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Prevalence and Major Bacterial Causes of Bovine Mastitis on Lactating Cows at Buno Bedele and Ilu Aba Bor Zone, South Western Ethiopia

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Abstract

Identifying the prevalence and major causing bacteria for mastitis are very important for further improvement of product and productivity of lactating cows. The objectives of this study were to assess and identify the prevalence and major causing bacteria species for existence of bovine mastitis in the study areas. The study was carried out in six districts namely Bedele, Didessa, Dega, Yayo, Mettu and Becho districts. A total of 474 households were participated in the study to carry out an interview and further examination of their cows. The summarized result of the study revealed that 92.9%, 4.4% and 2.7% of the interviewed households in Buno Bedele Zone and 81.1%, 15.7% and 3.2% of the respondents in Ilu Aba Bor Zone have been practicing extensive, semi-intensive and intensive rearing systems, respectively. In addition to this, an interviewed respondents living in Buno Bedele (88.9%) and Ilu Aba Bor (92.0%) Zones had ≤ 10 herd size whereas the remains had >10 herd size. The prevalence of mastitis ranges between 25.6% and 47.9%; the lowest obtained from Mettu district while the highest observed in Dega district. The *Staphylococcus aureus* was one of the major examined bacteria species from Bedele, Didessa, Dega,Yayo and Becho districts with isolation rate of 57.1%, 69.2%, 67.7%, 65.0% and 34.8% respectively, while *Enterobacteriaceae* and Micrococcus species were observed as a major causing bacteria in Mettu and Becho districts with isolation rate of 42.9% and 34.8%, respectively.

Keywords: Prevalence; Mastitis; Bacteriology; Ethiopia

Introduction

Livestock are the backbone of Ethiopian agricultural sector in terms of economic benefits and food supply [1]. Ethiopia is believed to have the largest livestock population in Africa. This livestock sector has been adding a significant effect on the economy of the country and still promising to bring development to the country. Product and by-products of livestock are well-known as the main animal protein source for enhancing the nutritional status of the people. In Ethiopia, cows represent the largest proportion of the cattle population of the country, while milk production does not satisfy the countries requirements due to multitude factors. This is partly due to the low genetic potential of milk production of indigenous zebu cattle. Although to increase milk production, cross breeding of indigenous zebu with exotic breeds particularly with Holstein Friesian is widely practiced which resulted in a larger portion of the dairy cattle population especially in urban and peri-urban areas. However, this market oriented dairy production and rapidly growing systems in many African countries are subjected to diseases of intensification including mastitis and reproductive disorders [2].

Mastitis is an inflammation of mammary gland that can be caused by physical or chemical agents but the majority of the causes are infectious and usually caused by bacteria [3,4]. Bovine mastitis is the most common and costly disease which is affecting the dairy farms all over the world and results for the economic losses mainly from decreasing of milk production, culling of chronically infected cows, cost of treatment and penalties of milk quality [5]. In Ethiopia the economic loss due to both clinical and subclinical mastitis per lactation is 270 ETB [6]. Due to significant effect of mastitis over the income from milk production, different effort has been made by different authors to assess the occurrence of mastitis on dairy herds in Ethiopia. Therefore, this disease is considered as the main constraint and recognized as the major root for low milk production in the country [7].

Horro breed of cattle is an indigenous breed mainly distributed in western and south western part of Ethiopia, while some of cross bred and exotic breeds (Holstein Friesian and Jersey) are also there in study areas. Studies on prevalence and major bacterial causes of mastitis on cattle reared in Bono Bedele and Ilu Aba Bor Zone are lacking and thus the study was conducted to study about the prevalence, and major bacterial causes of bovine mastitis in six selected districts.

Materials and Methods

Study area

This study was conducted at Buno Bedele and Ilu Aba Bor zones of Oromia Region. The centers of these zones are located at 480 km and 600 km distance from Addis Ababa towards South West Ethiopia, respectively. Totally the zones have 1,633,156.56 hectares of land of which 10% is high land, 67% medium land and 23% low land. The altitude of the zone ranges from 500-2575 meter above sea level. It is mostly known for its vegetation coverage, suitability for coffee, crop, livestock and bee production. The dominant crops being Maize, Teff, Coffee, Sorghum, Barley, Wheat, different pulse crops, finger millet, fruits, vegetables, spices and rice. Annual precipitation ranges from

1500-2200 mm with 6 to 9 months of rainfall. Agriculture is the mainly livelihood of people with a mixed farming system and livestock plays an integral role for agriculture [8].

Sampling method

During sampling process, multi-stage sampling techniques were used to collect data for both experimental and assessment studies. A random sampling technique was employed to select the study areas (districts) from two zones and three peasant associations from each district. Then after, purposive sampling techniques were used to select the households from each peasant association based on the presence and absence of lactating cows. Then based on the above techniques, the general information about husbandry practices was collected using a closed or structured questionnaire with an intention for summarizes the husbandry practices of the study areas.

Sample size determination

The number of animals required for the study was determined using the formula given by Thrusfield [9] for simple random sampling.

N=1.962 P exp (1-Pexp)/d2

Where; N=required sample size.

Pexp=expected prevalence.

d=desired absolute precision (usually 0.05).

The sample size determination was using 95% level of confidence, 50% expected prevalence and 0.05 desired absolute precision. Generally, a total of 474 lactating cows were randomly selected from 474 households and then the owners of cows were interviewed to assess the general information of husbandry practices.

Physical examination

Clinical detection of udder and milk from cows had been carried out by inspecting the size and consistency of quarters for checking of any abnormalities such as injury, swelling, firmness and blindness of the teat canal and two streaks of milk from each quarter in a strip of cup was inspected by visual inspection for checking the presence of any flakes, clots, pus, watery appearance, blood and color change.

CMT screening test

Clinically free of mastitis cows were tested by California mastitis test (CMT) and milk samples had been collected from cows in which clinical mastitis was not detected to look for sub-clinical mastitis. The sample was collected from each quarter of the udder and analyzed using CMT. From each quarters of udder, a squirt of milk sample was placed in each cup on the CMT paddle and an equal amount of 3% CMT reagent was added to each cup and mixed well. Reactions were graded as –ve, T,+,++ and +++ for negative, trace, slightly positive, positive and strongly positive, respectively [10].

Procedure of milk sample collection

Based on CMT result, ten milliliter of milk samples were collected using sterile test tubes after discarding the first three milk quirt for bacteriological analysis. Milk sample was taken from each positive quarter and transported in an icebox to Bedele regional veterinary laboratory for immediate culturing or where they stored at 40°C for maximum of 24 hrs until they were inoculated onto standard bacteriological media. Techniques of milk sampling were employed according to the standard of milk sampling techniques [3]. During milk sampling, udder and teats had been cleaned and dried before milk samples were collected and also dust particles of bedding and other filth were removed by brushing the surface of the teats and udder with a dry towel. Then after, the teats were swabbed with cotton soaked in 70% alcohol [10]. Recontamination of milk sample was prevented by scrubbing with alcohol starting from far teats side and followed by the near side.

Bacteriological examination

The collected milk samples were examined according to the procedures stated by Quinn et al. [11]. Refrigerated milk samples were warm at room temperature (250°C) for about an hour and then mixed by shaking in order to disperse bacteria and fat. The samples were allowed to stand for a while for foam to disperse before just inoculation. A loop-full of milk sample collected from each infected quarter was inoculated separately on Mac-Conkey agar and blood agar base. The inoculated plates were then incubated aerobically at 370°C for 24 to 48 hours. Identification of the bacteria on primary culture was done on the basis of colony morphology, hemolytic characteristics, gram stain reaction including shape and arrangements of the bacteria.

Data management and analysis

The collected data was entered into MS Excel spread sheet and then the summaries of descriptive statistics were analyzed using SPSS (version 20:0).

Results and Discussion

Husbandry practices

The overall rearing systems and herd size percentage of the study areas were presented in Table 1. A total of 225 households from Buno Bedele Zone and 249 households from Ilu Aba Bora Zone were interviewed during the study period. The result of the study indicated that, 92.9%, 4.4% and 2.7% of the respondents from Buno Bedele Zone have been practicing extensive, semi-intensive and intensive rearing system, respectively and also extensive (81.1%), semi-intensive (3.2%) and intensive (15.7%) system of rearing were observed in Ilu Aba Bor zone. As the result exhibited in the same table, 88.9% and 92% of the respondents from Buno Bedele and Ilu Aba Bor Zone had herd size of ≤ 10 cows while the remain percentage of the respondents had herd size >10 cows.

	Ilu Aba Bor Zone										BunoBedele Zone					
Variable	**Mettu**		**Yayo**		**Becho**		**Overall**		**Bedele**		**Dega**		**Didessa**		**Overall**	
Rearing System	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%

Semi-intensive	8	9.3	30	34.9	1	1.3	39	15.7	6	9.1	3	3.2	1	1.5	10	4.4
Extensive	70	81.4	56	65.1	76	98.7	202	81.1	54	81.8	91	96.8	64	98.5	209	92.9
Intensive	8	9.3					8	3.2	6	9.1					6	2.7
Herd size																
≤ 10 cows	86	100	82	95.3	61	79.2	229	92	64	97	79	84	57	87.7	200	88.9
>10 cows	-	-	4	4.7	16	20.8	20	8	2	3	15	16	8	12.3	25	11.1

Table 1: Husbandry practices of respondents in percentage, N=number of household owner.

Mastitis prevalence

According to the result indicated in Table 2, the overall prevalence of mastitis in Buno Bedele Zone was 40.9%, which is too near to the findings of Sarba et al. [12], Hajie et al. [13]; those reported 41.7% from Ambo district and 43.2% from East Shewa Zone, respectively. However, it is lower than the finding of Zeryehun et al. [14], Mekonnen et al. [15] those reported 74.7% in and around Addis Ababa, 71.0% in Holeta Town, 61.2% in Adama and 64.3% in Eastern Hararghe Zone, respectively. In contrast to the above, the result of this study is also higher than the findings of 34.7% prevalence in and around Wolayta Sodo by Jirata et al. [16] and 32.92% prevalence in Sodo town by Endale et al. [17]. Among the selected districts of this zone, Dega district (47.9%) had the highest mastitis prevalence followed by Didessa district (41.5%), while Bedele district (33.3%) had relatively the lowest prevalence. As the result presented in Table 2; 37.2% of overall prevalence was obtained in Ilu Aba Bor Zone and which is in accordance with the findings of Lakew et al. [18] those reported a prevalence of 34.7% in and around Wolayta Sodo and 36.7% in Asella, respectively. However, it is lower than the reports of studies done in different areas; in and around Addis Ababa (74.7%) by Zeryehun et al. [14], in Holeta Town (71.0%) by Mekonnen et al. [15], in Adama (61.2%) by Mekbib et al. and in Eastern Hararghe Zone (64.3%) by Tesfaheywet and Gerema. Among selected districts in Ilu Aba Bor Zone, Yayo (43.0%) and Becho (42.95) districts had almost similar prevalence and they are in accordance to the reported result of Sarba et al. [12,13]. However, Mettu (25.36%) district was identified as the lowest prevalent district in Ilu Aba Bor Zone. The observed differences in prevalence of mastitis in different study areas could be due to somewhat slight difference in management practices and husbandry systems, environmental conditions, intrinsic and extrinsic risk factors.

Districts (Study areas)	**Examined result in percentage (%)**	
	Negatives	**Positive**
Bedele	66.7	33.3
Dega	52.1	47.9
Didessa	58.5	41.5
Mettu	74.4	25.6
Becho	57.1	42.9
Yayo	57	43

Table 2: Prevalence percentage of mastitis at cow level in the study areas.

Bacteriology

The result observed in Table 3 indicates about the microbiological examination of collected milk samples in percentage. The present result showed that, highly prevalent bacterium in most of the study areas was *Staphylococcus aureus* which accounts 57.1%, 69.2%, 67.7%, 65.0% and 34.8% in Bedele, Didessa, Dega, Yayo and Becho districts, respectively. However, Micrococcus species of bacteria was also the dominant causing bacteria in Becho districts with equal isolation rate of 34.8% and *Enterobacteriaceae* was the predominant isolated bacteria species in Mettu district with isolation rate of 42.9%, and followed by *Staphylococcus aureus* and *Staphylococcus intermedius* with 28.6% isolation rate for each. The predominance and primary role of *Staphylococcus aureus* isolate in bovine mastitis has also been reported in other studies [13,14,16]. The predominance of *Staphylococcus aureus* could attribute to the wide ecological distribution of the organism on intramammary and skin of the udder and frequent colonization of the eroded and injured skin on the teat and/or udder of the cows by Jirata et al. [16] asserted that *Staphylococcus aureus* was well adapted to survive in the udder and usually establishes a mild sub clinical infection of long duration from which it shed in milk facilitating transmission to healthy animals mainly during unhygienic milking procedures. However, it was higher than some previous report of Bitew et al. those found 20.3% in Bahir Dar Town and 9% in Addis Ababa, respectively. The difference in isolation rate might be due to poor hygienic conditions, absence of dry therapy and low culling of animals with repeated infection [19-22].

	Study areas (districts)					
	Bedele	**Didessa**	**Dega**	**Mettu**	**Yayo**	**Becho**
Type of Bacteria Species	**Prevalence (%)**	**Prevalence (%)**	**Prevalence (%)**	**Prevalence (%)**	**Prevalence (%)**	**Prevalence (%)**
Enterobacteriaceae	28.6	3.8	9.7	42.9	15	21.7
Staphylococcus aureus	57.1	69.2	67.7	28.6	65	34.8
Staphylococcus intermedius	-	3.8	-	28.6	-	-
Rhodococcusequi	-	-	6.5	-	20	8.7
Micrococcus species	14.3	23.1	3.2	-	-	34.8
Bacillus species	-	-	12.9	-	-	-
Total	100	100	100	100	100	100

Table 3: Isolated types of causative bacteria species and their prevalence.

Conclusion

This study revealed that, mastitis is the prevalent diseases and it has a direct impact on food security as well as on economic income of the households. In general, the prevalence of mastitis in Mettu district was the lowest than the rest districts while it was the highest in Dega district. This indicated that, there was more expansion of the disease in Dega district. Generally, the slight difference in management practices, husbandry systems, and environmental conditions, intrinsic and extrinsic risk factors could be the reason for the differences in prevalence's among the study areas. *Staphylococcus aureus* and *Enterobacteriaceae* are the two main types of bacteria species which were identified in this study. The former was identified as the major causing bacteria in all five districts, while *Enterobacteriaceae* was in Mettu district. To reduce the influence of the mastitis on product and productivity of milk, the controlling and preclusion approaches would be designed and employed with deliberation of the prevalence rate and type of major causing bacteria species. The identified species of bacteria indicates that, there is the scope for further detail study on drug resistance of mastitis for better controlling and prevention.

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