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REVIEW ARTICLE

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Prevalence and Associated Risk Factors of Mastitic Milk Zebu Cows in Abuna Gindeberet District, West Shoa, Oromia, Ethiopia

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ABSTRACT

Among the animal diseases that require antibiotic treatment in dairy herds, mastitis is the commonest one. Mastitis pathogens like Staphylococcus species have received recent attention due to antimicrobial resistance potential. A cross-sectional study was carried out from, August 2017 to November 2017 to determine prevalence and risk factors of mastitis from mastitis local Zebu cows in districts of Abuna Gindeberet, West Shoa Zone, Ethiopia. A total of 384 lactating local zebu cows were examined physically as well as by California mastitis test (CMT) to detect clinical and sub clinical mastitis. Of the total dairy cattle examined, 107(27.68%) were found to be positively reactive to CMT. From the total count, the clinical and subclinical mastitis forms were 3.13% (12/384) and 27.68% (107/384) respectively. Out of 1536 quarters examined 48 (3.23%) were blind and 120(8.06%) were positive by CMT. Chi-square result indicated that the prevalence of mastitis in mastitic milk had statistically significant difference ($P<0.05$) between age, kebele, parity, lactation, bedding cleaned, udder washing and previous treatment. Other risk factor like, floor type, housing system, using towels and tick infestation had no statistically significant difference ($P>0.05$). The present study concluded that prevalence of mastitis particularly the subclinical mastitis was major problem of dairy cows in the area and hence warrants serious attention.

Keywords: Antibiotic treatment, Mastitis pathogens, Staphylococcus species and Subclinical mastitis.

INTRODUCTION

Ethiopia, with 49.3 million heads of genetically diverse cattle, has the largest population in Africa (CSA 2009). The agricultural sector in Ethiopia, engaging 85% of the population, contributes 52% to

the gross domestic product (GDP) and 90% to the foreign exchange earnings (CSA, 2008). Cattle produce a total of 3.2 billion liters of milk and 0.331 million tonnes of meat annually (FAO 2005; CSA 2008). The indigenous breeds accounted for 99.19 percent, while the hybrids and pure exotic breeds were represented by 0.72 and 0.09 percent, respectively (CSA, 2010). Even though Ethiopia is the most populous country in cattle than any African country, the per capital milk consumption was 16 kg, which was lower than other countries in the region (Asfaw, 1997). This is partly due to the low genetic milk production potential of the indigenous zebu cattle (Lemma *et al.*, 2001) and problem of mastitis (Hussen *et al.*, 1997).

Mastitis is inflammation of the udder and common disease among dairy cows worldwide. It is often associated with bacterial intra-mammary infections (IMI) and is subdivided into clinical mastitis (inflammation with visual signs of inflammation in the udder or milk; CM) and subclinical mastitis (inflammation without visual signs; SCM). Both CM and SCM influence milk quality and yield negatively, and mastitis is therefore of major economic concern for the farmer. Clinical mastitis is also of potential concern from an animal welfare perspective (Lundberg, 2015). Mungube *et al.* (2005) and Tesfaye *et al.* (2010) estimated the economic losses from mastitis in the urban and periurban areas of Addis Ababa, to be US\$ 58 and 78.65 per cow per lactation, respectively. The prevalence of clinical and subclinical mastitis in Ethiopia ranges from 1.2-21.5 and 25.2%, respectively (Hussein, 1999; Kassa *et al.*, 1999; Lemma *et al.*, 2001; Workineh *et al.*, 2002; Dege and Tareke, 2003; Bitew *et al.*, 2010).

Majority of microorganisms that are responsible for mastitis and spoilage of milk could be *Staphylococcus aureus*, *Streptococcus agalactiae*, *Corynebacterium bovis*, *Mycoplasma* species, *Streptococcus uberis* (Erskine, 2001), coliforms (*Escherichia coli*, *Klebsiella* species and *Enterobacter aerogenes*), *Serratia*, *Pseudomonas*, *Proteus* species, environmental *Streptococci*, *Enterobacter* species (Quinn *et al.*, 2002). Besides many of them rendering milk and milk product unsuitable for human consumption, they are responsible for diseases like tuberculosis, streptococcal intoxication, *colibacillosis*, *streptococcal* sore throat and brucellosis in human (Radostits *et al.*, 2007). As with most infectious disease, generally mastitis risk factors depend on three components; exposure to microbes, cow defense mechanism, environmental and management factors (Quinn *et al.*, 2002).

Statement of the problem

Majority of house hold in the country derive milk and milk products from cattle. The occurrence of mastitis caused by *Staphylococcus* species in Zebu cows can affect household food security for both home consumption and generation of income expected. This can affect the wellbeing of rural women in particular who use dairy products to generate their income and the disease should be studied as it causes financial loss as a result of reduced milk yield, discarded milk following antibiotic therapy, veterinary expense and culling mastitic cows (Hillerton, 1987).

Several studies have been conducted in various parts of Ethiopia focusing on towns and high yielding exotic/cross breed dairy cattle. No work has been done particularly in selected areas emphasizing indigenous breed of cattle, Moreover, according to (AGLFDO, 2017) in Abuna Gindebdret district mastitis was one of the major complains of the farmers. We were able to observe several cattle with clinical mastitis and blind teat and lack of knowledge regarding mastitis. Generally, the milk production of the country was improved if the health of the indigenous cattle is maintained.

Study of Objectives

General objective

- ✓ To estimate prevalence and to assess risk factor of mastitis in indigenous zebu cattle of Abuna Gindeberet District, West Shoa, Oromia

Specific objective

- ✓ To estimate prevalence of bovine mastitis at cow and quarter level
- ✓ To assess risk factors associated with local zebu cow mastitis

MATERIALS AND METHOD

Study Area

The study was conducted in districts of Abuna Gindeberet in selected kebele from August 2017 up to November 2018. Abuna Gindeberet is located 193 km west of the capital Addis Ababa, and 128 km west of Ambo. The area lies within the central countries with altitudes ranging from ---- meters above sea level (m.a.s.l). It receives an annual rainfall of 700-1400mm, and has an annual temperature range of 32°C-68°C. Out of the total area of 138,484 hectares, crop land accounts for 53751 hectares and the rest hektar, 13927.4hek and 25907.6hektar hectares are grazing land, forest land, and land for other purposes, respectively. The urban and rural human population is 8014 and 102741 respectively. The cattle population in the districts is 3, 27,093 (AGLFDO, 2017).

Study Population and sampling method

The study animals were the indigenous lactating Zebu cows managed under extensive farming system. A simple random sampling technique was employed to select kebele, households and the animals. Milk sample was collected from lactating Zebu cows owned by selected households volunteered for testing subclinical mastitis

Study Design and Sample size

A cross-sectional study design was used from August 2017 to November 2017. The sample size was calculated based on the formula given by Thrusfield (2005) considering with 5% desired absolute precision, 50% expected prevalence and 95% confidence interval the total sample size was 384 based on the given formula below

Study methodology

Questionnaires' Interview

Data regarding the different potential risk factors (age, parity, lactation stage, milking hygiene, tick infestation, floor type, Type of mastitis, previous treatment) will be collected for 384 lactating cows by interviewing the animal owner.

Physical examination of Udder and Milk

Lactating cows were tested for the presence of clinical mastitis if there are physical abnormalities such as swelling of the udder, presence of lesions; anatomical malformations and tick infestation were recorded. The milk will be examined for its color, odor, consistency and other abnormalities prior to milking (Radostits *et al.*, 2007).

California Mastitis test

The California mastitis test was carried out as described by Quinn *et al.* (2002). After discarding the first three milking streams a squirt of milk, about two ml from each quarter will be placed in each of four shallow cups in the CMT paddle. An equal amount of the commercial CMT reagent will be added to each cup. A gentle circular motion will be applied to the mixtures in a horizontal plane for 15 seconds (Appendices-II). Based on the thickness of the gel formed by CMT reagent-milk mixture, test results will be scored as 0 (negative/trace), +1 (weak positive), +2 (distinct positive), and +3 (strong positive). Positive CMT cows will be defined as having at least one CMT positive quarter

Data management and statistical analysis

All data collected were entered in to Microsoft excel spreadsheet and coded and statistical analysis was made using STATA software version 11.0 (Stata Corp., College Station, TX, USA, 2009). Computation of ratios and percentages was used to summarize the data. Chi-square was used to assess the association of risk factors with the prevalence of mastitis. In all these cases, 95 % confidence intervals and $p < 0.05$ were set for significance.

RESULTS

Prevalence of mastitis in local Zebu cows

From the total of 384 lactating Zebu cows examined, 30.99% (119/384) were positive for mastitis. Of these, 3.13% (12/384) and 27.86% (107/384) were found to be positive for clinical mastitis and subclinical mastitis, respectively. In all the study districts, a higher prevalence of sub clinical mastitis was recorded as compared to the clinical ones (Table1).

Risk factors associated with local zebu cow's mastitis

In this study, the risk factors of mastitis identified in Zebu cows under extensive farming system were kebele, age, stage of lactation, parity, housing system, floor type, udder washing, using towels, tick infestation, and previous treatment. The Chi square test showed that lactation, floor type, housing system, using towels and tick infestation variables were insignificantly associated with mastitis and six variables were found to be significantly associated with the prevalence of mastitis were kebele, age, parity, bedding clean, udder washing and previous treatment as it is indicated on (table 3).

Table 1. Prevalence of mastitis at cow level.

Mastitis type	No. of cow examined	No. of cow affected	Prevalence (%)
Clinical	384	12	3.13
Subclinical	384	107	27.86
Total	384	119	30.99

A total 1536 quarters were examined and among these, 1488(96.87%) quarters were found to be patent while the remaining 48(3.23%) were blind. At the quarter level, 120(8.06%) of them were total number of quarter affected (Table 2).

Table 2. Prevalence of mastitis at the quarter level.

Quarter examined	No. of quarter affected	Prevalence (%)
RF	46	3.09
RH	24	1.61
LF	30	2.02
LH	20	1.34
Total	120	8.06

No= Number; %= Percentage; RF= Right Front; RH=Right Hind; LF= Left Front; LH= Left Hind
From the entire observed Zebu cow milk during the study period, a total of 18 (1.21%) and 102(6.85%) infected quarters were identified from clinical and sub clinical mastitis case respectively (table 3).

Table 3. Prevalence of mastitis at cow and quarter level.

	Sub clinical N (%)	Clinical N (%)	Total prevalence N (%)
Cow level	107(27.86)	12(3.13)	119(30.99)
Quarter level	102(6.85)	18(1.21)	120(8.06)

DISCUSSION

Prevalence of mastitis in local Zebu cows

Zebu cows are a great economic importance for rural smallholder community throughout Ethiopia. However, loss or reduction of milk production as a result of mastitis has been known in most dairy farms raising cross bred or exotic cattle. The epidemiology of mastitis has less investigated in Zebu cattle. This study attempted to investigate into the prevalence of mastitis, in zebu mastitic milk in the rural area of Abuna Gindeberet districts. The overall prevalence of mastitis in Zebu cows recorded in present study was (30.99%) and in agreement with Bitaw *et al.* (2010) who reported 28.2% in and around Bahirdar town from local and cross breed dairy farm.

Table 4. Chi square test Analysis Risk factors associated with mastitis in local zebu cow's milk in study area.

Variables	Category	No of examined	No of Positive (%)	X ²	P-value
Kebele	Qalate	148	35(23.65)	13.5961	0.001
	Yagot	142	41 (28.87)		
	Dannisa	94	43(45.74)		
Age group	<5 years(young)	222	39(17.57)	64.1739	<0.001
	5-7 years(adult)	67	46(68.66)		
	>7 years(old)	95	34 (35.79)		
Lactation	1-4 month(early)	59	22(37.29)	2.4991	0.287
	4-7 month(mid)	44	10(22.873)		
	>7 month(late)	281	87(30.96)		
Parity number	1-3 calves(few)	118	17(14.41)	81.2284	<0.001
	3-6 calves(moderate)	200	52(26.00)		
	>6 calves(many)	66	50(75.76)		
Housing system	Separate	52	12(23.08)	1.7608	0.185
	Together with cow	332	107(32.23)		
Bedding is clean	< one week(good)	51	10(19.61)	73.7528	<0.001
	Once a week (moderate)	195	29(14.87)		
	>a week (poor)	138	80(57.97)		
Floor Type	Muddy(soil)	307	94 (30.62)	0.0984	0.754
	Concrete(cement)	78	25(32.05)		
Udder washing	No	288	108(37.50)	23.3166	<0.001
	Yes	96	11(11.46)		
Using towels	No	294	91(30.95)	0.0058	0.977
	Yes	90	28(31.11)		
Tick infestation	No	250	74(29.60)	0.6469	0.421
	Yes	134	45(33.58)		
Previous Rx	No	178	99(55.62)	94.1078	<0.001
	Yes	206	20 (9.71)		

This finding is lower than those of Mekbib *et al.* (2009), who reported 71% prevalence in Holeta farm, Zeryehun (2013) who reported 74.7 % prevalence, Ashenafi (2008) who reported 75% prevalence in and around kombolcha and Zarihun (1996) who reported 68.10 % prevalence in Astella dairy farm exotic and cross bred cows elsewhere in Ethiopia. This might be due to management system the farmers have practiced in the study area. Farmers have maximum of cow 2-3 and they release their cows to open grazing land this system decreases the chance of transmission of contagious mastitis between cows (Radostits *et al.*, 2007). Up on taking history on the cows' production of milk, they only give less than 1.5 liter/day. Local Zebu breed are low in milk production and resistant to mastitis (Almaw and Molla, 2000). Higher yielding cows have been found more susceptible to mastitis owing to position of teats, udder, and anatomy of teat canal making them prone to injury, and due to fewer efficacies of pathogenic cells in higher yielding cows associated to dilution (Schalm and Carrloles, 1971; Radostitis *et al.* 2007). The clinical mastitis prevalence in this study was 3.13% and in agreement with Bitaw *et al.* (2010) who reported 3 % in and around Bahirdar town in local and cross breed dairy farm. However, the present finding was higher than that of Gizat *et al.* (2010) who reported 0% prevalence in and around Bahirdar town in local cow (Fogera breeds), Balachew (2016) who reported 0.7 % prevalence in and around Bishoftu town in local zebu cows this is because of treatment of clinical mastitis in this a study area did not commonly practiced in local

Zebu cows due to CMT reagents provision by Oromia Livestock and every veterinarians working in veterinary clinic use incorrect drugs that not fit with clinical mastitis treat like oxy-tetracycline-10%, oxy-tetracycline-20% and penistrep.

The present finding of prevalence of sub-clinical mastitis was 27.86% in agreement with Seid *et al.* (2015) who reported 30.7% prevalence in local and cross breed dairy animals and Bitaw *et al.* (2010) who reported 25.2% prevalence in and around Bahirdar town. In the present study, as well in other conducted studies, over whelming cases of mastitis were sub-clinical compared to clinical mastitis (Warkinash, 2002; Deogo and Tareke, 2003). In the presented study high prevalence of sub-clinical mastitis is reported than Girma *et al.* (2012) who reported 15.89% prevalence in Doba districts, East Hararge in local Zebu lactating cows and Balachew (2016) who reported 5.3% prevalence around Bishoftu town in local cows, in current study area these is may be due to no dipping teat after milking and practicing of milk by contact labors use of lubricant, absence of order in milking cows of udder inflamed and there is no order milking in different ages groups.

Higher prevalence of sub clinical mastitis form was observed in comparison to clinical in the current study that may indicate the magnitude of subclinical mastitis problem and low level of attention that given to it in terms of diagnosis and treatment. In Ethiopia, the sub clinical form of mastitis received little attention and efforts have been concentrated on the treatment of clinical cases Hussein *et al.* (1997) while the high economic loss could come from sub clinical mastitis). According to Radostits *et al.* (2007) an infected quarter showed 30% and a cow 15% reduction in milk yield. This may be attributed to the difficulty of detecting sub-clinical mastitis by the owners compared to the easily detectable clinical cases which prompt owners seek treatment for their animals.

The overall quarter level prevalence recorded in this study (8.06%) is in agreement with Girma *et al.* (2012) who reported 10.12% prevalence in Doba District, East Hararge zone and and Bitaw *et al.* (2010) who reported 12.3% prevalence in and around Bahirdar town in local cow (Fogera breed). The present finding higher than that of Balachew (2016) who reported 6% prevalence around Bishoftu town and zeryehun *et al.* (2013) who reported 5.2% prevalence cows these is due to studied area were mainly found in the rural area where veterinary services are not adequate, most farmers use treatment on their own or get the services from Para veterinarians and women lubricated teat edges by faeces as a calf not sucking milk.

From the 120 (8.06%) CMT positive quarter milk samples, 48 (3.23%) blind teats. Blindness of the teat could be due to failure to detect the disease in early stage attributable to lack of strip cup examination and skill milker's to establish a prompt treatment. Generally, it indicates a poor treatment regime and husbandry (Kasa and Tagegne, 1999).

Risk factors associated with mastitis

The results of analysis of chi-square test for the risk factors showed that kebele, Age, Parity, Bedding cleaned, Udder washing and Previous treatments had significant effect on prevalence of mastitis.

The current study shows the occurrence of mastitis is significantly associated with dannisa kebele this is due lack of veterinary clinic our farmer bought drugs from black market without veterinarians judgment and incorrect used drugs for treatment (using oxytetracycline-10%).

The prevalence of mastitis was higher in adult cows (68.66%) than old age cows (35.79%). Radostits *et al.* (2007) have explained that older cows have largest teats and more relaxed sphincter muscles, which increase the accessibility of infectious agent in the cows' udder but present finding in similar with this researcher because naturally local zebu cows have small teat and less relaxed sphincter muscles.

The prevalence of mastitis was higher in many calves (75.76%) than few calves (14.41%). Zeryehun *et al.* (2013), Belayneh *et al.*, 2014 and Mekibib *et al.* (2010) finding were similar with presented findings. Also Abuna *et al.* (2013) reported cows with parity number greater than three had significantly higher mastitis prevalence than lesser number of parity ($p < 0.05$). This could be due to that fact that primiparous cows have more effective defence mechanism than multiparous cows (Eriskine, 2001).

The prevalence of mastitis was higher in early lactation (37.29%) than late lactation (30.96%). This current study was similar to previous reports of Biffa *et al.* (2005) and Tamirat (2007) showed that higher infection in cows is occurred at early stage of lactation followed by medium and late stages of lactation. Radostits *et al.* (2007) suggested that, the mammary gland is more susceptible to new infection during the early and mid which may be due to the absence of udder washing and teat dipping, which in turn may have increased the presence of potential pathogens on the skin of the teat.

The prevalence of mastitis was significantly associated with bedding cleaned greater than one weak (poor hygienic). These finding is similar with the study done by (Iakew *et al.*, 2012)

The prevalence of mastitis was significantly associated with not udder washing milking cows. In current finding cows with poor milking (not udder washing) hygiene standard are severely affected than those with (udder washing) and similar with (Lakew *et al.*, 2009; Sori *et al.*, 2005) founded cow with not udder washing was severely affected by mastitis cases than cow with udder washing. This might be due to no practice of udder washing in local animals and milking of cows with common udder cloth which could be vectors of spread especially for contagious mastitis (Radostitis *et al.*, 1994).

The investigation also revealed higher Prevalence of mastitis in dairy cattle that hadn't been treated with antibiotics comparing to members who had. The possible explanation for this may be to teat sickled cows is not as such commonly practiced by mastitis cases in local zebu cows. Therefore, the antibiotic treatment for mastitis infection in study area is still in good governance by veterinary practitioners.

CONCLUSION AND RECCOMENDATION

The overall prevalence of mastitis in the study area is 30.99% (3.12% clinical and 27.86% subclinical) in cows and 8.06% at quarter level and different risk factors are found to be associated with mastitis. Among different risk factors, age of the animal, bedding clean, parity, lactation, udder washing and previous treatment were predictor risk factor for the occurrence of mastitis.

Based on study and above conclusions, the following recommendations are forwarded:

- There is need to create farmers' awareness to improve efforts in using preventing measures including hygienic milking practice
- Regular screening for the detection of subclinical mastitis and proper treatment of the clinical cases as well as appropriate treatment of cows during early lactation period should be practiced

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