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Effect of Bio-Preparation on Physiological Status of Dry Cows

Olga Gorelik, Maksim Rebezov, Artem Gorelik, Svetlana Harlap, Irina Dolmatova, Tatiana Zaitseva, Nikolai Maksimuk, Natalya Fedoseeva, Natalya Novikova

Abstract*: The physiological maturity of newborn animals depends on the physiological and biochemical status of mother cows during the dry period. Any abnormality of this status initiates the appearance of disturbances in the mother-fetus functional system, affecting the harmonious development of the fetus in the last trimester of pregnancy. Therefore, adapting the vital processes in the body of dry cows can increase the viability of newborn calves, which is important. The aim of the research is to study the possibility of correcting the physiological state of the cows by using of the biotechnological preparation Albit-Bio. As a result of the study the natural resistance factors in animals during the research period, it was found that cows of the experimental group additionally fed with "Albit-Bio" were characterized by the best indicators of cellular protection factors compared with control group of cows. Particularly, the blood phagocytic activity was higher by 37.50%, (P≤0.05) and, the phagocytic index was higher by 51.37, (P≤0.05) and the phagocytic number - by 5.42%, which indicated a more pronounced aggressiveness of neutrophils. After calving, the animals of this group were characterized by a good neutrophil digesting ability.

Index Terms*: dry cows, biotechnological preparation Albit-Bio, physiological status, blood, natural resistance.

I. INTRODUCTION

The main goal of the development of dairy farming is to increase the livestock productivity at the lowest economic cost. However, with an increase of cow productivity level, the metabolic processes, reproductive function, natural resistance and immunological reactivity are decreased [1-3].

The biochemical status, including the age, breed, physiological and sex differences of cattle has been studied by many Russian and foreign scientists [4-7]. The composition and properties of peripheral blood remain more or less constant under the normal physiological condition of the animal. However, even minor changes in the functioning of organs and body systems inevitably lead to some changes in the morphological and biochemical composition of the blood [8–9].

High animal productivity is associated with the intensive metabolism which required intake in strictly defined quantities and in the optimal state of all nutrients into the body.

Nutrients deficiency and excess has a great effect to such a labile system as blood. Blood is the medium through which the tissues of the body receive from the external environment all the substances necessary for their vital activity. With the participation of blood, the metabolic waste products is removed from the cells [3,5,10].

It is known that the physiological maturity of newborn animals depends on the physiological and biochemical status of cows during the dry period. The change of the status originates the appearance of disturbances in the functional mother-fetus system, affecting the harmonious development of the fetus in the last trimester of pregnancy. Therefore, adjusting the life processes in the body of dry cows can increase the viability of newborn calves [9-16].

An important achievement of biology and, in particular, physiology for improving the life processes in animals is using of various biologically active substances. Biologically active substances in the diet of animals can increase the body's defenses, adjust metabolic processes and biotechnological parameters [16-24]. In this regard, the problem of finding new methods for correcting the physiological and biochemical state of calves in the early stages of postnatal ontogenesis is a prerequisite for increasing the viability of the body and future productivity. The scientific justification of using of "Albit-Bio" preparation for normalizing the morphophysiological, biochemical indicators in the body of dry cows is a relevant research topic.

The aim of the research is to study the possibility of correcting the physiological state of the cows with the help of the biotechnological preparation "Albit-Bio".

II. MATERIALS AND METHODS

For carrying out the experimental studies two groups of dry cows were formed according to the method of balanced groups, with due consideration of age, body weight, breed, gestational age, productivity for the second lactation. The first group of cows (control group, n=60 cows) were fed with general ration The cows of II group (experimental, n = 60 cows) at the beginning of the dry period for 5 days were fed with concentrated feed with biotechnological additive "Albit-Bio" in the amount of 40 ml per cow.

The samples of blood were taken from the jugular vein in cows during the beginning of the dry period and after calving.

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Olga Gorelik, Ural State Agrarian University, Yekaterinburg, Russia

Maksim Rebezov, Ural State Agrarian University, Yekaterinburg, Russia; South Ural State University (national research university), Chelyabinsk, Russia; V.M. The Gorbatov Federal Research Center for Food Systems of the Russian Academy of Sciences, Moscow, Russia

Artem Gorelik, Ural State Agrarian University, Yekaterinburg, Russia

Svetlana Harlap, Ural State Agrarian University, Yekaterinburg, Russia

Irina Dolmatova, Nosov Magnitogorsk State Technical University, Magnitogorsk, Russia

Tatiana Zaitseva, Nosov Magnitogorsk State Technical University, Magnitogorsk, Russia

Nikolai Maksimuk, Yaroslav-the-Wise Novgorod State University, Veliky Novgorod, Russia

Natalya Fedoseeva, Russian State Agrarian Correspondence University, Balashikha, Russia

Natalya Novikova, Russian State Agrarian Correspondence University, Balashikha, Russia

Morphological and biochemical indicators were determined in the blood using the generally accepted research methods: the content of red blood cells and white blood cells by counting in the Goryaev chamber, the hemoglobin was analyzed using the “Clini Test” reagents kit.

Phagocytic activity of the blood was determined by the method of VS Gosteva (EE Potemkin, RZ Pozdnyakova, LM Manukyan, 2003). A daily culture of E. coli at a concentration of 1 billion / ml was used as a test object. The method is based on the ability of blood phagocytes to capture any corpuscular objects. In stained blood films (using Romanovsky color), the number of active phagocytes, the total number of neutrophilic leucocytes, and the number of phagocytosed microbes were determined.

When determining the phagocytic activity, the following numerical indicators of the reaction were calculated:

- phagocytic index (PI) - reflecting the number of leucocytes (%) involved in phagocytosis. PI was calculated using the formula:

$$PI = Fa / Fp \cdot 100\%,$$

where *Fa* is the number of active leukocytes;
Fp - the total number of leukocytes;
100 - transfer to percents;

- phagocytic number (PN) - the average number of phagocytized microbes per active phagocyte. PN was calculated by the formula:

$$FC = Mf / Fa,$$

where *Fa* is the number of active leukocytes;
Mf is the number of phagocytosed microbes.

The amount of the complement component was determined by the RID method (immunodiffusion reaction) in the blood serum of cows, based on the precipitation reaction. The number of T-lymphocytes in the peripheral blood of animals was determined by spontaneous rosetting with sheep erythrocytes (E-ROCK); B lymphocytes - with erythrocytes of mice.

The bactericidal activity of the blood serum (BABS) was determined by a photo-colorimetric method based on the ability of the components of the blood serum to inhibit the growth and reproduction of the daily broth culture of E. coli.

The blood serum lysozyme activity was determined by a photoelectrocolorimetric method based on the ability of the blood lysozyme to destroy the cells of the Micrococuslisodecticus test culture and thereby reduce the optical density of the solution. The blood serum lysozyme activity was calculated by the formula:

$$X = \frac{E_1 - E_2}{E_1},$$

where *X* is the lysozyme activity of blood serum,%;
E_1 is the optical density of the serum sample before incubation;
E_2 is the optical density of the serum sample after incubation.

III. RESULTS AND DISCUSSION

Blood in the animal body plays an important role. The process of metabolism, which is the most important property of living organism, is passed through blood. The blood delivers the nutrients and oxygen to the cells of the body’s organs, removes metabolic products and carbon dioxide [??]. The hormonal regulation, protective functions of the body and the balance of electrolytes in the body is maintained through the blood. It reflects both the general structure of the body, its constitutional features, and its physiological state associated with the vital functions and living conditions [5,7,18-19].

Recently, much attention has been paid to the animal blood studying in order to find the objective data on the regular relationships of the blood composition with the physiological processes occurred in the animal’s body, animal productivity and metabolic rate. It has now become quite obvious that changes in the functions of the body affect the composition of the blood. but the composition of the blood in turn affects the activity of the organs of the animal, the course and direction of the physiological processes.

We studied the indicators associated with the formation of the physiological state of animals, determining their productivity (Table 1).

It is known that erythrocytes in the animal body perform the function of oxygen carrier, due to the presence of hemoglobin in their composition, which has the ability to absorb oxygen and form more strength compounds. The oxygen capacity of the blood is completely dependent on the hemoglobin content. Therefore, hemoglobin, like erythrocytes, is extremely important in the oxidation-reduction reactions of the body, determining the level of metabolic processes [21-24].

Table 1 - Morphological composition of cow’s blood (x±Sx; n=5)

Indicator	Group of cows	
	Control (I group)	Experimental (II group)
At the time of starting the experiments		
Erythrocyte, 10^{12}/l	7,16±1,03	7,22±0,66
Leucocyte, 10^{9}/l	9,80±0,86	9,91±0,72
Hemoglobin, g/l	100,0±3,76	102,65±5,63
After calving		
Erythrocyte, 10^{12}/l	5,60±0,57	5,89±0,52
Leucocyte, 10^{9}/l	9,40±1,63	9,80±0,86
Hemoglobin, g/l	97,40±4,30	100,00±4,50

* - P≤0,05; ** P≤0,01; *** P≤0,001 in relation to control group

Microbiological At the beginning of the experimental studies, the morphological parameters in the blood of cows of the experimental and control groups were almost the same. The difference between groups was insignificant and unreliable, while there was a slight increase in these indicators in animals of the second group. Consequently, the cows of the experimental groups had the same intensity of the respiratory function of the blood and, as a result, same level of metabolic processes in the body.

After calving, the blood of the animals of the experimental group was more saturated with erythrocytes and hemoglobin, the difference in erythrocytes was 3.2% and in hemoglobin 2.8% higher than in blood of cows from control groups. Consequently, Albit-Bio increased the intensity of the respiratory function of the blood, which means that the cows had a higher level of metabolism.

Leukocytes play an important role in protecting the body. Before the start of the experiment, the cows of the experimental groups had no significant differences in the number of leukocytes in the peripheral blood. Immediately after calving, the number of leukocytes decreased slightly. However, their level in cows of the 2nd group was higher by 4.25% than in cows from control group, which indicated a higher level of the general reagibility of the organism.

In recent years, there were increasing of abnormal physiological changes in the animal body, associated with a decrease resistance of animal body due to, first of all, violations of living conditions and feeding. Healthy animals have an immunodeficiency state, which can eventually lead to diseases. Therefore, immunostimulation is becoming increasingly important in comprehensive preventive care.

The blood leukocytes are indicators of the immune status of the animal body. From the data in the table 2 it can be seen that before the experimental studies, the leucogram in animals of both groups was almost the same. However, the high content of leukocytes was determined. It was also noted higher levels of lymphocytes during the dry period, which indicates a weakening of immune system. After calving the leucogram indicators revealed an improvement in the immune status of cows from the experimental group. The use of "Albit-Bio" during the dry period improved the cellular immunity indicators in the experimental group and the percentage ratio of T and B lymphocytes corresponds to the required value. In cows of the control group, the ratio between T-and B-lymphocytes decreased, despite the increase of both lymphocytes.

In general, the morphological composition of the blood of the experimental animals meets the limits of the physiological norms, which created the basis for producing healthy offspring.

Table 2 - Leucogram of cow's blood, % (x±Sx; n=5)

Indicator	Required value	Group of cows			
		Control (I group)		Experimental (II group)	
		At the time of starting the experiments	After calving	At the time of starting the experiments	After calving
Basophile	1.0	0.86±0.18	0.63±0.09	0.87±0.12	0.71±0.08
Eosinophils	6.5	4.64±0.96	3.19±1.12	4.59±1.72	2.97±1.28
Neutrophil - banded neutrophil - segmented neutrophil	3.0 28	2.8±0.21 20.3±1.96	2.9±0.32 20.6±2.03	2.8±0.16 20.8±1.87	2.6±0.21 26.5±1.97
Monocytes	4.5	2.97±0.31	3.76±0.26	2.99±0.21	3.91±0.08
Lymphocytes	57	73.7±4.18	70.6±4.96	72.8±5.81	59.9±3.38
T-lymphocytes	60	35.6±2.26	46.7±1.98	36.8±2.21	53.7±1.63
B-lymphocytes	30	21.7±2.36	29.7±3.12	21.5±3.17	29.8±2.26

* - P≤0,05; ** P≤0,01; *** P≤0,001 in relation to control group

At the next stage, the correlations of blood morphological parameters (erythrocytes, leukocytes, hemoglobin) with the components of the colostrum of the experimental and control groups were studied (Table 3). The highest values of the correlation coefficients were determined in dry matter of colostrum - red blood cells pairs, both in the control and experimental groups. Consequently, the biological value of colostrum was linked with the oxidative properties of blood. Thus, with an increase in the number of erythrocytes, the dry matter content in the colostrum of cows of both groups increases, with a high positive correlation in the range of 0.81–0.87.

The hemoglobin content does not always change parallel to increasing the dry matter in colostrum, which is apparently due to the mutual compensation of the oxidative properties of blood. However, the obtained correlation coefficients are high positive. It slightly higher in cows of II group in comparison with cows of I group.

There is an average positive correlation (0.62-0.65) between the content of leucocytes and the dry matter content of colostrum (Table 3), indicating that the level of the general resistance of the organism is related to the biological value of milk.

Table 3 - Correlation indexes of blood and colostral milk, (x±Sx; n=5)

Indicator	Group of cows	
	Control (I group)	Experimental (II group)
Hemoglobin – dry matter	0.64±0.050	0.92±0.021*
Erythrocyte - dry matter	0.81±0.019*	0.87±0.013*
Leucocyte – dry matter	0.62±0.059	0.65±0.034

* - P≤ 0,05

It is known that the adaptive abilities of animals largely depend on the natural resistance of the organism. At the same time, the phagocytes and the blood protein system take a special position among the protection factors of animal body (Table 4).

Table 4 – Indicators of the resistance state of the cows, (x±Sx; n=5)

Indicator	Group of cows			
	Control (I group)		Experimental (II group)	
	At the time of starting the experiments	After calving	At the time of starting the experiments	After calving
Leucocytes, 10^9/l	7.88±0.69	8.08±0.03	7.53±0.91	8.92±0.91*
Phagocytic activity of the blood, %	62.0±6.34	71.0±6.30	64.0±6.29	88.0±6.71*
Phagocytic number	2.00±0.18	2.00±0.18	2.03±0.09	2.14±0.10
Phagocytic index, %	13.10±0.41	13.81±0.05	12.4±0.08	18.77±0.21*
C3 component of complement, g/l	0.62±0.02	0.71±0.02	0.55±0.06	0.61±0.07

* - P≤0,05 in relation to control group

As a result of the study of natural resistance factors (Table 4) in animals, we found that cows in the experimental group after calving were characterized by the best indicators of cellular protection factors. During this period, higher phagocytic activity of the blood up to 37.5%, (P≤0.05), the phagocytic index up to 51.37%, (P≤0.05) and the phagocytic number up to

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5.42% were determined in II group of cows. These results indicated a more pronounced aggressiveness of neutrophils. Also, after calving, the animals of this group were characterized by a good neutrophil digesting ability.

The level of C3 component of the complement had no significant changes in both groups, which consequently could not significantly affect the process of phagocytosis. C3 component of the complement is participated in opsonization of target cells and effector cells preparation,

IV. CONCLUSION

In general, the obtained data on the study of the resistance state of cows showed that using of drug increases the phagocytic activity of neutrophils, which contributes to the formation of anabolic processes in the intermediary metabolism, normalization of the bioelemental status, improvement of the functional state of the liver and the organism as a whole. Thus, the results of this research indicated that adding of Albit-Biot into the diet of dry cows influenced the intensity of the respiratory function of the blood, the immunological status of the body and the biological value of colostrum.

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