

Research Article**Change in the morphological composition of the white blood of cows in various stages of pregnancy and use the woody fitopreparates****Alexander S. Zenkin, Dawood Salman Habeeb, Leonid P. Teltsov,****Alexey I. Svitin, Vladimir A. Stolyarov and Olga S. Bushukina**Federal State Budgetary Institution of Higher Education
“National Research Ogarev Mordovia State University”

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ABSTRACT:

The issue of ensuring food security and independence of the country in terms of key parameters is associated with the profitability and competitiveness of dairy cattle breeding, including indicators of the herd reproduction and the effectiveness of various methods of correcting the reproductive function of cows. This problem is far from being resolved. A promising direction is considered to be finding means of their number of plant-based products. In this article, experimental data are presented on the evaluation of the effectiveness of original wood-based herbal products on the white blood counts of cows at different periods of pregnancy. A total of 12 cows were involved in the studies, which were divided into 4 groups according to the principle of analogs (3 animals per group). The studies were carried out for 2 years. All experiments were carried out on the basis of NIVA livestock farm in Oktyabrsky district of the Republic of Mordovia. The cows of groups 1 and 3 used the herbal products obtained on the integration of methods for extracting valuable extractive substances by extracting the glycerol-based carotenoids. Animal studies were carried out for 2 years. Hematologic examinations were carried out on an automatic hematological analyzer for veterinary medicine MICROCC-20Vet, 20 indicators were obtained for each sample, 8 of which were the indicators of white blood cells - leukocytes, lymphocytes, average blood cells, blood granulocyte count, lymphocyte percentage, percentage of mid cells, percentage of granulocytes, and hematocrit volume. The studies have found that during pregnancy the leukocyte level and the percentage of mid cells had a pronounced upward trend. The use of herbal products modifies the number of leukocytes to decrease (reduces their level to the upper limit of normal), we also mentioned the reduction of the percentage of granulocytes, which is compensated by their high absolute values, the ratio of the total volume of all formed elements to the total volume of blood in the experimental cows was low. Thus, the use of wood-based herbal products stabilizes the level of leukocytes, lymphocytes and granulocytes to the limits of physiologically normal state in pregnant cows. The data obtained can be useful in veterinary practice for researchers dealing with the accelerated involution of genital organs and the preparation of organism for fertile insemination.

Keywords: pregnant cows, wood-based herbal products, white blood counts.**INTRODUCTION.**

The blood washes all internal organs, connecting them to each other in a single network, which is why the blood as a mirror reflects all the processes that occur in the body, sensitively reacting to any change in health status, including the reproductive health [1,2,3]. Currently, the blood test is an essential part of the examination, when diagnosing many diseases, as well as evaluating the health status. Technologies that are based on integrated

accounting of the most important biotechnological factors and borrowings from wildlife become promising in animal husbandry. An alternative to fodder antibiotics and part of the concept for their replacement in animal diets can be herbal products, containing the herbal supplements with good flavor, aromatic and medicinal properties, known both in ancient traditional medicine and in modern veterinary science and practice [4,5,6]. In

connection with the foregoing, in the present study we examined the white blood counts of cows at different stages of pregnancy against the use of various the woody fitopreparates.

Material and methods of the study.

A total of 12 cows were involved in the studies, which were divided into 4 groups according to the principle of analogs (3 animals per group). All experiments were carried out on the basis of NIVA livestock farm in Oktyabrsky district of the Republic of Mordovia. The herbal products obtained on the basis of complex processing of fur needles, aspen bark and willow bark were introduced in the diet of cows of group 1 - 3. The animals of group 4 did not get the drug and served as a control. The drug was introduced into the diet

1 month before the expected delivery and fed for 10 days (Table 1).

Hematologic studies were conducted in the conditions of veterinary clinic of the Agrarian Institute of the Federal State Budgetary Institution of Higher Education FGBI HE Ogarev Mordovia Ogarev State University on the automatic hematological analyzer for veterinary medicine MI-CROCC-20Vet (HTI, USA). For each sample, 20 indicators were obtained.

The manufacturer of drugs is Research and Development Centre Khiminvest LLC, Nizhny Novgorod. Based on the integration of methods for extracting valuable extractive substances, they had developed a process of integrated processing. The additives are obtained by extracting the glycerol-based carotenoids [7,8].

Table 1 - Schedule of experiments.

Set of experiments	Product based on	Group of animals	Number of animals	Drug dose, mL	Time Schedule	Remarks
Before delivery (1)	Fir needles	1	3	200	1. One month before delivery and the use of drug. 2. On day 11 after the use of drug 3. On the day of delivery 4. On day 11 after delivery. 5. 1 month after delivery. 6. 2 months after delivery. 7. 3 months after delivery.	The drug was introduced into the diet 1 month before the expected delivery and fed for 10 days.
		2	3	100		
		3	3	50		
	Control	4	3	-		
After delivery	Fir needles	1	3	200	8. One month before delivery and the use of drug. 9. On day 11 after the use of drug 10. On the day of delivery	Drugs were introduced into the diet on the day of delivery and fed for 10 days.
	Willow bark	2	3	100		
	Aspen bark	3	3	100		
	Control	4	3	-		
Before delivery (2)	Fir needles	1	3	200	8. One month before delivery and the use of drug. 9. On day 11 after the use of drug 10. On the day of delivery	The drug was introduced into the diet 1 month before the expected delivery and fed for 10 days.
		2	3	100		
		3	3	50		
	Control	4	3	-		

Results and their discussion. Results of the study of white blood counts in whole blood of experimental animals were processed statistically and are summarized in Table 2.

Table 2 - Changes in the white blood counts of cows with the use of herbal products.

Item No.	Indicators	Group of animals	Time Schedule										
			Limits of normal	1	2	3	4	5	6	7	8	9	10
1	Leukocytes (WBC) 10 ⁹ /L 10 ³ /mcL	1	4.5-12.0	11.4 ± 3.8	18.1 ± 3.3	17.1 ± 2.4	17.9 ± 1.3	14.4 ± 5.4	11.5 ± 4.9	17.7 ± 4.9	16.2 ± 9.2	22.2 ± 6.6	14.6 ± 3.9
		2		8.5 ± 2.3	18.9 ± 1.3	11.0 ± 2.6	11.6 ± 1.6	9.8 ± 2.5	8.3 ± 1.9	9.5 ± 1.3	5.7 ± 2.2	13.8 ± 3.0	10.2 ± 3.2
		3		8.9 ±	12.7 ±	10.8 ±	8.9 ±	7.8 ±	9.6 ±	8.4 ±	8.8 ±	11.9 ±	16.5 ±

				1.3	0.7	1.8	0.7	0.3	0.3	1.4	0.9	0.4	4.9			
		4		10.7	20.0	18.4	13.1	10.3	14.4	13.2	7.0	13.4	14.8			
				±	±	±	±	±	±	±	±	±	±			
				5.6	1.9	3.3	1.2	3.3	8.1	1.8	0.8	1.1	5.4			
2	Lymphocytes (LYM) 10 ⁹ /L 10 ³ /mcL	1	0.6 - 4.1	7.5	9.9	10.3	12.4	9.1	6.1	9.5	10.5	15.8	9.5			
				±	±	±	±	±	±	±	±	±	±	±		
							3.4	1.5	2.5	1.2	5.3	3.1	4.9	6.6	4.9	4.1
		2		3.4	8.5	6.9	7.5	5.5	4.03	4.3	3.0	9.2	6.7	±	±	
				±	±	±	±	±	±	±	±	±	±	±	±	
							1.5	0.8	1.6	0.8	2.3	1.7	0.9	1.2	1.7	2.7
		3		3.8	5.8	6.2	5.5	3.7	3.6	4.4	5.0	8.2	8.5	±	±	
				±	±	±	±	±	±	±	±	±	±	±	±	
							0.2	0.8	1.2	0.7	0.5	0.7	1.1	0.7	0.1	1.4
		4		7.2	8.3	9.1	6.9	5.0	9.2	4.8	2.5	7.4	9.2	±	±	
				±	±	±	±	±	±	±	±	±	±	±	±	
							4.4	1.6	1.9	0.0	2.0	6.9	0.3	0.1	1.2	2.3
3	Mid blood cell level (MID) 10 ⁹ /L 10 ³ /mcL	1	0.1- 1.8	1.9	2.8	2.6	2.1	1.8	1.9	2.9	2.4	3.6	3.1			
				±	±	±	±	±	±	±	±	±	±	±		
							0.3	0.7	0.3	0.7	0.6	0.4	1.1	1.2	0.7	0.4
		2		1.8	2.9	2.03	1.9	2.03	1.5	2.3	1.0	2.4	1.9	±	±	
				±	±	±	±	±	±	±	±	±	±	±	±	
							0.5	0.5	0.3	0.7	0.6	0.3	0.4	0.4	0.7	0.6
		3		1.4	1.6	1.2	1.4	1.3	1.5	1.6	1.7	1.9	1.9	±	±	
				±	±	±	±	±	±	±	±	±	±	±	±	
							0.1	0.2	0.1	0.1	0.1	0.1	0.4	0.4	0.2	0.3
		4		2.0	2.9	2.9	2.2	1.8	2.2	2.1	1.3	3.2	2.1	±	±	
				±	±	±	±	±	±	±	±	±	±	±	±	
							0.9	0.1	0.2	0.3	0.4	1.0	0.0	0.1	0.7	0.9
4	Blood granulocytes level (GRA) 10 ⁹ /L 10 ³ /mcL	1	2 - 7.8	2.0	5.3	4.1	3.3	3.5	3.4	5.3	3.4	2.9	2.0			
				±	±	±	±	±	±	±	±	±	±	±		
							0.4	1.2	1.8	1.2	0.8	1.2	1.1	1.5	0.9	0.6
		2		2.3	7.5	1.9	2.1	2.2	2.7	2.8	1.7	2.2	1.7	±	±	
				±	±	±	±	±	±	±	±	±	±	±	±	
							0.2	1.1	0.8	0.1	0.4	0.2	0.4	0.8	0.6	0.1
		3		3.7	5.2	3.3	2.03	2.7	4.3	2.4	2.1	1.8	6.2	±	±	
				±	±	±	±	±	±	±	±	±	±	±	±	
							1.2	0.2	1.0	0.6	0.2	0.6	0.6	0.4	0.4	3.3
		4		1.5	8.7	6.3	3.9	3.4	3.0	6.3	3.2	2.9	3.5	±	±	
				±	±	±	±	±	±	±	±	±	±	±	±	
							0.6	1.8	1.6	0.9	0.8	0.2	1.4	0.8	0.6	2.2
5	Percentage of lymphocytes (LYM) %	1	40 - 60	60.9	56.1	56.6	71.1	54.1	35.8	50.7	62.4	71.2	61.9			
				±	±	±	±	±	±	±	±	±	±	±		
							7.5	1.1	8.9	8.4	12.7	16.4	14.7	6.4	2.5	11.5
		2		48.0	41.1	62.9	64.6	51.7	44.5	45.6	57.2	67.1	63.5	±	±	
				±	±	±	±	±	±	±	±	±	±	±	±	
							3.9	6.6	3.5	1.8	8.7	9.2	7.4	7.9	2.3	6.1
		3		44.1	45.7	57.6	61.0	46.7	38.3	51.3	55.9	69.2	54.4	±	±	
				±	±	±	±	±	±	±	±	±	±	±	±	
							5.2	3.9	6.0	6.2	4.4	6.4	6.3	3.8	3.1	6.5
		4		61.4	42.8	50.6	53.2	47.0	54.9	36.2	36.3	54.5	66.1	±	±	
				±	±	±	±	±	±	±	±	±	±	±	±	
							7.1	6.5	6.2	5.04	4.1	18.1	2.1	2.8	4.4	7.1
6	Percentage of mid cells (MID) %	1	1- 15	18.7	15.7	15.8	11.6	13.5	19.3	16.5	15.9	17.5	22.0			
				±	±	±	±	±	±	±	±	±	±	±		
							2.6	2.3	1.5	3.8	1.1	3.8	2.9	0.7	1.2	3.2
		2		20.6	16.0	19.4	15.6	19.8	19.4	23.8	18.4	17.1	17.9	±	±	
				±	±	±	±	±	±	±	±	±	±	±	±	
							1.02	3.7	3.1	3.6	2.3	1.9	3.9	2.2	1.3	0.3
		3		16.4	13.1	12.4	15.8	17.1	16.2	18.3	18.9	15.6	12.3	±	±	
				±	±	±	±	±	±	±	±	±	±	±	±	
							2.6	3.1	3.1	0.5	1.4	1.03	2.3	2.7	1.5	1.7
							22.5	15.3	16.6	16.9	17.9	16.6	16.4	18.9	24.3	13.9

		4		± 4.7	± 1.5	± 1.1	± 1.1	± 1.3	± 1.6	± 2.2	± 3.2	± 6.8	± 1.7
7	Percentage of granulocytes (GRA) %	1	40 - 70	20.3	28.1	26.4	17.2	32.3	30.9	32.7	21.8	11.3	16.1
				±	±	±	±	±	±	±	±		
				6.5	1.5	10.1	6.7	12.8	4.3	17.7	5.8	1.2	8.3
				30.4	38.3	17.6	19.6	28.4	36.0	30.5	24.4	15.9	18.6
		±		±	±	±	±	±	±	±	±	±	
		4.6		1.5	6.1	1.8	9.5	7.9	3.6	8.1	0.9	5.8	
		39.3		41.1	29.9	23.1	36.03	45.3	30.3	25.3	15.2	33.4	
		±		±	±	±	±	±	±	±	±	±	
7.2	0.9	5.4	6.2	3.8	7.1	7.7	5.9	3.1	8.2				
16.1	41.7	32.6	29.8	35.04	28.5	47.2	44.9	21.2	20.0				
±	±	±	±	±	±	±	±	±	±				
7.6	7.2	5.9	3.9	2.7	16.5	4.2	6.1	2.4	5.4				
8	Hematocrit volume (HCT) % (L/L)	1	30 - 50	29.2	39.2	31.6	34.1	27.7	25.1	26.7	24.7	31.9	30.0
				±	±	±	±	±	±	±	±	±	±
				2.7	5.1	3.5	3.3	0.8	0.6	0.8	1.4	2.6	4.6
				27.6	44.8	31.1	29.6	30.9	28.1	29.6	24.8	28.1	31.8
		±		±	±	±	±	±	±	±	±	±	
		0.8		1.3	2.6	1.1	1.9	2.2	3.6	1.4	2.1	3.4	
		26.5		33.9	38.9	27.1	27.9	26.2	26.1	23.3	25.2	31.9	
		±		±	±	±	±	±	±	±	±	±	
0.7	0.9	3.9	0.9	1.6	0.3	0.8	1.8	1.3	4.9				
24.9	41.2	36.7	27.9	28.8	24.0	27.1	21.7	25.7	29.5				
±	±	±	±	±	±	±	±	±	±				
4.02	2.5	4.4	0.8	0.1	1.4	2.9	1.7	2.7	2.4				

According to data in Table 2, changes in the number of leukocytes were of a marked nature, their number in all experimental cows was significantly increased one month before the delivery. It was noted that the level of leukocytes in cows who got herbal products the level of leukocytes was within the limits of normal fluctuation on day 11, while in control animals it was significantly higher than normal (18.4 ± 3.3), except for the cows of group 1 in both the first and second set of experiments.

In general, the studies found that during pregnancy, the level of leukocytes had a pronounced upward trend. The use of herbal products modifies the number of leukocytes to low. The spontaneous and periodic fluctuations of leukocytes during pregnancy are extremely labile and associated with its redistribution in the blood flow as a result of a number of factors. The greatest value in ruminant animals has digestive factors (digestive leukocytosis), as well as various inflammatory processes in the body of animals [9,10,11].

The level of lymphocytes changed similar to the number of leukocytes. At the 2nd, 3rd, 9th and 10th terms of the study, the number of lymphocytes increased, significantly exceeding the

normal level. It was found that 3 months after the delivery, and a month before the delivery (2nd set of experiments), the number of lymphocytes was at a lower level, except for the cows of group 1. It is known that in pregnancy, certain functions of lymphocytes can play a negative role, if their balance is broken. These white blood cells perform such tasks: identify foreign or mutated cells, produce antibodies against foreign agents, have a cytotoxic effect, and form immunity. Changes in the level of lymphocytes at different terms are associated mainly with physiological processes in the body of pregnant cows, the pronounced effect of herbal products on changes in the level of lymphocytes is not established [12,13].

The level of mid cells in the blood of the experimental cows varied with a pronounced trend to high levels. Monocytes, eosinophils, basophils and their precursors circulate in the blood in small amounts, that is why such cells are often combined into one group, which is referred to as MID or MXD. This group can be expressed as a percentage of the total number of leukocytes (MXD%), or an absolute number (MXD#, MID#). These types of blood cells also belong to leukocytes and perform important functions (control of parasites, bacteria, development of allergic reactions, etc.). The absolute and percentage content of this indicators

increases, if the number of cells increases in its composition. To determine the nature of changes, usually the percentage ratio of each cell type (monocytes, eosinophils, basophils and their predecessors) is studied. Reduced concentration of cells is observed in severe infectious diseases, bone marrow damage, and anemia. Also, the indicator for acute injuries may appear to be lower: shock, after surgical interventions, and with trauma.

In general, these studies didn't show any abnormalities in the composition of such cells, as well as any significant effects of herbal products, and all changes are most likely associated with physiological processes in the body of cows during pregnancy.

Changes in the level of granulocytes in the blood of the experimental cows are mainly associated with their increase in the majority of study terms. However, it should be noted that the values of granulocytes fit the limits of normal fluctuations. Exceptions were some animals of group 2. It is believed that the only case when a high level of granulocytes can be considered the normal is the period of pregnancy. However, the inflated indicators can cause a fetal pathology. The data obtained in the present studies on changes in the number of granulocytes testify to the normal course of pregnancy in experimental cows, and some of their increase is physiological in nature [14,15]. The significant effect of herbal products on the change in indicators is not observed.

Thus, the studies have established the features of changes in the level of granulocytes in cows at different stages of pregnancy, the modifying effect of herbal products has not been revealed.

The percentage of lymphocytes in the blood of experimental cows changed during the period under study. In general, it was noted that the changes in this indicator downward (below the normal limits) were of a one-off nature (control animals in 3 months after delivery, and a month before delivery - the 2nd set of experiments). Increasing percentage of lymphocytes in the experimental animals was observed in some terms (on the day of delivery or after the use of products both in the 1st and the 2nd set of experiments).

Thus, the studies have established that changes in the percentage of lymphocytes were mainly physiological in nature, and the marked modifying effect of herbal products have been noted [16,

17,18].

Normal values of mid cells indicate the correct ratio of white blood cells in this population. At pathological parameters, it is necessary to look through the leukocyte formula. Changing percentage of mid cells in the present studies indicates that they have been observed to increase in most of the animals studied for the most study terms. Most of the indicators have been fluctuated at the upper limits of normal, slightly exceeding them. In the 2nd set of experiments, a certain modifying effect of herbal products have been observed downward to the limits of normal. Thus, an increase in the percentage of med cells in experimental cows was established. The use of herbal products leads to a decrease in their level to the upper limits of normal.

The percentage of granulocytes in the experimental cows was predominantly at or below the lower limits of normal. Higher numbers often indicate the inflammatory diseases of infectious nature. An increase in the level of individual forms can talk about other body reactions: basophils grow with allergies, eosinophils - with helminthic invasions and allergies too. Physiologically, the granulocyte volume increases during pregnancy (the second half), aborting, after taking food. A decrease in the percentage of granulocytes, other than hematological pathology, may induce some pharmaceutical agents (antibiotics, sulfonamides, antitumor drugs, etc.) or be a consequence of genetically determined diseases. However, the low percentage of granulocytes in cows during these studies is quite compensated by their high absolute values. It is impossible to determine which indicator is found in the experimental and control cows. Thus, the experimental cows showed a decrease in the percentage of granulocytes, which is completely compensated by their high absolute values. Herbal products do not have a significant effect on the changing percentage of granulocytes in the blood of experimental cows.

Hematocrit (hematocrit value, packed cell volume) is defined as ratio of the total volume of all formed elements (erythrocytes, leukocytes, platelets) to the total volume of blood. In the present studies, it was found that the hematocrit was mainly at the lower limits of normal. On the day of delivery, the indicator was within the normal range. No differences between experimental and control cows

are established. Ratio of the total volume of all formed elements to the total volume of blood in the experimental cows was slightly lowered, and the modifying effect of herbal products was not revealed.

In general, the studies have found that during pregnancy, the level of leukocytes had a pronounced trend to increase. The use of herbal products modifies the number of leukocytes to decrease. Changes in the level of lymphocytes at different terms are associated mainly with physiological processes in the body of pregnant cows, the expressed effect of herbal products on changes in the level of lymphocytes is not established, which to some extent corresponds with our previously obtained own data, as well as information of other scientists [19-27]. A decrease in the percentage of granulocytes, which is completely compensated by their high absolute values, was noted. The herbal products do not have a significant effect on changing percentage of granulocytes in the blood of experimental cows. Changes in the percentage of lymphocytes were mainly physiological in nature, a marked modifying effect of herbal products was found.

An increasing percentage of mid cells in experimental cows was established. The use of herbal products leads to a decrease in their level to the upper limits of normal.

A decrease in the percentage of granulocytes, which is completely compensated by their high absolute values, was found. The herbal products do not have a significant effect on changing percentage of granulocytes in the blood of experimental cows. Ratio of the total volume of all formed elements to the total volume of blood in the experimental cows was slightly lowered, the modifying effect of herbal products was not revealed.

Findings.

1. It was found that during pregnancy the level of leukocytes had a pronounced upward trend. The use of herbal products modifies the number of leukocytes to decrease. Changes in the level of lymphocytes at different terms are associated mainly with physiological processes in the body of pregnant cows, the pronounced effect of herbal products on changes in the level of lymphocytes is not established.

2. A decrease in the percentage of granulocytes, which is completely compensated by their high absolute values, was found. The herbal products do not have a significant effect on changing percentage of granulocytes in the blood of experimental cows. Changes in the percentage of lymphocytes were mainly physiological in nature, a marked modifying effect of herbal products was found.

3. An increasing percentage of mid cells in experimental cows was established. The use of herbal products leads to a decrease in their level to the upper limits of normal. A decrease in the percentage of granulocytes, which is completely compensated by their high absolute values, was found. The herbal products do not have a significant effect on changing percentage of granulocytes in the blood of experimental cows.

4. Ratio of the total volume of all formed elements to the total volume of blood in the experimental cows was slightly lowered, the modifying effect of herbal products was not revealed.

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