

Prevalence of Subclinical Mastitis from Milking Dairy Goat Species Reared in Different Climatic Conditions in Morogoro Region

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Abstract: A total of 96 dairy goats kidding once and primiparous of Toggenburg (T) and Norwegian white (NW) breeds were involved in this study. Study was carried in Morogoro municipality (N=37: T=16, NW=21), Mgeta in Mvomero district (N=44: T=14, NW=30) and Gairo town in Gairo district (N=15: T=6, NW=9). The prevalence of subclinical mastitis (SCM) was determined using California Mastitis Test (CMT). A total of 192 composite milk samples (one sample per teat) were aseptically collected from each quarter of the apparently healthy dairy goat and screened by using California Mastitis Reagent which contains Alkyary sulphate and Bromocresol purple. The milk samples that scored 0, Trace (T), and +1 were considered as negative, while the samples with the scores +2 or +3 were taken as positive and used in the screening test. From Morogoro Municipality, the prevalence was 31.08% (23/74), right quarters (RQ) having 18.92% (14/74) and left quarters (LQ) with 12.16% (9/74). In Mgeta, out of 88 samples, 37.5% (33/88) were positive for mastitis, RQ 23.86% (21/88) while the LQ had 13.64% (12/88). Dairy goats from different farmers at Gairo had 33.33% (10/30), RQ had 20% (6/30) while for the LQ were 10% (3/30). Overall prevalence in all three studied areas was 34.38% (66/192) whereby for the right quarters were 21.35% (41/192) and left quarters 12.5% (24/192). Regarding prevalence within the breeds, T breed had 25% (18/72) within the breed and 9.38% (18/192) of the total milk samples while in NW had 40% (48/120) and 25% respectively. From these findings it is concluded that right quarters of the udder were mostly affected with subclinical mastitis than left quarters. NW breed is more susceptible to SCM than T. Farmers should be educated on this disease and education should include proper managerial practice especially avoiding risk factors such as poor hygiene of the udder and personnel, care of the injuries on the teats and proper milking. Regular screening of milking goats with CMT using expert and proper treatment of the Clinical Mastitis should be advocated. Bacteria causing mastitis should be isolated and tested for their Antimicrobial Resistance by using commonly used antimicrobials in the study areas.

Keywords: Subclinical Mastitis, Left and Right Teats, Toggenburg, Norwegian White, California Mastitis Test, Morogoro, Tanzania

1. Introduction

Mastitis is the inflammation of the mammary gland and is characterized by physical, chemical and bacteriological changes in the milk and pathological changes in the glandular tissue of the udder [17]. Mastitis is one of the most important diseases of dairy animals world-wide. Economically, it is one of the most devastating diseases affecting the dairy animals [10]. The economic losses are attributable to reduced milk production,

discarded/ poor quality milk, early culling, cost of veterinary services, decreased export of milk as well as milk products and the extra cost of management [22]. Mastitis affects both quantity and quality of milk and is characterized by physical, chemical, microbiological, and pathological changes in the udder and milk [12]. Sub-clinical mastitis (SCM) is the most common in goats [16] and is 15-40 times more prevalent than the clinical form [7]. In subclinical mastitis, milk appears normal with no visible abnormalities in the mammary tissue of the affected goat. The

subclinical mastitis usually precedes the clinical form and constitutes a reservoir of microorganisms that act as a source of infection to the healthy animals [22]. *Staphylococcus* species have been reported as the most common pathogen group associated with subclinical mastitis in dairy goats [13, 23]. *Staphylococcus aureus*, a coagulase-positive *Staphylococcus* pp, have been found as the most common bacterial pathogen associated with clinical mastitis in dairy goats, whereas coagulase-negative *Staphylococci* spp have been reported as the most prevalent in subclinical mastitis in the goats [12] *Streptococci* spp, are considered as the most common cause of the clinical as well as SCM in goats after *Staphylococci* spp [2]

Apart from the above-mentioned bacteria other causative organisms include: Bacteria eg. Coliform, *Corynebacterium*, *Pseudomonas*, *Nocardia*, *Mycoplasma* spp, Yeast eg. *Candida* spp, *Aspergillus fumigatus* and *Cryptococcus neoformis*. Virus eg. *Caprine arthritis encephalitis virus* [13, 15, 14].

Epithelial cells and leukocytes present in milk in response to intramammary infection are considered as milk somatic cells [12]. Milk somatic cells are good indicators of intramammary infection and can be employed to assess the level or occurrence of SCM in herds or individual animal [11, 12]. In addition to somatic cell count, California mastitis test is commonly used to detect SCM in animals by estimating number of leucocytes present on the reaction of milk with CMT reagent [9].

Subclinical mastitis is the most prevalent and costly disease that affects dairy animals. Many producers have been implemented to corner the disease for years but it continues to be the single largest obstacle for the dairy industry [13]. Studies have been done concerning subclinical mastitis in dairy goats in the country [13] and other study was carried out by [15] in Kenya for dairy goats. Due to climatic changes there was a need to find out the current situation of SCM in these areas. The goat dairy farmers are discouraged on keeping them because of the loss they got for the challenges of subclinical mastitis in their dairy farms. Subclinical mastitis infections affect the dairy products bottom line by reducing milk production, decreasing milk yield and suppressing reproductive performance. This study was carried out to determine the prevalence of subclinical mastitis in dairy goats in Morogoro urban, Gairo and Mvomero districts and assessed the risk factors associating with subclinical mastitis in dairy goats.

2. Materials and Methods

2.1. Study Area

The study was carried out in Morogoro urban (Magadu dairy farm, LITA Morogoro dairy Farm), Mvomero district (Mgeta village) and Gairo district (Gairo town). Farmers were selected randomly and be given a verbal consent for their goat to be screened for subclinical mastitis. The study started from November 2019 to March 2020 and the results were obtained and analysed.

2.2. Study Design

The study design used was Cross-sectional study design to

determine the Prevalence of sub clinical Mastitis in dairy goats.

2.3. Sample Collection

A total of 96 apparently health milking goats with 192 quarters were selected from the study stations (Table 1). Goats were restrained and the teats were thoroughly washed and wiped. Milk samples (4-5mls) were aseptically collected from each Quarter.

Table 1. Goat from different study stations.

Study sites	Breeds		Total
	Toggenburg	Norwegian white	
LITA-Morogoro Dairy Farm	7	8	15
Magadu Dairy Farm	9	13	22
Mgeta Village	14	30	44
Gairo Town	6	9	15
Total	36	60	96

2.4. Screening of Milk Samples

The milk samples collected screened for subclinical Mastitis using California Mastitis Test (Figure 1). The milk sample was mixed with equal volume of CMT reagent by swirling / circling motion. The results were taken as positive for those samples graded +2 and +3 while 0, Trace and +1 were regarded as negative as instructed in CMT manual (Figure 2). Table 2 is showing CMT somatic cell count estimate and the features of milk changes after mixing CMT reagent with few mills (5mls) of milk.



Figure 1. Collection of milk samples from the goat.



Figure 2. Reaction of milk with CMT reagent.

Table 2. Grading CMT reactions; Defining CMT scores and estimates of corresponding SCC (Immune Cell CMT kit).

Cmt score	Interpretation	Visible reaction	Total cell count
0	Negative	Milk fluid and normal	0 – 200,000 0 – 25% neutrophils
T	Trace	Slight precipitation	150,000 – 500,000 30 – 40% neutrophils
1	Weak positive	Distinct precipitation but no gel formation	400,000 – 1,500,000 40 – 60% neutrophils
2	Distinct positive	Mixture thickens with a gel formation	800,000 – 5,000,000 60 – 70% neutrophil
3	Strong positive	Viscosity greatly increased, Strong gel that is cohesive with a convex surface.	>5,000,000 70 – 80% neutrophils

Source: Persson and Olofsson, 2011.

2.5. Associated Risk Factors for SCM

Factors including age, parity, hygiene and breed were also investigated to determine their contribution to SCM. Every milking goat that was included in this study these parameters were collected and used in the study. Hygiene were personally observed and recorded accordingly.

2.6. Statistical Analysis

Data obtained from CMT test and SCC was used to determine the Prevalence of the SCM in Dairy goats. The effect of the variables such as Age, Parity, Breed, environmental changes in different areas where study was carried on the Prevalence of the disease was determined using Chi- square (X^2) test through Statistical Package for the Social Sciences (2015 IBM SPSS Statistics). Where by the Prevalence was calculated by $P =$

$(N/NT * 100)$ where P is Prevalence, N number of positive samples and NT is the total number of screened goats. Data was presented in table and by Bar charts.

3. Results

The overall Prevalence was 34.38% to the all number of dairy goats tested using California Mastitis test (Table 3). Also, between the quarters of the udder the right halves were most affected compared to the left halves having the prevalence of 21.35% (41/192) while the left halves were 13.02% (25/192) (Table 3). The Prevalence of subclinical mastitis in dairy goats basing on the sample sources were 16.67% from LITA Morogoro dairy farm, 40.91% at Magadu dairy farm, 37.5% at Mgeta village and 33.33% at Gairo district (Table 3).

Table 3. CMT results after screening the dairy goats from different locations.

Locations Quarters		N	Quarter	CMT Readings					Prevalence
				0	T	+1	+2	+3	
LITA –Morogoro dairy farm	15	n = 30	Right	0	8	5	3	0	16.67%
			Left	0	4	7	1	1	
Magadu dairy farm	22	n = 44	Right	0	5	8	10	1	40.91%
			Left	0	6	7	6	1	
Mgeta village	44	n = 88	Right	0	3	20	18	3	37.5%
			Left	0	9	23	9	3	
Gairo Town	15	n = 30	Right	0	0	9	5	1	33.33%
			Left	0	5	7	3	1	
Total	96	192		40	86	55	11		34.38%

3.1. Associated Risk Factors for Subclinical Mastitis

Table 4 shows the prevalence and associated factors with subclinical mastitis. Poor hygiene, parity and breeds have shown to be contributory factors to SCM. Dairy goats that are less than 4 years are more prone to SMC than the aged ones

Table 4. Prevalence and association of risk factors with subclinical mastitis in goats.

Risk factors	Number of goats examined	Goats with subclinical mastitis	Prevalence of subclinical mastitis
AGE			
<4 years	56	20	35.71%
>4 years	40	12	30%
PARITY BY NUMBERS			
1-3	20	3	15%
3-5	42	11	26.19%
>5	35	13	37.14%
HYGIENE			
Poor hygiene	75	42	56%

Risk factors	Number of goats examined	Goats with subclinical mastitis	Prevalence of subclinical mastitis
Good hygiene	21	6	28.57%
BREED			
Cross breed Toggenburg	35	13	37.14%
Cross breed Norwegian white	61	20	32.79%
Total	96	33	34.38%

3.2. Effect of SCM to Udder Quarters

From figures 3 it has been learnt that right quarters are more affected than the left ones. This is a cross cutting problem basing on the breeds and location from the sites that were involved in this study.

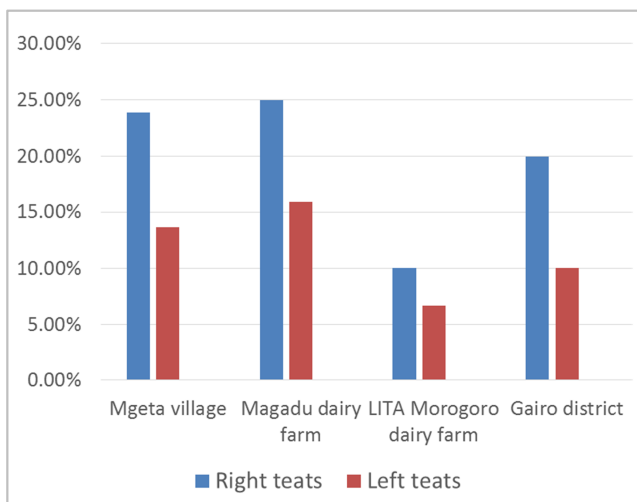


Figure 3. A bar charts showing left and right teats prevalence of subclinical mastitis in different study areas.

4. Discussion

The current investigation showed the considerable prevalence of the Subclinical mastitis among the dairy goats in the study areas which may have negative impact on the health and production of the dairy goats. In order to prevent the infections, the does affected by mastitis should be isolated, milked last and ultimately culled as this reduces exposure of other does, and increase selection pressure for genetic resistance. In herds where there is a high incidence of mastitis udders should be checked regularly and any lesions present should be treated immediately [2] Mastitis in goats is an important pathological condition and is responsible for serious economic loss to goat farmers, and is mainly encountered in dairy goats is subclinical form [13, 3]. It should be noted that SCM cannot be diagnosed by general physical examination such as palpation and organoleptic examination [11, 3].

It has been observed that right quarters were more affected than left ones in both breeds. This is in agreement with Hase et al. (2013), who reported the same findings in cattle. Higher prevalence was recorded in right-hind quarter (37.78%) followed by left-hind quarter (26.08%) while it was (21.73%) in right-fore and (17.39%) in left-fore quarters respectively. The similar pattern of affection of quarters i.e Right hind (28.98%), Left hind (27.53%), Right fore (23.67%) and Left

fore (19.80%) was also observed by Shastri (2001). Despite of this study was carried in goats that have two quarters, still both right fore and hind quarters in cattle had higher SCM than the left ones. However, these findings are in contrary from Khan and Muhammad (2005), who reported highest prevalence of clinical mastitis in the left hind-quarter in buffaloes while Sarker and Samad recorded SCM in left udder-halves (n = 44; 40.74%) in comparison to right udder-halves (n = 11; 1019%) in Black Bengal goats.

Considering risk factors, two breeds were compared in this study. Norwegian white (NW) had high prevalence of SCM than Toggenburg (T). It has been observed that the extent of subclinical mastitis in pure breed eg. Norwegian white is most susceptible compared to local goat breeds. Apart from breed it has been found that age of does, parity and hygiene are also risk factors of SCM. A study by Sazed et al. (2020), depicted the odds of SCM to be significantly higher in poor and fair body conditioned compared to cachectic goats, goats in late lactation, Jamnapari breed and in goats with bottle shaped teats rather than conical or cylindrical teat shapes.

In the study, no statistically significance association between prevalence of the disease and risk factors such as age and parity were found [5]. The potential variability in the prevalence in different locations may be attributed to climatic conditions within study areas, the difference in genetic resistance of bacteria, hygiene, milking practices, management systems and technical knowledge of the investigators [7]. The climate at Mgeta is temperate and in winter there is much less rainfall than in summer, the temperature there averages 20.7°C and about 1473 mm of precipitation falls annually. Morogoro urban has tropical climate with relatively low rainfall with relative humidity between 80 and 85%, the temperature ranges from 22 to 37°C while in Gairo the climate is warm and temperate and when compared with winters the summers have much more rainfall (<https://en.climate-data.org/africa>).

High Prevalence at Magadu dairy farm was due to the associated factors that contribute to the occurrence of the infections. Some of the associated factors were; poor environmental hygiene especially in the house they stay since the goats stays on the bare floor with faecal contamination and wet environment, also number of dairy goats have injuries on their teats providing route of infections, poor milking hygiene since the procedure of milking did not involve the cleaning of the udder [13, 19]. In other farms the dairy goats were kept on raised slated floor house with good hygiene but the milking procedure was not properly in terms of hygiene [1] It was also I found that, most of the farmers that keep dairy goats they were not managing their goats properly in terms of hygiene and health, for example in Gairo they are no longer milk their goats even if they keep dairy goats and those breeds of dairy tend to disappear because of

crossing with local breeds. At Mgeta they still have the project for dairy goats and they keep milking their goats but they don't bother with the health of the udder especially for subclinical mastitis and because of this the production trend of milk tend to decrease compared to the initial stage of lactations [13, 15, 19].

5. Conclusion

The current investigation showed the considerable prevalence of the Subclinical mastitis among the dairy goats in the study areas which may have negative impact on the health and production of the dairy goats. In order to prevent the infections the does affected by mastitis should be isolated, milked last and ultimately culled as this reduces exposure of other does, and increase selection pressure for genetic resistance. In herds where there is a high incidence of mastitis udders should be checked regularly and any lesions present should be treated immediately (Bergonier et al 2003). Thus, there is need to improve management practices such as general environmental hygiene eg. Supply of clean and dry bedding, proper and hygienic milking practice and care of lesions on the teats and udder (wounds), dry period treatment, implementing a milking order ie. Healthy females first and culling persistent infectors in the farms in order to decrease the prevalent of the disease to a possible lower limit. Awareness to the farmers has to be provided by extension officers / NGO's in order to understand the economic importance of the disease since the disease tend to reduce the milk yield and quality of the milk to the affected goats hence loss of targeted goals in dairy industry. Proper control and prevention should be instilled in order to protect the public from diseases and reduce economic losses (Tomita et al., 2001). Further, there is a need to carry out a detailed epidemiological investigation study to assess the actual prevalence of Subclinical mastitis in dairy goats at National level.

Study/ Investigation of the pathogens associated with intramammary infections helps in designing effective preventive and control strategies against mastitis such bacterins and vaccines (Sharma et al., 2013). Most of the recommended antibiotics eg. Penistrep, Gentamicin, Tetracycline, Cephalexin and Ampicillin can be used against subclinical mastitis at the farm in order to avoid antibiotic resistance [5]. Further studies should be carried out in the study areas to identify organisms that are causing subclinical mastitis. After being isolated the antimicrobial resistant test should be carried out and establish whether the current antimicrobials are still combating the problem of SCM or already being resisted.

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