

HEMATOLOGICAL CHANGES ASSOCIATED WITH SUBCLINICAL MASTITIS IN GOATS

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Abstract

The aim of this study was to investigate haematological changes in lactating goats with subclinical mastitis. Determination of mammary health status was based on CMT results, microbiological and cytological examination. Blood samples were taken from all goats included in the study by venopuncture of the jugular vein and blood was collected in vacuum blood collection tubes. The results showed that the mean \pm SE in healthy animals and goats with subclinical mastitis were as follows: Red Blood Cell count (RBC) $10.43 \pm 0.63 \times 10^{12}/L$ and $9.38 \pm 0.42 \times 10^{12}/L$; Haemoglobin (Hb) 85.69 ± 2.43 g/L and 77.13 ± 1.73 g/L; Hematocrit (HCT) 18.77 ± 0.87 % and 17.77 ± 0.68 %; Red Blood Cell Distribution (RDW) 21.55 ± 0.16 % and 22.21 ± 0.13 %; Mean Cell Volume (MCV) 16.96 ± 0.29 fL and 15.63 ± 0.20 fL; Mean Cell Haemoglobin (MCH) 6.18 ± 0.10 pg and 6.73 ± 0.09 pg; Mean Cell Haemoglobin Concentration (MCHC) 379.81 ± 3.72 g/L and 378 ± 3.12 g/L; White Blood Cell Count (WBC) $13.37 \pm 1.60 \times 10^9/L$ and $16.66 \pm 1.23 \times 10^9/L$. The RBC and Hb were significantly higher ($P < 0.05$) in normal lactating compared to goats with subclinical mastitis. RDW, MCH and WBC count was significantly lower in healthy goats.

Key words: Hematological parameters, goats, subclinical mastitis.

INTRODUCTION

Inflammation of the mammary gland in lactating productive animals is one of the main diseases causing significant economic losses for farmers. Mastitis in small ruminants in its subclinical form is estimated with an annual prevalence of 5-30% (Bergonier et al., 2003). Diagnosis is based on the use of various indicators of inflammation and isolation of microorganisms, most commonly coagulase-negative staphylococci being isolated (Wilson et al., 1995). The major changes include the migration of ions, proteins and enzymes from the blood into the milk due to an increased blood vessel permeability and active phagocytic invasion occurrence, resulting in an increase in cellular composition and reduction of several components in the milk. All of the affected halves produce specific inflammatory substances - acute phase proteins, which can also be used as indicators of an inflammatory process. Somatic cell levels and the isolation of microbial agents is accepted as the "gold standard" in the diagnosis of subclinical mastitis. In goats, the level of somatic cells as an indicator for

mammary gland infection should be carefully interpreted. Overall, goat milk contains a higher amount of cytoplasmic particles and epithelial cells than cows (Paape and Capuco, 1997), due to the peculiarities of milk secretion in this species. The existence of a correlation between somatic cell level and California mastitis test (CMT), has been investigated by other authors (Persson and Olofsson, 2011). According to Contreras et al. (1996) scores 0 and 1 show 79% of uninfected halves, and in the 2-3 score there is an increase in somatic cells and suspicion of infection, which requires sampling for microbiological examination.

MATERIALS AND METHODS

Animals

This study used 32 locally bred goats, between 3 and 7 years of age, from licensed farms in Bulgaria. Milking was done manually, herds were free of brucellosis, tuberculosis and mycoplasmosis. All of the animals were clinically healthy and free from internal and external parasites. Their health status was evaluated based on rectal temperature, heart rate,

respiratory profile, appetite, faecal consistency. The animals were divided into two experimental groups. In group A (healthy animals) included only animals with both mammary halves with CMT score (-) or (+). Group B (with subclinical mastitis) included only animals in which both mammary halves had a CMT score (++) or (+++). In additional microbiological and cytological study of these samples, the diagnosis of subclinical mastitis was confirmed.

Sample collection

Blood samples were collected from all animals, by venopuncture of the jugular vein with closed blood collection system in vacuum tubes, containing EDTA. Samples were transported in ice box to the laboratory for analysis. Haematological analysis included red blood cell count (RBC), haemoglobin (Hb), hematocrit (HCT), red blood cell distribution (RDW), mean cell volume (MCV), mean cell haemoglobin (MCH), mean cell haemoglobin concentration (MCHC), white blood cell (WBC), count using BC-2800 haematology analyzer (Mindray, China).

All udder halves of the lactating animals were examined using a CMT-Test (Kruuse, Denmark) to detect subclinical mastitis. The CMT reagent reacts with DNA of epithelial and inflammatory cells present in the milk. CMT results were read immediately and were scored for each teat depending on the amount and thickness of gel formed. In this study, CMT scores of '0' and 'trace' were considered as negative or normal while CMT scores of 1 (weak positive), 2 (distinct positive) and 3 (strong positive) were taken as indicators of subclinical mastitis.

Statistical analysis

Statistical analysis was performed using SPSS 16.0

RESULTS AND DISCUSSIONS

Table 1 shows the results of the CMT test of the animals included in the study. According to these results, the first group (healthy), included 9 negative (-) and 7 weak positive (+) goats. The second group (with subclinical mastitis) included 12 animals with (++) and 4 with (+++). Diagnosis of subclinical mastitis was confirmed in the previous microbiological and

cytological study of these samples (Hristov et al., 2016).

Table 1. Results of CMT analysis of goats

	Investigated	CMT score			
		(-)	(+)	(++)	(+++)
goats	32	9	7	12	4
halves	64	19	13	26	6

Table 2. Results of haematological analysis of goat blood samples

Parameter		healthy goats	with subclinical mastitis
RBC x 10 ¹² /L	Mean ± SE	10.43 ± 0.63*	9.38 ± 0.42
	Min	5.41	6.63
	Max	14.84	12.91
Hb g/L	Mean ± SE	85.69 ± 2.43*	77.13 ± 1.73
	Min	65	68
	Max	98	89
HCT %	Mean ± SE	18.77 ± 0.87	17.77 ± 0.68
	Min	11.5	11.9
	Max	22.6	20.4
RDW %	Mean ± SE	21.55 ± 0.16	22.21±0.13*
	Min	20	21.4
	Max	22.4	23.3
MCV fL	Mean ± SE	16.96 ± 0.29	15.63 ± 0.20
	Min	15.5	14.3
	Max	18.8	16.8
MCH pg	Mean ± SE	6.18 ± 0.10	6.73 ± 0.09*
	Min	5.5	6.1
	Max	6.6	7.3
MCHC g/L	Mean ± SE	379.81 ± 3.72	378 ± 3.12
	Min	359	360
	Max	402	396
WBC x 10 ⁹ /L	Mean ± SE	13.37 ± 1.60	16.66±1.23*
	Min	7.8	8.2
	Max	18.9	23.5

* P ≤ 0.05 statistically significant difference between groups

Table 2 illustrates the haematological parameters for healthy and goats with subclinical mastitis. The ranges and means ± SE of haema-

tological parameters were as follows: RBC $\times 10^{12}/L$ (A) 5.41 – 14.84 and 10.43 ± 0.63 ; (B) 6.63 – 12.91 and 9.38 ± 0.42 ; Hb g/L (A) 65 – 98 and 85.69 ± 2.43 ; (B) 68 – 89 and 77.13 ± 1.73 ; HCT % (A) 11.5 – 22.6 and 18.77 ± 0.87 ; (B) 11.9 – 20.4 and 17.77 ± 0.68 ; RDW % (A) 20 – 22.4 and 21.55 ± 0.16 ; (B) 21.4 – 23.3 and 22.21 ± 0.13 ; MCV fL (A) 15.5 – 18.8 and 16.96 ± 0.29 ; (B) 14.3 – 16.8 and 15.63 ± 0.20 ; MCH pg (A) 5.5 – 6.6 and 6.18 ± 0.10 (B) 6.1 – 7.3 and 6.73 ± 0.09 ; MCHC g/L (A) 359 – 402 and 379.81 ± 3.72 (B) 360 – 396 and 378 ± 3.12 ; WBC $\times 10^9/L$ (A) 7.8 – 18.9 and 13.37 ± 1.60 ; (B) 8.2 – 23.5 and 16.66 ± 1.23 .

The mean RBC and Hb averaged in this study were statistically higher in healthy animals than those with subclinical mastitis. At the same time, MCH, RDW and WBC values were statistically higher in goats with subclinical mastitis. The MCV, HCT and MCHC values did not show statistically significant differences.

Although there is a significant decrease ($P \leq 0.05$) in RBC and Hb in animals with subclinical mastitis, those parameters are within the normal limit for this species (Douglas J. Weiss and K. Jane Wardrop, 2010). This indicates that the mentioned blood indicators are not substantially affected by the inflammation. The broad range of measured values as well as the difference in the two groups of animals can be explained by the influence of many additional factors such as nutrition, habitat, environment, age, reproductive status and stress. (Zumbo et al., 2011; Waziri et al., 2010). Changes in the mean values of MCV, MCH, MCHC and RDW, relative to the reference values for healthy goats, are insignificant and have no clinical relevance. This is confirmed by the results of other studies (Piccione et al., 2014), reporting values in healthy goats similar to ours or even higher.

A significant increase ($P \leq 0.05$) of WBC was observed in goats affected by subclinical mastitis compared to healthy animals. A similar increase in WBC with an increase in absolute number of monocytes, eosinophils and neutrophils has also been reported in lactating cows in other studies (Alhussien et al., 2015; Sarvesha et al., 2016). WBCs increase as a result of the invasion and spread of pathogenic microorganisms in the mammary gland and systemic reaction of the body. At the same

time, such increase in WBC is not always found in all lactating animals (Dang et al., 2007; Khaled et al., 2015). This is indicative that in some cases the process can be localized only in the mammary gland without systemic response. A possible explanation for these findings could be the different immunological status of the animals and the degree of pathogenicity of microorganisms causing subclinical mastitis.

CONCLUSIONS

The haematological parameters in goats with subclinical mastitis are mainly expressed by the elevation of the WBC levels. Changes in other parameters (RBC, Hb, MCV, MCH, MCHC, RDW) are insignificant in relation to healthy animals and have no clinical relevance.

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