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Impact of mastitis on milk production and composition in lactating cows at the dairy farm

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Abstract: The problem of mastitis is the most occurring and rising disease in dairy cattle world-wide. It is also responsible on milk production and composition effects by a more or less severe depression. Summary values in the literature for losses of milk production were proposed at 10 to 15% drop in early stage. The disease was more associated with high lactating females and its occurrence was more during spring and summer months. The physico-chemical properties were pointed out that specific gravity acidity, fat content and total solid decreases was significantly ($p>0.05$) with severity of mastitis. To support decision making for udder health control, it is necessary to use a marginal approach, based on the comparison of the losses avoided and the additional costs of modified plans, compared to the existing ones.

Key words: Milk, Mastitis, Vactating cows, Depression

Introduction

India has a large livestock population including 199.1 million cattle, 73.0 million adult female cattle, 105.3 million buffaloes; 54.5 million adult female buffaloes constitute 304.4 million total bovines, 140.5 million goats and 71.6 millions sheep. These constitute 529.7 million total livestock population (NDDB, 2012). Milk is regarded as complete diet for human beings due to its essential components (Battaglia, 2007; Javaid *et al.,* 2009). During last years the demand for liquid milk has increased tremendously worldwide due to increased population growth (Klaas, 2000). India is the largest producer of milk in the world, is set to produce over 133 million tonnes milk during 2012-13. The overall annual milk production in our country stands at 140 million tonnes making the present per capita availability of milk 290 gms (NDDB, 2012) as against only 280 gms, recommended by the nutrition experts of Indian Council of Medical Research. Mastitis is said to be an inflammation of mammary gland affecting dairy cattle industry worldwide (Wallenberg *et al*., 2002; Seegers *et al*., 2003). It is often classified as subclinical or clinical depending on the severity of the disease or contagious and environmental based on the causative agents (Andrews *et al*., 2003).The reason behind occurrence of mastitis is due to the interaction between microbial agent, host and environmental factors. The consequences of mastitis in dairy cows could be visualized by examining the changes in its composition (Gianneechini *et al*., 2002). Mastitis reduces the yield percentage, lactose content and butter fat. Milk protein levels increases slightly with mastitis, but the protein is of lower quality, with increased levels of globulin and decreased casein content (Andrews *et al*. 2003).

Materials and Methods

Collection of animals: Lactating cows of the different age group and lactation were selected for the present series of investigations. All animals were kept on uniform pattern for feeding, breeding and management throughout of the experimental period.

Housing and management: All the experimental animals were housed in well ventilated cattle shed of Dairy farm, Banaras Hindu University, Varanasi on the pattern of tail to tail system. Proper sanitation of the cattle shed was maintained by cleaning it twice a day. The animals were left out for grazing and exercising during the day for few hours.

Feeding of animals : Well balanced ration as per their requirement and fresh drinking water was regularly provided to all the animals each day during experimental period.

Milking of animals: Just after calving the cows were hand and machine milched twice a day both morning and evening at regular intervals throughout the lactation period. The amount of milk produced by each cow was individually recorded every day in the milk record register. The lactation yield was considered as the milk produced by a cow in 305 days. The service and birth records were also maintained at B.H.U. Dairy Farm.

Sampling of milk: For analysis 100 ml, freshly drawn milk from each quarter of the cows was collected separately in clean, well sterilized and previously dried sample bottle. The samples were taken from morning and evening milking at regular interval for laboratory analysis. Before withdrawing portion for chemical analysis milk samples were brought to the temperature of 68°F (room temperature) and mixed thoroughly into a clean receptacle in order to get homogenous samples.

Analysis of milk: Milk samples properly collected from each cow were analyzed for the content of fat, specific gravity, total solids (T.S.), solids-not-fats (S.N.F.) and acidity with the help of AOAC (1995) method. In addition to these tests detection of mastitis in lactating cows was also performed which includes white side test (WST), paper strips impregnated with bromothymol blue test (Galdhar *et al*., 2005) and physical examination of milk, udder and teats.

Statistical analysis: Paired t-test was done for the calculation of the result.

Results and Discussion

Impact of mastitis on specific gravity of milk: Statistical analysis indicated a significant difference between Healthy and infected quarters. The findings of this study pointed out that specific gravity lowers with severity of mastitis (Fig. 1). It may be attributed to increase in chloride and decrease in lactose contents as specific

gravity is positively correlated with lactose and negatively correlated with chloride contents. The findings of this study are in line with those of Bardan *et al*. (1986) and Haggag *et al.* (1991) who pointed out that specific gravity lowers with severity of mastitis.

Impact of mastitis on acidity of milk: Normal fresh milk is titrated with an alkali solution using phenolphthalein as an indicator, acidity ranges from 0.10 to 0.26 percent. If it is assumed that the acidity is due to lactic acid but real fresh milk contains no lactic acid. The acidity of fresh milk is known to be due to the phosphates of milk, the protein (casein and albumin) and to a slight degree due to the presence of CO_2 and citrates. The data regarding severity of mastitis may be attributed to the lowered acidity as has been found in mastitis affected milk (Figure1). The lowered acidity in mastitis affected milk is due to reduction in lactose contents as the lactic acid formation is minimum in this case. Finding of this study is similar to Bilal and Ahmad (2004) pointed out that acidity decreases with the severity of mastitis.

Impact of mastitis on milk constituents:

Fat percentage: Data regarding the impact of mastitis on fat % of milk has been shown in Figure 1. From this data it is quite evident that the fat content of mastitis milk is lower than that of normal milk and this decrease is significant as per statistical analysis. This finding is in agreement with observations made by (Goncalves, 2012) who reported lower fat content in milk from infected quarters.

Total solids percentage: The total solids content of mastitis milk was found to be decreased by 0.5% and this decrease was significant as compared to total solid of milk obtained from healthy quarters (Fig. 1).

SNF percentage: Data regarding that solid non fat (SNF) were not significantly ($p>0.05$) lower in milk from cows infected with sub clinical mastitis as compared with milk from uninfected cows. Decrease in SNF in infected cow's milk depends on the destruction that occurs by invasion of pathogens to the mammary tissue causes decrease in synthetic activity of mammary gland (Fig.1). This finding is similar to study done by Hassan *et al*. 2009.

Impact of mastitis on milk production and on udder and teats of dairy cows: Milk obtained from clinically affected quarters was abnormal in physical appearance and less in quantity. There was about 10 to 15% drop in total milk production during early stages of the disease. This decrease was more marked in chronic cases and with increase of number of lactations. The udder was pendulous in the beginning and fibrous later. In certain cases the teats became blocked and smaller in size in lactating females. Milk drawn from such quarters was watery, scanty and sometimes blood mixed. Few teats were seen blind and atrophied. The data regarding milk production of cows reduced due to mastitis. Cow no.145, 212 and 133 produced 349, 330 and 310 liters milk per month but, after mastitis infection they reduced their milk up to 224, 250 and 205 liters per month, respectively. Cows over five lactation period were found to be more prone to this infection. Out of 480 quarters examined in total 21 were found to be clinically and sub-clinically infected. Out of 21 infected quarters 9 quarter should be blind due to mastitis. The disease was more associated with high lactating females and its occurrence was more during spring and summer months. Similar observations have been reported by Sinha and Thombare (2013). Cows with medium milking rate had less mastitis than very slow or fast milking. Prevailing high temperature (30-40 °C) in the cattle shed during summer months may be a predisposing factor for inducing mastitis infection in dairy cows. Such a finding has also been reported by Sinha and Thombare (2013). This study was concluded that the mastitis infected quarters are reducing the percentage of yield as well as specific gravity, acidity, fat, SNF, and total solid of cow milk. The reason behind occurrence of mastitis is due to the interaction between microbial agent, host and environmental factors.

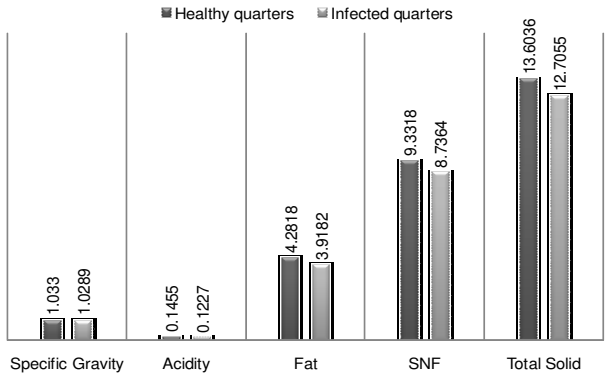

Fig. 1: Effect of mastitis on the physico-chemical properties of milk

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