



## Research Article

**Prevalence, Associated Risk Factors and Bacterial Pathogens of Camel Mastitis in Borena Zone Oromia Regional State, Ethiopia**Wubishet Z<sup>1</sup>, Dabaso A<sup>1</sup> and Getachew G<sup>2</sup>

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**ABSTRACT**

The study was carried out to determine the prevalence and risk factors of mastitis and associated bacterial pathogens in lactating camels of Borena zone pastoral area Oromia Regional state; Southern Ethiopia. A total of 414 lactating camels were tested for subclinical and clinical mastitis. Subclinical mastitis was diagnosed by California Mastitis Test (CMT) while clinical mastitis was detected by physical examination of teat and udder. Out of 414 lactating camels were diagnosed for mastitis, 52(12.5%) were of clinical Mastitis with abnormal secretions 29(55.7%), udder lesion 20(38.4%) and udder wound containing pus 4(7.6%). The prevalence of subclinical mastitis was 92(22.2%) in camels. Overall prevalence of mastitis was 34.7% in camel; out of which 12.5% was clinical mastitis and 22.2% was sub-clinical mastitis. Risk factors analysis revealed that prevalence of mastitis was significantly higher ( $p=0.00$ ) among lactating camels with tick infestation, tying teat, udder/teat injury and parity number. The most frequently isolated bacterial species from clinical and sub-clinical mastitis milk samples were *Staphylococcus aureus* 55(38.1%) in order by *Streptococcus agalactiae* 37(25.6%) and *Escherichia coli* 12(8.3%). The prevalence of camel mastitis in the study area was found to be significantly high. Udder and teat injury caused by tick bite, tear or scratch, tying teat to prevent sucking, absence of hygienic measures during milking and poor environmental conditions has probably contributed to the highest prevalence of mastitis. The pastorals are almost exclusively dependent on milk for food. The economic impact is hence several folds because of the very prevalence of the disease itself and its subclinical form presentation which makes identification and treatment very difficult by owners.

**Key words:** Borena, Camel, Ethiopia, Mastitis, Pastoral, Prevalence, Tick, Tying teat

**INTRODUCTION**

Camels are a subset of huge livestock resources in Ethiopia with the population estimated to be over one million. The arid and semi-arid areas of the country that constitutes more than 60% of the total area and home of 7.8 million pastorals and agro pastoral communities are suitable for camel production (Abebe, 2000). The eastern and southern parts of the country, namely Afar, Somale and Borena are the major areas where camel husbandry is widely practiced. In these areas, the livelihood of the pastoral communities is certainly ensured by dromedaries (Teka, 1991; Wossene, 1991).

Borena pastoralists, who traditionally are based on cattle husbandry for milk production and wealth storage, have recently developed considerable interest in camel production. Ecological changes, social conditions

(religion, marriage linkage, conflict) and extensive seasonal migration have been the main driving forces behind the increased camel production in the Borena plateau (Biffa and Chaka, 2003). At past the known camel keeping community in Borena are Gabra; currently all Community in the zone keeping camel as a result of their ability to tolerate drought than cattle. It has been speculated that Gabra herders along with Somali ethnic groups played an instrumental role in the introduction of camels to the Borena areas (Coppcock, 1994; Megersaet al., 2008). The difference in the level of indigenous knowledge of camel keeping between the Gabra and Borenas can be observed in the way of herding strategies that has already been demonstrated to influence some production parameters may also result in variations of disease occurrences (Megersaet al., 2008). Camels are important milk producers in arid lands and camel milk is

an essential food for livelihood of people and it may be the only milk available in places where other milking animals cannot be maintained (Wilson 1984). Camel milk is popular among pastoralists and has been steadily gaining popularity among urban dwellers in many countries (Mehaia 1993).

The health problems of camels in Ethiopia in general are attributable to lack of attention and negligence and toward camels; and majority of camel diseases that have been a major setback to herd productivity (Megersa, 2010).

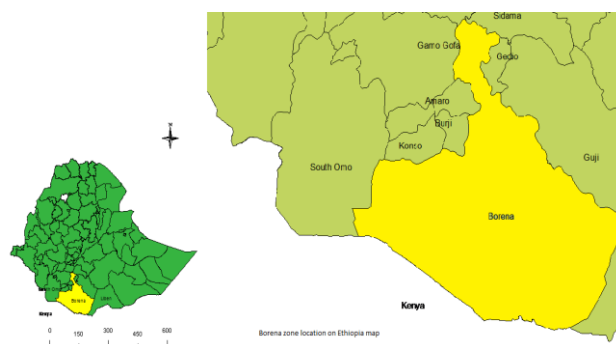
Mastitis is globally recognized as the most costly disease of dairy industry, affecting almost all domesticated species of the animals. The disease causes colossal losses in terms of reduced milk production, deterioration of milk quality, discarding of milk, and cost of treatment, culling and sometimes mortality. Bacterial infections are considered the primary causes of mastitis in domestic animals. Therefore, successful prevention and control of mastitis depends upon knowing the incidence and etiology of mastitis in a particular area. There are few data concerning the etiology, occurrence and pathogenesis of mastitis in the genus *Camelidae* (Abdurahman et al 1995; Abdel Gadir et al 2006). Relative importance of different infections is likely to vary in different areas and countries (Husein et al., 2013). Mastitis in camel is one of important diseases present with high incidences and accompanied with many microorganism infections either single or mixed (Ainena M et al., 2011). Detection of sub-clinical mastitis is, however, difficult and depends on various test procedures aimed at detecting the cause or products of inflammation in milk (IDF 1987). As camels are important dairy animals in arid lands, information on the mastitis is essential for future development. In Borena zone Oromia regional state, the cause of camel mastitis and prevalence is not studied widely so far. Therefore, this study is designed to:

- 1- Study the prevalence and risk factors of mastitis in camels
- 2- Identification of most prevalent mastitis pathogens in camels.

## MATERIALS AND METHODS

### Study area

Borena zone is located to southern part of Ethiopia, under Oromia regional state. The Zone consist thirteen districts and borders Kenya in the south and Somali region in the east and southeast, SNNP in the north and west. The altitude of the zone ranges between 943 and 2,400 meters above sea level with average annual rain fall of 400 and 1100mm exhibiting a bimodal rainfall (long and short rainy seasons). The long rainy season extends from March to May whereas the short rainy season occurs from mid-September to the mid November. The annual temperature varies between 19 – 42°C. The area is known for being the origin of the Boran cattle breed, a known dual purpose animal. The pastoralists usually follow their animals depending on the availability of forage and water for their animals. Milk is the main source of food in addition to being the source of income particularly during the rainy season when it produced in excess.



Borena zone location on Ethiopian map

### Sampling procedure and CMT

A total of 414 lactating camels kept by nomadic pastoralists under traditional management system and accessible at the time of visit were included in this study. Information on teat tie, teat/udder injury, parity number, tick infestation and milk yield was gathered in a “Data Capture Form”. Age of camels, lactation stage and parity was grouped according to Abdurahman (2006). The Lactation stage was grouped into 3 categories (0-1, 2-3 and  $\geq 3$  months). Parity was grouped into five categories (1, 2, 3, 4, and  $\geq 5$ ). For clinical mastitis, visual observation and palpation of the mammary gland quarters was attempted and macroscopic examination of the milk streaks was undertaken in strip cups for the presence of abnormal color, consistency, flakes and other abnormalities. Subclinical mastitis was detected by California Mastitis Test (CMT). The calf is allowed to suckle for a short time, prior to milking, to stimulate milk letdown. An equal volume of milk and CMT reagent was mixed on CMT plate and reaction was recorded as positive or negative. The milk samples positive for subclinical mastitis were collected in sterile test tubes by discarding the first few streams of milk from each quarter for bacteriology. These milk samples were collected under aseptic conditions to prevent contamination viz. washing of teats and disinfection of teat end 70% alcohol moistened cotton; then labeled with the identification number. In addition, sterile swab also used for udder wound and swelling that has no sufficient discharge for sampling. After collection, the samples were placed in ice box and were transported to Yabello Regional Veterinary Laboratory for Bacterial culturing and isolation.

### Bacteria Culturing and Isolation

In Yabello regional Veterinary Laboratory these samples were cultured on Sheep Blood agar and Nutrient agar according to their identification number and incubated in + 37°C incubator for 24 hours. Individual colonies were picked for identification and processed according to Quien et al., (2004) different biochemical tests used to isolate species of bacteria. On top of bacteria culturing and isolation; fungal media was also used for the presence of fungi in clinical mastitis. The milk was sampled from all positive quarters within the same vial for bacterial isolation. Both general and selective media were used with further identification of the causative agents on the basis of colony morphology, hemolytic characteristics, Gram's stain, biochemical tests such as coagulase test, oxidase, catalase and growth characteristic on Edward's medium and sugar fermentation.

### Statistical data analysis

All the data were organized in Microsoft excel sheet and analyzed using SPSS version 15 statistical data analyzing software. Descriptive statistics were used to determine the prevalence of mastitis and other variables. A Chi-square test ( $\chi^2$ ) was used to study differences among variables and the fixed effect of considered risk factors. The effect of significance was held at  $p < 0.05$  due to parity number, tick infestation, teat/udder injury and teat tie practice were analyzed. Depending upon P value obtained from analyzed data; the relation between tick infestation, teat tie, teat/udder injury and parity number with CMT result was tabulated (Table 1).

## RESULTS

### Clinical and subclinical mastitis

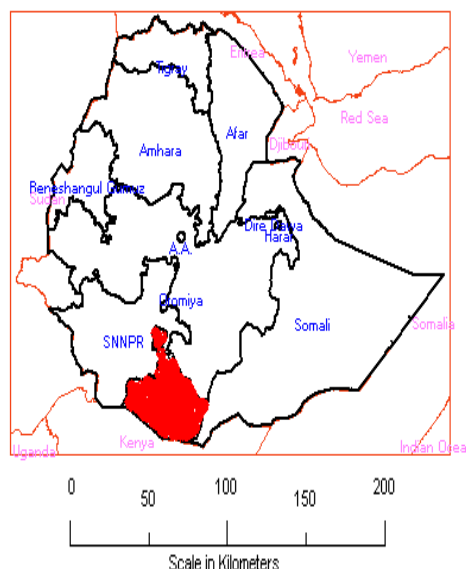
Out of 414 lactating camels diagnosed for mastitis, 52(12.5%) were identified as clinical Mastitis with abnormal secretion from teat 29(55.7%), udder lesion 20(38.4%) and udder wound containing pus 4(7.6%). Of the remaining 362 lactating camels tested for subclinical mastitis, 92(25.4%) were positive for subclinical mastitis. The most frequently isolated bacterial species is *Staphylococcus aureus* 55(38.1%) in ordered by *Streptococcus agalactiae* 37(25.6%) and *Escherichia coli* 12(8.3%)(Table 2).Prevalence of mastitis was significantly higher ( $p=0.00$ ) among lactating camels with tick infestation, tying teat, udder/teat injury and parity number. Prevalence of mastitis in camel in respective of tick infestation is 0%, 25.5% and 46.6% for no tick, medium and high tick infestation respectively. The percentage prevalence of party number is 112(27.1%), 58(14%), 49(11.9%), 71(17.2%) and 124(29.9%) for Parity no 1, Parity no 2, Parity no 3, Parity no 4 and parity no  $\geq 5$  respectively; whereas percentage prevalence of tick infestation and teat tie is 247(59.7%) and 158(38.2) respectively.

This study showed that overall prevalence of 34.7% camel mastitis in study area; out of which 12.5% clinical mastitis and 22.2% subclinical mastitis.

As the information collected from the community showed; most of the cause of udder and teat injury arises from tick bite followed by tear or scratch and tying teat to prevent sucking. It facilitates pyogenic (pus forming bacteria) bacteria to get into teat or udder tissue leading to pus formation and wound (picture 1A and 1B). The most important bacteria which can cause mastitis following teat/udder injury could be mentioned as environmental bacteria and normal flora of skin and teat canal. In this study Tick bite and tear/scratch by sharp wood while browsing in a bush also identified as cause of injury both on teat and udder. In addition, traditional husbandry practice, like tying teat practice by fibers causes teat injury. The pastoralists use this fiber on the teat to prevent the calf from sucking the dam (figure 2).

### Laboratory findings

Out 144 bacteria cultured 142 bacteria and 2 *candidia albicans* (fungi) was isolated, the most prevalent bacteria were *staphylococcus aureus* in ordered by *streptococcus agalactiae* (Table 2).



**Fig. 1:** Location of Borena Zone on Ethiopia Map.

**Table 1:** Prevalence of mastitis in association to different risk factors in Lactating Camels

| Factors              | N   | $\chi^2$ | P-Value |
|----------------------|-----|----------|---------|
| Tick infestation     |     |          |         |
| Absent               | 166 | 16.242   | 0.000   |
| Present              | 248 |          |         |
| Tying teat by fibers |     |          |         |
| Absent               | 256 | 23.198   | 0.000   |
| Present              | 158 |          |         |
| Udder or Teat injury |     |          |         |
| Absent               | 353 | 205.952  | 0.000   |
| Present              | 61  |          |         |
| Parity number        |     |          |         |
| Parity no 1          | 112 | 73.559   | 0.000   |
| Parity no 2          | 58  |          |         |
| Parity no 3          | 49  |          |         |
| Parity no 4          | 71  |          |         |
| >5                   | 123 |          |         |

**Table 2:** Frequency of Organisms Isolated from milk sample and udder wound swabs

| Microorganisms isolated          | Frequency | Percent (%) |
|----------------------------------|-----------|-------------|
| <i>Staphylococcus aureus</i>     | 55        | 38.0        |
| <i>Staphylococcus hyicus</i>     | 9         | 6.1         |
| <i>Streptococcus agalactiae</i>  | 37        | 27.5        |
| <i>Escherichia coli</i>          | 12        | 8.2         |
| <i>Streptococcus intermedius</i> | 11        | 7.4         |
| <i>Micrococcus spp</i>           | 4         | 2.5         |
| <i>Candidia albicans</i>         | 2         | 1.2         |
| Mixed bacteria                   | 4         | 2.5         |
| <i>Corynebacterium species</i>   | 2         | 1.3         |
| Other coliform bacteria          | 6         | 4.1         |
| <i>Streptococcus dysgalactia</i> | 2         | 1.2         |
| Total                            | 144       | 100.0       |

## DISCUSSION

Mastitis is an important camel disease that affecting the livelihood of the pastoralists and this agree with study reported by Megersa (2010). Camels are still multipurpose animal increasingly kept for milk in pastoral area of the country Ethiopia. In traditionally kept camel Mastitis is common due to Sanitary and Management problem. When one of lactating camel infected in a herd there is high

probability of transmitting disease to uninfected lactating camel while milking. Taking care of milking infected and uninfected camel is not common in pastoral community and this increases the disease prevalence in a herd. The infection of most lactating camel in herd by bacteria which easily transmissible once it seen in a herd is common in traditionally managed camel herd; and this is in agreement with Quinn et al (2004). Reports of mastitis in traditionally managed camels are on the rise as reported by different workers Mohammed et al 2005, Abdurahman and Younan 2004, Khedid and Soulaïmani 2003, Guliye et al 2002, Bekele and Molla 2001. It is an undeniable fact that camels are kept in infrastructure and resource poor marginal areas. The CMT score shows that where there is tick infestation there is high probability of being positive for sub-clinical mastitis. This is due to the reason that udder is a predilection site for tick infestation which causes skin and teat lesions, facilitates bacterial entry into teat or udder tissue leaving behind permanent tissue damage. This agrees with study reported by Abdurahman et al (1995) and Obeid et al (1996). In Borena zone traditional husbandry practice, like tying fibers used on the teat to prevent the calf from suckling the dam. This fiber is damaging the udder and is predisposing factor to mastitis. This in agreement with study conducted by Abdurahman O A Sh (2006). In the present study bacteria culturing and isolation was done according to Quinn et al 2004 procedures. The most bacteria isolated are bacteria's that were reported by different researchers Abdurahman O A Sh (2006), Abdurahman (1996) and Megersa (2010) that causing mastitis in Camel, cow, sheep and goat. The

most prevalent bacteria are *Staphylococcus aureus* followed by *Streptococcus agalactiae* and *Escherichia coli*. It seems to be important udder pathogens in the camel. In addition, fungi species; *Candida albicans* was isolated from severely inflamed and deep udder wound containing pus this in agree with report of Almaw G. and Molla B. (2000) and Quandil SS, Oudar J. (1984). However, the camel has not been the subject of experimental mastitis studies and the epidemiology and pathogenesis of mastitis causing organisms remain unclear. Camels that affected by mastitis have shorter lactation period as reported by Barbour et al (1985). The disease is not usually treated in traditionally managed camels and will often take a natural course to chronicity resulting in permanent loss of milk production (Abdurahman et al 1991, Obeid et al 1996). Thus, it affects livelihood of pastoral community households which are dependent and use camel milk as source of food for their child to bring up them and for income generation.

### Conclusion

Camel mastitis is major health problem of lactating camels with high prevalence in the study area. The vast majority being subclinical in occurrence imply a higher economic loss from its adverse effect on productivity. The multi-purpose nature of the camel, the subsistence production system, the prevalence of mastitis and other major diseases, and less attention given for the camel made the condition serious. There were a number of identified risk factors affecting the prevalence of mastitis considerably. Poor management, unhygienic milking

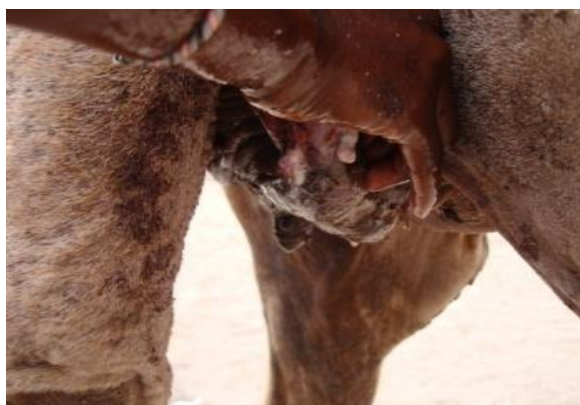


Fig. 2a: Udder lesion containing pus



Fig. 2b: Deep udder wound



Fig. 3: Traditional husbandry practice of tying teat to prevent suckling.



practices (poor hand washing before milking, poor cleaning of udder before milking) and traditional husbandry systems like tying of teats to prevent the calf from sucking, tick infestations are the most predisposing factor for mastitis in the study area. The fact that the most important bacteria isolated in this study were both contagious and environmental pathogens. In addition fungi (*Candidia albicans*) isolated from udder wound. It is possible to prevent mastitis by improving hygienic milking practice, removing tick regularly and stopping tying teat should be measures to be taken than to treat by medication Further study should aim at creating awareness about the importance of subclinical mastitis among the pastoralist and evaluation of its economic impact.

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