Seasonal Variation of Incidences and Etiological Agents of Bovine Mastitis in Friesian Cattle in Sudan

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Abstract: The present study was conducted with the aim of comparing the incidences and the etiological agents of mastitis in Friesian cows, during summer and winter and among the different quarters of the studied cows in Sudan. The subclinical mastitis incidences were found to be higher than the clinical incidences of mastitis both during summer and winter. The highest subclinical incidences were observed in the left forequarters and the lower incidences were found in the left hind quarters. However the clinical incidences of the disease, revealed an opposite occurrence. Most of these incidences were due to Staphylococcus aureus (23.56%), followed by S. epidermidis (14.37%), Actinomyces pyogenes (9.77%), Escherichia coli (6.32%), Acinetobacter antratus (7.47%), Bacillus cereus (6.86%) and Bacillus subtilis (4.59%). Moreover it is clear that S. epidermidis, Bacillus subtilis and Bacillus spp. were isolated only during winter, while Klebsiella aerogenes, E. coli, A. pyogenes and yeast were found during summer survey only. The incidences of the isolated organisms were compared within the different quarters according to their location and their California Mastitis Test (CMT), during summer and winter. Similarly this study investigated the incidences of purulent and hemorrhagic mastitis and demonstrated the dry quarters, during both seasons. The present study concluded that isolation and specific identification of the etiological agents were still one of the most efficient procedures for the diagnosis of the disease (mastitis), since the pathogenic organisms were isolated from CMT- negative quarters (normal). This should be taken into account in hygiene training to ensure that dairy practitioners understand the role of mastitis pathogens, which can serve as foodborne disease and illness. Similarly special attention should be directed towards the broad environmental factors in order to improve and enhance proper preventive measures for the disease.

Key words: Mastitis, season, etiology, Friesian cows, CMT, quarters, sudan.

INTRODUCTION

Mastitis is the inflammation of the mammary gland or breast, due to the injury of any type. However the udder disease of major concern is that associated with microbial infection[6]. Farah[9] reviewed the most important mastitis pathogens, their mode of transmission of the disease and their control.

Hilerton et al[9] reported that most cases of mastitis were found to affect only single quarters and usually the front one. However Fitzgerald et al[3] reported that intra mammary infection and high somatic cell counts were found less often in front and left quarters than in rear and right quarters. The incidences of clinical mastitis in cows and buffaloes were found to be 22 and 11% in left forequarters, 33 and 30% in left hindquarters, 21 and 11% in right forequarters and 24 and 48% in right hind quarters, respectively for cows and buffaloes[11]. However CMT readings among the quarters, demonstrated that the subclinical quarters (46%) were the highest, while those with blood and pus (2.5% each) among the clinical cases (20.9%) were the lowest[14]. On the other hand, Batra[3] found that the incidences of clinical mastitis were higher in hind than in the forequarters in Holstein- Friesian and Ayrshire cows.

The present study is aimed to investigate and compare the etiology and the incidences of mastitis among the different quarters and to estimate these differences during both summer and winter seasons.

MATERIALS AND METHODS

Source of data: Lactating dairy farms of the Arab Company for Agricultural Production and Processing;
Dairy Unit in Sudan were investigated for the present study.

**Diagnosis of mastitis:** California Mastitis Test (CMT) was performed in the selected dairy farms herds. Physical examinations were also conducted on all CMT-positive cows. Microbiological examinations were carried out in all mastitis-suspected milk samples.

**Incidence of Mastitis:** The incidence of mastitis was calculated for the diseased cows and they were evaluated as clinically infected (subdivided as watery, haemorrhagic or purulent), subclinically infected and healthy. Similarly the dry quarters, which mostly as a result of previous infections, were also recorded.

**Isolation and identification of the mastitis causing agents Collection of milk samples:** Quarter milk samples were aseptically collected according to the known routine procedures[2]. The udder was thoroughly washed with running water and dried with clean towel; the teats were then rinsed with 70% ethanol and dried. Tow milliliters of each samples was collected into sterile bottles after a few squirts of milk had been discarded, cooled (4 -5°C) and transferred to the laboratory in an icebox. Milk samples were activated by incubation for 12 hours at 37° C before undertaking the bacteriological analysis.

**Identification of the organisms:** Isolation and identification of the causative bacteria was performed according to Cowan and Steel’s Manual[2]. A loop (50µl) of the sample was streaked on a quadrant of both a blood and MacConkey agar plate. After incubation (24- 48 hours; 37°C), suspect colonies were picked up, subcultured and identified according to their morphological, biochemical and sugar fermentation reactions.

**Statistical analysis:** The examined cow’s quarters were grouped into clinical (subdivided to watery, haemorrhagic and purulent), subclinical, dry and healthy. Data was seasonally represented i.e., during summer, winter and both seasons. Similarly the incidence of each isolated organism was calculated as a percentage of the total isolates during both seasons.

**RESULTS AND DISCUSSIONS**

**Incidence of mastitis within the quarters during summer and winter:** The studied quarters showed higher subclinical mastitis incidence than the clinical one during both summer and winter (Fig. 1). Moreover subclinical mastitis showed a higher incidence during winter in all examined quarters than summer. However the clinical mastitis showed a higher occurrence, during summer than winter. Similarly the quarters that excreted pus and blood were higher during summer. Comparison of the quarters also revealed that higher incidences of subclinical mastitis were in the left quarters and the lower incidences were in the right forequarters (Fig. 1). However the clinical mastitis showed its highest occurrences in the right hindquarters and the lowest occurrences in the right forequarters of the examined cows. The left forequarters show the lowest incidences for purulent and haemorrhagic mastitis, which are higher in the right fore- and right hind quarters. The dry quarters showed their highest occurrences in the right forequarters and the lowest within the right hind quarters.

**Incidences of mastitis isolated organisms among the examined quarters during summer and winter:** Summer seasons revealed a higher incidence for *Staphylococcus aureus*, followed by *Actinomyces pyogenes* and *Escherichia coli* for both the right fore- and hind quarters. In the left fore and hind quarters, the common isolated organisms were *S. aureus* followed by *Klebsiella aerogenes*, *A. pyogenes* and *E. coli*. However during winter the most prevalent organisms were *S. epidermidis* followed by *S. aureus* and *Micrococcus spp.*, in all quarters (Fig. 2). Incidences of the other organisms are represented for each season in the same figure.

**Comparison of incidences of mastitis isolated organisms and CMT results during summer and winter:** Figure 3 shows the incidences of mastitis isolated organisms in the different quarters. The higher prevalence was that of *S. aureus* for subclinical and clinical mastitis during summer. However *S. epidermidis* revealed the highest occurrence for subclinical mastitis during winter. Moreover *S. epidermidis* and *Bacillus subtilis* were isolated only during winter. However *A. pyogenes*, *K. aerogenes* and *E. coli* were isolated during summer only. The purulent mastitis was found to be associated mainly with *A. pyogenes* followed by *S. aureus*. *Bacillus subtilis*, *K. aerogenes*, *E. coli* and *A. antratus* were also isolated. Hemorrhagic mastitis was associated with *A. pyogenes* and *E. coli*. Similarly *S. aureus*, *B. cereus* and *Micrococcus spp.* were also isolated from at least one hemorrhagic mastitic quarter.

Some CMT- negative quarters were also found to be positive to mastitis pathogens. Since *S. aureus*, *K. aerogenes* and *A. pyogenes*, yeast and other pathogens (Fig. 3) were isolated from them.
The comparison of mastitis infection in the studied herds revealed differences for subclinical and clinical (including purulent and hemorrhagic) mastitis. These differences were also noticed for the dry quarters (mostly as a result of previous infection) for both summer and winter (Fig. 1 and Fig. 2).

The highest incidences of subclinical mastitis were observed for the left hindquarters during summer and for subclinical mastitis in the right hindquarters during winter. These findings were similar to the finding of Bansal et al.[1]. They reported that the frequency of clinical mastitis was higher in the left hind followed by the right hindquarters. Moreover Batra[3] found the incidences of clinical mastitis to be higher in the hindquarters than in the forequarters in Holstein-Friesian and Ayrshire cows. However those results were in contrast to our findings, which revealed that during summer, the left forequarters showed the highest subclinical mastitis incidences and the higher numbers of the dry quarters. Moreover Fitzgerald et al.[7] reported that intramammary infection and high somatic cell counts were found less often in the front and left quarters than in rear and right quarters. Similar to our findings, Hillerton et al.[8] reported that cases of mastitis were found to affect only a single quarter and usually a front one. The higher incidences obtained for the hindquarters might be due to increased exposure to feces[11]. Moreover they added that hindquarters produce more milk and hence they were of high risk to counteract
mastitis infection. However the higher incidences in the forequarters (Fig. 1 and Fig. 2) were in line with Hillerton et al's findings. It may be due to over milking the forequarters, since they used machine milking in the studied farm. The incidences of mastitis in the forequarters, both during winter and summer, showed an increased of subclinical incidences than that of clinical mastitis incidences, which is more pronounced during winter (Fig. 1 and Fig. 2). These supported the previous findings of Mohamed et al, when estimating 17.29% and 3.67% for subclinical and clinical mastitis incidences, respectively. The higher incidences during summer might be due to extreme summer stress on cows and/or the increased subclinical incidences, which might be due to the clinical cases that becoming subclinical. This could be due to the result of inefficiency of treatment or development of drug resistance. Moreover the wet season was during summer, which resulted in flare up of mastitis causing organisms, when the cows udders contact the muddy wet floor.

The dominant isolated organisms were *S. aureus* (Fig. 3). This supported the previous findings of Jain, Lydia et al, Trinidad et al and Mohamed et al. It might be due as stated by Farah that *S. aureus* was the most important cause of mastitis where machine milking replaced hand milking and where treatment with penicillin was still practiced. *A. pyogenes* was the dominant organisms in both purulent and hemorrhagic quarters (Fig. 3), which in accord with Hiroven et al who found thick purulent secretions, with a foul odor when inoculated the hindquarters of pregnant heifers with *A. pyogenes*. The isolation of mastitis pyogenes from CMT-negative quarters was in accord with Pereira and Siqueira-Juino, who isolated *S. aureus* from healthy cattle in Brazil.

In conclusion mastitis incidences and etiological agents vary within the quarters of the cows according to season of the year and the virulence of the infecting organisms together with the level of the disease (CMT score). Moreover the proper isolation and identification of the causative agents are still one of the most efficient procedures for diagnosing the disease and for proper antibiotic therapy in order to avoid antibiotic resistant hazards. In order to minimize the incidences of the disease, special attention should be directed to the milking machine as well as of the dairy cows.

**REFERENCES**


