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Impact of Subacute Ruminal Acidosis (SARA) on Milk Yield and Milk Fat Content in Crossbred Dairy Cows

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ABSTRACT

Subacute ruminal acidosis (SARA) is an important production disease of dairy cattle, characterized by episodes of lower ruminal pH and occurring consequent to high concentrate and low fibre diet. SARA results in heavy economic impact to dairy industry owing to lower milk production and milk fat depression. Present study was conducted to estimate impact of SARA on these production parameters. Twenty SARA positive milch cattle were selected for the study based on their rumen pH and compared their average daily milk production and milk fat content with the values of non affected animals. Cattle suffering from SARA had a significantly lower average daily production and milk fat content than the other group (Mean±SE values of average daily milk yield being 10.65±0.60L and 13.45±0.58L respectively and Mean±SE values of milk fat content being 3.51±0.10 per cent and 3.92±0.18 per cent respectively). Positive correlation exists between both milk yield and milk fat percentage with the ruminal pH. Regression studies established that unit increase in ruminal pH causes 0.401 per cent increase in fat content of milk with 1.30 per cent at zero pH. Various reasons for the production losses are discussed in detail and concluded that routine monitoring of production details will be a useful tool for predicting ruminal pH in dairy cattle.

KEYWORDS SARA, ruminal pH, average daily milk yield, milk fat content

Introduction

Subacute ruminal acidosis (SARA) has been considered as a major health issue of dairy cattle which causes serious economic consequences to dairy industry. SARA can be a consequence of maximizing energy intake, which requires provision of appropriate levels of physical and chemical dietary components (1). It is a digestive disorder indicated by symptoms that are subtle, nonexclusive, and often delayed from the time of incidence (2). Rumen pH parameters are the only reliable tools to diagnose SARA, although ruminal pH varies considerably at different locations in the rumen and during the day. This makes it difficult to rely on one time ruminal pH measurement as a diagnostic method for SARA.

One of the serious consequences of SARA is the lowered milk production and milk fat depression in affected cows. A case study of 500 dairy cows and observed that a decrease in milk production of 3 kg/cow/day and decreased milk-fat from 37 to 34 g/kg (3). A depression of milk-fat percentage in cows affected by SARA or generally non-acute forms of ruminal acidosis, respectively, has been documented (4, 5, 6). Because it usually occurs in individuals, the decrease of milk-fat remains undetected in the bulk tank testing (1, 7).

Present study has been taken up to study the impact of SARA on milk production as well as milk fat content in cross bred cattle and to draw correlations between ruminal pH and these production parameters.

Materials and Methods

Twenty SARA positive cattle were selected randomly from commercial dairy farms by checking the pH of rumen liquor collected by rumenocentesis (8). Animals with ruminal pH within the range of 5.2 to 5.6 and remained in the same range for three hours were considered as positive. An equal number of non-affected animals were served as control group. Milk production details were obtained from the farm records. Average daily milk production was calculated based on last seven days records. Milk samples were collected from all cows in fresh containers for milk fat estimation using Electronic Milk Fat Tester (Rajasthan Electronic and Instruments Ltd, Jaipur, India.

The data obtained were analyzed using the statistical software *viz*. Microsoft excel 2007, SPSS version 20 and GraphPad Prism version 5.01 for windows. The data were analyzed by Student's t-test (Paired and independent) and Pearson's bivariate correlation and linear regression methods.

Results

Comparison of average daily milk yield in both groups is given in Table 1and Fig. 1. Average daily total milk production varied significantly between SARA positive and negative groups. Present study showed that Mean±SE values of average total daily milk production of SARA affected cattle were significantly ($p \leq 0.05$) lower than that of the other group. Cattle suffering from SARA showed 10.65±0.60L while that of SARA negative group yielded 13.45±0.58L milk based on data collected during previous one week's milk production records. Average daily milk production in SARA positive cattle ranged from as high as 17L to as low as 7L per day while that of unaffected group ranged from 17.50L to 9L. It is noticed that a significant positive correlation exists between rumen liquor pH and average daily milk yield ($p \leq 0.05$).

Observations made in the current study clearly indicated a significant milk fat depression among SARA positive cattle (Table 1 and Fig. 2). Mean±SE milk fat percentage of SARA positive group was 3.51±0.10 per cent, which was significantly lower ($p \leq 0.05$) compared to a value of 3.92±0.18 per cent in the milk from non SARA group of animals. SARA positive animals showed a range of milk fat percentage from 2.80 to 4.30 while that of SARA negative group ranged from 2.7 to 5.8. A significant positive correlation can be established between ruminal pH and milk fat content ($p \leq 0.05$). Regression studies on rumen pH and milk fat content established that unit increase in ruminal pH causes 0.401 per cent increase in fat content of milk with 1.30 per cent at zero pH (Fig. 3).

Table 1: Comparison of average daily milk yield (litres/day) and milk fat content (%) (Mean±SE) of SARA positive and negative dairy cattle

	SARA positive	SARA negative	P value	95% confidence interval between differences	
				Lower	Upper
Average daily milk yield (L/day) (Mean±SE)	10.65±0.60	13.45±0.58	0.034*	0.18	4.42
Milk fat content (%) (Mean±SE)	3.51±0.10	3.92±0.18	0.05*	-0.83	0.01

* Means differ significantly (p≤0.05)

Fig. 1: Box and whiskers showing comparison of average daily milk yield (L) of rumen liquor in SARA positive and negative dairy cattle

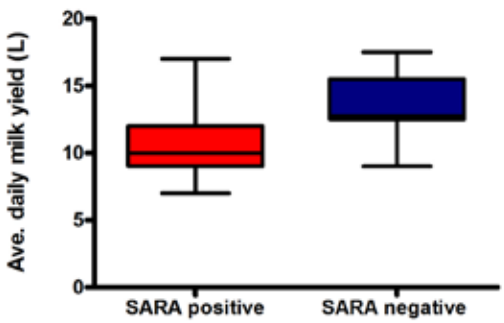


Fig. 2: Box and whiskers showing comparison of milk fat content (%) of SARA positive and negative dairy cattle

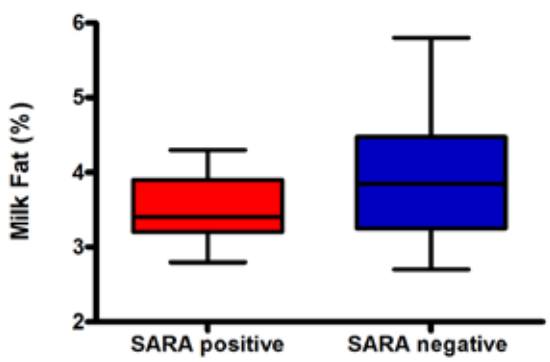
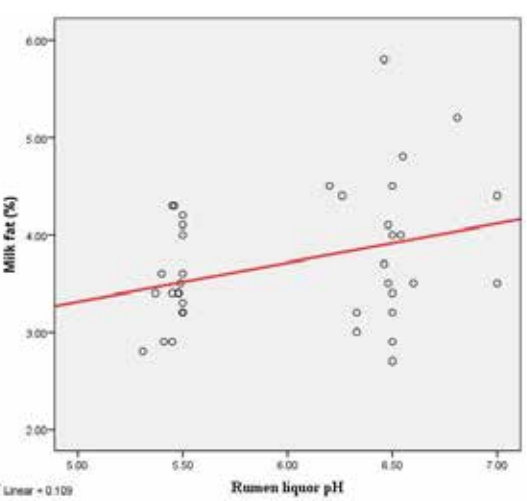


Fig. 3: Regression graph showing relationship of rumen liquor pH with milk fat content



Discussion

Average daily total milk production varied significantly between SARA positive and negative groups. Present study showed that Mean±SE values of average total daily milk production of SARA affected cattle were significantly (p≤0.05) lower than that of the other group. Significantly low milk production by cattle suffering from SARA in Karanataka state has been stated in previous reports (1, 9, 10, 11). Present study shows a positive correlation between ruminal pH and average daily milk yield (p≤0.05). The rumen pH is the major determinant of the type of digestion that occurs in the rumen. A decrease in rumen pH causes the decrement of cellulolytic bacteria (12, 13). Further, SARA also affects fibre digestion (12). SARA also depresses dry matter intake in dairy cows (14). Reasons for the feed intake depression can include reduced fibre digestibility and increases in volatile fatty acids, especially propionate, and in the osmolarity in the rumen, thus resulting in reduced production (15). Increased concentrate feeding can cause an increase in milk production initially, but all these factors can contribute to the considerable reduction in daily milk production in SARA positive cattle.

Considering the significant reduction among SARA suffering cattle, approximately three litres loss per day per animal is estimated. This will account to almost 900 litres per year per animal and cause a loss of more than Rs. 20,000/- at the present milk prices. Krause and Oetzel (16) reported that the impact of SARA on economic losses to farmers mainly due to decreased milk production and decreased efficiency of milk production.

Observations made in the current study clearly indicated a significant milk fat depression among SARA positive cattle. Mean±SE milk fat percentage of SARA positive group was 3.51±0.10 per cent, which was significantly lower (p≤0.05) compared to a value of 3.92±0.18 per cent in the milk from non SARA group of animals. Many authors are of the opinion that SARA causes decrease in milk fat content (1, 14, 17). Several factors, such as lactation state, breed and composition of feed rations affect the fat percentage of milk (18). Lower milk fat content is frequently used in farms as an indicator of SARA and to predict the effectiveness of diet structure for chewing (19). Positive correlation between ruminal pH and milk fat content in cows was obtained by earlier workers (20, 21). A depression of milk fat percentage in SARA affected cows has been documented by many authors. Alteration in the ruminal fermentation pattern is an important cause for this (14). He also opined that this milk fat depression usually occurs in some individuals which lead to the failure of detection from bulk tank testing.

Milk fat depression has been associated with a reduction in acetate to propionate ratio and increased insulin (22, 23). Decrease in milk fat content occurs following alterations in ration and not because of the decrease in Acetate, but an increase in Propionate and result reduction in acetate to propionate ratio (24, 25). Results of the present study also indicate lower acetate to propionate ratio and significantly lower milk fat content in SARA affected animals.

Conclusions

Results of the present study clearly indicate that SARA significantly affects milk production and milk fat content of cross-

bred dairy cows and hence seriously causes financial losses to farmers. Altered ruminal fermentation, reduced fibre digestion, dry matter intake depression, altered VFA ratio in rumen, triggered inflammatory response and impaired general health condition of animals could be possible reasons for poor production performance of high yielding animals. Correlation studies indicates that milk fat assessment, which is less invasive and part of routine farm operations, can be used as a non specific screening tool for predicting ruminal pH and consider interventions in feeding management of dairy cows.

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