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PREVALENCE OF MASTITIS AND DYNAMICS OF HEALTH STATUS MAMMARY GLAND DURING LACTATION AND DRY PERIOD IN GOATS

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Abstract

The purpose of this study was to investigate the prevalence of mastitis and dynamics of different mastitis forms in goats during lactation and the dry period .The prevalence of mastitis was analyzed in 250 goats. Parallel traced 52 dairy halves with different mastitis forms during lactation and 56 halves during the dry period. Express diagnosis was made on the farm with rapid mastitis test CMT-Test (Kruuse, Denmark) and test Porta SCC (Porta Check, USA). For precise determination of the health condition of all dairy halves was conducted laboratory analysis including determining the number of somatic cells by Fossomatic (Foss, Denmark) and microbiological testing for isolation of pathogenic microorganisms. Prevalence of mastitis was found within 45.8 % and results indicated that 41.67 % of the cases diagnosed with subclinical mastitis in early lactation, persisted at the end of the lactation period. At the same time the latent infection persisted in 15.38 % while secretory disorder was in 26.67 %. During the dry period the highest percentage of persisting indicated subclinical mastitis - 71.43 % and only 14.29 % were found healing, compared with secretory disorder that persisted in 42.86 % as they were healed halves. The latent infection persisted also in 42.86 %, but healing again was found only in 14.29 %. Non-clinical mastitis in the absence of the treatment are stored in 76.19%
Key words*: goats, mammary gland, health status, mastitis, dynamics*

INTRODUCTION

Mastitis is inflammation of the mammary gland, which causes biochemical, physical and bacteriological changes in the milk of affected animals (Matthews,1999). Mastitis is commonly associated with poor hygienic practices as well as with trauma of the mammary tissue and papillae or other types of skin wounds, as the skin is an important barrier against infections. In goats, under the influence of stress factors, such as extreme temperature changes, unhygienic and damp rearing conditions or a sudden change in the diet, the immune system needs to respond quickly against the invasion of pathogens that cause mastitis. That is why it is of particular importance to study the dynamics of non-clinical inflammation of the mammary gland in goats during the lactation and dry period. This is commonly based on observations of the duration of infection, the shift from one form into another and cases of recovery without therapeutic intervention. Such studies are important to precisely identify the animals that should be subject to treatment and the choice of appropriate time for intracisternal infusion as well as to develop a general strategy for control of mastitis in each particular farm.

MATERIALS AND METHODS

Animals included in the study

The prevalence of mastitis was analyzed in 250 goats. To study the dynamics of mammary gland inflammation, the animals were grouped into experimental groups consisting of a different number of animals depending on the condition of the mammary gland. The study included farms located in four different administrative districts in Bulgaria.

Sample collection

Milk samples were collected aseptically from all udder halves. Prior to sample collection, the udder and papillae were washed and then disinfected with 70° ethanol. The first portions of milk were discarded, then duplicate samples were collected from each udder half. Samples for microbiological analysis (10 ml) were collected in sterile tubes and those for somatic cell counts (50 ml), in milk containers. Milk samples were transported to the laboratory in an ice chest at 4°C and all analytical procedures

were performed within 16 hours from sample collection.

Cytological analysis

Cell counts were indirectly determined by the rapid mastitis tests CMT-Test (Kruuse, Denmark) and Porta SCC (Porta Check, USA). The results from the CMT-Test were interpreted based on the Smith and Sherman (2009) scale, and those from the Porta SCC test, based on the manufacturer's instructions.

Direct determination of somatic cell counts was performed according to BS EN ISO 13366-2/IDF 148-2:2006 at the National Reference Laboratory for Milk and Dairy Products, Regional Directorate for Food Safety–Sofia (Bulgaria), using Fossomatic (Foss, Denmark).

Microbiological analysis

Isolation and identification of microorganisms causing mastitis in goats was carried out according to routine methods (National Mastitis Council, 1999). Ten-microliter aliquots from each sample were inoculated on elective and selective culture media for bacteria and fungi and were incubated at 37°C and 28°C for 24–72 h in aerobic conditions. Bacterial isolates were taxonomically identified based on Gram and Pfeiffer staining, cultural characteristics and biochemical properties determined using Polymicrotest (National Center for Infectious and Parasitic Diseases–Sofia) and additional tests for oxidase, catalase activity etc. using reagents from Antisel – Scharlau Chemie S. A. (Spain). Identification of bacterial isolates was done using Bergey's Manual.

Statistical analysis

Statistical analysis was performed using the program SPSS 16.0.

RESULTS AND DISCUSSIONS

It was shown that, of the 500 studied udder halves, 54.2% were found to be healthy, and 45.8%, with a different type of mastitis (Table 1). These results are similar to those observed by Contreras et al. (1999) but higher than the 36.4% reported by Whiteand Hinckley (1999) in the USA. There are, however, data from other goat farms showing even higher percentages ranging from 45.25% to 82.51% (Mhase et al. 2007). This considerable prevalence of affected udder halves highlights how significant the problem is in goats.

Detailed data about the relative share of different mastitis forms in the studied animals are presented in Table 2. There was subclinical mastitis (SM) in 31.6% of the examined udder halves, whereas udder secretion disorder (SD), in 8%, and latent infections (LI) and clinical mastitis (CM), in 3.4% and 2.8%, respectively. The prevalence of subclinical mastitis in our study was similar to the 33% reported by Hall and Rycroft (2007) in the United Kingdom and the 29%, by Boscos et al.(1996) in the region of Thessaloniki (Greece). However, Kostelić et al.(2009) determined 20% prevalence, and **Persson and Olofsson (2011),** 18% in Sweden, suggesting that there are high variations in the prevalence of subclinical mastitis.

The prevalence of CM observed by us, 2.8%, is in agreement with the results of Bergonier et al. 2003, who showed it to be under 5%. A slightly higher percentage (6.33%) has been reported by Ameh et al. (2000), unlike Jensen et al. (1996), who observed 37% prevalence of CM. In previous studies in Bulgaria, Bozhkova et al. (2000) showed 7.26% and 39.05% prevalence of clinical and subclinical mastitis in goats, respectively, which, compared to the results from our study, indicates a reduction in these two types of mastitis over the last 15 years.

Together with the prevalence of mastitis, we studied the dynamics of different forms of mammary gland inflammation during a lactation period and its subsequent dry period. The dynamics of subclinical mastitis during the lactation period is presented in Table 3. Of all SM cases diagnosed at the beginning of the study, 41.67% persisted until the dry period. In comparison, this percent in sheep is twice as high, 86.11% (Koleva, 1998). Despite this, with time, there was a steady trend for gradual self-healing during lactation, the percentage of self-healed udder halves at the end of lactation being 20.83%. These results indicate that the self-healing ability of the mammary gland in goats could be considered higher than that in buffalo, where the self-healing rate is 12.7% (Parvanov,2000).

Table 1. Prevalence of mastitis in goats

State dairy halves	n (500)	P (%)	Δ
Healthy	271	54,2	4,76
With mastitis	229	45,8	3,86

Table. 2. Prevalence of various forms of mastitis in goats

State dairy halves		n (229)	P (%)	Δ
With mastitis	**clinical mastitis**	14	2,8	1,12
	subclinical mastitis	158	31,6 **	3,64
	secretory disorder	40	8 **	1,85
	latent infection	17	3,4 **	1,23

* p<0.05, ** p<0.01, *** p<0.001

Table. 3. Dynamics of subclinical mastitis during lactation in goats

	1 month		3 month		5 month		7 month		9 month	
	n	%	n	%	n	%	n	%	n	%
Self-healing			1	4,17	3	12,5	3	12,5	5	20,82
Secretory disorder			2	8,3	3	12,5	4	16,67	3	12,5
Latent infection					1	4,17	1	4,17	1	4,17
Subclinical mastitis	24	100	20	83,3	14	58,33	12	50	10	41,67
Clinical mastitis			1	4,17	2	8,33	1	4,17	1	4,17
Cured					1	4,17	3	12,5	4	16,67

Table. 4. Dynamics of latent infection during lactation in goats.

	1 month		3 month		5 month		7 month		9 month	
	n	%	n	%	n	%	n	%	n	%
Self-healing			1	7,69	1	7,69	1	7,69	2	15,38
Secretory disorder			3	23,08	3	23,08	2	15,39	2	15,38
Latent infection	13	100	6	46,15	5	38,46	4	30,77	2	15,38
Subclinical mastitis			3	23,08	3	23,08	4	30,77	5	38,48
Clinical mastitis					1	7,69	1	7,69		
Cured							1	7,69	2	15,38

Table. 5. Dynamics of secretory disorders during lactation in goats

	1 month		3 month		5 month		7 month		9 month	
	n	%	n	%	n	%	n	%	n	%
Self- healing			4	26,67	5	33,33	6	40	5	33,32
Secretory disorder	15	100	8	53,33	7	46,67	4	26,67	4	26,67
Latent infection			1	6,67			1	6,67	1	6,67
Subclinical mastitis			2	13,33	2	13,33	3	20	4	26,67
Clinical mastitis					1	6,67				
Cured							1	6,67	1	6,67

Table.6. Dynamics of the non-clinical forms of mastitis in goats during the dry period

Status of dairy halves before drying	dairy halves	Health status of dairy halves in early lactation									
		Healthy		Subclinical mastitis		Latent infection		Secretory disorder		Non-clinical mastitis (SM + LI + SD)	
	n	n	%	n	%	n	%	n	%	n	%
Healthy	14	11	78,57	1	7,14	1	7,14	1	7,14	3	21,43
Subclinical mastitis	14	2	14,29	10	71,43			2	14,29		
Latent infection	14	2	14,29	5	35,71	6	42,86	1	7,14		
Secretory disorder	14	6	42,86	1	7,14	1	7,14	6	42,86		
Non-clinical mastitis (SM + LI + SD)	42	10	23,81							32	76,19

Another important characteristic of the SM dynamics was the transition to SD at the end of lactation in 12.5% of the cases. Throughout the lactation period, the percentage of CM remained relatively constant at 4.17%. These cases were all treated in a timely manner and were presented in the results as having been cured. Thus, at the end of lactation their relative share was 16.67%. A percentage as low as that indicates that the mammary gland could be considered resistant to clinical forms of inflammation despite the presence of subclinical infection. Regarding the transition of SM to LI, the latter became observable as late as the 5th month of lactation in just 4.17% of the cases and remained at this level until the end of lactation.

One of the main characteristics of LI dynamics in goats is its gradual but steady decrease with time during lactation. At the end of lactation, LI was diagnosed in 15.38% of the studied udder halves (Table 4). Most of the udder halves showing LI at the end of lactation were diagnosed with subclinical mastitis (38.48%). These dynamics are clinically important, especially at the end of lactation, and should be taken into account in the drying-off of udder halves. This is also supported by the results for the relative shares of self-healed udder halves and those with SD at the end of lactation, which were both 15.38%.

Regarding the dynamics of SD (Table 5), it is noteworthy that there is still no universal global standard about the somatic cell counts per 1 ml milk from healthy mammary glands in goats. That is why for the purpose of the present study we assumed that there was SD in the udder halves showing over 500×10^3/ml somatic cell counts. Compared to all other forms of non-clinical mastitis, SD showed the highest self-healing percentage at the end of lactation, 33.32%. At the same time, the percentage of udder halves diagnosed with SM (26.67%) was the same as that with SD. It was only in rare cases that SD showed complications and developed into CM (6.67%) and this was only observed in the 5th month of lactation. The trend for LI, which was also diagnosed in 6.67% of the udder halves, was, however, different in that it occurred throughout the whole lactation period. These results in goats are in agreement with data in sheep, where according to Koleva (1998), SD persisted in 40% of cases, was self-healed in30%and developed into CM in another 30%.

The dynamics of the non-clinical forms of mastitis in goats during the dry period (Table 6) showed that they remained persistent in 76.19% of the cases and were self-healed in 23.81%. Of the udder halves diagnosed with SM at drying-off, 71.43% showed the same condition at the beginning of the next lactation period. There was self-healing and SD in 14.29%. LI remained persistent in 42.86%, developed into SM at the beginning of lactation in 35.71%, or into SD, in 7.14%. The rate of self-healing in this form of non-clinical mastitis was 14.59%. SD showed a tendency to persist in 42.86% and to develop into SM in 7.14% and into LI in another 7.14%.Of all forms of non-clinical mastitis, the self-healing rate was highest in SD, 42.86%.

The obtained results also showed that 78.57% of the udder halves that were diagnosed as healthy at drying-off remained healthy until the beginning of the next lactation. There were a total of 21.43% new cases of non-

clinical mastitis, including equal shares (7.14%) of each of the three forms of non-clinical mastitis.

The total relative share of self-healed udder halves was 23.81%, which indicates that the dry period has a positive effect on the mammary gland health. At the same time, this percentage only insignificantly exceeds the new cases of non-clinical mastitis. This insignificant difference between the percentages of self-healed cases and new ones, from a clinical point of view, suggests that the dry period could be considered an appropriate time for treatment and prophylaxis of non-clinical mastitis in goats.

CONCLUSIONS

The results from this study showed a high prevalence of mastitis in goats. This indicates that it is necessary to perform regular screening of the mammary gland health in goats. The analysis of the dynamics of different mammary gland conditions during the lactation and dry period showed that special attention needs to be paid to subclinical mastitis. What is more, proper prophylaxis and treatment of non-clinical mastitis during the dry period in goats would reduce the losses due to mammary gland inflammations during the following lactation period.

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REFERENCES

Ameh, J. A. and I. S. Tari. 2000. Observations on the prevalence of caprine mastitis in relation to predisposing factors in Maiduguri. Small Ruminant Res. 35. 1–5.

Bergonier, D., R. De Cremoux, R. Rupp, G. Lagriffoul, X. Berthelot, 2003. Mastitis of dairy small ruminants. Vet Res. 34:689-716.

Bozkova, G., T. Galabinov, N. Korudzhiyski, V. Filipov, J.Baychev, R.Becheva. 2000. The problem of mastitis and milk production in goats. Agricultural Science. 6. 24-26

Boscos, C., A. Stefanakis, C. Alexopoulos, F. Samartzi. 1996. Prevalence of subclinical mastitis and influence of breed, parity, stage of lactation and mammary bacteriological status on coulter counter counts and California Mastitis Test in the milk of Saanen and autochthonous Greek goats. Small Rumin. Res. 21:139-147.

Contreras, A., M. J. Paapeb, R. H. Millerb. 1999. Prevalence of subclinical intramammary infection caused by Staphylococcus epidermidis in a commercial dairy goat herd. Small Ruminant Research. 31. 203 ± 208.

Hall, S. M. and A. N. Rycroft. 2007. Causative organisms and somatic cell counts in subclinical intramammary infections in milking goats in the UK. The Veterinary Record. 160: 19-22.

Jensen, H. E., A. Espinosa de los Monteros and L. Carrasco. 1996. Caprine mastitis due to Aspergillosis and Zygomycosis: a pathological and immunohistochemical study,Journal of Comparative Pathology. 114. 2:183–191.

Kostelić, A., M. Cergolj, B. Tariba, V. Rupić, M. Benić, V. Gantner, I. Štoković. 2009. Prevalence and aetiology of subclinical mastitis in goats. J.Anim.Sci. vol. 8 (Suppl. 3).134-136.

Koleva, M., 1998. Studies on the incidence, etiology, pathogenesis, treatment and prevention of mastitis in sheep. PhD Thesis Stara Zagora.

Matthews, J. 1999. Diseases of the Goat. 2nd Ed. Oxford, Blackwell Science.

Mhase P. P., S. D. Harne and P. R. Suryawanshi. 2007. Comparative efficacy of different direct and indirect tests for diagnosis of mastitis in goats, J. Bombay Vet. Coll. 15 (1-2) :59-62

National Mastitis Council. 1999. Laboratory and Field Handbook on Bovine Mastitis. Revised edition. Fort Atkinson, WI, National Mastitis Council.

Parvanov, P. 2000. Prevalence and clinical aspects of the etiology, diagnosis, treatment and prevention of mastitis in buffaloes. PhD Thesis, Sofia.

Persson, Y. and I. Olofsson. 2011. Direct and indirect measurement of somatic cell count as indicator of intramammary infection in dairy goats, Acta Veterinaria Scandinavica. 53.

Smith, M. C. and D. M. Sherman. 2009. Goat Medicine, Second Edition, Wiley-Blackwell. ISBN: 978-0-781-79643-9.

White, E. and L. Hinckley. 1999. Prevalence of mastitis pathogens in goat milk. Small Ruminant Research. 33. 117-121