Advances in Dairy Research
ISSN: 2329-888X

Abraham et al., J Adv Dairy Res 2017, 5:3
DOI: 10.4172/2329-888X.1000184

Research Article Open Access

Prevalence of Bovine Clinical Mastitis and Farmer's Awareness in and Around Wolaita Sodo, Southern Ethiopia

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Received date: 18 July, 2017; **Accepted date:** 16 August, 2017; **Published date:** 26 August, 2017

Abstract

A cross sectional study was conducted to determine prevalence and awareness of farm owners from November, 2016 to April, 2017 in randomly selected dairy farms in and around Wolaita Sodo town. A total of 155 lactating cows of three breeds (local, Local-Holstein Frisian cross and exotic (Jersey) from twenty five dairy farms were considered for the study. The overall prevalence of bovine clinical mastitis was 5.1%. Among the variables included in the study only lactation stage and presence of teat end lesion had significant association with prevalence of bovine clinical mastitis (P<0.05). The questionnaire based interview of smallholder dairy farm owners/attendants about awareness of bovine mastitis showed serious gap about awareness on effect, clinical manifestations and subclinical mastitis. Hence, it is recommended to implement strategic extension program to control and prevention of the disease and the smallholder dairy farmers need awareness training to enhance production and productivity of productive life of the cow.

Keywords: Awareness; Clinical mastitis; Ethiopia; Prevalence; Wolaita Sodo

Introduction

Ethiopia, a country with a human population of about 102 million (annual population growth rate, 2.48%) and a land size of 999,541 km^2. Livestock represent a major national resource and form an integral part of the agricultural production system. The country has the huge livestock with an estimated 56.71 million. Cows represent the largest proportion of cattle population of the country, 20.7% of the total cattle heads for the private holdings are milking cows [1].

Milk provides an important dietary source for the majority of rural as well as a considerable number of the urban and peri-urban population. However, milk production often does not satisfy the country's requirements due to a multitude of factors includes; low genetic potential for milk production of indigenous breeds, the extensive and low inputs husbandry practice under which they are reared and widespread livestock diseases [2].

The udder is the most important part of the body of the dairy cow and its physiological characteristics affect health of cows and play a vital role in sustainable economic milk production [3,4]. Udder health disorders were always related to a decreased profitability, and an increase in unexpected culling. More recently, udder health is becoming more important due to strict milk quality regulations [5].

It is an inflammation of the mammary gland, mastitis, can be caused by physical or chemical agents but the majority of the causes are infectious and usually caused by bacteria [6-8]. It is the most important and expensive disease of dairy industry, is among the various factors contributing to a reduced milk production [9]. It results in severe economic losses from reduced milk production, treatment cost, increased labor, milk withheld following treatment and premature culling [10].

Mastitis, in view of the degree of inflammation, can be classified as clinical and sub clinical types [11]. Clinical mastitis includes gross abnormality in milk, physical abnormalities of udder and abnormality of cow with systemic involvement. Sub clinical mastitis is characterized by the absence of gross lesion and an increase in number of somatic cells in the milk. The clinical mastitis leads to important economic losses from both milk production quantity, milk quality decreases, discarded milk and transient reductions milk yield, treatment and culling costs; death of the cow, reduced milk quality and price of the milk [12-15], because of its multi factorial causation [16].

The occurrence of bovine clinical mastitis can be reduced by implementation of preventive measures [17]. However several control measures and studies have been conducted in the past of clinical and subclinical mastitis in the study area, the disease is endemically important in dairy farms. In association with multitude factors, knowledge and awareness of mastitis influences farmer perceptions and decisions, which in turn will affect preventive and treatment protocols in small scale dairy production [18]. Hence, it is essential to assess farmer's awareness about the disease in association status of the disease in order to recommend applicable preventive and control measures. Therefore, the study was aimed at determining the prevalence of clinical mastitis and assessing smallholder dairy farm owners' awareness on bovine mastitis in and around Wolaita Sodo.

Materials and Methods

Study area

The study was conducted from November 2016 to April 2017 in and around Sodo town, the administrative center of Wolaita Zone, Southern Nation Nationalities People Regional State, Ethiopia. Wolaita Sodo town is located about 329 kms south of Addis Ababa and located at latitude of 6°54°N and longitude of 37°45°E. The Altitude varies from 1100-2950 m.a.s.l. The area experiences mean annual

temperature of about 20°C. The mean maximum temperature is 26.2°C and the average monthly minimum temperature is 11.4°C. The rainfall regimes over much of the area are typically bimodal with the big rainy season extending from June to September and a small rainy season occurring from February to April. The mean annual rain fall of the area ranges from 450-1446 mm with the lowest being in low land and highest in high land. The livestock population in the area is estimated to be 68,900 cattle, 1992 sheep, 382 goats, 121 horses, 131 mules, 488 donkeys and 55,191 chickens [19].

Study animals

A total of 22 smallholder dairy farms and government owned three dairy farms with a total of 155 randomly selected lactating dairy cows in and around Wolaita Sodo were included in the study. The size of the selected farms varied from 4 to 23 lactating dairy cows comprising local, cross (Holstein Frisian X local) and exotic (Jersey) breeds. The farms were kept under intensive, semi-intensive and extensive management systems.

Study design

Cross-sectional questionnaire interview was conducted to collect general farm information, assess status of bovine clinical mastitis, and farm owners' awareness about the disease. All lactating cows in selected farms were eligible for the study and followed until dry off or end of the study period. Attendants or milkers of the cows were pre-informed/trained to how and when reported the disease cases and identified cases of clinical mastitis on the basis of abnormalities in milk, in the udder or systemic abnormalities of the cow during the study period. Moreover, cases subsequent to the first case of clinical mastitis considered as new, if at least 15 days had passed between any two cases of clinical mastitis [20]. Body condition score was also measured during farm visits as poor (score 1 and 2), medium (score 3) and good (4 and 5) according to OMAFRA [21].

Sampling and sample size determination

Smallholder dairy farm house hold was randomly selected from livestock and fishery office documentations and listed owners by professional in charge of following the dairy production in the study area. And also, individual cow level inclusion to the study was done by registering all lactating dairy cows in the smallholder selected for the study. The sample size taken was determined according to Thrusfield [22] at 95% confidence interval, 5% precision and with expected prevalence of bovine clinical mastitis as 2.6% [23].

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

Where; n=required sample size;

d=desired absolute precision=5%;

P Exp=Expected prevalence= 2.6%

Accordingly total of 155 lactating dairy cows were sampled by the following formula and in order to increase the precision the calculated sample size was increased.

Study methodology

Questionnaire interview survey: Cross-sectional study by using semi-structured questionnaire was administered to farm owner or attendant about general farm management activities, status of the disease in the farms and specific cow attributes such as age, lactation stage and parity. Besides, knowledge and awareness of smallholder dairy farm owners about the disease were asked to assess the perception in relation to their practices in the farms.

Clinical examination: During farm visit days, cow udder and milk clinical examination was conducted. The udder was first examined visually and then palpated to detect possible fibrosis, inflammatory swelling, and atrophy of the tissue. The size and consistency of the mammary quarter were inspected for the presence of any abnormalities such as disproportional symmetry, swelling, firmness, and blindness. In addition, milk from each quarter was inspected by visual inspection for presence of any flakes, clots and color change.

Data analysis

The data collected during the study periods was entered into MS-Excel spread sheet and analyzed using SPSS software version 20 (2011). Descriptive statistics such as mean, minimum, maximum and standard deviations were used to describe prevalence and farm owner's awareness about bovine mastitis. The association of different risk factors with dependent variables was analyzed by chi- square which was used to compare the different groups of age, breed, parity, and various risk factors, with the outcome variable bovine clinical mastitis.

Results

General smallholder dairy farm conditions

The questionnaire interview result showed that 25 smallholder dairy farms with a total of 155 dairy cows comprising local zebu; crossbred (local zebu X Holstein Frisian) and exotic/Jersey breed cattle were included in the study. Out of all farms investigated smallholder dairy farms, 18 (72%) were semi intensively and extensively managed and the rest 7(28%) were managed intensively. Most of the farms (76%) had unhygienic soil floor type with the rest few farms had concrete and stone floor type of the barn.

The farm owners were also asked about the type of insemination of cattle in their farms and responded that artificial insemination (AI) is the most common method accounting 56% followed by natural/bull and both representing 36 and 8%, respectively. In addition, 80% of the farms experience milking twice a day and all of them had a practice of hand milking procedure and also milking practices were generally poor having only 50.6% of those farms use individual towels to dry teats before milking whereas the rest do not have either common or individual cow towel.

Prevalence and associated risk factors of Bovine clinical mastitis

The prevalence of bovine clinical mastitis was studied in the study population farm attendants report and clinical examination of the researchers during farm visit. From the total of 155 lactating cows investigated, 8 (5.1%) were found to be clinically mastitic as shown on Table 1. The prevalence of mastitis in breed wise was 7.69, 3.57 and 2.04% in cross breeds, exotic (jersey) and local breeds, respectively.

Variable	Category	Total no. examined	frequency (Positive for CM)	Prevalence (%)	X^2	P-Value
Breed	Local	49	1	2.04	2.14	0.343
	Cross	78	6	7.69		
	Exotic (Jersey)	28	1	3.57		
Age	2-4	24	1	4.1	0.107	0.948
	5-7	80	4	5		
	≥ 8	51	3	5.88		
Lactation stage	Early	41	6	14.6	11.205	0.004
	Mid	48	2	4.16		
	Late	66	0	0		
BCS	Poor	29	1	3.44	1.894	0.388
	Medium	104	7	6.7		
	Good	22	0	0		
Parity	Heifer, 2-3	107	5	4.67	0.716	0.699
	4-6 calves	42	3	7.14		
	≥ 7	6	0	0		
Tick	Absent	122	5	4.09	1.323	0.25
	Present	33	3	9.09		
Teat end Lesion	Absent	140	3	2.14	26.97	0
	Present	15	5	33.3		
Use of towel	No	79	2	2.5	2.276	0.131
	Yes	76	6	7.89		
Wash udder before milking	Yes	148	8	5.71	0.399	0.528
	No	7	0	0		
X^2=Chi-square						

Table 1: Prevalence of bovine clinical mastitis and its associated risk factors in and around Wolaita Sodo town.

Considerable risk factors such as breed, age, lactation stage, body condition score, parity, tick and teat end lesion were examined as potential risk factor, but only lactation stage and teat end lesions were found significantly associated with the disease prevalence ($P<0.05$). On the other hand, cows at the early stages of lactation were found to be more susceptible to clinical mastitis followed by late and middle stage of lactation. Presence of teat end lesion made the cows more prone for occurrence of clinical mastitis in comparison to dairy cows without teat end lesion.

Smallholder farm owner's awareness about bovine mastitis

The farmers awareness about the disease was attributed as all of the respondents were aware of the udder disease of cows with 96% of them had encountered a clinical mastitis since their enrollment. Commonly described clinical signs of mastitis list by the farm owners were swelling of the udder, fever (systemic) and flakes in the milk followed by blood tinged milk, teat lesion and blind teat. A total of 68% of respondents doesn't know about sub clinical mastitis.

The breed, parity and stage of lactation were interviewed as risk for mastitis susceptibility, of which exotic breed, parity greater than 7 and late lactation stage were pointed out as most susceptible by the farm owners. Two (8%), 7 (28%) and 16 (64%) of the respondents were aware of the effect of mastitis as only reduction in quality, only reduction in yield and both yield and quality, respectively.

As part of prevention two questions; udder washing and milking mastitic cow last were asked to the farm owners. The result revealed 48% of the farmers were aware of milking mastitic cows last can have a great role in the preventive measure and practiced it. The 96 and 19.5% of farmers were able to wash the udder before milking and usage of

individual towel for each teat assuming it is worthy to prevent mastitis, respectively (Table 2).

Variables	Category	Frequency (N=25)	Percent (%)
Milking mastitic cow last to prevents mastitis	Yes	12	48
	No	13	52
Awareness of udder disease/mastitis of cows	Yes	25	100
	No	0	0
Have you encountered mastitis in your farm	Yes	24	96
	No	1	4
Common clinical signs by farm owners	Swelling	18	72
	Fever	23	92
	Flakes	21	84
	Blood tinged milk	8	32
	Teat Lesion	4	16
	Blind teat	1	4
Do you know sub clinical mastitis	Yes	8	32
	No	17	68
Which breed is most susceptible	Local	2	8
	Cross	6	24
	Exotic	17	68
Parity at which cows become more susceptible	1-2	8	32
	3-6	2	8
	7 and above	15	60
Lactation stage at which cows become more susceptible	Early	18	72
	Middle	0	0
	Late	7	28
Effect of mastitis on milk	Decreases quality	2	8
	Decreases yield	7	28
	Both	16	64

Table 2: Farm owner's awareness about bovine mastitis in and around Wolaita Sodo town.

Discussion

The finding of current study revealed a prevalence of 5.1% which is in line with the report of [24] who reported 5% in urban and peri urban farms of Addis Ababa and 4% [25] in Tanzania. But, the result was higher than 2.6% [23] 3.75% in and around Wolaita Sodo [26] and 3% in and around Bahir Dar [27]. However, the current finding was lower than 9.9% reported [28] in Ambo, central Ethiopia. The prevalence of mastitis in breed wise was 7.69, 3.57 and 2.04% in crossbred, exotic (jersey) and local breeds, respectively. The crossbred prevalence in the study was comparable with 5.3% in Addis Ababa [29] while higher than.9% in Bahir Dar [30].

Breed, age, lactation stage, body condition score, parity, tick and teat end lesion were considered in the study as potential risk factors; however, only lactation stage and teat end lesions had significant association. Lactation stage was significant factor for the occurrence of clinical mastitis ($P<0.05$) in the study. Accordingly, prevalence of mastitis is high in early stages of lactation and it might be due to the carryover of infection from the dry period and in cows most new infections occur during the early part of the dry period and in the first two months of lactation [7]. Then, the prevalence is followed by middle and late stages of lactation which are in line with previous reports [31,32].

In smallholder dairy cows teat and udder lesions are highly prevalent [33]. Teat lesions can be frequently colonized by bacterial species [34]. Consequently, high new infection rates and increased numbers of mastitis cases are common squeals in herds where teat lesions are prevalent [33]. The present study showed that teat end lesion was significant factor that affect the prevalence of bovine clinical mastitis. In addition, cows with teat end lesion had higher prevalence of subclinical mastitis [35]. In line to this finding prevalence of mastitis was significantly associated with udder/teat injuries that as many as 68.8% of cows with udder/teat injuries had mastitis compared with only 18.2% of cows with no injuries [9].

Perception and awareness of the farmers about the disease is pivotal in the control and prevention of the disease [18,33]. The study showed that there was farmer's awareness and perception gap in terms, effect, preventive measures, subclinical form and related issues. Among the 25 surveyed farms all respondents were aware of the bovine mastitis and 96% had encountered clinical mastitis in their farms that showed the significant prevalence of the disease. Yieng [36] reported 97% of respondents were encountered clinical mastitis in their farm which agrees with the current study result. Even more awareness gap was reported by Karimuribo and co-workers [37] who investigated farmer's awareness of mastitis in the Southern Highlands of Tanzania, and it was recorded that 62.1% of the farmers were aware of clinical mastitis and 28.6% had clinical mastitis cases in their farms, based on clinical signs recognizable by farmers.

Perception refers to what a farmer thinks the economic losses of mastitis are on their farm. Moreover, the basis of the economics of mastitis decision making lies in the costs of cases of clinical and subclinical mastitis in relation to costs of management procedures [18]. Not only in developing countries but also in developed countries with good diary industry development like in Netherlands farmers underestimated the cost of mastitis for their farm business [38]. Similarly, in this study about 68% of the farmers interviewed had lack of aware about the presence of sub-clinical mastitis. The current study revealed relatively better awareness about subclinical mastitis in Tanzania as reported by Kivaria [33] who reported that only 5% of the owners interviewed were aware of the presence of sub-clinical mastitis.

This study also revealed that about 36% of farmers from the total respondents' don't recognize mastitis affects both milk yield and quality. Almost all recognize and emphasize on the quantity, not quality which is important for soundness measure for human consumption. In the study about 64% of farmers had a mind set up that mastitis affects the quality of milk in addition to the quality. Kivaria [33] from Tanzania also pin pointed about 83.7% of his study population had knowhow about qualitative effect on the milk by mastitic animals.

Almost half of the respondents had awareness and practice milking of mastitic cow as one of the prevention method of the spread of mastitis in the current study. Comparatively lesser proportion of respondents from Hawassa (32%) was aware and experience milking mastitic cow last according to the report of [39] in order to prevent bovine mastitis.

More than half of the farms owners (60%), in the study, believed that there would be an increase in clinical mastitis risk as parity increases. In agreement with several previous researchers which showed that cows with greater parity number had significantly higher mastitis prevalence primiparous [40] and this may be due to primiparous cows have more effective defense mechanism than multiparous cows [40].

In the present study all the respondents were able to wash udder before milking knowing this practice as prevents mastitis. Whereas farmers in different rural parts of Ethiopia including a report by Yieng [36] which showed that 28.6% of the total respondents in Gambella were milking their cows without washing the udder before milking.

Conclusions

Generally, mastitis is one of the most economically significant diseases of smallholder dairy cows. To study this important disease of dairy industry, three breeds (local zebu, cross and jersey) of cattle under extensive, intensive and semi-intensive management system which had trend of using AI. Majority of the smallholder dairy farms had experience of some managemental prevention methods like udder washing; use of towel for drying the udder before milking and milking mastitic cow last etc. The current study revealed prevalence of 5.1% and presence of teat lesion and lactation stage had significant influence on prevalence of clinical mastitis. Farm owners/attendants interview showed that they had lack sufficient awareness and perception about bovine mastitis including manifestation of clinical mastitis, subclinical form and effect on quality of milk, prevention methods of the disease. Therefore, wide variety of preventive and control programs should be done through extension works by different stakeholders; also, awareness and perception of the farmers or farm attendants is pivotal for the whole process of control and prevention. Moreover, awareness creation and training for the farmers is critical to enhance production and productivity of smallholder dairy farming.

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