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Research Article

Prevalence of Subclinical Mastitis and Associated Risk Factors in Dairy Cattle from Institution Farms in Morogoro Municipality

Frida Richard Mgonja[1], Makapi Mgulambwa Charles[2] and Abdul Suleiman Katakweba[3]*

[1]*Department of Veterinary Physiology, Biochemistry and Pharmacology, College of Veterinary Medicine and Biomedical Sciences, Sokoine University of Agriculture, Tanzania*

[2]*Department of Veterinary Medicine and Public Health, College of Veterinary Medicine and Biomedical Sciences, Sokoine University of Agriculture, Tanzania*

[3]*Institute of Pest Management, Sokoine University of Agriculture, Tanzania*

Abstract

Background and aim: Mastitis is caused by several microorganisms that are in different groups such as bacteria, protozoa, yeasts/fungi, and algae that can invade the udder, multiply there, and produce harmful substances that result in inflammation. Therefore, it is the aim of this study to observe the prevalence of subclinical mastitis and associated risk factors in dairy cattle from institution farms in Morogoro Municipality. A cross-sectional study was carried out from August 2022 to February 2023 to determine the prevalence of Subclinical Mastitis and associated risk factors in dairy cattle from institution farms in Morogoro Municipality. Four dairy farms were involved in this study, LITA Morogoro dairy farm (25), SUA-Animal Research Unit (ARU) (20), SUA-Magadu Dairy Farm (MGDF) (22), and SUA-Mazimbu Dairy Farm (MZDF) (33). Out of 100 milking dairy cows in the study areas, there were Friesian (53), Ayrshire (26), and Crossbreed (21) with a total of 386 functional quarters. The prevalence was determined by using the screening test technique of the California Mastitis Test (CMT). All samples that scored 0 were taken as negative while those samples that scored +1, +2, and +3 were taken as positive samples. An overall prevalence of 65% (65/100) cows and 57.78% (223/386) quarters had sub-clinical mastitis. With regards to the location of the positive quarters, 61.46% (59/96), 58.33% (56/96), 56.70% (55/97), and 54.64% (53/97) were detected from fore right, fore left, hind right, and hind left respectively. Compared to different study farms, the LITA Morogoro dairy farm had a prevalence of 44% (11/25) cows and 40% (38/95) quarters since only 95 were functional quarters. Based on the locations of subclinical mastitis udder quarters, 41.67% (10/24), 37.50% (9/24), 41.675 (10/24), and 39.13% (9/23) were for fore right, fore left, hind right and hind left respectively. In this study, there were several risk factors that were associated with subclinical mastitis. The factors included age, which was under three categories 1-5 years, 6-10 years, and above 10 years old. Their prevalence was 55.10% (27/49), 53.19% (25/47), and 75% (3/4) respectively. The institution dairy cow farms have a high rate of a subclinical form of mastitis therefore efforts should be made to make sure that subclinical mastitis is managed for better production of dairy cows.

Keywords: Dairy cow; Subclinical form of mastitis; Associated risk factors; Prevalence; Morogoro

Introduction

The optimal milk productivity of dairy animals in Tanzania has not yet been realized due to several constraints that include poor animal management, poor feeding, particularly during the dry season when the pastures and water become scarce, and the high prevalence of diseases including mastitis as a result of poor diseases control programs [1]. The major health constraints in Tanzania include tick-borne diseases (East Coast fever, Babesiosis and Anaplasmosis and Cowdriosis or Heartwater), Trypanosomoses, Helminthosis, and Nutritional disorders (Ketosis, Downer cow syndrome, Milk fever, and Magnesium tetani), Viral and Bacterial diseases [2].

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***Corresponding author:** Frida Richard Mgonja, Department of Veterinary Physiology, Biochemistry and Pharmacology, College of Veterinary Medicine and Biomedical Sciences, Sokoine University of Agriculture, Tanzania

Of all the bacterial diseases mastitis is the most important disease in the dairy production sector worldwide and is more prevalent in dairy cattle [3]. On the other hand, mastitis is also increasingly being incriminating as an important disease in dairy animals. Sub-clinical mastitis is the most prevalent in Tanzania [4-6] and elsewhere and can cause a reduction in milk yields of about 70% [7]. Mastitis, is inflammation of the parenchyma of the mammary gland or udder regardless of the causes, almost always due to infection by microorganisms affecting different species (examples; cattle, sheep, and goats) [8].

Mastitis is therefore characterized by a range of physical and chemical changes in milk and pathologic changes in the glandular tissues. Inflammation of the mammary glands caused by bacterial infection, trauma, or injury due to physical and chemical agents to the udder, generally, bacteria are the main causes of mastitis hence mastitis remains the most common and expensive disease affecting dairy cattle throughout the world [9].

Mastitis is caused by several microorganisms which are in different groups such as bacteria, protozoa, yeasts/fungi, and algae that can invade the udder, multiply there and produce harmful substances that result in inflammation [9,10]. It reduces the productivity of the cow as well as the quality of milk causing enormous losses for breeders and dairy keepers and consequently, to the national income of the country. This disease can be caused by an infectious or noninfectious etiological agent [9,11]. The infectious type of mastitis is the most important one that frequently occurs due to infection by one and/or the other pathogens, such as bacteria, viruses, mycoplasma, yeasts, and algae [12].

Classically, the mastitis pathogens may either be contagious or environmental. The contagious pathogens are the organisms that are adapted to survive within the host, in particular within the mammary gland, and are capable of establishing subclinical infections, which are typically spread from cow to cow at or around the time of milking (e.g. *Staphylococcus aureus*, *Streptococcus agalactiae*, *Streptococcus dysgalactiae*) [8].

According to [11], who found that bacteria are the most common cause of intramammary infection, and the range of causal bacterial species varies with geographical location and management. The environmental pathogens are opportunistic invaders of the mammary gland which typically invade, multiply, engender a host immune response, and are rapidly eliminated (e.g. *Escherichia coli*, *Klebsiella* species, *Enterobacter aerogenes*, *Streptococcus uberis*, *Corynebacterium bovis*, *Mycoplasma* species, *Serratia*, *Pseudomonas*, *Proteus* species, environmental *Streptococci*) [13]. Despite intensive research, the etiology of around 20% to 35% of clinical cases of bovine mastitis cannot be established readily [9]. Therefore, it is the aim of this study to observe the prevalence of subclinical mastitis and associated risk factors in dairy cattle from institution farms in Morogoro Municipality.

Materials and Methods

Material

Materials used were a California Mastitis Test paddle, California Mastitis Test reagent, notebook, pen, syringes, and container, where the syringes were used for measuring the volume/amount of reagent equal to that of the milk sample, and the container was used for keeping reagent.

Study area

This study was conducted at Morogoro Municipal which is one of the administrative districts in the Morogoro Region, located in the central part of the country. Latitude and longitude coordinates are -6.830373 and 37.670589 respectively. Morogoro Municipal is about 195 km to the west of Dar es Salaam and is situated on the lower slopes of the Uluguru Mountains whose peak is about 1,600 feet above sea level. Morogoro Municipal is one of the nine councils in the Morogoro Region. The respondents were animal attendants and animal health practitioners as well as farm managers and were selected randomly and given a verbal concert for their dairy cows to be screened for subclinical mastitis. The study started from August 2022 to March 2023. Consider Figure 1 below, source: Field Data and Tanzania Administrative Boundaries Map (2002).

Study design

The study design used was a cross-sectional study design to collect the demographic information/data of the study areas to determine the prevalence of subclinical mastitis in 100 milking dairy cows.

Study population

The targeted population of this study was farm managers who were given verbal and written consent forms to provide permission for their cows to be screened for subclinical mastitis. Dairy cows in selected farms (SUA-Magadu dairy farm, SUA-Animal Research Unit dairy farm (ARU Dairy farm), SUA-Mazimbu dairy farm, and LITA Morogoro dairy farm) were also part of the study population of this study.

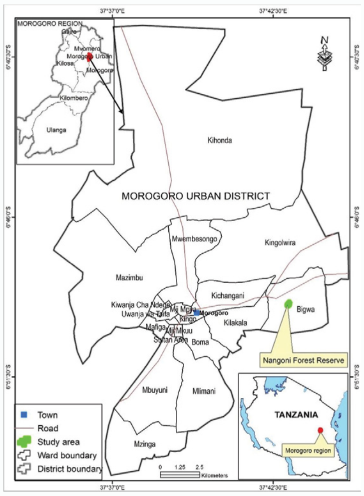

Figure 1: Map of the Morogoro Municipality to show the study area.

Sample size determination

The sample size has been estimated using the Cochran formula

N=[Zα2*P (1-P)] e2

Where: N=sample size, Zα=number of units of SD at significance level α, P=prevalence from the previous study, e=level of precision Zα=1.96, P=48.8, e= 0.05, N= 384 cows.

Owing to limited time and money, only 100 cows (26% of the estimated sample size) were in the study.

Study animal

The study animals in this study were lactating-milked dairy cows. The target of this study was 100 lactating cows, and each 25-lactating dairy cow was supposed to be taken as representative samples from each selected farm. Consider Table 1.

Table 1: Shows the number of study animals from four selected institution dairy farms in Morogoro Municipality.

	Breeds			Total
Study areas	Friesian	Ayrshire	Crossbreed	
LITA Morogoro dairy farm	11	14	0	25
SUA-ARU dairy farm	0	0	20	20
SUA-Magadu dairy farm	22	0	0	22
SUA-Mazimbu dairy farm	20	12	1	33
Total	53	26	21	100

Sample collection

A total of 100 milking dairy cows which were apparently healthy with 386 functional quarters were selected randomly from the selected institution farms for this study. First, milked milk samples were collected during milking in at evening time in the milking parlor while cows were well restrained and teats were thoroughly washed and wiped. Milk samples (3 ml to 4 ml) were aseptically collected from each quarter. Figure 2 shows the milk samples collection.

Screening of the milk sample

The first milk samples were collected during milking in the evening time and screened for subclinical mastitis. California Mastitis Test was used as a screening tool/method. The milk samples (3 ml to 4 ml) were mixed with an equal amount of California Mastitis Test reagents accordingly and moved in a circular motion by swirling a paddle in a circular manner. The results were taken as positive for those samples graded +1, +2, and +3 while 0 and trace results for all four quarters were regarded as negative, but if one or two quarters reads trace was also taken as positive as infections are possible as instructed in a CMT manual [14]. Interpretation of CMT scores, CMT scores are directly related to average somatic cell counts [6]. The following Table 2 shows how they are related. Any reaction of T (trace) or higher indicates that the quarter has subclinical mastitis. Consider Table 2 and Figure 3.

Figure 2: Collection of milk samples from the cow.

Table 2: Grading CMT reactions; Defining CMT scores and estimates of corresponding Somatic cell count.

CMT Score	Somatic Cell Range			Gelling
None	0	To	200,000	None
Trace	200,000	To	400,000	Very Mild
1	400,000	To	1,200,000	Mild
2	1,200,000	To	5,000,000	Moderate
3	Over 5,000,000			Heavy, almost Solidifies

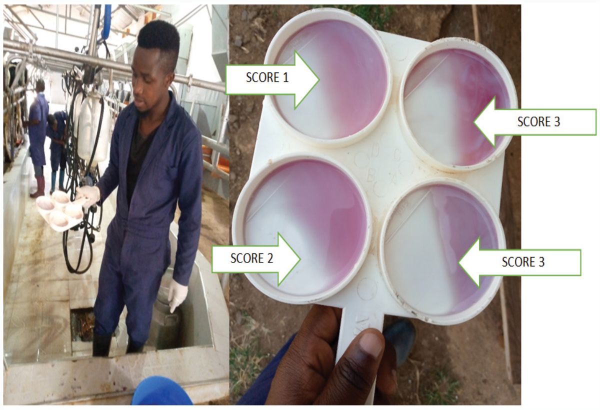

Figure 3: Reaction of milk with CMT reagent.

Associated risk factors for subclinical mastitis

In this study factors such as age, parity, and breed were investigated to determine their contribution to subclinical mastitis. Every milking dairy cow that was used randomly was selected to be included in this study these parameters were collected and recorded accordingly and effectively and used in this study. Also, milking hygiene and adherence to dry cow therapy were personally observed and recorded accordingly as supported by [6].

Statistical analysis of data

Data obtained from the CMT test was stored in Microsoft Excel 2019 and analyzed. The outcome variable was the Prevalence of sub-clinical mastitis in milking dairy cows as defined by the California Mastitis Test Tool. A cow was considered mastitis if at least one quarter was reacting positively on the California Mastitis Test Tool. The effect of the variables such as age, parity, breed, hygiene, and dry cow therapy in different study areas where the study was carried out the prevalence was determined by using the Chi-square (x2) test through Microsoft Excel 2019. Where by the prevalence was calculated by P=(N/NT*), where P is Prevalence, N is the number of positive milking dairy cows in the CMT test, and NT total number of milking dairy cows screened during the running CMT test. Data was presented in Tabular form and bar charts [6].

Results

Prevalence of sub-clinical mastitis obtained by using CMT screening test

In summary, an overall prevalence of 65% (65/100) cows and 57.78% (223/386) quarters of sub-clinical mastitis was obtained, whereas, with regards to the location of the positive quarters, 61.46% (59/96), 58.33% (56/96), 56.70% (55/97) and 54.64% (53/97), for fore right, fore left, hind right and hind left respectively were found positive from 386 the total functional teat examined. Table 3 shows the prevalence of cows and quarters level as well as with regards to the locations of quarters.

In the present study, since the screening for sub-clinical mastitis by using the CMT test was performed in different study locations/ areas the prevalence was determined accordingly based on specific dairy farm teats wisely, consider Table 4.

The severity or status of the reaction between the CMT reagent and milk sample was recorded according to their grades as reactions were depending on the number of somatic cells present in the milk samples. Table 5 shows the reaction status between the milk sample and the CMT reagent.

Blind teats were also, found during examination of the udder health and sample collection and their prevalence was obtained. Blind teats act as a source of pathogens to other healthier teats and cause infection of subclinical mastitis [15]. Table 6 shows the prevalence of blind teas.

Associated risk factors for sub-clinical mastitis

Table 7 shows the prevalence and associated risk factors with sub-clinical mastitis in milking dairy cows. Regarding the risk factors observed, parity number contributed much to the occurrence of subclinical mastitis as it was observed that as parity number increases the chance for subclinical mastitis increases this observation supports the reports of [16-18]. The breed was one of the factors whereas Crossbreed was much infected with subclinical mastitis followed

Table 3: Total cows and quarter-level prevalence of mastitis using the California Mastitis Test.

Quarters	Number of Examined Cmt Quarter		Prevalence
Fore right teats	96	59	61.46%
Fore left teats	96	56	58.33%
Hind right teats	97	55	56.70%
Hind left teats	97	53	54.64%
Total quarters examined	386	223	57.78%
Total cows examined	100	65	65%

Table 4: Prevalence of Sub-clinical Mastitis in different study areas/locations using CMT test.

Study Areas	Number of Cows	Quarters	Number of Examined Quarters	Positive Quarters	Prevalence
Lita Morogoro Dairy Farm	25	Fore right teats	24	10	41.67%
		Fore left teats	24	9	37.50%
		Hind right teats	24	10	41.67%
		Hind left teats	23	9	39.13%
		Total quarters	95	38	40%
Sua-Aru Dairy Farm	20	Fore right teats	19	15	78.95%
		Fore left teats	18	15	83.33%
		Hind right teats	20	14	70%
		Hind left teats	20	15	75%
		Total quarters	77	59	76.62%
Sua-Magadu Dairy Farm	22	Fore right teats	22	15	68.18%
		Fore left teats	22	11	50%
		Hind right teats	22	12	54.55%
		Hind left teats	22	9	40.91%
		Total quarters	88	47	53.41%
Sua-Mazimbu Dairy Farm	33	Fore right teats	31	20	64.52%
		Fore left teats	32	21	65.63%
		Hind right teats	31	20	64.52%
		Hind left teats	32	20	62.50%
		Total quarters	126	81	64.29%

Table 5: Relationship between the positive CMT and infection status of the quarters.

Severity Indication	Total CMT Positive Quarter	CMT Reaction (Severity)
Weak positive (+1)	153	39.63%
Distinct positive (+2)	56	14.51%
Strong positive (+3)	15	3.89%
Negative (0)	162	41.97%
Total	386	100%

Table 6: Quarter-level prevalence of Blind teats.

Blind quarters	No. of examined quarters	Frequency of blind quarters	Prevalence
Fore right	96	4	4.17%
Fore left	96	4	4.17%
Hind right	97	3	3.09%
Hind left	97	3	3.09%
Total-quarters examined	386	14	3.63%
Total cows examined	100	14	14%

Table 7: Prevalence and associated risk factors with Sub-clinical mastitis in milking dairy cows.

Risk Factors	NUMBER OF COWS EXAMINED	COWS WITH MASTITIS	PREVALENCE
AGE			
1-5	49	27	55.10%
1-10	47	25	53.19%
>10	4	3	75%
PARITY			
1-3	67	41	61.19%
4-6	29	21	72.41%
>6	4	3	75%
BREED			
Crossbreed	21	19	90.47%
Friesian	53	33	62.26
Ayrshire	26	14	53.85%
MILKING HYGIENE			
Poor hygiene	100	65	65%
Good hygiene	0	0	0%
DRY COW THERAPY			
	100	65	65%
Adherence to dry cow	0	0	0%

by Friesian and lastly was Ayrshire despite the fact that Friesian is a higher milk producer than Crossbreed and Ayrshire [19]. The high prevalence of subclinical mastitis was due to management causes. Age was one of the factors, age increased increasing the chance for subclinical mastitis but in this study, the effect due to age contributed to a smaller percentage of subclinical mastitis compared to parity and breed. This finding agrees with [20], who reported the highest prevalence of subclinical mastitis in lactating cows with the advancement of age. Milking hygiene and adherence to dry cow therapy were personally observed, as they contributed much to the effect of subclinical mastitis in the study area since none of the farms practiced good milking hygiene and adherence to dry cow therapy, this observation was supported with the study of [10], Table 7 and Table 8 (Figure 4-6).

Discussion

This study was carried out to establish the prevalence of bovine sub-clinical mastitis and risk factors associated with sub-clinical mastitis in milking dairy cows from institution dairy farms in Morogoro Municipal. Out of 100 milking dairy cows that were examined the prevalence obtained was 65% (65/100). The result of the present study is comparable with the findings of [21], who reported a prevalence of 63.4% in Ethiopia, [22], who reported a prevalence of 61.11% in Holstein cross in Southern Wollo in Ethiopia, [23], in Stella dairy

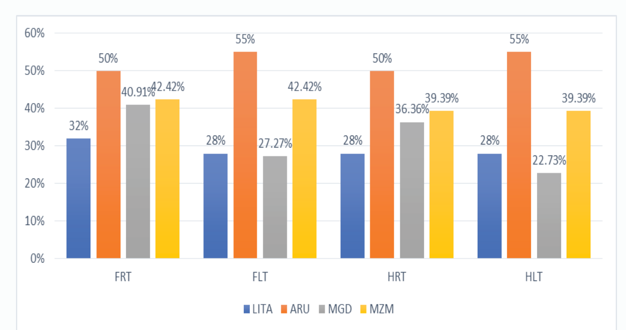

Figure 4: A bar chart above shows the status/severity between the milk sample and CMT reagent that scored 1.

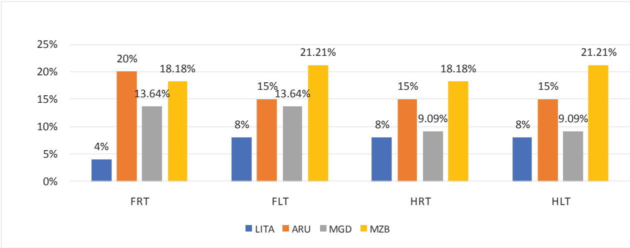

Figure 5: A bar chart above shows the status/severity between the milk sample and CMT reagent that scored 2.

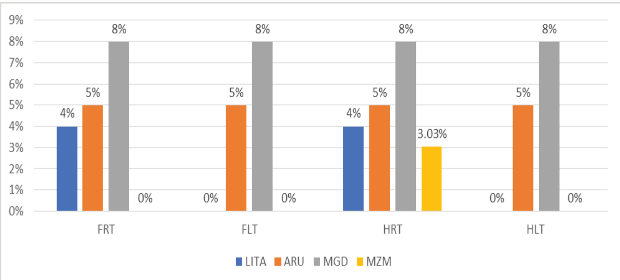

Figure 6: A bar chart above shows the status/severity between the milk sample and CMT reagent that scored 3.

farm in Ethiopia with the prevalence of 86.1% and [10], who reported a prevalence of 62.7% in a dairy cow in Tanzania [24], also, found that out of 64 cows tested 41(64%) had sub-clinical mastitis in Tanzania. The variation in the prevalence of bovine mastitis particularly sub-clinical from reports of different authors was probably due to the laboratory technique used, skills and knowledge of the researchers, study design, climate, geographical area, the level of production, and management practices, a season of the study, proportion of the exotic gene inheritance, and breed of animal studied. The seasonal variation of the prevalence of subclinical mastitis has been supported by the study conducted by [25], in Ethiopia. They reported that mastitis decreases as weather changes from summer with high incidences through spring with moderate infection to low infection in cold weather as during winter and autumn.

The prevalence of 65% (65/100) at the cows' level and 57.78% (223/386) at the quarters level for functional quarters examined only, a prevalence at the cows' level seemed to be higher than the prevalence at quarters level the reasons were other quarters were nonfunctional with blind teats in this study area. The difference was attributed to the different factors that were related to animals' husbandry practices and milk handling practices which are undertaken in those four different dairy farms in the study area [26], found that there are several practices at the farm level such as the type of animal house floor, and not washing hands and udders/teats before milking can contribute to subclinical mastitis. Other factors include milking sick animals and those with udder problems before milking non-mastitis cows [24-27]. Water used for washing hands and milking equipment was not clean in the study locations hence acting as a contributing factor for mastitis infection. This personal observation was supported by the study of [10], who found that water used for cleanliness in washing hands and milking equipment was not clean and may be a potential source of infection. Also, it has been reported in different studies a number of factors that influence the occurrence of mastitis in dairy cattle. They include managerial factors particularly those related to poor milking hygiene, the environmental population of mastitis pathogens, predisposing factors such as teat injuries and sores and incomplete emptying of the mammary gland quarters, and hereditary factors [4,28-31], in Rwanda, found that failure to practice good farming management and screen for subclinical mastitis at an earlier stage may lead to the occurrence of high-infection subclinical mastitis. Also, failure to treat subclinical cases of mastitis earlier leads to the spread of infections to other healthier cows [15].

In the current study which was conducted in four dairy farms in the study area, the prevalence with regards to the location of the positive quarters was, 61.46% (59/96), 58.33% (56/96), 56.70% (55/97), and 54.64% (53/97) for right fore, left fore, right hind and left hind quarters respectively. As compared to other quarters the right fore quarters were most affected with sub-clinical mastitis with the highest infection rate. The left-fore quarters were the second followed by right hind quarters and lastly left hind quarters. The quarter-wise prevalence of the current result disagrees with the report of [32], Bangladesh reported 28.1% in left fore, 33.1% in left hind, 24.5% in right fore, and 17.3% in right hind quarters which was higher in prevalence in left fore and left hind quarters. Also, [15], in Northwest Ethiopia found that the prevalence quarter-wise was 45 (13.98%), 27 (7.96%), 37 (11.42%), and 33 (10.03%) for right front, left front, right hind, and left hind quarters position respectively. The higher prevalence of sub-clinical mastitis in right-fore quarters and left front quarters compared to the right hind and left hind quarters in the present study was most probably due to the easy grasping of front quarters especially right front quarters first while milking for those farms that practice milking by using hands, LITA-Morogoro dairy farm and SUA-Animal Research Unit dairy farm then followed by hind quarters due to ginger production of the hind quarters as supported by [33] and fecal contamination also for the case of hind quarters [34,24], found that the fore and hind quarters (46%) and (45.4%) respectively of all tested cows had positive CMT scores (i.e. +1 and above). Poor milking practices and faulty milking machines were contributing factors for the SUA-Mazimbu dairy farm and SUA-Magadu dairy farm. The use of dirty hands for complete emptying of the udder plays the source of spreading infection from those with subclinical mastitis to healthier cows.

The results of the mastitis infection status of the quarters had the following prevalence 39.63% (153/386), 14.51% (56/386), 3.89% (15/386), and 41.97% (162/386) for weak positive (+1), distinct positive (+2), strong positive (+3) and negative respectively. The prevalence of the positive CMT and infection status of the quarters in the present study disagreed with that reported by [15], in Northwest Ethiopia who found that 61 (4.64%), 47 (3.58%), 34 (2.59%), and 1172 (89.19%) for weak positive (+1), distinct positive, strong positive and negative respectively where the results reported were lower than of the present study. These differences were contributed by different managerial practices and milking practices that were used in this study area. Also, the level of environmental cleanliness and sanitation, are the reasons for dirty environment harbor pathogens [35].

This study revealed that 14% (14/100) of cows examined have one or more blind teats whereas a prevalence of 3.63% (14/386) of the total quarters examined. By comparing the prevalence of blind teats between fore quarters and hind quarters in this present study the fore quarters were more affected with the highest rate of 4.17% (4/96) for both right quarters and left quarters compared to that of 3.09% (3/97) for hind quarters for both right and hind quarters. This present

Table 8: Prevalence and Association of Risk Factors with Sub-clinical Mastitis in Milking dairy cows in different study areas in this study. Table 8a, 8b, 8c and 8d respectively.

Table 8A: Prevalence and associated risk factors of subclinical mastitis at LITA-Morogoro dairy farm.

Study area	Risk factors	Number of cows examined	Number of cows with mastitis	Prevalence
LITA	AGE			
	1.0-5.0	11	2	18.18%
	6.0-10	13	9	69.23%
	>10	1	0	0%
	PARITY			
	1.0-3.0	20	8	40%
	4.0-6.0	4	3	75%
	>6	1	0	0%
	BREED			
	Friesian	11	4	36.36%
	Ayrshire	14	7	50%
	MILKING HYGIENE			
	Poor hygiene	25	11	44%
	Good hygiene	0	0	0%
	DRY COW THERAPY			
	No dry cow therapy used	25	11	44%
	Adherence to dry cow therapy	0	0	0%

Table 8B: Prevalence and associated risk factors of subclinical mastitis at SUA-Animal Research Unit dairy farm.

Study area	Risk factors	Number of cows examined	Number of cows with mastitis	Prevalence
ARU	AGE			
	1.0-5.0	6	4	66.67%
	6.0-10	11	10	90.91%
	>10	3	3	100%
	PARITY			
	1.0-3.0	8	6	75%
	4.0-6.0	9	8	88.89%
	>6	3	3	100%
	BREED			
	Cross breed	20	17	85%
	MILKING HYGIENE			
	Poor hygiene	20	17	85%
	Good hygiene	0	0	0%
	DRY COW THERAPY			
	No dry cow therapy used	20	17	85%
	Adherence to dry cow therapy	0	0	0%

Table 8C: Prevalence and associated risk factors of subclinical mastitis at SUA-Magadu dairy farm.

Study area	Risk factors	Number of cows examined	Number of cows with mastitis	Prevalence
MAGADU	AGE			
	1.0-5.0	5	3	60%
	6.0-10	17	11	64.70%
	>10	0	0	0%
	PARITY			
	1.0-3.0	8	6	75%
	4.0-6.0	14	8	57.14%
	>6	0	0	0%
	BREED			
	Friesian	22	14	63.63%
	MILKING HYGIENE			
	Poor hygiene	22	14	63.63%
	Good hygiene	0	0	0%
	DRY COW THERAPY			
	No dry cow therapy used	22	14	63.63%
	Adherence to dry cow therapy	0	0	0%

study disagreed with that of [15], in Northwest Ethiopia found that 88 (24.79%) cows were found with one or more teats blind, and from the total of 1420 quarters examined, 108 (7.61%) were also blinded with the highest incidence rate in the right front and right hind quarters, this difference was contributed by the variation of the sample size used. Lack of screening subclinical for mastitis, high amount of milk incomplete during milking, and late treatment of/or not treating clinical cases of mastitis could possibly lead to the blindness of the mammary gland [15,34], in Ethiopia, found that blind mammary gland quarters are a source of pathogens and contribute to high subclinical mastitis and loss of milk production with a subsequent impact on food security.

The risk factors considered for this study were breed, age group, parity, milking hygiene, and dry cow therapy. In the present study from selected potential risk factors breed, age, parity, milking hygiene, and

Table 8D: Prevalence and associated risk factors of subclinical mastitis at SUA-Mazimbu dairy farm.

Study area	Risk factors	Number of cows examined	Number of cows with mastitis	Prevalence
MAZIMBU	AGE			
	1.0-5.0	27	18	66.67%
	6.0-10	6	5	83.33%
	>10	0	0	0%
	PARITY			
	1.0-3.0	31	21	67.74%
	4.0-6.0	2	2	100%
	>6	0	0	0%
	BREED			
	Crossbreed	1	1	100%
	Friesian	20	15	75%
	Ayrshire	12	7	58.33%
	MILKING HYGIENE			
	Poor hygiene	33	23	69.69%
	Good hygiene	0	0	0%
	DRY COW THERAPY			
	No dry cow therapy used	33	23	69.69%
	Adherence to dry cow therapy	0	0	0%

dry cow therapy had a statistically significant effect (P<0.05) on the occurrence of mastitis which agrees with the report by [36] in Addis Ababa, Ethiopia. In this current study age factor was categorized into three categories; 1-5 years old, 6-10 years old, and >10 years old, their prevalence was 55.10%, 53.19%, and 75% respectively. Thus, age in relation to subclinical mastitis in this study seems as age increases the chance of being infected with mastitis increases. This has been reported by [9], in India who found that age increases the risk of subclinical mastitis [37], Batticaloa in Sri Lanka found that the prevalence of different age groups was recorded ranges of below 5 years (45%), 5-8 years (62.5%), and above 8 years (75%). This might be higher chances for SCM infection in older animals than younger and its teat canal is more dilated and partially or permanently opened. Therefore, a high chance entering of environmental and skin pathogens in the teat canal [38]. The increase in subclinical mastitis with age is consistent with other studies in Bangladesh, and India [39,40].

Another risk factor was parity which was also divided into three categories 1-3 parity numbers, 4-6 parity numbers, and >6 parity numbers, and their prevalence was 61.19%, 72%, and 75% respectively. The prevalence of CMT positive showed that increasing tendency with the increase in the number of parties. The result of the present study is similar to [37], Batticaloa District in Sri Lanka which found that a higher prevalence of CMT positive was observed in >5 parity number (75%), whereas in 1-2 and 3-5 parity, the prevalence was 28.4% and 53.3%, respectively. The study showed that there were significant statistical associations (P< 0.05) between the prevalence of mastitis and the parity number of animals; cows with many numbers of calves were with a higher prevalence of mastitis. The risk of mastitis increased with the increasing parity number which agrees with the findings by [41] and [42], in Southern Ethiopia and the West Shewa Zone of the Oromia region, Ethiopia respectively. The higher prevalence in the cows at three and above calved could be due to increasing ease of penetration of the tear duct by pathogens and accumulated previous infection [43]. It is postulated that the younger animal is less susceptible; through a more effective host defense mechanism. Older cows, especially after four calves are more prone to mastitis [44].

Breed as a risk factor in this current study three breeds were studied; Friesian, Ayrshire, and Crossbreed whereas 53 were Friesian, 26 were Ayrshire and 21 were Crossbreed but crossbreed cows were results of crossing pure breeds (Ayrshire, Jersey, Friesian) and local breeds (Tanzania short horn zebu, Boran, and Ankole) and make a total of 100 cows. Among them cows reacted positively with CMT were as follows, for the Friesian breed 33 out of 53 (62.26%), the Ayrshire breed 14 out of 26 (53.85%), and Crossbreed 19 out of 21 (90.47%). In the current study, it seems Crossbreed were most affected by SCM with a prevalence of 90.47% followed by the Friesian breed with a prevalence of 62.26% and, lastly Ayrshire breed with a prevalence of 53.85%. This could be explained as European crossbreeds are high-yield breeds and they are more susceptible to mastitis disease and anatomical structure also favors causing the SCM. However local breeds have more resistance to mastitis and they are low milk producers than crossbreed cows [45,46]. The prevalence of SCM in the Friesian breed was higher (62.26%) than that of the Ayrshire breed (53.85%) these results are similar to that of [24], in Tanzania who found that Friesian cattle had relatively higher incidences (69.7%) of subclinical mastitis than Ayrshire (58.1%). Also, [19], in Finland found that breed was another factor related to somatic cell count: Holsteins had significantly higher average somatic cell count and OR for SCM and CSCM (Chronic Subclinical Mastitis). This result agrees with the previous studies in which the Holstein breed was shown to be more susceptible to mastitis [47-49]. The incidence of mastitis is greater in Holstein Friesian than in Jerseys and Ayrshire, and this is due to the fact that Holstein Friesian is a good milk producer, and this may reflect differences in management rather than a true genetic difference. Valid comparisons between breeds have not been reported [50].

The variability in the prevalence of dairy farms involved in this study may be attributed to the genetic resistance of bacteria, milking hygiene, milking practices, management system, and technical knowledge of the investigator [51]. The high prevalence of 85% at the ARU dairy farm was due to the associated risk factors that contribute to the occurrence of infections. These associated risk factors were; poor environmental hygiene and sanitation, especially in the house where the cows stay as it was of the bare floor with fecal contamination and a wet environment. Poor milking hygiene was practiced due to the milking procedure which involved cleaning teats with unclean water, cows sharing the same towel for wiping and drying after cleaning the udder, and milking the cows by using their hands. Most of the cows were more than five years old and had more than three parity numbers, hence, increasing the chance of mastitis infections, as the rate of infections increases with age and parity numbers [52,53]. Also, there was no dry cow therapy application to the cow during drying and drying off the cows as well as a teat dip antimicrobial application after milking. At the SUA-Mazimbu dairy farm, the prevalence was 69.70%, slightly different from the SUA-Magadu dairy farm with 63.64%, the reasons could be farms practicing milking procedures under unhygienic environments, using milking machines that were not well cleaned, and not well maintained hence these machines act as sources of teat injuries and predisposes to infections. Although their cows were kept in good hygienic and clean houses with no fecal contamination and a wet environment. At LITA Morogoro dairy farm the prevalence was 44%, which was smaller compared to other farms this was contributed by practicing good milking hygiene and milking procedures, the bedding was clean, and no fecal contamination, and then a wet environment. Though milking was conducted by using hands that were not cleaned well during the milking procedure which was acting as sources of infections of mastitis. Furthermore, all farms did not care much about the health of the udder, especially for subclinical mastitis, and because of this, the production trends of milk tend to decrease compared to the initial stage of lactation finally causing a loss in terms of production of milk which results to economic loss [51,53].

Conclusion

This current study found that bovine sub-clinical mastitis has a great negative impact on the health of the cows and on the milk production of the dairy cows in the study area. From the findings of this study, it is concluded that the prevalence of subclinical mastitis in the study area was high, as an overall prevalence was 65% cows and 57.78% quarter prevalence. Also, based on the prevalence at the farm level; the SUA-Animal Research Unit dairy farm prevalence was 85% cows and 76.62% quarters which was most affected followed by SUA-Mazimbu dairy farm which was 69.70% cows and 64.29% quarters and SUA-Magadu dairy farm which had a prevalence of 63.64% cows and 53.41% quarters and LITA-Morogoro dairy farm was 44% cows and 40% quarters prevalence.

Ethical Approval

The permission to carry out this study was granted by the Sokoine University of Agriculture (SUA) which issued a research permit letter on behalf of the Tanzania Commission for Science and Technology.

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