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PREVALENCE OF BOVINE SUBCLINICAL MASTITIS AND ASSOCIATED RISK FACTORS IN ADDIS ABABA, CENTRAL ETHIOPIA

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ABSTRACT: A cross-sectional study was conducted with the objective of determining the prevalence of bovine Subclinical mastitis (SCM) in dairy cows and assessing its associated potential risk factors from November, 2016 to April, 2017 in Addis Ababa, Central Ethiopia using California mastitis test. A total of 390 lactating cows comprising different cattle breed from sixteen dairy farms were purposively sampled. The overall prevalence of SCM among the study animal was 49.23 % (192/390). Of this, the highest prevalence of SCM was observed in Holstein-Friesian (51.6%) followed by Jersey (50.0%) and cross (37.1%). The prevalence of SCM in <5 months, 5-8 months and >8 months stage of lactation was 73.9%, 38.5% and 47.5%, respectively. In terms of milk yield, the prevalence of SCM was higher in cows having more than 15 liters of milk production (61.5%) and 7-15 liters (45.8%) and lower in <7 liters (41.4%). The prevalence of SCM in parity group 1-3, 4-6 and >6 was 41.3%, 52.9%, and 78.7%, respectively. Regarding floor type, the highest prevalence was recorded in bad concrete floor (64.2%) than good concrete (43.7%). The prevalence of SCM was higher in cows having teat lesion (75.3%) than no teat lesion (42.4%). Breed, parity, stage of lactation, milk yield, teat lesion, floor type were found to have statistically significant difference (P<0.05). However, age, towel usage and body condition score showed non-significant difference (P>0.05). In general, Subclinical mastitis was a major health problem of dairy cows in the study area. Therefore, more emphasis should be given on regular screening of cows, designing effective control and prevention strategies for subclinical mastitis.

Keywords: Addis Ababa Dairy cows, Prevalence and Risk factor, Subclinical mastitis

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INTRODUCTION

World have about 1,287,520,000 head cattle out of these dairy consists of 225,502,000 heads. In Africa there are 192,180,000 total populations of cattle, among these diary consists of 34,057,000 in number (ILRI, 2008). Ethiopia has the largest cattle population in Africa with an estimated population of 56.71 million. Cow represents the biggest portion of cattle population of the country, around 20.7% of the total cattle heads are milking cows (CSA, 2014). Even though Ethiopia is the most populous country in cattle than any African country; the per capita milk consumption was lower than other countries in the region. This is partly due to the low genetic milk production potential of the indigenous zebu cattle or by several types of diseases which potentially infect and affect the wellbeing of livestock population among which mastitis is the common and costly disease causing loss in milk yield, treatment cost for dairy farmers and culling of animals at unacceptable age (Vaarst and Envoldsen, 1997). Bovine mastitis is one of the threatening production diseases of dairy animals which directly or indirectly affect the economy of the farmers and ultimately affect the economy of the country. Mastitis is a globally economically warming diseases which affects animals health, quality of milk, milk yield which suffer enormous economically losses. It is well recognized that subclinical mastitis (SCM) is the major form of bovine mastitis which caused an extensive problem and economically losses in the dairy industry worldwide (Sharma et al., 2012). Huge loss in milk yield the sub-clinically affected animals remain a continuous source of infection to other herd mates. If the infection

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persists for longer periods, then it may form a fibrous tissue barrier between the organisms and the antibiotic preparations, thus, limiting their efficacy (Kader et al., 2002). It is characterized by having no visible signs either in the udder or in the milk, but the milk yield decreases and the Somatic cell count (SCC) increases, having greater impact in older lactating animals than in first lactation heifers (Erskine, 2001).

In Ethiopia, subclinical mastitis has received little attention; even, it is often surprising to producers, moreover, sub-clinically infected udder quarters can developed clinical mastitis and the rate of new infections can be high (Zdunczyk et al*.,* 2003). But, focused should be on the treatment line of cases. Subclinical mastitis causes more than three times losses as compared to clinical mastitis (Kayesh et al., 2014; Singh, 1994). The subclinical mastitis is more serious and causes much greater loss to the dairy industry (Abrahmsen et al*.,* 2014). This is explained by the fact that subclinical mastitis is more difficult to diagnose and therefore usually persists longer in the herds, causing production losses. According to Getahun et al. (2008) economic losses are due to loss in milk production, discarding abnormal milk and milk withheld from cows treated with antibiotics, degrading of milk quality and price due to high bacterial or somatic cell count (SCC), costs of drugs, veterinary services and increased labor costs, increased risk of subsequent mastitis, herd replacement, and problems related to antibiotics residues in milk and its products. There might also be potential food safety risks indirectly associated with high somatic cell count. The lower quality and the diminished sustainability of milk with a high somatic cell count both constitute a potential health risk and also affect the possibility of producing other dairy products, e.g., cheese and yoghurt (Andersson et al*.,* 2011).

Various researchers revealed subclinical mastitis as grievous and frequently encountered diseases in the dairy industry of different parts of Ethiopia. Among these most studies were carried out in Addis Ababa and its surroundings, which are not representative of other regions of the country (Almaw et al*.,* 2009), but others were studied in some part of different agro-ecological zone of the country. (Kerro and Tareke, 2003; Mungube et al*.,* 2004; Demelash et al*.,* 2005; Sori et al*.,* 2005; Matios et al*.,*2009; Girma, 2010; Nesru, 1999; Mekonnen and Tesfaye, 2010 and Nibret et al*.,* 2011).

According to Hussein et al. (1997) the prevalence of subclinical mastitis in the central regions of Ethiopia are found to be 19% on cow basis. Current experimental survey was conducted at two major Ethiopian dairy farms (Repi and Debre-Zeit), out of 186 lactating cows, 71 (38%) were sub-clinically infected (Workineh et al., 2002). Abera et al. (2012) also noted that, out of 245 examined lactating cows 70 (28.6%) cows were with subclinical mastitis reported in shashemene, southern Ethiopia.

Generally, as with most infectious disease, mastitis risk factors depends on exposure to the microbes, Immune system and environment or management factors (Suriyasathaporn et al., 2000). Host factors include breed, anatomy of teat canal, sphincter tone and presence of teat lesion. Agent factor includes the ability to colonize the teat duct, the ability to adhere to the mammary epithelium and not to be flushed out with milk flow. Environmental factor includes milking practice, housing system and bedding (Quinn et al*.,* 1994). Thus, it is necessary to have epidemiological information about subclinical mastitis and factors associated with udder infection so as to improve dairy production and uphold quality of milk for consumers. Hence this study was initiated with the objectives of to determine the prevalence of bovine Subclinical mastitis in apparently healthy dairy cows in Addis Ababa, Central Ethiopia and to assess associated risk factors of bovine subclinical mastitis in the study area.

MATERIAL AND METHOD

Selection of site

The study was conducted in Addis Ababa, which is the capital city and administration centre for the Federal Democratic Republic of Ethiopia starting from November, 2016 to April, 2017. The city covers an area of 530.14 km2 and is sub divided into ten sub-cites namely, Arada, Bole, Addis Ketema, Nefas Silk Lafto, Kolfe Keranio, Akaki Kality, Yeka, Lideta, Kirkos and Gulele sub-cites (CSA, 2007). Addis Ababa lies at 9.030 North latitude and 38.80 East longitudes with an average altitude of 2400 meters above sea level. It has an average annual temperature of 15.9^{0}C. It also receives an annual rain fall of 1089 mm or 91 mm per month with 60.1% annual relative humidity which ranges from 49% in February to 82% in July (NMSA, 2007).

Study animal

The study was conducted on a total of 390 Holstein Friesian (HF), Jersey and Cross (HF x Local) lactating cows from Sixteen dairy farms in Addis Ababa. The study populations were lactating cows of different age, lactation stage, parity, milk production and body condition. According to Ortegon (2013) cows were classified their age as 3 to 5 years, 5 to 7 years, and >7 years based on their dental eruption patterns. Concerning body condition score, the sampled animals were classified as poor, moderate and good based on the classification by Webster (1989). As parity is concerned, it was categorized as 1-3 calves, 4- 6 calves and greater than six calves. Lactation period was

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also classified as <5months, 5-8 months and >8 months (Demelash, 2005). Similarly, floor type was categorized as, good and bad concrete type and milk yield recorded by amount of litter as less than 7, between 8-15 and greater than 15 liters (Mureithi et al., 2016). All the farms examined were practiced intensive husbandry management and there milking system was manual (by hand).

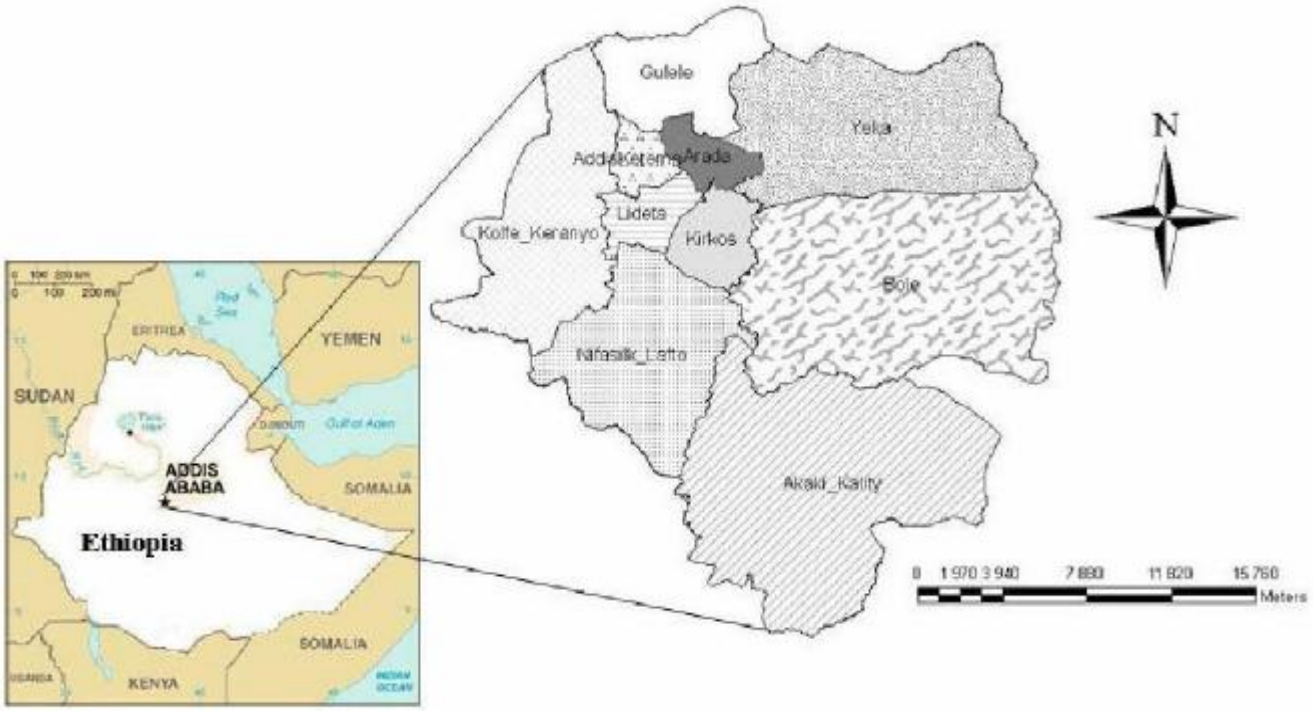

Figure 1 - Map of the study area

Study design

A Cross sectional study was conducted from November, 2016 to April, 2017 to determine the prevalence of bovine subclinical mastitis and its associated risk factor in Addis Ababa, central Ethiopia based on CMT.

Sample size and sampling method

Sixteen dairy farms were purposively selected based on their ease of accessibility, availability of lactating cows within the farm and the owners' willingness. Simple random sampling technique was applied for the selection of individual animals (lactating cows) in the farms. Milking practice during sampling was done with careful hygiene. To reduce contamination of the teat ends during sample collection, the near teats were sampled first followed by the far once. The milk is collected from each quarter into labeled sterile screwed test tube after discarding the first three milking streams. The sample size was determined according to (Thrusfield, 2005). Previous study conducted by Alebachew and Alemu, (2015) on the prevalence of bovine subclinical mastitis in the same area showed 46.8%. Therefore, using 46.8% as expected prevalence and 5% absolute precision at 95% confidence level, the number of animals needed in the study was 383. However, to increase the precision in this study 390 lactating dairy cows were sampled.

$$n = \frac{1.96^2 \, Pexp \, (1-Pexp)}{d^2}$$

where:

n = sample size

Pexp = expected prevalence

d = desired absolute precision

Data Collection

Farm inspection was practiced to assess the housing conditions, feeding practices and milking practices. The housing condition was qualified as bad when there is bad smell and the animals flank, udder and belly were soiled. The housing condition was qualified as good when none of the above indicated. Milking practice was investigated through close observation at the time of milking. Data concerning floor, body condition score, and teat lesion were collected by observation, while age, parity, lactation stage, and milk yield were determined by asking owner and

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farm attendant using a properly designed format and from the farm records where available. An apparently normal milk that was negative on the California mastitis test were considered to be normal milk (with no precipitation), while those that were CMT positive were considered to have subclinical mastitis. The reaction involved in the CMT is the disintegration of leukocytes when milk is mixed with the CMT reagent (Babaei et al., 2007). The CMT was carried out as described by Quinn et al. (2004). A squirt of milk, about 3 ml from each quarter was placed on shallow cups in the CMT paddle. An equal amount of the commercial CMT reagent was added to each cup. A gentle circular motion was applied to the mixtures in a horizontal plane for 15 seconds. The result of the test was indicated on the basis of gel formation. . The result was scored from 0-4. Finally cows with CMT score of 1 or above were judged as positive for sub clinical mastitis; otherwise negative (Quinn et al., 1999).

Data management and analysis

The collected data was entered in to Microsoft excel work sheet 2007. The data were thoroughly screened for errors and properly coded before subjecting to statistical analysis. The data were imported from Microsoft excel and analyzed using Statistical Package for the Social Sciences (SPSS) software version 20. Descriptive statistics was used to quantify the prevalence of subclinical mastitis in relation to different explanatory variables. The associations of the Subclinical mastitis with the different risk factors such as breed, age, lactation period, parity, towel usage, milk yield, floor, body condition and teat lesion were assessed by using logistic regression. Univariable and multivariable logistic regression models were fitted containing the appropriate independent variables with 95% confident interval and less than 0.05 level of precision.

RESULTS

Out of 390 lactating cows examined 192 representing 49.23% were CMT positive for subclinical mastitis in the study area. Among the different potential risk factors considered for a univariate logistic regression, most risk factors except breed and towel usage other factors like, age, parity, body condition, floor, lactation stage, milk yield and teat lesion were found statistically significant ($P<0.05$). The highest prevalence of subclinical mastitis was occurred in Holstein Friesian animal (51.6%), followed by Jersey (50.0%) than in cross (37.1%). The odd of having subclinical mastitis was 2 times more likely to occur in Holstein Friesian cows than cross (OR=2. 012, CI= 0.989-4.094). Concerning age categories, cows at age group of 3-5, 5-7 and greater than seven years had an infection rate of 40.2%, 53.6% and 62.6%, respectively. According to lactation stage, the highest prevalence of subclinical mastitis was recorded in less than 5 months (73.9%) followed by greater than 8 months (47.5%) and 5-8 months (38.5%) of lactation stage. The risk of acquiring subclinical mastitis in lactation stage less than 5 months was almost 2 times more likely than those greater than 8 months of lactation stage (OR=1.987, CI= 1.001-3.944). Regarding parity, the highest prevalence of subclinical mastitis were observed in cows having parity number greater than six (78.7%) followed by 4-6 parity (52.9%) and 1-3 parity (41.3%). The odds of having subclinical mastitis were 5.9 times more likely in greater than six parity than 1-3 parity (OR=5.847, CI= 2.062-16.58). The risk of acquiring subclinical mastitis was 1.12 times more likely in 4-6 parity than 1-3 parity (OR=1.108, CI= 0.535-2.294). The prevalence of subclinical mastitis related to towel usage showed that cows, which were washed and dried their teat with towel had high subclinical mastitis prevalence (51.4%) than that of not washed and dried by towel (43.8%). Based on milk yield, the prevalence of SCM was highest (61.5%) in cows having more than 15 liters of milk production and lowest (41.4%) in cows producing <7 liters of milk production. The odds of having SCM was 8 times more likely in cows producing more than 15 liters of milk than cows producing less than 7 liters (OR= 8.1, CI= 3.343-19.87). The risk of having subclinical mastitis in animals giving seven to fifteen liters was 3 times more likely than 7 liters (OR=3.059, CI: 1.385-6.758). The prevalence of subclinical mastitis associated with good concrete floor was 43.7% and with bad concrete floor was 64.2%. The risk of having SCM is 3.7 time more likely in floors made of bad concrete than good concrete floor (OR= 3.685, CI= 1.767-7.685). Concerning body condition, the prevalence was high in poor body condition (81.8%) followed by moderate body condition (56.6%) and good body condition (44.4%). Cows having teat lesion were more prone to subclinical mastitis (75.5%) than cows with no teat lesion (42.4%). Accordingly, the likelihood of the subclinical mastitis was 4.8 times more in cows having a teat lesion (OR = 4.8; 95% CI = 2.336-9.748) than cows that have no teat lesion.

Breed, lactation stage, parity, milk yield, floor type and teat lesion were found to be statistically significant ($P<0.05$) association with the occurrence of subclinical mastitis in lactating dairy cows. On the other hand, body condition, age and towel usage did not significantly ($P>0.05$) influence the occurrences of Subclinical mastitis in the current study using multivariate logistic regression (Table 1).

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Table 1 - Analysis of the risk factors for the prevalence of bovine subclinical mastitis

Variables	Category	Number examined	Number Positive (%)	COR (CI: 95%)	AOR (CI: 95%)	P-value
Breed	Cross	62	23(37.1)	1	1	0.026
	Jersey	24	12(50.0)	1.696(0.655-4.392)	0.63(0.186-2.129)	
	Holstein-Friesian	304	157(51.6)	1.8(1.032-3.178)	2.012(0.989-4.094)	
Age	>7 years	107	67(62.6)	1	1	0.481
	5-7 years	84	45(53.6)	0.689(0.385-1.231)	1.615(0.687-3.792)	
	3-5 years	199	80(40.2)	0.4(0.248-0.651)	1.168(0.511-2.67)	
Lactation stage	>8months	120	57(47.5)	1	1	0.0001
	5-8months	182	70(38.5)	0.691(0.433-1.101)	0.481(0.274-0.843)	
	<5 months	88	65(73.9)	3.124(1.722-5.665)	1.987(1.001-3.944)	
Parity	1-3 calves	259	107(41.3)	1	1	0.002
	4-6 calves	70	37(52.9)	1.593(0.937-2.707)	1.108(0.535-2.294)	
	>6 calves	61	48(78.7)	5.245(2.709-10.16)	5.847(2.062-16.58)	
Use towel	Yes	278	143(51.4)	1	1	0.249
	No	112	49(43.8)	0.734(0.472-1.142)	0.731(0.429-1.246)	
Milk yield per day	<7 liters	70	29(41.4)	1	1	0.000
	7-15 liters	216	99(45.8)	1.196(0.693-2.065)	3.059(1.385-6.758)	
	>15 liters	104	64(61.5)	2.309(1.456-3.661)	8.149(3.343-19.87)	
Floor type	Good	284	124(43.7)	1	1	0.001
	Bad	106	68(64.2)	0.433(0.273-0.687)	3.685(1.767-7.685)	
Body condition	Poor	11	9(81.8)	1	1	0.154
	Moderate	122	69(56.6)	0.289(0.06-1.395)	0.202(0.32-1.272)	
	Good	257	114(44.4)	0.177(0.038-0.836)	0.163(0.25-1.048)	
Teat lesion	Absent	309	131(42.4)	1	1	0.000
	present	81	61(75.3)	4.144(2.384-7.206)	4.772(2.336-9.748)	

*COR= Crude odds ratio, AOR= Adjusted odds ratio, P<0.05= Statistically significant

DISCUSSION

This study showed the overall prevalence of subclinical mastitis at cow level was found to be 49.23%, which is in close agreement with the report of Alebachew and Alemu (2015), Mekibib et al. (2010) and Yien (2014), who found the prevalence rate of 46.8%, 48.6% and 48.76% in dairy farms of Addis Ababa, Holeta and Gambella, Ethiopia, respectively. However, it was higher than the findings of other authors in different regions of Ethiopia like: 36.67% by Hundera Sori et al. (2005) in Sebeta, 36.86% by Fufa (2013) in Addis Ababa, 41.02% by Ayano et al. (2013) in Holeta, 13.6% by Getahun et al. (2008) in Selalle, 28.6% by Abera et al. (2012) in Shashemene, Southern Ethiopia, 44.6% by Mekonnen and Tesfaye (2010) in Adama, 23.0% by Biffa et al. (2005) in Southern Ethiopia and 25.2% by Almaw (2009) in and surrounding of Gondar town. But, lower than the findings of Tadesse (2014) who indicated that 85.4% were positive for subclinical mastitis at cows' level reported in Addis Ababa, 54.5% in Asella by Birhanu (2013), 55.1% in Addis Ababa by Zeryehun et al. (2013). The variability in the prevalence of bovine subclinical mastitis between findings could be suggested the complexity of the disease which involves interaction of several factors, mainly the difference in husbandry system, breeds considered, environment, management of the farms, factors related to causative agent, variation in veterinary service coverage and awareness of the owner toward the disease, and technical know-how of the researchers (Radostits et al., 2007).

In current study, the highest prevalence of SCM was observed in HF breed (51.6%) followed by Jersey (50.0%) and cross breed (37.1%) and there was statistically significant association with SCM (P<0.05). This finding is comparable with report of other studies such as Almaw et al. (2009) in and surrounding of Gondar town, G/Michael et al. (2013) in and around areka, Southern Ethiopia, Sori et al. (2005) in and around Sebeta, Ethiopia and Junaidu et al. (2011) at Sokoto metropolis. Biffa et al. (2005) also reported that Holstein-Friesian cows are more frequently affected (56.5%) than local zebu (30.9%) and Jersey cows (28.9%). Sharma and Maiti (2010) also found that Holstein and Jersey cows are at higher risk (94.54%) for subclinical mastitis than Holstein Friesian-local zebu cross

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cows (31.25%). This variation of subclinical mastitis prevalence in breeds level could be that the disease influence the animals by some inheritable characteristic such as capacity of milk production (high yielding cows are more susceptible to mastitis than low-yielding ones), teat characteristic and udder conformation (Abaineh, 1997).

The current study showed, the prevalence rate of subclinical mastitis at cow level was higher as the age advances; 40.2% in 3-5 years, 53.6% in 5-7 years and 62.6% in >7 years. This study showed that, there were no statistically significant among the age. This finding is in agreement with the finding of Belachew (2016) around Debrezeit, Ethiopia which report insignificant upon age. In this finding, the prevalence of SCM in <5 months, 5-8 months and >8 months stage of lactation was 73.9%, 38.5% and 47.5%, respectively and there was statistically significant association between SCM and stages of lactation ($p<0.05$). This study is in agreement with Demelash et al. (2005), Nesru et al. (1999), Kerro and Tareke (2003), Hughes (1960), Kehrli and Shuster (1994), Radostits and Blood (1994) who reported subclinical mastitis prevalence was higher in early lactation and lower in mid stage lactation. In contrary different reports reflected prevalence of subclinical mastitis was higher in late stage of lactation than early (Getahun et al., 2008; Gizat et al., 2008, GebreMichael et al., 2013 and Biffa et al., 2005). On the other hand authors like; Kayesh et al. (2014), Mureithi (2016) and Rahman et al. (1997) reported higher prevalence (34.00%) of subclinical mastitis during the mid of lactation. The occurrence of high prevalence during earlier lactation stage may be due to absence of dry cow therapy and birth related influences (Quinn *et al*., 2005). The amount of milk ejected is also higher during earlier lactation periods and this cause increased in patency of the teats and decreased local defense factors. Similarly, the mammary gland is more susceptible to new infection during early lactation and late dry period, which may be due to the absence of udder washing and teat dipping, which may in turn increase the number of potential pathogens on the skin of the teat (Islam et al., 2011).

In the present study, the prevalence of SCM in parity group 1-3, 4-6 and >6 was 41.3%, 52.9%, and 78.7%, respectively and there was statistically significant association between SCM and parity number ($P<0.05$). This finding is in agreement with Mungube et al. (2004), Demelash et al. (2005), Matios et al. (2009), Gizat et al. (2008), Girma (2010) and Molalegn et al. (2010) who identified parity as risk factor to mastitis and Rasool et al. (1985) and Devi et al. (1997) both of them reported an increasing prevalence of subclinical mastitis with advancing parity. This might be due to cows with advanced parity become more productive, so it can be assumed that as the parity of cows advance and the age increases cows become prone to mastitis. In addition, to this active mononuclear leukocyte functioned better in primiparous cows than the multiparous cows (Jha et al., 2010).

Towel usage was found to be associated with the occurrence of subclinical mastitis, higher in animals/farms where towels were used for drying teats (51.4%) than not used (43.8%). This is because of using common source of water (bucket) for washing many towels and using of common a single towel for different lactating cows. This observation is in agreement with the reports of Fufa (2013) who report 54.28% prevalence in farms where towel was used and 43.55% in farms in which towel not used.

Milk yield considering as a risk factor for sub clinical mastitis revealed that the highest prevalence of subclinical mastitis in cows with a milk production of more than 15 liters was 61.5% and 45.8% in 7-15 liters and lowest in <7 liters (41.4%). It has a significant value ($P<0.05$), which is consistent with the report of Islam et al. (2011) who reported increased prevalence of SCM (42.85%) with the increased milk production and Siddiquee et al. (2013) who reports the prevalence of SCM was higher (73.7%) in cows producing more than 15 liters of milk. According to Grohn et al. (2004) high producing cows were susceptible for subclinical mastitis than low milk producing cows. This is due to the reason that higher milk production has affected the capacity of the immune system of dairy cows to combat infections, and the associated bacteria have adapted to changes in their hosts and environment (Tripura et al., 2014). This finding showed that, cows with poor body condition had more prevalence rate (81.8%) than those with moderate (56.6%) good body condition (44.4%) though the difference was not statistically significant.

The higher prevalence of subclinical mastitis reported in cows maintained in crackled (bad) concrete floor (64.2%) and low prevalence was observed in good concrete (43.7%). It was actually found to be statistically significant with a P-value of 0.001. This result is coincided with Mekibib et al. (2010) and Seid et al., (2015) who reports higher prevalence in good concrete than bad concrete floor type. Dirty floor would be a potential source that favors the proliferation and transmission of mastitis causing organism. This substantiates the importance of sanitation in the epidemiology of subclinical mastitis (Mureithi et al., 2016).

The present study showed that teat lesion was found to be the risk factor for subclinical mastitis with the prevalence of 75.3% in cows with teat lesion and 42.4% in cows with no lesion. It was found statistically highly significant. This is in consistent with the finding by Seykora and McDaniel (1995) that identified a positive association between teat-end lesion score and subclinical mastitis. However, Farnsworth (1995) in contradicted it with the findings. Thus, whenever teat lesions are present, it shown to be readily colonized by bacterial organisms and sever as reservoirs of infection (Mulei, 1999).

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CONCLUSION

The result of the present study (49.2%) indicated a relatively high prevalence of subclinical mastitis in dairy cattle of the study area. This high prevalence rate of subclinical mastitis in this study implied that it is the most serious health problem of the dairy cows in farm, which can interfere with efficiency of milk production and has high economic importance. The most important risk factor affecting the prevalence of sub clinical mastitis in cow were stage of lactation, parity number, floor type, breed and teat lesion. The highest prevalence was observed in cows with advanced age groups, Holstein Friesian breed, multiple parity, poor body condition score, high milk producers, early lactation stage and cows having teat lesion. Since subclinical mastitis is an economically important disease, hygienic milking practice, use of effective antibiotics, strategic mastitis control programs should be of paramount importance.

Recommendation

- Proper milking procedure with post milking teat disinfection, prompt treating of subclinical mastitis positive cows, segregation of positive cows and culling incurable cows should be encouraged in the study area to reduce the prevalence of bovine subclinical mastitis.
- Milkers should be trained on proper hygienic milking methods.
- Dry cow therapy should be applied to reduce the occurrence of new infection after parturition.
- Milkers should avoid using of common source of water (bucket) and common towel.
- Regular investigation and screening of subclinical mastitis for early detection and treatment, and culling of chronically infected cows should be practiced.

Author's contribution

Yilma M performed the data collection, laboratory works and write up of the manuscript. S Derso and Atsedemariam N analyzed the data and revised the manuscript. All authors read and approved the final manuscript.

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Conflict of interests

No conflict of interest

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