Global Veterinaria 11 (5): 604-608, 2013
ISSN 1992-6197

DOI: 10.5829/idosi.gv.2013.11.5.8112

Prevalence and Etiology of Subclinical Mastitis in Goats of the Tiaret Region, Algeria

[1]A. Bourabah, [3]A. Ayad, [1]L. Boukraa, [1]S.M. Hammoudi and [2]H. Benbarek

[1]Veterinary Institute, Ibn Khaldoun University, 14000, Tiaret, Algeria
[2]Faculty of Life and Nature Sciences, University of Mascara, 29000, Mascara, Algeria
[3]Department of Organism and Populations Biology,
Faculty of Life and Nature Sciences, University A. Mira, 06000, Bejaia, Algeria

Abstract: To investigate the periodic prevalence and etiology of subclinical mastitis in goats in Tiaret region (Western Algeria), milk samples were collected from 298 lactating goats for bacteriological and fungal analysis during March 2009 and February 2010. The *Californian Mastitis Test* showed a prevalence of 33.9% among the tested goats. *Enterobacteria*ceae were the predominant bacterial isolated (54.02%). Whereas; *Aspergillus niger* was the predominant one among fungi. In conclusion, the present investigation reveals a weak impact of the subclinical mastitis whereas the Coagulase negative *Staphylococci* is the causal agent of the majority of the mastitis.

Key words: Subclinical Mastitis · Goat · Etiology · Prevalence

INTRODUCTION

Caprine breeding constitutes an axe of the current development projects especially in rural environment. In Algeria, the goat breeding represents an important alternative to the livestock productions and their total number are estimated to be 3.96212 million, with uneven distribution in different regions and under various climatic and environmental conditions. The adaptation of the caprine species to its environment as well as its traditional anchoring, are strong foundations on which could be based new development initiatives such as dairy and meat production.

Worldwide, the mammary pathology in goat remains insufficient and marginal compared to that of bovine mastitis. Subclinical mastitis (SCM) is a crucial economic and hygienic problem in dairy goats [1, 2]. Scientific studies showed that the subclinical mastitis reduce dairy production and modify milk composition [3].

The mammary infection diagnosis consists of underlining the germ responsible for the infection. These methods are very sensitive but often expensive and not realizable in field. Other techniques cheap and easy to implement include, the subclinical mastitis detection by California Mastitis Test (CMT) [4] and electronic detector device. The CMT allows a semi-quantitative evaluation of the cellular contents of milk. That is ensured by observing the flocculation intensity of the milk sample upon addition of the detergent.

The knowledge of the nature, the frequency and the transmission modes of the germs responsible for the mastitis are crucial for judicious choice of mammary pathology control programs.

The objective of the present study is to determine the prevalence and etiology of the goat subclinical mastitis in semi-arid area (Tiaret, Algeria). The ultimate goal is to contribute to data bank settlement concerning a mammary pathology and further participate to the programs retained for the control of the mammary pathology and eventually avoid human contamination.

MATERIALS AND METHODS

Animals and Sampling: The study was carried out on different breeding of the province of Tiaret (Figure 1). This zone of study is situated in the high plateaus of Algeria, at an altitude of 1086 m (350°15' NR, 10°26' E). These experiments were performed on two seasons of kidding (March 2009 to February 2010). A total of 298 milk samples were taken from each half-udder from 149 goats.

Corresponding Author: Bourabah Akila, Veterinary Institute, Ibn Khaldoun University, 14000, Tiaret, Algeria.
Tel: +213(0)779810372.

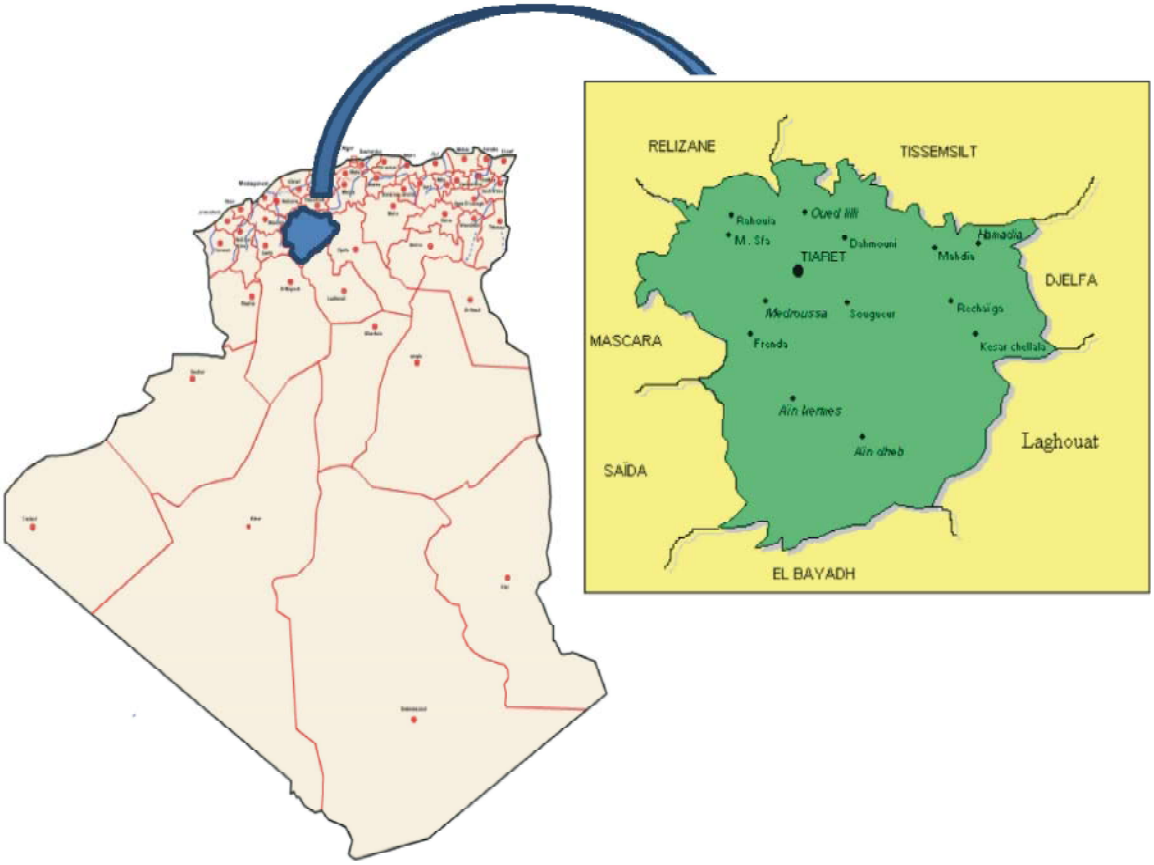

Fig. 1: Geographical location of the area of study

the milk samples were collected after the colostral period (i.e. 21 days after lambing). This was carried out after cleaning the teat by disinfectant (Potassium Permanganate) and discarding the first milk jets.

California Mastitis Test (CMT): The milk samples were collected in a cup of the CMT plate to which was added 2 ml of the leucocytes reagent [5]. The CMT is applied after the 3rd week of lactation because its interpretation is not very reliable before this period [6]. The CMT results were classified as: - (negative), ± (traces), ++ (positive) and +++ (strong positive). All milk samples collected in sterile pots were then transported to the Veterinary Institute Laboratory of microbiology (University of Tiaret) for bacterialal and fungal analysis.

Bacterial and Fungal Analysis: Insulation was carried out by simultaneous sowing of the milk drops on nutrient agar, Chapman agar, MacConkey agar, Sabouraud agar and blood agar for the detection of hemolytic bacteria. After incubation during 24h at 37 °C, the colonies were identified and preserved for future analyzes.

Statistical Analysis: The prevalence (%) of the bacterial type was estimated as the ratio of the positive sample number to the total number of samples collected for bacteriological analysis. Calculations were performed using Statistica software (6th version).

RESULTS

During the study period, 298 milk samples were collected from 149 dairy goats. The analysis of the milk samples by the CMT revealed a subclinical mastitis rate of 33.9% (101 cases). Bacteria were isolated from 106 with a positive and a negative CMT milk samples (100 and 6 cases, respectively) (Table 1). Note that the specificity and the sensitivity of the CMT test used for the subclinical mastitis detection were 96% and 99%, respectively (Table 1).

The bacteriological analysis, milk samples were taken from lactating. All milk samples collected in sterile pots were then transported to the Veterinary Institute Laboratory of microbiology (University of Tiaret) for bacterialal analysis and immediately inoculated on

Table 1: Relationship between bacteriological and California mastitis test (CMT) results of the goats' milk samples

		Bacteriology			
		+	–	Total	Sensitivity
CMT	+	100	1	101	99%
	–	6	191	197	
Total		106	192	298	
	Specificity		96%		

Table 2: Etiology of the subclinical mastitis and its prevalence (%) in goat

Family	Species	%
Enterobacteriaceae		54.02
	E coli and pontoea spp.	23.40
	Klebsiella spp.	55.31
	Enterobacter spp.	17.02
Micrococcaceae	*SNC*	15.54
	S aureus	2.75
	Micrococcus spp.	10.09
Pseudomonaceae	*Pseudomonas aeruginosa*	27.58
Authors germs	*Streptococcus D*	2.75
	Bacillus spp.	2.75
	Corynebacterium spp.	0.91

nutrient agar, Chapman agar, MacConkey agar, Sabouraud agar and blood agar for the detection of hemolytic bacteria. After incubation, during 24h at 37°C. Colonial morphology was used as the first identification step for the bacterial isolates. The bacterial isolates were then identified by the Gram staining and biochemical characterization (Api E, Api Staph galleries) according to standart produres [7].

(Table 2) allowed the insulation of the following bacteria: *Enterobacter*iaceae (54.02%), *Pseudomonas aeruginosa* (27.58%), *Escherichia coli* and *Pantoea* spp. (23.4%), *Klebsiella* spp. (55.31%), *Enterobacter* spp. (17.02%), *Citrobacter* spp., kluyvera (at weak rates, only one case for each one), *Coagulase-negative Staphylococcus* (15.54%).

The mycetes identified were *Aspergillus niger* and *Aspergillus nidulans*, with a percentage of 24.7%. But *Aspergillus nig*er is more frequency than *Aspergillus nidulans* (96 versus 04% respectively).

DISCUSSION

The mastitis is one of the important pathologies in goats with serious financial consequences. In a previous study, it has been confirmed that the teat is an open gate for the causal agents [8]. The inflammation of mammary gland in the goat, commonly called mastitis, is mainly subclinical [9]. Note that the subclinical mastitis cannot be detected by clinical methods such as the inspection, palpation and the organoleptic examination. Its diagnosis is based on the somatic cells count (SCC), California Mastitis Test (CMT) and the bacteriological examination of milk [10, 11]. The CMT test is based on the reaction between the CMT reagent and DNA in the somatic cells and high concentration of somatic cells leads to a higher CMT score. The somatic cell count indicates the number of neutrophils, which are directly related to grandular irritation [12]. However, Wilson *et al*. [13] found that 90% of the differences in the goats'SCC was not due to infection but was caused by increased days in milking parity and reduce milk production. The fact that only one of the examined goats had clinical mastitis probably indicates that the CMT positivity was not directly related to infection in the goats. This is also supported by the fact that most of the milk samples were bacteriologically negative. The present study on the goat subclinical mastitis allows gaining knowledge on the species responsible of the mammary pathology in a steppe area of Algeria.

Indeed, the results obtained by the CMT revealed a prevalence of the subclinical mastitis of 33.9%. This result is similar to that observed in Spain [9, 11] and Kenya [14] but a slightly higher than that reported in France [15]. Tests carried out by Mdegela and collaborators [16] on goats of Tanzania revealed a very low percentage of positive CMT, with 33.5% of specificity and 74.5% of sensitivity. A similar prevalence is obtained by Beheshti *et al.* [3] in Iran.

The high percentage of the subclinical mastitis could be due to a lack of hygiene and to the practice of traditional breeding of extensive type, which favors diseases [17]. This finding was confirmed by Shekimweri [18] who conclude that major cases of the observed clinical and subclinical mastitis are of hygienic origin. Many studies undertaken in goats reported a prevalence of mastitis ranging from 6 to 47% [19-22].

As the subclinical mastitis diagnosis is only possible by the CMT, it is necessary to conduct additional tests such as SCC (Somatic Cells Count) [12, 23] and/or develop complementary bacteriological methods [23, 24, 25].

In our study, coagulase-negative *Staphylococci* (CNS) are the most frequent bacteria encountered. In general, CNS is the prevalent bacteria in the subclinical mastitis [10, 11, 26, 27, 28]. It is usually isolated from the respiratory tract and the teat skin or the teat-end from milk [29].

Staphylococcus aureus, *Bacillus* spp., *Corynebacterium* were also isolated but with a poor prevalence.

The isolated species are the same as those identified in previous studies [21, 30, 31]. Based on 478 goats in Bulgaria Bochev and Russenova [32] found high rates of CNS and *Staphylococcus aureus* (80.2% and 19.8%, respectively). In another study, Contreras *et al.* [9] reported that the main CNS isolated was *S. caprea* (22%); this is in agreement with our results. Other bacterial species were identified such as *S. lentus; S. suiuri;* and *S. xylosus*. A relatively low percentage of *S. aureus* was found compared to that reported by Contreras and associated [9] (2.75 vs. 6%).

The subclinical mastitis rate (43%) caused by CNS (*S. caprea*) reported by Moroni *et al.* [30] appeared higher than that observed in our study. Contrary to the present investigation, Kostelic and co-authors [20] reported a high rate of *S. aureus* (72%). In contrast, the CNS rates (16%), *Streptococcus D* (6%) and *Bacillus* spp. (2%) agree well with our results.

S. aureus is found in the subclinical mastitis including the gangrenous mastitis with other bacterial agents (*Escherichia coli*, *Clostridium perfringens*, *Streptococcus*, *Pseudomonas*) [1, 33, 34]. According to Lerondelle and Poutrel [35], the majority of the subclinical infections originate from SNC (24.1 %). Beheshti *et al.* [3] reported that in the sheep, the same agents are responsible for the subclinical mastitis: CNS(69.2 %), *S. aureus* (19.2 %), *E. coli* (8 %) and *Corynebacterium bovis* (8 %).The same bacterial agents reported by Tadesse *et al*. [36] in bovine mastitis. Concerning *Aspergillus niger* and *A. nidulens*, they are responsible for the subclinical mastitis in goat of the wet area as in Sidi Hosni.

In conclusion, the present study showed an Important prevalence in goat subclinical mastitis of the area of Tiaret whereas; the coagulase-negative staphylococcus is the principal causal agent.

ACKNOWLEDGEMENT

The authors wish to thank Abdallah F. and Maachi M. for the assistance technical and Dr. Nabti E/H. (University of Bejaia, Algeria) for their advice and review of the present manuscript. The authors thank Dr. Harrats Ch. (University of Oran, Algeria) for the English correction.

REFERENCES

1. Bergonier, D., R. De Grémoux, R. Rupp, G. Lagriffoul and X. Berthelot, 2003. Mastitis of dairy small ruminants. Veterinary Research, 34: 689-716.
2. Contreras, A., C. Luengo, A. Sánchez and J.C. Corrales, 2003. The role of intramammary pathogens in dairy goats. Livestock Production Sciences, 79: 273-283.
3. Beheshti, R., J. Shaieghi, B. Eshratkhah, J.G. Ghalehkandi and N. Maheri-Sis, 2010. Prevalence and etiology of subclinical mastitis in ewes of the Tabriz region, Iran. Global Veterinaria, 4: 299-302.
4. Razi, K.M.A., B. Rahman, G.H. Flores-Gutiérrez and T. Rahman, 2012. Prevalence of caprine subclinical mastitis in Mymensingh area, Bangladesh and characterization of associated bacterial agents and the risk factors. Microbes and Health, 1: 1-5.
5. Schalm, O.W. and D.O. Noorlander 1957. Bovine Mastitis. Lea and Febiger, Philadelphia, pp: 95-123.
6. David, V., R. De Cremoux., P. Roussel, B. Lamoureux, P. Mercier and T. Vidart, 2000. Le CMT ou test au teepol. Institut de l'élevage, Disponible au: URL: http://www.inst-elevage.asso.fr.
7. Carter, G.R., M.M. Chengapa and G. William, 1991. Essential of Veterinary Bacteriology and Mycology, 4th edition, Philadelphia, London, pp: 109-237.
8. Portolano, B., R. Finocchiaro, J.B.C.H.M. Van Kaam, V. Riggio and D.O. Maizon, 2007. Time-to-event analysis of mastitis at first-lactation in Valle del Belice ewes. Livestock Science, 110: 273-279.
9. Contreras, A., J.C. Corrales, D. Sierra and J. Marco, 1995. Prevalence and aetiology of non-clinical intramammary infection in Murciano-Granadina goats. Small Ruminant Research, 17: 71-78.
10. Gebrewahid, T.T., B.H. Abera and H.T. Menghistu, 2012. Prevalence and etiology of Subclinical Mastitis in Small ruminants of Tygray Regional State, North Ethiopia. Vet. World, 5: 103-109.
11. Islam, M.A., M.A. Samad and A.K.M. Anisur Rahman, 2011. Bacterial pathogens and risks factors associated with mastitis in Black Bengal goats in Bengladesh. Bangl. J. Vet. Med., 9: 155-159.
12. Poutrel, B. and C. Lerondelle, 1983. Cell counts of goat milk: California mastitis test, coulter counter and fossomatic for predicting half infection. Journal of Dairy Science, 66: 2575-2579.
13. Wilson, D.J., K.N. Strwart and P.M. Sears, 1995. Effects of stage of lactation, production and season on somatic cell counts in infected and non-infected dairy goats.Small Ruminant Research, 16: 165.
14. Shivairo, J. Matofari, C.I. Muleke, P.K. Migwi and E. Lugairi, 2013. California mastitis test and somatic cell counts as indicators of intramammary infectionin dairy goats in Kenya. Journal of Natural Sciences Research www. iiste. Org., 3(8).

15. Poutrel, B., R. De Crémoux, M. Ducelliez and D. Verneau, 1997. Control of intramammary infections in goats: Impact on somatic cell counts. Journal of Animal Science, 75: 556-570.
16. Mdegela, R.H., L.J. Kusiluka, A.M. Kapaga, E.D. Karimuribo, F.M. Turuka, A. Bundala, F. Kivaria, B. Kabula, A. Manjurano, T Loken and D.M. Kambarage, 2004. Prevalence and determinants of mastitis and milk-borne zoonoses in smallholder dairy farming sector in Kibaha and Morogoro districts in Eastern Tanzania. Journal of Veterinary Medicine B, Infectious Diseases and Veterinary Public Health, 51: 123-128.
17. Blowey, R.W. and P. Edmondson, 2000. Mastitis control in dairy herds: An illustrated practice guide. Farming press, Toubridge, United Kingdom, pp: 103-118.
18 Shekimweri, M.T., 1992. Mastitis incidence, predisposing factors and the strategy of control in smallholder dairy farms in Morogoro. (Thèse de MSc), Sokoine University of Agriculture Tanzania.
19. Hall, S.M. and A.N. Rycroft, 2007. Causative organisms and somatic cell counts in subclinical intramammary infections in milking goats in the UK. Veterinary Record, 160: 19-22.
20. Kostelić, A., M. Cergolj, B. Tariba, V. Rupić, M. Benić, V. Gantner and I. Štoković, 2009. Prevalence and aetiology of subclinical mastitis in goats. Italalian Journal of Animal Science, 8: 134-136.
21. Sánchez, A., A. Contreras, J.C. Corrales and P. Muñoz, 2004. Influence of sampling time on bacteriological diagnosis of goat's intramammary infection. Veterinary Microbialogy, 98: 329-332.
22. White, E.C. and L.S. Hinckley, 1999. Prevalence of mastitis pathogens in goat milk. Small Ruminant. Research, 33: 117-121.
23. Maisi, P. and I. Riipinen, 1988. Use of California mastitis test, N-acetyl-beta-glucosaminosidase antitrypsin to diagnose caprine subclinical mastitis. Journal of Dairy Research, 55: 309-314.
24. Radostitis, O.M., C.C. Gay, K.W. Hinchcliff and P.D. Constable, 2007. A text book of diseases of cattle, Horses, Sheep, Pigs and Goats. (Ed.) Philadelphia Saunders, Veterinary Medicine, pp: 1052-1053.
25. González-Rodríguez, M.C. and P. Cármenes, 1996. Evaluation of the California mastitis test as a discriminant method to detect subclinical mastitis in ewes. Small Ruminant Research, 21: 245-250.
26. Fthenakis, G.C., 1995. California mastitis test and whiteside test in diagnosis of subclinical mastitis in dairy ewes. Small Ruminant Research, 16: 271-276.
27. Ylva Persson and Ida Olofsson, 2011. Direct and indirect measurement of somatic cell count as indicator of intramammary infection in dairy goats. 2011. Acta Veterinaria Scandinavica 2011, 53: 15 doi: 10.1186/1751-0147-53-15.
28. Sarker, H. and M.A. Samad, 2011. Udder-halve-wise comparative prevalence of clinical and subclinical mastitis in lactating goats with their bacterial pathogens and antibiotics sensitivity patterns in Bangladesh. Bangl. J. Med., 09(2): 137-143.
29. Kiossis, E., C.N. Brozos, E. Petridou and C. Boscos, 2007. Program for the control of subclinical mastitis in dairy Chios breed ewes during lactation. Small Ruminant Research, 73: 194-199.
30. Moroni, P., G. Pisoni, C. Vimercati, M. Rinaldi, B. Castiglioni P. Gremonesi and P. Boettcher, 2005a. Characterization of staphylococcus aureus isolated from chronically infected dairy goats. Journal of Dairy Science, 88: 3500-3509.
31. McDougall, S., W. Pankey, C. Delaney, J. Barlow, P.A. Murdough and D. Scruton, 2002. Prevalence and incidence of subclinical mastitis in goats and dairy ewes in Vermont, USA. Small Ruminant Research, 46: 115-121.
32. Bochev, I. and N. Russenova, 2005. Resistance of staphylococcus spp. Strains isolated from goats with subclinical mastitis. Bulgarian Jouranl of Veterinary Medicine, 8: 109-118.
33. Ibrahim, E.A., N.A.T. Allam, E.E.Z. Kotb, G.A. El-Rafey, M.M. Alaa El-Deen and M.G. Fadlallah: Sequence-Based typing-study on the relationship between Subclinical Mastitis and BoLA-DRB3.2* allelic polymorphism in Egyptian Cows. Global Veterinaria, 9: 08-22.
34. Amin, A.S., R.H. Hamouda and A.A.A. Abdel-All, 2011. PCR Assays for detecting major pathogens of mastitis in milk simples. World Journal of Dairy and Food Sciences, 6: 199-206.
35. Lerondelle, C. and B. Poutrel, 1984. Characteristics of non-clinical mammary infections of goats. Annales de Recherches Vétérinaires, 15: 105-112.
36. Tadesse, A. and M. Chanie, 2012. Study on the occurrence of bovine Mastitis in Addis Ababa dairy farms and associated risks factors. Advences in Biological Research, 6: 151-158.