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Prevalencia de mastitis y su relación con factores de riesgo en granjas lecheras de pequeños propietarios en Mekelle y sus alrededores - Prevalence of mastitis and its relationship with risk factors in smallholder dairy farms in and around Mekelle

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RESUMEN

El estudio se realizó en Mekelle y sus alrededores, en lecherías de pequeños propietarios en el período comprendido de noviembre 2010 hasta abril 2011 con el objetivo de investigar la prevalencia de la mastitis clínica y subclínica por cuarto y vaca así como su impacto y factores de riesgo de la enfermedad. Para la determinación de la prevalencia de la mastitis, los datos fueron procesados mediante SPSS versión 17. El predominio global y proporción de mastitis fue 62.9% (221/351) para la mastitis subclinica y para la mastitis clínica 54.4% (191/351), 3.9%, (14/351) y 7.4% (26/351) respectivamente. Igualmente, se examinaron 1404 cuartos, y las proporciones fueron: 28.34% (398) y 3.27% (46) para la mastitis subclínica y la mastitis clínica. El predominio de mastitis clínica entre las razas mostró que era más alto en las razas locales 2(66.7%) comparada con las razas cruzadas 5(6.5%). El predominio en Paridad diferente, también revelaba que la mastitis subclinica era más alta en vacas que tienen ≥9 paridad 2(100%) pero la mastitis clínica fue más alta en aquéllas tienen 5-8 paridad 5(7.8%)). La mastitis clínica fue más alta al inicio de la época de lactación 6(5.8%) donde la mastitis subclínica fue más alta a mediado del período de lactación con las proporciones de 72 (61.5%). El hallazgo actual también indicó que la mastitis subclinica fue más alta cuando utilizaban toallas comunes para el secado de las ubres 48(64%) pero la mastitis clínica era más alta donde usaban toallas individuales 7(5.4%). En cuanto a la condiciones del suelo de la casa de ordeño; en los suelos de piedra en los que se derrama la leche en el piso, la mastitis subclinica fue más alta, en esas vacas con incontinencia en sus pezones y en las granjas donde no poseían novillas en ordeño, las primeras con las proporciones de 41(55.4%), 21(61.8%) y 25(59.5%)

respectivamente comparada con la mastitis clínica, más alta en el piso de tierra compactada o apisonada , con las proporciones de 4(9.8%) y 14 (4.4%) respectivamente. Del mismo modo se determinó la relación, entre la ocurrencia de la enfermedad y el uso de la toalla, preparación de la ubre y preparación de las manos de los ordeñadores. En casi todos casos la asociación de los factores riesgo con la ocurrencia de la enfermedad no fueron estadísticamente significativos (P>0.05). De manera general, con un ordeño higiénico e igualmente el medio ambiente, de cada individuo así como los utensilios utilizados para la práctica del ordeño son algunas de los aspectos más importantes que merecen la atención para la prevención de la enfermedad.

Palabras claves: mastitis clínica; vaca; predominio; mastitis subclínica; pezón

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ABSTRACT

The study was conducted in and around Mekelle small holder's dairy farms from November 2010 to April 2011 with the objectives of investigating the prevalence of bovine clinical and subclinical mastitis at quarter and cow level and determining impact of risk factors with the disease. The SPSS version 17 statistics was used for data analysis and determination of the prevalence of mastitis and accordingly the overall prevalence of mastitis was 62.9% (221/351) of which the rate for subclinical, clinical and both subclinical and clinical mastitis was 54.4% (191/351), 3.9%, (14/351) and 7.4% (26/351) respectively. Similarly, 1404 cuarters were examined and the rates were 28.34% (398) and 3.27% (46) for subclinical mastitis and clinical mastitis. The prevalence of clinical mastitis among breeds showed that it was higher in local breed 2(66.7%) compared to clinical mastitis which was higher in cross breed 5(6.5%). The prevalence in different Parity also revealed subclinical mastitis was higher in cows having ≥9 parity 2(100%) but clinical mastitis was higher in those having 5-8 parity 5(7.8%)). Clinical mastitis was higher on early stage of lactation 6(5.8%) where as subclinical mastitis was higher in mid stage lactations with the rates of 72 (61.5%). The current finding also indicated that subclinical mastitis was higher on common towel users 48(64%) but clinical mastitis was higher on individual towel users 7(5.4%)._As to the floor condition of the house, milk leaking and milking order subclinical mastitis was higher on stone floors, on those cows whose milk was leaking via their teats and on those farm which milks heifers first with the rates of 41(55.4%), 21(61.8%) and 25(59.5%) respectively compared to clinical which was higher on Rammed soil floor, non leakers with the rates of 4(9.8%) and 14 (4.4%) respectively. Similarly, the association of the disease prevalence with usage of towel, udder preparation

and hand preparation was also determined. In almost all cases the association of the risk factors with the occurrence of the disease was not statistically significant (P>0.05). Generally, milking order, hygienic of the environment and every individuals and utensils used for milking practice and managemental improvements are some of the important things which merits attention in the prevention of the disease.

Key words: Clinical mastitis; Cow; Prevalence; Subclinical mastitis; Teat

1. INTRODUCTION

In Ethiopia, livestock represents major national resource and form an integral part of agriculture production system. The country has a largest livestock population of any African country with estimated 35 million cattle, 42 million sheep and goats, 7 million equines, 1.2million camels, and more than 53million chickens and immense bee and fishery resources CSA (2003) with estimation of 4,519,972 and 939,047 cattle populations around Tigray region and Enderta woreda respectively (RSTBARD, 2009). Cow represents the largest population of cattle production of the country, 42% of the total cattle heads are milking cows. However compared to other countries in Africa, Ethiopians consume less dairy products. Per capital consumption of milk in Ethiopia is as low as 17 kg per head while the average figure for Africa is 26 kg per head (Gebrewold *et al*., 2000).Given the considerable potential for small holder income and employment generation from high-value dairy products development of the dairy sector in Ethiopia can contribute significantly to poverty alleviation and nutrition in the country (Staal, 1995). Nevertheless the quality and quantity of milk in the country deteriorates because of various causes. The incriminated biological causes include the low genetic potential of the animals, poor nutrition and prevalence of diseases. Mastitis is one of the most important diseases of dairy cattle (Atyabi *et al*., 2006).

Mastitis is an inflammation of the mammary gland which together with physical, chemical and microbiological changes, is characterized by an increase in the number of somatic cells in the milk and by pathological changes in the mammary tissue (International Daily Federation, 1987). The inflammation is as a result of penetrations of pathogens through the teat duct in to the interior of the gland and then bacterial growth produces irritation of metabolism that affects tissue and consequently causes an inflammatory response (Schalm *et al*., 1971).

Predisposing factors like udder hygiene, parity(older cows, especially after four lactations are more susceptible to mastitis (Quinn *et al*.,1999)), quality, quantity(high-yielding cows are more susceptible to mastitis than low-yielding) and management of housing system, udder and/or teat injury(foci for the entrance of pathogens), stage of lactation(mammary gland is more susceptible to new infection during the early and late dry period),and others have got either direct or indirect impact on the occurrence of mastitis in dairy cows (Radostitis *et al*.,2000).

The clinical manifestations after infections either clinical or subclinical is: clinical mastitis, in which abnormal milk readily detected and subclinical mastitis, no change in the milk is apparent, may both reduce milk production. Even though subclinical udder infection are more prevalent than clinical mastitis (Machang and Muyungi (1988); Radostitis *et al*., 2000), In Ethiopia, the subclinical form of mastitis received little attention and efforts because subclinical disease is not manifested as visible changes in the mammary glands or in the milk, it is therefore not easily recognized by farmers (Shekimweri, 1992; Omore *et al*., 1996),So they had been concentrated on the treatment of clinical cases (Hussein *et al.*,1997).

In and around Mekelle, dairy development in small holder level is relatively very old in none organized form which is emerged in association with backyard crop production system and feeds of industrial by products. However, demand for milk is increasing dramatically with little improvement in management, health (like mastitis) and production which satisfies the demand of the population. This is due to limited researches having been preformed regarding mastitis. There fore the objective of this paper was

- To assess the prevalence of clinical and subclinical mastitis
- To assess the risk factors associated with the prevalence of mastitis
- To assess the difference in prevalence among quarter and cow level

2. MATERIALS AND METHODS

2.1. Study Area

This study was conducted from November 2010 to April 2011 in and around Mekelle small scale dairy farms. Mekelle is the largest city in northern Ethiopia and is one of the sixth largest cities in Ethiopia which is located at 39^0 29′ E and 13^0 30'N which covers 28 km square that is 783 km north of Addis Ababa at an altitude of 2000 m.a.s.l. The climate of the study area conforms to that of Ethiopia highlands. The mean annual rain fall of the study area is 628.8 mm and rain is associated with the north and south oscillation of inter-tropical conversion zone (ITZ). The rain fall is bimodal with short rainy season occurring from March to May and from middle of September to February. The annual minimum and maximum temperature is 11.8^0c and 29.94^0c, respectively (Bureau of planning and economic development., 1998).

2.2. Study Population and Sample Size Determination

The study animals in this study were from small holder farms with an average herd size of 3.65 cow/herd which herd size ranges 1-20 cows with different breeds such as local, cross and exotic, having different age groups: young, adult and old, and from these animals reared intensively and semi intensively as well animals in different stage of lactation was examined as study population to assess risk factors and prevalence of mastitis.
The sample size was determined with an expected prevalence of 37.4% as previously reported in Mekelle, Tigray region by Rigbe (2010) and absolute precision of 5% and level of confidence of 95% were used hence, the sample size will be calculated according to the formula described by Thrustifield (2005).

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

Where n= the sample size

d= the desired absolute precision

P= the expected prevalence

Accordingly a total of 351 dairy cattle in 96 farms of small holders from 20 kebelles with systemic random sampling gives as 5 herd/kebelle and with an average herd size of 3.65 cow/herd which herd size ranges 1-20 cows were included in the study to determine the risk factors and prevalence of mastitis.

2.3. Study Design

Cross sectional study was utilized at cow and quarter level based on clinical examination for clinical mastitis and indirect tests (CMT) for subclinical mastitis to determine the risk factors and prevalence of mastitis in and around small scale farms of mekelle. A total of 351cows and 1404 teat quarter was examined for clinical and sub clinical mastitis.

2.4. Study Methodology

2.4.1. Questionnaire

In this study information on the age, parity, stage of lactation, and prevalence of infection in the herd, breed, milking characteristics and morphology of mammary gland and physical condition of teat was obtained from the owner's interview. Taking in to consideration of owners' information, the age of the animals was estimated on the base of the dentations formula as described by Aiello. (1998).

2.4.2. Routine examination of mammary gland and there barn

Clinical findings like abnormalities of secretions, abnormalities of size, consistency and temperature of mammary gland were examined by visual inspection and palpation. Pain reaction upon palpation, changes in the milk (blood tinged milk, watery secretions, clots, pus), and change in consistency of udder were considered as indications of the presence of clinical mastitis. However, a large proportion of mastitis glands are not ready detected by manual palpation or by visual examination as a result, the diagnosis of mastitis depends largely on indirect test (Sears *et al.*, 1993).

Clean environment decrease bacterial challenge to the teat end and lower rates of infection. Sand has been shown to harbor lower bacterial numbers than straw or wood shavings. To reduce the incidence of mastitis minimizing environmental stress, facilitating effluent drainage and disposal, and avoiding injury especially to the teat should be considered in housing design (Jimmy and Robert., 1999).

2.4.3. Sample collection

First the udder was examined visually and then palpation to detect the possible fibrosis, inflammatory swelling, atrophy of the tissue and swelling of supramammary lymph nodes. The size and consistency of the mammary quarters were inspected for the presence of clots, flakes, bloody and watery appearance of milk. Milk sample was collected from individual quarters during morning milking time. The teat ends were washed and disinfected using swabs which will have 70% ethanol dip. The first three to four drops of

milk from each quarter will be discarded and two to three stripes was examined for the presence of clots, flakes, blood or pus and then approximately 2ml of milk from each quarter will drown on to paddle cups for the CMT test.

2.4.4. California mastitis test (CMT)

California mastitis test (CMT) is an indirect method of monitoring the level of occurrence of subclinical mastitis in herds or in individual cows or quarters (Dohoo and Meek, 1982).California mastitis test is a screening test for subclinical mastitis in which the milk from individual quarter can be tested. CMT reagent consists of a detergent and acid/base indicator. Somatic cells are ruptured by the detergent, releasing nuclear material (DNA).Mixing the DNA and detergent results in precipitation or gel formation that is proportional to the quantity of DNA present. The more the sample gels, the more somatic cells those are present in milk. This is a reflection of the degree of udder inflammation. There is degree of correlation between the CMT and the somatic cell count (Hui, 1993). Evaluation is performed based on the thickness of the gel formed by CMT reagent milk mixture, test results were scored as negative/trace, + (weak positive), ++ (distinct positive), and +++ (strong positive). Positive CMT cows were defined as having at least one CMT-positive quarter (Hogan *et al*., 1999).

2.5. Data Management and Analysis

Data were divided into groups with regard to the possible risk factors; such as lactating and non-lactating (dry) cows; cows with lesions and/or tick infestation on the skin of the udder and/or teats and without this factor; breed as indigenous local, cross or exotic; lactation stages into early lactation (1-120 days), mid-lactation (121-240 days) or late lactation (above 240 days); parity number as 1-4 ,5-8 and above 9; all the cows under the study were hand- milked twice a day without any post milking teat dip procedure.

Finally, the data obtained from small scale dairy farms were entered in to Microsoft excel spread sheet and coded appropriately. For the data analysis SPSS version 17 was used and the prevalence was calculated by dividing the number of positive animals by the total sampled population. The chi-square (χ^2) test was used to assess the association among the risk factors namely the age, breed, management system and stage of lactation with the occurrence of the disease. In all the analysis, confidence level was held at 95% and statistical analysis was consider significant at $p<0.05$ (Thrusfield, 2005).

3. RESULT

During the study period 351 lactating cows were clinically examined from 96 small holder dairy farms in Mekelle; 221(62.9%) were mastitic, of which 191(54.4%) were positive for subclinical mastitis, 14(3.9%) for clinical mastitis at cow levels and 26 (7.4%) were positive for both subclinical and clinical mastitis in a single cow. All quarters of the study animals were examined, and the result showed an over all prevalence of 398 (28.34%) subclinical mastitis and 46 (3.27%) clinical mastitis at quarter level was observed.

The prevalence of mastitis in exotic breeds were 152(56.1%), 9(3.3%) and 17(6.3%) subclinical, clinical and both respectively while the rate in cross breeds were 37(48.1%), 5(6.5%) and 8(10.4%) respectively . However, the prevalence in local breeds were 2(66.7%), 0(0%) and 1 (33.3%) respectively. The result showed that the disease is not significantly associated with breed (P>0.05) as shown in (Table 1).

Table 1: Prevalence of mastitis among different breeds

Risk factor		Total count	CMT-result with breed			P-value	χ^2
			subclinical	clinical	both		
Breed	Local	3	2(66.7%)	0(0%)	1(33.3%)	0.270	7.591
	Cross	77	37(48.1%)	5(6.5%)	8(10.4%)		
	Exotic	271	152(56.1%)	9(3.3%)	17(6.3%)		
	Total	351	191(54.4%)	14(3.9%)	26(7.4%)		

The study revealed that the rate of mastitis was increased with an increase in parity number where these cows with 1-4 parity has 154(54%) subclinical, 9(3.2%) clinical and 22(7.7%) both but cows with 5-8 parity had 35(54.7%) subclinical, 5(7.8%) clinical and 4(6.2%) both prevalence's even highest 2(100%) subclinical mastitis with ≥ 9 parity.The result showed that the disease is not significantly associated with parity (P>0.05)(Table 2).

Table 2: Prevalence of mastitis with respect to parity

Risk factor		Total count	CMT-result with parity			P-value	χ^2
			subclinical	clinical	both		
Parity	1-4	285	154(54%)	9(3.2%)	22(7.7%)	0.556	4.905
	5-8	64	35(54.7%)	5(7.8%)	4(6.2%)		
	≥9	2	2(100%)	0(0%)	0(0%)		
	Total	351	191(54.4%)	14(3.9%)	26(7.4%)		

The prevalence of cinical mastitis on early, mid and late stage of lactation was 6(5.8%), 4(3.4%) and 4(3.1%) respectively. However, the rate of subclinical mastitis was 49(47.6%),72(61.5%) and 70(53.4%) on early, mid and late stage of lactations respectively. But the occurrence of both subclinical and clinical mastitis in one cow was also observed on late stage of lactation with the rate of 12(9.2%).The result showed that the disease is not significantly associated with stage of lactation (P>0.05)(Table 3).

Table 3: Prevalence of mastitis with respect to stage of lactation

Risk factor		Total count	CMT-result with stage of lactation			P-value	χ^2
			subclinical	clinical	both		
Stage of lactation	Early	103	49(47.6%)	6(5.8%)	5(4.9%)	0.235	8.039
	Mid	117	72(61.5%)	4(3.4%)	9(7.7%)		
	Late	131	70(53.4%)	4(3.1%)	12(9.2%)		
	Total	351	191(54.4%)	14(3.9%)	26(7.4%)		

The occurrence of subclinical mastitis on those who used common udder towel was 48(64%), followed by none towel users 78(53.1%) and on those individual who used individual towel for every animal 65(50.4%) respectively. However,clinical mastitis on those who used individual towel, common udder towel and with out towel was 7(5.4%), 3(4%) and 4(2.7%) respectively. The presence of subclinical and clinical masttis in one cow was 12(8.2%), 6(8%) and 8(6.2%) in those who used no towel, common udder towel and individual towel respectively.The prevalence of the disease in those who used common towel and individual towel was not statistically significant (P> 0.05) (Table 4).

Table 4: Prevalence of mastitis with respect to udder towel

Risk factor		Total count	CMT-result with udder towel			P-value	χ^2
			subclinical	clinical	both		
Udder towel	No towel	147	78(53.1%)	4(2.7%)	12(8.2%)	0.387	6.334
	Individual	129	65(50.4%)	7(5.4%)	8(6.2%)		
	Common	75	48(64%)	3(4%)	6(8%)		
	Total	351	191(54.4%)	14(3.9%)	26(7.4%)		

The prevalence of clinical mastitis was 2(8.3%)) on these cow which don't have udder preparation before milking and in those practicing before milking teat only 6(3.8%) and whole udder 6(3.5%) respectively . However, subclinical mastitis in those cows with teat preparation only was 20(41.7%), whole udder preparation 91(53.5%) and no udder preparation 20(41.7%). The risk of acquiring both subclinical and clinical mastitis in one cow who prepared the udder of the cow before milking was 15(8.8%) but on those who prepared teat only 9(5.7%) prevalence was observed.The result showed that the disease is not significantly associated with udder preparation (P>0.05) (Table 5).

Table 5: Prevalence of mastitis with respect to udder preparation

Risk factor		Total count	CMTresult with udder preparation			P-value	χ^2
			subclinical	clinical	both		
Udder preparation	Whole udder	170	91(53.5%)	6(3.5%)	15(8.8%)	0.710	3.750
	Teat only	157	90(57.3%)	6(3.8%)	9(5.7%)		
	none	24	20(41.7%)	2(8.3%)	2(8.3%)		
	Total	351	191(54.4%)	14(3.9%)	26(7.45%)		

Even though hand preparation was found to minimize mastitis,on those individuals who don't use hand preparation up on milking subclinical mastitis 4(40%) was observed but the rate of the occurrence of subclinical and clinical mastitis in a single cow was 2(20%). The prevalence of subclinical and clinical mastits in those individual who wash their hand with out soap was 74(55.6%) and 7(5.3%) respectively but in those individuals who washed their hands with soap the rate of subclinical and clinical mastitis was 113(54.3%) and 7(3.4%) respectvely.The result showed that the disease is not significantly associated with hand preparation (P>0.05)(Table 6).

Table 6: Prevalence of mastitis with respect to hand preparation

Risk factor		Total count	CMT-result with hand preparation			P-value	χ^2
			subclinical	clinical	both		
Hand preparation	With soap	208	113(54.3%)	7(3.4%)	14(6.7%)	0.634	4.314
	Without soap	133	74(55.6%)	7(5.3%)	10(7.5%)		
	none	10	4(40%)	0(0%)	2(20%)		
	Total	351	191(54.4%)	14(3.9%)	26(7.4%)		

The rate of clinical mastitis on those cows having solid/blind teats was 10(25.6%) but on those which don't have solid/blind teats the rate was 4(1.3%). Regarding subclinical mastitis the rate was 187(59.9%) in these cows with absence of solid/blind teats but presence of clinical and subclinical mastitis in one cow in the presence of solid/blind teats was 23(59%).The result showed that the disease is not significantly associated with blind teat (P>0.05) (Table 7).

Table 7: Prevalence of mastitis with respect to solid or blind teat

Risk factor		Total count	CMT-result with solid teat			P-value	χ^2
			subclinical	clinical	both		
Solid or blind teat	Present	39	4(10.3%)	10(25.6%)	23(59%)	0.000	2.356
	Absent	312	187(59.9%)	4(1.3%)	3(1%)		
	Total	351	191(54.4%)	14(3.9%)	26(7.4%)		

Age specific prevalence of subclinical, clinical and both clinical and subclinical mastitis indicated that it was 119(58.6%), 5(2.5%) and 11(5.4%) in age ranging from 1-5 years respectively, while the rate in cows whose age ranging from 5 to 10 years was 63(45.3%), 9(6.5%) and 15(10.8%) respectively. However, animal with greater than 10 years of age have the prevalence of 9 (100%), 0(0%) and 0(0%) of subclinical, clinical and both in single cow respectively.The result showed that the disease is not significantly associated with age (P>0.05) as shown in **(**Table.8).

Table 8: Prevalence of mastitis with respect to age

Risk factor		Total count	CMT-result with age			P-value	χ^2
			subclinical	clinical	both		
Age	1-5	203	119(58.6%)	5(2.5%)	11(5.4%)	0.008	17.332
	5<8<10	139	63(45.3%)	9(6.5%)	15(10.8%)		
	>10	9	9(100%)	0(0%)	0(0%)		
	Total	351	191(54.4%)	14(3.9%)	26(7.4%)		

Similarly, animals confined at concrete floor have prevalence of 129(54.7%), 9(3.8%) and 17(72%) of subclinical, clinical and both in single cow respectively while the rate in animals in rammed soil floor was 21(51.2%), 4(9.8%) and 4(9.8%) respectively. But, these animals confined at stone floor have the rates of 41(55.4%), 1(1.4%) and 5(6.8%) of subclinical, clinical and both in single cow respectively. The result showed that the disease is not significantly associated with pen floor (P>0.05) as shown in (Table 9).

Table 9: Prevalence of mastitis with respect to pen floor

Risk factor		Total count	CMT-result with Pen floor			P-value	χ^2
			subclinical	clinical	both		
Pen floor	Concrete	236	129(54.7%)	9(3.8%)	17(72%)	0.471	5.587
	Rammed soil	41	21(51.2%)	4(9.8%)	4(9.8%)		
	Stone	74	41(55.4%)	1(1.4%)	5(6.8%)		
	Total	351	191(54.4%)	14(3.9%)	26(7.4%)		

The rate of subclinical, clinical and both clinical and subclinical mastitis in those cows which leaks milk via their teat was 21(61.8%), 0(0%) and 1(2.9%) in single cow respectively while the rate was 170(53.6%), 14(4.4%) and 25(7.9%) in cows with absence of milk leak. The result showed that the disease is not significantly associated with milk leak (P>0.05) as shown in (Table 10).

Table 10: Prevalence of mastitis with respect to estimation of milk leak

Risk factor		Total count	CMT-result with milk leak			P-value	χ^2
			subclinical	clinical	both		
Milk leak	Present	34	21(61.8%)	0(0%)	1(2.9%)	0.407	2.902
	Absent	317	170(53.6%)	14(4.4%)	25(7.9%)		
	Total	351	191(54.4%)	14(3.9%)	26(7.4%)		

The prevalence of subclinical ,clinical and both clinical and subclinical mastitis in single cow in those farms which milk heifers first was 25(59.5%) 1(2.4%) 3(7.1%) respectively where as these farms which didn't milk heifers first has the rate of 22(53.7%) , 2(4.9%) and 1(2.4%) respectively. Eventhough the prevalence of the disease was different it was not statistically significant (P>0.05) as shown in (Table 11).

Table 11: Prevalence of mastitis with respect to heifer milking

Risk factor		Total count	CMT-result with heifer milking			P-value	χ^2
			subclinical	clinical	both		
Heifers milking first	Present	42	25(59.5%)	1(2.4%)	3(7.1%)	0.856	2.607
	Absent	41	22(53.7%)	2(4.9%)	1(2.4%)		
	Total	83	47(56.6%)	3(3.6%)	4(4.8%)		

The rates of subclinical and clinical mastitis in front right revealed that its rate was 98(27.9%) and 19(5.4%) respectively, and front left has 92(26.2%) and 7(2%), hind right has also 108(30.8%) and 10(2.8%) of subclinical and clinical mastitis, and hind left had 100(28.1%) subclinical and10 (2.8%) clinical mastitis as shown in **(**Table 12).

Table 12: Overall Quarter level prevalence of mastitis

Quarters	Total examined	Quarter level CMT-result	
		subclinical	clinical
Front Right	351	98(27.9%)	19(5.4%)
Front Lift	351	92(26.2%)	7(2%)
Hind Right	351	108(30.8%)	10(2.8%)
Hind Lift	351	100(28.1%)	10(2.8%)
Total prevalence	1404	398(28.34%)	46(3.27%)

4. DISCUSSION

This study has given a due attention to determine the prevalence of Bovine subclinical and clinical mastitis as well as its risk factors assessment even though almost all the study conducted in Ethiopia deals on it along with clinical and subclinical separatetly on cow level. The over prevalence of this study was 62.9%, of which 54.4% were positive for subclinical mastitis, 3.9% for clinical mastitis and 7.4% were positive for both subclinical and clinical mastitis in one cow. In this study, the prevalence of subclinical mastitis (54.4%) was higher than that of clinical mastitis with the rate of (3.9%), which was reported by Machang and Muyungi.(1988) which stated that subclinical mastitis were higher in the tropics with the rates of 67% than the clinical mastitis having the prevalence of 0.03%. Similarly, Biru (1989) also staed that the rate was higher for subclinical mastits with the rate of (39.5%) compared to clinical mastitis having the rate of (23.9%). This was due to , subclinical disease is not appreciated by observing the mammary glands or the milk, it is therefore not easily recognized by farmers (Shekimweri, 1992; Omore *et al*., 1996) but the over all prevalence was less than to the study conducted by Tiruneh (1996) in Deber Zeit who reported the prevalence of (68.1%) in central Ethiopia but slightly higher than to the report of Tolla (1996) in Southern Wollo who reported prevalence of (61.1 %). The current prevalence is also higher than the reports from Southern Ethiopia (34.9%) (Biffa,1994); Bahir Dar (44.6%) (Mengistu,1986); Arsi (53%) (Takele,1987) and Soddo (45.9%) Shmelis (1990).This might be attributed to the fact that most of the animals included in the present study were exotic breeds of cattle which are susceptible to udder infections (Radostitis *et al*., 2000). In addition, most of the animals in these cooperative farms were brought from central part of Ethiopia and distributed to the small scale farm holders.

In the current study the prevalence of clinical mastitis was 3.9% which was almost similar to the reports done in different dairy farms: in southern parts of Ethiopia (3.8%) by Shimels (1990); Diredawa Autonomous and East Hararge Administrative Region (3.54%) by Daresema (1991) even though slight variation was observed but it was slighty lower than to the reports done in and around Mekelle (6.55%) by Wudu (1999); in the central high land Ethiopia (6.6%) (Mungube *et al*., 2004); in three state dairy farms around Addis ababa (7%) (Yirgalem,1987); extremlly lower than the study in welayta sodo,Southern Ethiopia(15.1%) (Biffa,1994); in and around sebeta in Ethiopia (16.11%) (Hunderra *et al.*,2008); in dairy farms in Dire Dawa Administrative council and Eastern Hararghe zone (19.8%) (Birhanu,1997). However, the current subclinical mastitis was higher as compared to the study conducted by Rigbe (2010) in mekelle having the rate of (33.8%). Similary, quarter level result of subclinical and clinical

mastitis was higher than that of Rigbe (2010) having the rates of 11.9% and 2.4% .

The prevalence of subclinical mastitis were higher in local breeds (66.7%) , followed by both clinical and subclinical mastitis in single cow and clinical mastitis with the rates of (33.3%) and (6.5%) respectively, and this result showed the prevalence was higher in cross breeds as compared to the other breeds this might be due to poor management. The higher prevalence of clinical mastitis in crossbreds which was 6.5% and none in local zebu 0% breeds in this study was comparable with that of Bishi (1998) who reported 5.3% prevalence in Addis Ababa. However, exoticbreeds had lower pervalance of subclinical , clinical mastitis and both clinical and subclinical in a single cow with the rates of 56.1%, 3.3% and 6.3% . This might be due to value , management and hygiene of exotic breeds of the farmers in small scale level.On the other hand, Radostits *et al.* (2000) also stated that the difference between breeds may be due to other uncontrolled factors, such as management, rather than a true breed difference. The variation in prevalence of mastitis among breeds was not statistically significant ($P > 0.05$).

The study also revealed that the prevalence of mastitis increases with parity where cows with 5-8 parity has the rates of (54.7%), (7.8%) and (6.2%) subclinical, clinical and both respectively. Even highest (100%) subclinical mastitis was also observed in animals having greater than 9 parity and this study was in consistent with Kerro and Tareke (2003), Mungube *et al.* (2004), Biffa *et al.* (2005) and Getahun *et al.* (2008) who stated cows with more than seven parity were highly susceptible to mastitis. Quinnin *et al.* (1999), have stated older cows, especially after four lactations are more susceptible to mastitis. The prevalence of the disease among the different parities were not statistically significant ($P > 0.05$).

Clinical mastitis was highly prevalent on early stage of lactation (5.8%) followed by mid and late stage of lactations with the rates of (3.4%) and (3.1%) respectively. The occurrence of both subclinical and clinical mastitis in one cow was found higher on late stage of lactation (9.2%) which might be the reason for inceament of clinical mastitis on the early stage of lactation (5.8%) and transmission of clinical mastitis of the early to subclinical mastits (61.5%) quarters on mid stage of lactation. Eventhough statistically significant was not observed the study agrees with Gravert (1987) which stated ,about 30% of the new infections are observed in the dry period, mostly during the first 3weeks. About 50% of these infections persist until the next lactation causing clinical symptoms with in the first 2 weeks after calving. At the beginning and end of lactation the proportion of healthy quarters is lower than in the other stage of lactations. As age advances new mastitic diseases and secretory disturbances occur in addition

to those already existing or non-cured.On the other hand, the study is in agreement with Radostits *et al.* (2000) which suggested that the mammary gland is more susceptible to new infection during the early and late stage of lactation, due to the absence of udder washing and teat dipping, which in turn may have increased the number of potential pathogens on the skin of the teats. This result showed the rates among the different stage of lactation was not statistically significant (P > 0.05).

Barkema *et al.* (1999) recently stated that the incidence of clinical mastitis is higher in animals having poor management practices such as housing, hygiene, feeding and machine milking. In this study washing hands before milking with soap or with water only or absence of hand washing has got non siginificant influence (P>0.05) on the prevalence of mastitis. The occurrence of subclinical and clinical mastitis in people Washing their hands without soap was found (55.6%) and (5.3%) respectively. How ever, the prevalences in those washing with soap was (54.3%) and (3.4%) respectively . this study was inconsistent with ideas of owners who practiced washing of hands with water only has got agreater chance in acquiring clinical mastitis with (8.4%) than washing with soap before milking (0.2%) as stated by Tewodros (2008).

The study also showed that the rate for subclinical mastitis was higher in those who used common udder towel (64%) followed by none towel and individual towel users whose rate was (53.1%) and 50.4% respectively which indicate that udder towel was found good media for transmission of mastitis and this agrees with Radostitis *et al.* (2000) which suggests that the use of a separate drying cloth for each cow is associated with a lower SCC and mastitis. But, clinical mastitis was higher on these individual udder towel utilizers 5.4%, and this might be due to farmers didn't milk their cow if they were clinically diseased so clinical mastitis transmission with towel was confined to other risks. Even though, such variation was observed in those who used common and individual towel it was not stastically significant (P>0.05).

Similarly, age specific prevalence also showed that the rates of clinical mastitis was higher in age ranging from 5 to 10 with the rate of (6.5%) as compared to those the other age groups and this finding agrees with the finding of Rigbe (2010) who stated cows older than 6 years were more affected (52.4%) with both clinical and subclinical mastitis compared to young adult cows (19.9%) in which case subclinical mastitis predominated. More ever age was not also statistically significant (P>0.05) .

Radostitis *et al.* (2000) reported heavy fecal contamination and gradual deposition of wet dirty materials on the floor enhanced the buildup of coliform bacterial infection and transmission. As a result, the reported

higher prevalence of clinical mastitis 9.8% in cows maintained in rammed soil pen floor was found in agreement with Radostitis *et al.* (2000) which suggested that barn floor and beddings have crucial role in the microbial contamination and transmission of the infection from animals to animals. However, subclinical mastitis was found higher in concrete 54.7% and stone 55.4% . This might be due to predisposion of udder or teat to injury, and then cows with skin lesions on their teats and/or udder had a high prevalence of mastitis; similar observation has been recorded by Getahun *et al.* (2008) in Central Ethiopia, but in this study pen floor didn't influence prevalence of mastitis significantly(P>0.05) due to variation in the proportion or number of study animals found in different pen floor.

The rate of subclinical mastitis in the current finding also indicates that it was higher in those animals whose milk is leaking via the teat than in those animals where milk is not leaking via the teat with the rates of 61.8% and 53.6% respectively but clinical mastitis have the rate of (0)%). However, this finding disagree with Trond *et al.(*1995) which stated that milk leak was associated with clinical mastitis having the prevalence of 50% . the difference of the rates between these animals whose milk is leaking and not leaking is not statistically significant (P>0.05).

Considering the order of milking of different cows clinical mastitis was higher in these farms which don't milk heifers first with the rate of (4.9%) but subclinical mastitis was higher in these farms which milk heifers first and this study disagrees with finding of Pankey *et al.(*1996) which stated the rate of subclinical mastitis was declined from 21.8% to 15.9% in some farms after they apply heifer milking first. The prevalence of the disease in milking order of animals were not statistically significant (P>0.05).

5. CONCULISION AND RECOMMENDATIONS

Mastitis is the most complex disease associated with different risk factors(age, breed, stage of lactation, parity, udder towel, udder lesion and physiological status of cows and agents) specially in developing countries like Ethiopian small scale farm holders which their cows are maintained in inadequate hygienic condition of dairy environment, poor animal health service, and lack of proper attention to health of the mammary gland with which have different prevalence of the disease among the risk factors. Mastitis has been known to cause a great loss of productivity, quality and quantity of milk yield, and animals due to culling. The overall prevalence of mastitis in the present study is almost two times than that shown before so impact of the disease in small scale dairy farms in mekelle should have to be managed before it leads to economic crises.

Therefore based on the above conclusion the following points are forwarded as recommendations.

- To reduce the prevalence of the disease different epidemiological factors that interplay in mastitis occurrence should be well studied.
- Extension service including health education must be launched to make the public aware of the disease because small scale farm holders are widely distributed.
- Implementation of better management practices with introduction of high yielding and comparatively mastitis tolerant animals.
- A practical mastitis control strategy in the herd and national approach is needed.
- Adequate housing with proper sanitation and regular screening for early detection and treatment, follow up of chronic cases, culling of older cows with repeated attacks are recommended to control the disease.
- Drying off procedure, dry cow therapy in non lactating, and proper milking procedure with post milking teat disinfection should be encouraged in the study area to reduce the prevalence of mastitis.

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7. ANNEXES

Annex 1: Estimation of Age in cattle by dental eruption and wear

Eruption time of teeth.

I_1 = 1.5-2 year
I_2= 2-2.2 year
I_3 = 3 year
C = 3.5- 4 year

Time of wear

5 year all incisors in wear
6 year – I_1 is leveled and neck is visible
7 year –I_2 is leveled and neck is visible
8 year –I_3 is leveled and neck is visible 3 ,I_4 may be leveled
9 year – C is leveled and neck is visible
Source; Aiello, 1998

Annex 2: Questionnaire format

Date _____/_____/_____

1.General information

1.1 Farm name _____ owner name _____
1.2 Location: sub city _____ kebele _____
1.3 When established _____

2.Cow history

2.1.Cow ID / ear tag No _____ or local name _____
2.2.Breed: local _____ cross _____ exotic _____
2.3.Age: young _____ adult _____ old _____ 2.4. Party: _____
2.5.Stage of location: early ____ mid _____ late_____ dry off ____
2.6.Body condition score ____ poor ____ good _____ very food _____
2.7.Herd size of dairy cows ____No. of people working with the herd___
2.8.Daily milk yield per cow _____ calving date_____

3.Milking procedures

3.1.Udder preparation: whole udder wash ____ test wash _____ none ____
3.2.Hand preparation: with soap wash ____ without soap ____ none ____
3.3.Udder towel: no towel _____ individual _____ common _____
3.4.Milk let down: introduce calf_____ concentrate_____ massage_____
3.5.Restraint for milking: Back leg_____ around the neck_____
3.6.Milking activity: manual_____ machine_____
3.7.Type of milking: all quarters _____ leave some quarters _____
3.8.Way of milking: five finger_____ strike_____
3.9.Provision of feed: before milking_____ after milking_____
3.10.Milking frequency: morning_____ after noon_____
3.11.Mastitis or problematic cow milking: at last _____ in between ____
3.12.Heifer milking: first_____ middle _____ last_____
3.13.Pre and post teat dipping: present _____ absent _____
3.14.Dry off procedure: gradual _____ abrupt: _____

4.Management

4.1 Farm condition/system: intensive ___semiintensive __extensive __
4.2 Housing
a. Type of house: close _____ open _____
b.Barn i. Barn floor type: concrete ____rammed soil _____ stone ____
ii. Bedding: yes___ No__ Bedding replacement: yes___No___
iii. Sleeping area of for cows: same as feeding area __ not__
iv. Dirty barn floor: yes _____ no _____
v. Barn size _____
vi. Magnitude and direction of the slope: good & sloppy__ poor & flat__
c. Separate house I. Calf units yes _____ no _____
ii. Feeding area yes _____ no _____
iii. Milking area yes _____ no _____
iv. Dry cow units yes _____ no _____
d. Lighting and ventilation: presence _____ absence _____
4.3. Feeding and watering system
A. feeding: free grazing _____ totally in door _____
B.Calf feeding system:Bucket__residualsuckling__somequarters left__
C. source of feed:
- private grazing area _____
- communal grazing area _____
- buying hay, bail, grass, industrial product _____
- others _____

D. Water availability: frequent _____ rare _____
E. Water source: Tap water_____ bore-well_____
: drink inside the farm ___ drink outside the farm ___
4.4. Hygiene of barns and cows
A. Cleanliness of barn: clean _____ not _____
B. Dung disposal: piled up war the barn _____far away _____

C. Cows with dirty: things _____ udder / teats _____perineum ____
D. teat disinfection in dry cows yes _____ no _____
E. frequency of cleaning and disinfection _____
F. presence of excessive numbers of flies and biting insects: yes__No___

5.Clinical inspection, diseases and diseases prevention.

5.1 Udder or teat lesions: yes _____ no _____
5.2 Udder consistency: normal _____ fibrotic _____
5.3 Soiled or blinded quarters: yes __ no __ which __ FR, FL, HR, HL
5.4 estimates of leaking milk: yes___no__which _____ FR, FL, HR, HL
5.5 CMT result: FL_____ FR_____ HL_____ HR_____
5.6 Mastitis checks in the dry period: yes _____ no _____
5.7 Dry cow therapy: yes _____ no _____
5.8 Duration of treatment: _____
5.9 Drug type: Intramammary tubes _____ inject able _____

6.Economic aspect

6.1 What the cost of milk per liter? _____
6.2 Do you take cows to veterinary clinics for treatment? Yes ___ no ___
6.3 In what clinics do you prefer to go? Private ____ governmental ____
6.4 How much is the cost for veterinary service and for the drug? Vet/ drug
6.5 Do you respect the withdrawal period for milking of the cow? Yes _no_
6.6 How much litter of milk do you get per cow?
Before mastitis / problem ____ after

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