. The preservation of health in piglets during the study and in the subsequent month after it gives a good reason for this.

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