# Changes in Blood Cytochemical Indexes in Animals during Pregnancy and after Labor

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Intraleukocytic microbicidal activity of blood neutrophilic granulocytes in cows increased with increasing the term of pregnancy, decreased over the first 2 days after labor, and increased again in the follow-up period. Activity of microbicidal systems markedly decreased after labor, especially in the winter-spring period.

**Key Words:** *alkaline and acid phosphatases; myeloperoxidase; lysosomal cationic proteins*

The study of functional activity in blood neutrophilic granulocytes (NG) during pregnancy and after labor is of considerable importance, since these cells play a protective role in warm-blooded animals.

The protective role of neutrophils is related to high intracellular content of enzymes and energy substrates. Neutrophils can migrate and rapidly accumulate in the inflammatory focus acting as "professional phagocytes" [2].

Here we studied intraleukocytic microbicidal systems of blood NG in cows during pregnancy and after labor in various seasons.

## MATERIALS AND METHODS

Experiments were performed on black-brindled cows (Reflection Sovering and Montvige Chieftain) kept in a farm in the Krasnodar krai. Microbicidal properties of blood NG were studied during pregnancy and after labor in the winter-spring and spring-summer period.

Activities of alkaline and acid phosphatases were measured by the method of M. G. Shubich [5] in our modification [1]. Myeloperoxidase activity was determined by the method of Sato [6] in our modification [1]. The content of lysosomal cationic proteins (CP) was estimated by the method of V. M. Pigarevskii [3].

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## RESULTS

Alkaline phosphatase (ALP) activity in cows varied depending on the term of pregnancy. Enzyme activity was minimum over the first 4 months of pregnancy (Fig. 1), progressively increased in parallel with the rise of estrogen concentration in the mother-fetus system, and reached a maximum by the 8th month (1.05±0.01 arb. units). ALP activity slightly decreased immediately before labor and remained unchanged over 1-2 days after labor. Enzyme activity was low until the next fertilization.

ALP activity in NG was different in nonpregnant (19-21 days postpartum) and pregnant animals. Enzyme activity increased during pregnancy, but decreased after labor and over the first 3 months of pregnancy.

In the winter-spring and spring-summer period ALP activity tended to increase or decrease depending on the physiological state of cows. In the winter-spring period ALP activity on the 2nd, 7th, and 9th months of pregnancy was 1.6, 2, and 1.3 times lower, respectively, than in the spring-summer period.

Activity of acid phosphatase (ACP) in NG underwent opposite changes. It decreased during pregnancy, but increased after labor (Fig. 1). By the 7th and 9th months of pregnancy ACP activity in NG was 2 and 3 times lower, respectively, compared to that observed on the 2nd month. Enzyme activity on days 1-2 after labor was 2-fold higher than during the last month of

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pregnancy. On days 19-21 after labor ACP activity surpassed that on the 9th month of pregnancy and 1-2 days after labor by 3.2 and 1.6 times, respectively. A decrease in enzyme activity correlated with an increase in the duration of pregnancy. However, ACP activity increased after labor.

Changes in ACP activity depended on the physiological state of animals to a greater extent than on the season. However, enzyme activity differed in various months. For example, in the winter-spring period ACP activity on the 2nd, 7th, and 9th months of pregnancy and after labor was 1.1, 1.5, 1.2, and 1.1 times lower, respectively, than in the spring-summer period (correlation coefficients 0.978, 0.988, 0.986, and 0.970, respectively).

Myeloperoxidase (MP) is a component of the oxygen-dependent microbicidal system in NG [4] and is usually found in young cells. MP activity depended on the physiological state of animals (Fig. 2). Enzyme activity in NG on the 2nd month of pregnancy was 0.22-0.35 U and increased by 2 (0.46-0.74 U) and 5-7 times (1.55-1.73 U) on the 5th and 9th months, respectively. MP activity decreased to 1.38-1.59 U on days 5-7 after labor, but then increased to a level observed before labor. Enzyme activity in NG was maximum in nonpregnant cows and animals at the late stage of pregnancy (compared to other stages of pregnancy and early postpartum period). MP activity was maximum in the spring-summer period and minimum in the winter-spring period. In the winter-spring period MP activity decreased by 1.6, 1.3, and 1.1 times on the 2nd, 7th, and 9th months of pregnancy, respectively.

The content of nonenzymatic lysosomal CP continuously increased during pregnancy (Fig. 2). By the end of the first trimester the mean cytochemical index increased from 0.33-0.65 (2nd month of pregnancy) to 0.74-1.10 arb. units (5th month of pregnancy). Before labor this index increased by 1.21-1.71 times.

The content of CP in NG was maximum in nonpregnant cows and before labor. CP content increased during pregnancy. It should be emphasized that the content of CP in NG decreased over the first 2 days after labor. The content of CP was maximum in the spring-summer period and minimum in the winter-spring period. In the winter-spring period the mean cytochemical index of CP on the 2nd month of pregnancy, 7th and 9th months of pregnancy, 1-2 days after labor, and 19-21 days after labor decreased by 2, 1.4, 1.6, and 1.4 times, respectively, compared to the spring-summer period.

The study of intraleukocytic microbicidal systems of NG in cows showed that activities of ALP and MP and content of CP increased, while ACP activity decreased during pregnancy and after labor. Activities of ALP and MP and content of CP slightly decreased

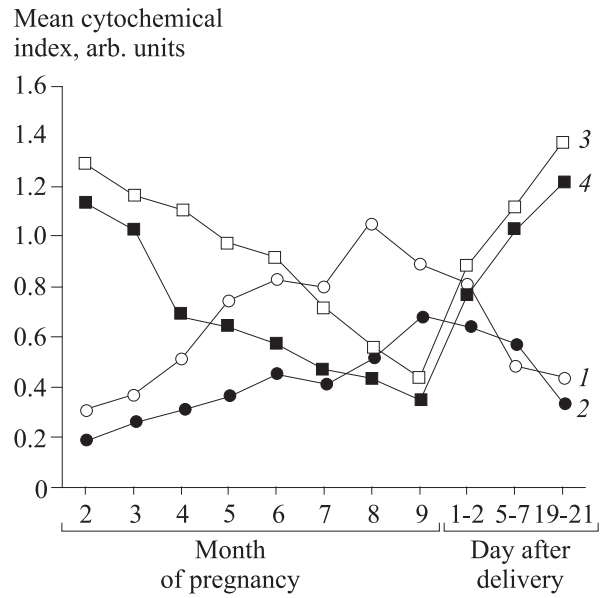


**Fig. 1.** Activities of alkaline (ALP) and acid phosphatases (ACP) in neutrophilic granulocytes from cows in various seasons ($n$=10). Here and in Fig. 2: spring-summer, ALP (*1*); winter-spring, ALP (*2*); spring-summer, ACP (*3*); and winter-spring, ACP (*4*).

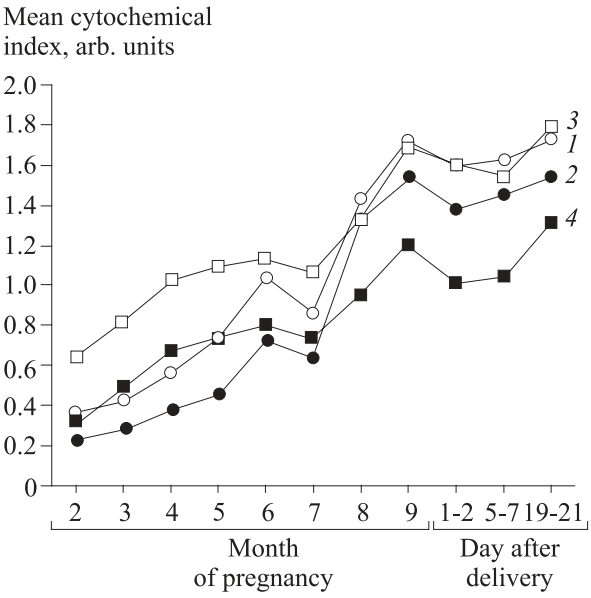


**Fig. 2.** Myeloperoxidase activity and content of cationic proteins in blood neutrophilic granulocytes in various seasons ($n$=10).

1-2 days after labor. MP activity and CP content increased from days 5-7 to the next insemination. In this period ACP activity increased, while ALP activity decreased.

ALP modulates intracellular metabolism in NG and plays a role in phagocytosis. Enzyme activity 2-fold increased during labor and early postpartum period, which reflects an increase in the natural resistance in cows. A decrease in ALP activity at the early stage of pregnancy characterizes the involvement of this enzyme in physiological immunosuppression to

prevent rejection of the fetus. ACP activity determines functional activity of NG and increases during phagocytosis of microorganisms. Inactivation of the enzyme can be considered to be typical of pregnancy, since changes in activities of ALP and ACP occur in parallel. The coefficients of correlation between changes in ALP and ACP activities in the spring-summer and winter-spring period were -0.903 and -0.523, respectively. The decrease in ACP activity before labor probably reflects the compensatory and adaptive reactions to activation of ALP and MP. Similarly to ACP, MP is a antibacterial system that suppresses the growth of microorganisms. High level of MP and CP has an important physiological value and prepare the animals for labor.

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