Physiological characteristics of cattle of different ages

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Abstract. A major role in the normal course of ontogenesis of agricultural animals play age-related changes is highly variable hematological parameters. Even in one household from healthy cattle they can have very wide variations. Especially great practical significance have a total blood protein and its fractions, activity of the system-oxidation and indicators of natural resistance. In the work conducted and the parameters of protein metabolism in cows of three and five years of age were comparable, the globulins in the blood there were a few more, and the albumin was slightly less. Level antioxiiditnoe activity of blood in adult cows with increased age, thus ensuring they have a decrease in the blood between three and five years of life the number of products of peroxidation. In the blood of the examined cows with age increased levels of lysozyme and seromukoidov and decreased the number of circulating immune complexes. In calves between 5 days and 1.5-month age there was increase of total protein and its fractions. This was accompanied by increased antioxidant activity in their blood with a decrease in the level of diene conjugates and malonic dialdehyde. With increasing age of calves lysozyme activity of blood decreased a little in the stability of the concentration of seromukoidov and the increase in the number of circulating immune complexes. The obtained data can be regarded as normative for further research on cattle kept under the conditions of Central Russia.

1. Introduction
Physiological well-being of agricultural animals during ontogeny is a biological basis for the development of their productive qualities [1,2]. A major role in the normal development of their morphological and physiological characteristics play many age-related changes of hematological parameters [3,4]. They are an important marker of the dynamics of the functional regulation of the organism and reflect the overall biological stability of the animal to adverse effects [5,6].

Blood is a liquid connective tissue and is a very complex cocktail of products synthesized by various cells throughout the body [7]. For this reason for its composition, it is possible to evaluate many aspects of the functioning of animals at any age, in any functional status and any environmental conditions [8,9]. It is very important to track the changes of the General condition of farm animals, monitoring of the main hematological parameters [10].

The efficiency of formation of the productive characteristics of the productive animals is associated with many parameters in the blood and in particular with their state of immune reactivity, as well as the level of lipid peroxidation and their antioxidant system [11]. Comes the understanding that the record normal values need to every specific sector, since the concept of "norm" in their relationship is very movable and is connected with many factors: the breed of animal, level of feeding, age, their current
physiological state, and especially with the conditions of the farms where there are animals and a mass of uncontrolled, but is able to change factors [12,13].

The study in terms of each household age dynamics of indicators of immune reactivity and prooxidant-antioxidant systems in cattle is highly relevant in view of the possibility of using the rules to draw conclusions about the state of health of each calf or cow [14]. The regular dynamic monitoring of these indicators can provide effective monitoring of the health of animals and to track them and risk the possibility of disease or diagnose its presence [15].

In modern animal husbandry it is important to conduct regularly scheduled diagnostic procedures with prophylactic and therapeutic purposes, aimed at creating a healthy productive animals and a sharp reduction in the frequency of various diseases [16]. Monitoring of hematologic parameters will allow you to monitor the status of all the internal organs of young and adult animals, giving the opportunity to take timely measures for their rehabilitation [17].

These measures are very relevant for livestock breeding, where long-term repair heifers, as a rule, use 2-3, maximum 4 lactations, and then are rejected due to the previously latent pathology that was not detected early [18]. In this regard, the creation of a database of normative hematological indicators of an immune nature and a peroxidation-antioxidation system for various regions is relevant. If there are standards for different regions, it will be possible to quickly comprehensively evaluate the metabolic processes in the animals observed, the level of resistance, and generally judge the effectiveness of measures taken on the farm for specific and non-specific prevention among cattle of any age.

Objective: to comprehensively assess the health status of cattle at different ages in the conditions of central Russia.

2. Materials and methods
The study was conducted in full compliance with accepted ethical standards studies on vertebrates. To assess the physiological characteristics of a number of hematological parameters in cattle at a private farm in Central Russia, a survey of healthy calves and cows of black-motley breed. The study was conducted on the basis of the company “Kolos” located in the Kursk region of Russia. Animals placed under observation, was kept in pre-cleaned, washed and disinfected the premises. To conduct the study under observation taken on 22 lactating cows three years of age with average milk yields, 21 lactating cow five years of age also had average milk yields and calves (n=26) a five-day age and calves (n=24) 1.5-month of age.

The blood of calves and cows were taken from the jugular vein in the morning. Before taking the blood the future site of the puncture pre-cut and disinfected with 70% alcohol solution, and then pierced a vein at a right angle with a sterile injection needle. Assessment of the health status of the animals was realized by taking into account the content of blood total protein by refractometric method, albumin by reaction with bromocresol green, the level of activity of lysozyme turbidimetric, number of circulating immune complexes, the average molecular weight, the concentration of seromukoidov, products of the process of lipid peroxidation – diene conjugates and malonic dialdehyde and the level of the antioxidant activity of plasma [19]. Obtained digital data were processed using t-student criterion.

3. Research results and discussion
To assess the health of cows (table 1) and calves (table 2), a number of physiological and biochemical blood parameters were recorded on farm conditions.

| Table 1. Levels of indicators in the examined cows. |
|-----------------------------------------------------|
| Blood counts | Physiological norms for cows | Survey results |
|--------------|-----------------------------|----------------|
|              |                             | Three year old cows, n=22, M±m | Five year old cows, n=21, M±m |
| Total protein, g/l | 71.0–85.0                   | Lim 65.0–81.0, 74.2±2.52       | Lim 67.0–80.0, 71.2±1.36 |
| Albumin, %   | 37.0–50.0                   | Lim 33.0–42.0                   | Lim 20.0–30.0 |


or this reason, for each climate zone, it is possible that for the technology of keeping animals in this farm [20].

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As a result of the work performed in the farm where the study was conducted, the following levels of physiological and biochemical parameters were established in cows. The parameters of protein metabolism in three-year-old cows were within the normal range and averaged 71.2±1.36 g/l, albumin 36.2±2.15, and the level of globulins - 45.1±1.82%. Evaluation of similar indicators in five-year-old animals also revealed a normal, but slightly different content in their blood of total protein (71.2±1.36 g/l) and globulins (45.1±1.82%) with a lower content in it albumin (25.2±1.06%), which indicated some dynamics of protein metabolism in cattle with age.

The parameters of hematological homeostasis in cows, including levels of diene conjugates, malondialdehyde, circulating immune complexes, seromucoid, antioxidant and lysozyme activity, have very controversial norms for blood. For this reason, for each climate zone, it is possible that for the conditions of each economy it is advisable to develop standard values for these indicators.

It becomes clear that even in one farm cows have fluctuations in blood counts as they are used economically. At the same time, the scatter of indicators in animals of the same age was not associated with the influence of economic conditions on animals — they are often comparable, but with individual characteristics of cows that are not dependent on the technology of keeping animals in this farm [20]. We can assume that in cows of both age groups, these indicators are biologically very important for the formation of the general resistance of the body and are strongly associated with the work of their liver [21]. If the content of globulins in three-year-old animals is kept close to the lower limit of the norm, then in five-year-old cows they become larger in their blood, indicating an increase in their general resistance both naturally and through routine vaccinations, especially with the help of targeted vaccines of corrective effect [22]. The differences in the levels of lipid peroxidation products - diene conjugates and malondialdehyde in cows of three and five years revealed in the work indicated functional maturation of the antioxidant system in them. This facilitated the process of functioning of the entire immune system with their age, activating the protective forces of their body, and allowed cows with age to have a slightly lower level of circulating immune complexes, apparently due to the strengthening of their cellular immunity [23].

### Table 2. Levels of indicators in the examined calves.

| Blood counts          | Physiological norms for calves | Survey results |
|-----------------------|-------------------------------|---------------|
|                       | 5 day old calves, n=26, M±m   | 1.5 month old calves, n=24, M±m |
| Total protein, g/l    | Newborns 35.0–50.0             | Lim 45.0–62.0 | Lim 66.3–83.0 |
|                       | Older 55.0–70.0                | 54.3±1.51     | 71.5±1.32**   |
| Albumin, %            | 40.0–60.0                      | Lim 20.0–30.0 | Lim 22.0–36.0 |

Symbols of significance of differences: * p <0.05, ** p <0.01. In the following table, the notation is similar.
In calves at 1.5 months of age, there was an increase in the level of total protein in the blood to 71.5±1.32 g/l with a normal level of basic protein fractions. In calves of five days old, the level of total protein was lower, but was within the boundaries of the generally accepted norm and was 54.3±1.51 g/l, with an albumin content of 25.2±0.85 g/l, which was their normal value.

The content of diene conjugates in calves of five days of age was 2.80±0.65 μmol/l, and in 1.5-month-olds - 2.41 ± 0.42 μmol/l, i.e. the difference was 16.2% (p <0.05). In calves at the age of five days, the level of malondialdehyde was 0.52±0.27 μmol/ml, i.e. the difference was 16.2% (p <0.05). In animals of 1.5 months of age the level of malondialdehyde was 2.41±0.42* μmol/ml, and in 1.5 month olds - 2.80±0.65 μmol/l, which significantly differs by 28.7% due to the strengthening of this indicator with age up to 79.9±0.87% (p<0.01).

The lysozyme activity of five day-old calves was higher than that of 1.5 month olds - 48.2±0.68 μg/ml. The level of circulating immune complexes in calves of 5 days of age was 0.16±0.005**, while in calves of five days of age (p<0.01).

It becomes clear that during the transition from five days to 1.5 months of age, calves tend to increase the level of total protein in the blood, which occurs against the background of maintaining a normal level and balance of protein fractions. At the same time, the rate of antioxidant activity increased by 28.7% with increasing age, largely due to increased synthesis of proteins with antioxidant properties.

The lysozyme activity of five-day-old calves was higher than that of 1.5-month-old calves, which indicated a pronounced activation of nonspecific antibacterial blood function at birth. Moreover, the content of circulating immune complexes in calves, on the contrary, increased with age (p <0.01), which, obviously, is associated with the realization of colostral immunity in them. Their initially low immune reactivity is enhanced in calves due to their consumption of a sufficient amount of high-quality colostrum in the first day of life [24]. The importance of this process is due to the fact that the synthesis of their own immunoglobulins in calves slowly begins from 5-7 days of life, and therefore the resistance of the calves for a long time remains not high and strongly depends on the correctness of drinking colostrum [25, 26].

After analyzing table 2, we can say that in calves, the level of lipid peroxidation products - diene conjugates and malondialdehyde significantly decreases with age. This is due to the age-related increase in antioxidant defense of their body. This occurs simultaneously with the activation of their specific immune defense, and for this reason, lysozyme activity in calves by the age of 1.5 months begins to weaken due to the development of a balance in their mechanisms that implement the antibacterial function of the blood [27]. Apparently, with age, the level of resistance in calves increases due to the
overlap of protection factors that came with colostrum and the gradual increase in the synthesis of their own immunoglobulins.

4. Conclusion
Ontogenesis of cattle is associated with age-related changes in many functional parameters of the animal organism. Of great importance in this is protein metabolism and immunological resistance parameters. It becomes clear that their dynamics may vary under different conditions of detention. In the study, we obtained indicators of protein metabolism and immunological reactivity in healthy cattle - young animals and lactating cows kept in Central Russia. The data obtained can be considered as normative for the parameters taken into account and can be taken into account in the course of further studies on cattle kept in the middle zone of Russia.

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