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Prevalence and Potential Risk Factors of Bovine Mastitis in Selected Dairy Farms of Dire Dawa Town, Eastern Ethiopia

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Abstract: A cross sectional study was conducted to determine the prevalence and potential risk factors of bovine mastitis in selected dairy farms of Dire Dawa town. A total of 385 lactating cows were examined clinically by using CMT (California Mastitis Test). Of the total cows, 35 (9.09%) were clinically mastitic and 170 (44.16%) were subclinically mastitic. The prevalence of mastitis was 53.25% (n=205) and 30.32% (n=467) to the cow and quarter level respectively. But out of all quarters, 1.69% (n=26), 9.68% (n=149) and 20.65% (n=318) were blind, clinical and subclinical mastitic respectively. Chi- square was used to compare the association between the potential risk factors and the prevalence of mastitis at cow level where a statistically significant difference among different parity numbers (p=0.000), farms (p=0.005), awareness of milkers (p=0.016), status barn floors (p=0.000), milking sequence of clinically mastitic cows (p=0.036), hygiene of milking process (p=0.000) and age groups (p=0.000) were observed. The prevalence of mastitis at the quarters level showed statistically significant difference among difierent hygiene of milking process, parity numbers and status of barn floor. There should be an improvement in the management practice of the farms in order to reduce the high prevalence of infection.

Key words: Clinical and Subclinical Mastitis · Prevalence at Cow and Quarter Level

INTRODUCTION

Dairy cows are most efficient converters of forage to food for humans. Mastitis is the most common infectious disease encountered in dairy cattle [1] and is a common disease that decreases milk yield and quality in lactating cows[2]. In most countries, the survey in dairy herds indicates that the prevalence of mastitis pathogens is about 50% of cows and 10-25% of quarters [3]. Bovine mastitis is caused by bacterial, viral or fungal pathogens and results in an elevated level of somatic cells in milk [4]. Intramammary infections are often described as clinical and subclinical mastitis [5]. Discoloration, presence of clots and changes of mammary glands such as swelling, heat, pain and edema are characteristics in many clinical mastitis cases [6,7]. Flakes or clots in the milk with slight swelling of the udder or quarter are mild signs of clinical mastitis. Abnormal secretion, hot, swollen quarter or udder, fever of the cow, rapid pulse, appetite loss, dehydration, depression and may be death are sever signs of clinical mastitis [8]. The subclinical mastitis which accounts for a large proportion of mastitic mammary glands are not readily detectable by manual palpation nor by visual examination of the milk but only by use of diagnostic tests and applied to the milk or secretions [5, 9].

The prevalence and contribution of different potential risk factors of bovine mastitis were reported by different researchers in different parts of Ethiopia: in Batu and its environments [10], in and around Gondor [11], in Bahir Dar and its environments [12], in around Holeta area [13]. So, the current study was conducted to determine the prevalence and potential risk factors associated with bovine mastitis in the selected dairy farms of Dire Dawa town.

MATERIALS AND METHODS

Study Area: The study was conducted in Dire Dawa administrative region which is located in eastern part of Ethiopia about 515 kms from Addis Ababa. It is located approximately between Latitude 9°27’ and 9°49’ N and

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Longitude 41°38' and 42°19' E and lies 950-1250 m.a.s.l. It shares boundary to the south, south east and south west with eastern Hararghe zone of the Oromia regional state and the north, north east and west with shinile zone of Somali regional state. The mean annual temperature of Dire Dawa is about 25.4°C. The average maximum and minimum temperature is 31.4 °C and 18.2 °C respectively. The region has a bi modal type of rainfall, April month with small rains and July with big rains. The average annual rain fall that the region gets from these two seasons is about 604 mm [14].

Study Population and Husbandry Practice: The study included lactating Holstein-Zebu cross breeds and local Zebu cows from 21 dairy farms of Dire Dawa Administrative Council Town. The farms were categorized in to SSDP (Small scale dairy production), MSDP (Medium scale dairy production) and LSDP (Large scale dairy production) based on their herd size that is less than or equal to 5, 6 up to 70 and above 70 respectively [15]. The animals were kept indoors and are supplemented with concentrates, by products of beer, molasses and hay. Most of the farms were intensive production in which dairy animals are kept indoors at zero grazing.

Sample Size Determination: The desired sample size for the study was calculated using the formula [16] where an expected prevalence rate of 50%, 95% confidence interval and 5% absolute precision.

$$n=\frac{1.96^2\ P_{exp}\ (1-P_{exp})}{d^2}$$

Where,

n = required sample size
P_{exp} = expected prevalence
d = desired absolute precision

So, the calculated sample size for the study was 384 lactating cows.

Study Design and Sampling Strategy: A cross sectional study was conducted to determine the prevalence and potential risk factors of bovine mastitis. Cows were examined directly for clinical and indirectly based on CMT for subclinical mastitis. A total of 385 cows and 1540 teat quarters were examined for clinical and subclinical mastitic. Purposive sampling method was employed to select study farms based on their willingness to be part of the study and the time of their milking practice.

Study Methodology

Questionnaire Survey: Structured questionnaire was prepared and information regarding cow attributes and farm attributes were collected. The age, lactation stage and parity numbers were recorded from farm record documents, farm owners and milkers. The farm attributes like herd size, production type, hygiene of milking process, status of barn floor, milkers awareness, milking sequence of clinical mastitic cow were also recorded.

The age groups used for the cows were; 2.5-4 years old (young adult), 4-7 years old (Adult) and above 7 years old (old) age groups [17]. The study animals were categorized into the different parity groups according to [10] into few (1-3 calves), moderate (4-6 calves) and many (7 and above calves). The barn floor was grouped in to poor (Barn which was not well managed and muddy) and good (Barn floor which is concrete or well managed). Milkers were grouped in to awared and non-awared milkers about mastitis. Cows were grouped into three lactation stage groups that is up to 3 months (Early), 3-6 months (Middle) and over 6 months (Late) lactation stage according to [18].

Clinical Inspection and Preparation of Udder and Teat for Sample Collection: Udders or teats were physically examined first by visualization and then by palpation to detect if there is lesion, fibrosis, swelling, inflammation, visible injury, tick infestation, atrophy of tissue and any blindness. Viscosity and appearance of milk secretion from each quarter were examined for watery secretions [11]. After the hands were cleaned by detergents and clean water, the udder and teats were also cleaned by clean water and dried by using clean towel before the sample collection. Recontamination of the teats during scrub was avoided. The teat on the far side of the udder is cleaned first than those on the near side. Scrubbing was continued until the towel remains clean [11].

Milk Sample Collection and California Mastitis Test (CMT): The first two streams of milk were discarded and approximately 2-3 ml milk sample was collected in mastitis paddle from individual quarters immediately after the udder is dry. California mastitis test was used for screening subclinical mastitis [7, 11].

Data Management and Analysis: The data generated during the sample collection were entered to the Microsoft excel spread sheets and was later analyzed by using STATA version 11 soft ware. Chi-square (X^2) was

used to analysis different association between the potential risk factors with the infection rates and is considered as statistically significant if P <0.05.

RESULTS

Out of 385 cows, 9.09% (n=35) were clinically mastitic and 44.16% (n=170) were subclinically mastitic with an overall the prevalence of 53.25% (n=205) at the cow level.

Overall Prevalence of Mastitis at the Quarter Level: The prevalence of mastitis to the quarter level was 30.32% (n=467).But of the all quarters 1.69% (n=26) were blind. Out of all 1540 quarters 9.68% (n= 149) were clinically mastitic and 20.65% (n=318) were subclinical mastitic.

Prevalence of Mastitis at Farms Level: The study also showed that the prevalence of mastitis at different farms due to different animal based and farm based factors.

Table 1: The Prevalence of Mastitis Based on the Different Risk Factors

			Mastitis positive (Prevalence in %)				
Risk Factors		Total animals examined	Clinical	Subclinical	Total	x^2	p-value
Age	Young adult	106	2(1.89)	48(45.28)	50(47.17)	22.4022	0.000
	Adult	226	20(8.85)	103(45.58)	123(54.43)		
	Old	53	13(24.53)	19(35.85)	32(60.38)		
	Total	385	35(9.09)	170(44.16)	205(53.25)		
Parity number	Few	305	18(5.90)	(137)44.92	155(50.82)	24.0568	0.000
	Moderate	76	15(19.74)	33(43.42)	48(63.16)		
	Many	4	2(50)	0(0)	2(50)		
	Total	385	35(9.09)	170(44.16)	205(53.25)		
Barn floor	Poor	173	19 (10.98)	94 (54.36)	113(65.32)	8.2588	0.000
	Good	212	16(7.55)	76(35.85)	92(43.4)		
	Total	385	35(9.09)	170(44.16)	205(53.25)		
Awareness	Awared	210	18(8.57)	80(38.1)	98(46.67)	8.2588	0.016
	Non-awared	175	17(9.71)	90(51.43)	107(61.14)		
	Total	385	35(9.09)	170(44.16)	205(53.25)		

Table 2: Prevalence of mastitis based on different production type, lactation stages and milking hygiene practices

			Mastitis positive (Prevalence in %)				
Risk Factors		Total animals	Clinical	Subclinical	Total	x^2	p-value
Production type	SSDP	2	0(0)	0(0)	0(0)	2.8683	0.580
	MSDP	295	28(9.49)	128(43.39)	156(52.88)		
	LSDP	88	7(7.95)	42(47.73)	49(55.68)		
	Total	385	35(9.09)	170(44.16)	205(53.25)		
Lactation Stage	Early	115	6(5.22)	49(42.61)	55(47.83)	6.4848	0.166
	Middle	123	11(8.94)	51(41.46)	62(50.4)		
	Late	147	18(12.24)	70(47.62)	88(59.86)		
	Total	385	35(9.09)	170(44.16)	205(53.25)		
Hygiene of milking process	Good	222	16(7.21)	83(37.39)	99(44.60)	15.8827	0.000
	Bad	163	19(11.66)	87(53.37)	106(65.03)		
	Total	385	35(9.09)	170(44.16)	205(53.25)		

Table 3: Overall Prevalence of Subclinical Mastitis to the Quarter Level.

		Subclinical mastitis positive				
Quarter	Total quarter examined	+1	+2	+3	Total	Total Prevalence in %)
Right Front	385	7	32	31	70	18.18
Right Hind	385	14	43	37	94	24.42
Left Front	385	10	26	39	75	19.48
Left Hind	385	10	27	42	79	20.52
total	1540	41	128	119	318	20.65
Total prevalence		2.66	8.31	9.67	20.65	

Table 3: Prevalence of Mastitis at farms level

		Mastitis positive (Prevalence %)		
Farm name	Total animal examined	Clinical	Subclinical	Total
1	28	3(10.71)	12(42.86)	15(53.57)
2	26	4(15.38)	8(30.77)	12(46.15)
3	12	1(8.33)	6(50)	7(58.33)
4	30	6(20)	8(26.67)	14(46.67)
5	8	0(0)	4(50)	4(50)
6	2	0(0)	0(0)	0(0)
7	8	0(0)	3(37.5)	3(37.5)
8	28	0(0)	14(50)	14(50)
9	21	1(4.76)	10(47.62)	11(52.38)
10	16	1(6.25)	7(43.75)	8(50)
11	22	1(4.55)	10(45.45)	11(50)
12	27	6(22.22)	9(33.33)	15(55)
13	18	3(16.67)	4(22.22)	7(38.89)
14	8	0(0)	3(37.5)	3(37.5)
15	13	1(7.69)	4(30.77)	5(38.46)
16	9	1(11.11)	4(44.44)	5(55.55)
17	5	1(20)	3(60)	4(80)
18	10	2(20)	8(80)	10(100)
19	40	3(7.5)	27(15)	30(75)
20	20	1(5)	3(15)	4(20)
21	34	0(0)	23(67.65)	23(67.56)
Total	385	35(9.09)	170(44.16)	205(53.25)

DISCUSSION

The present study showed a prevalence of 53.25% and the result was in agreement with 52.78% report in and around Sebeta [19] and closely in agreement with the report of 56.5% in Batu and its environment [10] and 56.16% report in the Oran Region, in West Algeria [2] and 46.7% in Adama town [20]. But, the study is far different than the reports of 71% around Holeta Town [21], 75.22% in Jimma Town [22], 44.1% around Holeta areas [13], 32.6% in and around Gondor [11] and 28.2% in Bahir Dar and its environments [12] and 34.9% in the Southern Ethiopia [23]. The difference in results could be due to difference in the breed, age, lactation stage, herd size, parity numbers, production type, management system groups and the epidemiological status [3].

The study showed a prevalence of 9.09% for clinical mastitis that was near to the reports of 10.0% in Adama town [20], 10.3% at Asella [24], 10.3% around Holeta Town [13] and 11.9% in Bahir Dar and its environments [23]. But, the study result was much higher than the study reports of 0.93% in and around Gondor [11], 3% in Bahir Dar and its environments [12], 5.3% in Batu and its environments [10] and much lower than the reports 22.4% around Holeta Town [21] and 16.11% in and around Sebeta [19]. Risk factors which influence the prevalence of infection for clinical mastitis were out lined as animal, pathogen and environmental risk factors [3].

The study also revealed 44.16% prevalence for subclinical mastitis that is in cooperation with the study result of 44.6% around Holeta Town [21] and 40.6% in Batu and its environment [10]. But, the subclinical mastitis result in this study is not closer to the studies 33.8% around Holeta areas [13], 36.67% in and around Sebeta [19], 31.67% in and around Gondor [11] and 23.0% in Bahir Dar and its environments [12]. Prevalence of mastitis at cow level was dependent on breed, parity, age, lactation stage and management problems like milking of cows at any stage [3].

The quarter level prevalence of mastitis in the study was 30.32% where 9.68% were clinical and 20.65% were subclinical. So the study result is closer to the reports of 10% for clinical and far than 34.8% for subclinical with an overall prevalence 44.9 % around Holeta Town [21]. But it was much lower than the study reports of 47.52% at Addis Ababa and Sebeta Town [25] and in west Harerghe Zone, Doba Woreda [26]. The difference may be due to greater experience in drying off, the potential effect of level of milking hygiene, herd size and cleanness and the application of sanitary measures such as post milking teat dipping in these farms.

The study showed that there were significant statistical associations between the prevalence of mastitis with the different groups of parity numbers, farms awareness of milkers, sequence of milking clinically mastitic cows and hygiene of milking process, age and

barn floor status. So, the present result is in agreement with [11] which states that parity and age are positively associated with the infection rates; parity number around Holeta areas [13]; age groups in Khartoum, Sudan [27] and; barn floor status in Batu and its environment [10], age groups around Holeta Town [21], hygiene of milking process in Asella [28] and parity number in Bahir Dar and its environments [12]. But, the study showed statistically insignificant difference among different breeds, production types and lactation stages that is in agreement with the study reports of breed in Bahir Dar and its environments [12], lactation stage in Batu and its environment [10], in and around Gondor [11], in and around Sebeta [19], in Bahir Dar and its environments [12], in Khartoum, Sudan [27]. The high prevalence of mastitis may be attributed to improper milking hygiene, lack of post milk teat dipping and contact labors used, absence of order in milking cows of different ages and milking of mastitic animals before the healthy ones [3]. The frequency of mastitis was higher in animals with poor hygienic practice of milking process, poor status of barn floor, non awareness of milkers about mastitis and lack of consideration of milking sequence clinically mastitic cows.

CONCLUSION

The study indicates a high prevalence of bovine mastitis in dairy cows of the study farms. Although the dairy farms own high milk producing breeds, their production was not efficient due to the different risk factors.

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