

# Haematological Alterations Associated with Subacute Ruminal Acidosis (SARA) in Dairy Cattle

Bipin, K. C<sup>1</sup>, Ramesh, P. T<sup>2</sup>, Ansar Kamran, C<sup>3</sup>

Assistant Professor, Dept. of Veterinary Epidemiology and Preventive Medicine, College of Veterinary and Animal Sciences, Pookode, Wayanad, Kerala, India<sup>1</sup>

Professor and Head, Dept. of Veterinary Medicine, Veterinary College, Hebbal, Bangalore, India<sup>2</sup>

Professor and Head, Dept. of Teaching Veterinary Clinical Complex, Veterinary College, Hassan, Karnataka, India<sup>3</sup>

**ABSTRACT:** Subacute ruminal acidosis (SARA) is considered as an important digestive disorder of cows reared high concentrate, low fibre diet and causing heavy economic impact. Diagnosis and screening of the condition requires rumenocentesis and monitoring ruminal pH frequently, causing undue stress to dairy cattle. Present study examined the possibility of using haematological parameters as indirect predictors of ruminal pH. Twenty SARA positive cattle were selected randomly based on pH of rumen liquor and haematological parameters were assessed and values were statistically compared with those of healthy SARA negative animals. Mean total erythrocyte count, total leukocyte count, haematocrit values, haemoglobin concentration and platelet counts were high in SARA positive group. Granulocytes proportion of SARA positive cattle was found to be significantly higher ( $p \leq 0.01$ ) than that of SARA negative group with Mean  $\pm$  SE values  $52.10 \pm 2.26$  per cent and  $42.23 \pm 1.53$  per cent respectively, with significant granulocytosis ( $p \leq 0.01$ ). A strong negative correlation was obtained between rumen liquor pH and granulocyte count in blood ( $p \leq 0.01$ ). Various reasons for altered haemogram are discussed and concluded that haematology can be employed as a satisfactory tool for indirect screening for SARA in a herd.

**KEYWORDS:** SARA, ruminal pH, haematology, granulocytosis.

## I. INTRODUCTION

Subacute Ruminal Acidosis (SARA) poses a serious threat to dairying industry because of its serious impact on production parameters and animal health, though having a silent and often undetected presence in the herds. SARA, also known as chronic acidosis or sub-clinical rumen acidosis, is characterized by daily episodes of lower ruminal pH, which is a well recognized and economically important digestive disorder found particularly in well-managed dairy herds. It is considered as one of the significant nutritional disorders of dairy cattle. The costs of SARA result from decreased efficiency of milk production, reduced milk fat yield, and increased veterinary costs, and involuntary culling (1).

Field studies revealed the presence of SARA in 11 to 29.3 per cent of the early lactation cows and in 18 to 26.4 per cent of the mid-lactation cows (2, 3, 4). Even in well managed dairy farms, SARA can be a serious and economically important problem and can be considered as the most important nutritional disease affecting dairy cattle (5).

Diagnosing SARA is difficult because clinical signs are subtle and delayed after the time of the acidotic insult. As a result, routine monitoring and recording of related disease incidences, clinical signs and the dynamics of affected, para-clinical parameters may be the only ways to recognise SARA at an early enough stage to allow for corrective measures to management or feeding procedures (5).

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Present study is aimed to find out some alternate field level diagnostic options for herd screening for SARA. Various literatures indicate that alterations in haematological parameters can be occurred among SARA positive cattle (6, 7).

## II. MATERIALS AND METHODS

Twenty SARA positive milch cattle from various commercial dairy farms were selected randomly for this study. Dairy cows with rumen pH ranging from 5.2 to 5.6 and continues to be in the same range for minimum of 3 hrs were considered as positive for SARA (8). An equal number of SARA negative animals also were selected randomly as control. Blood samples from all the animals were collected in EDTA and assessed total erythrocyte count (TEC), total leukocyte count (TLC), differential leukocyte count (DLC), haemoglobin concentration (Hb), haematocrit value (HCT) and platelet count (Plt) employing standard procedures.

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.

## III. RESULTS

Comparison of various haematological parameters in SARA positive and SARA negative animals are given in Table 1. In the present study, various haematological parameters of SARA positive and negative animals were compared. Mean  $\pm$  SE values of total erythrocyte count, haemoglobin concentration and haematocrit values showed an elevation in animals suffering from SARA compared with non SARA group. Platelets count was higher in SARA positive group. Mean  $\pm$  SE values of total leukocyte counts were higher ( $12.02 \pm 0.81 \times 10^3$ /cmm) when compared with the other group ( $11.84 \pm 0.71 \times 10^3$ /cmm), though the increase is not statistically significant.

Parameter	SARA positive	SARA negative	P value	95% confidence interval between differences	
				Lower	Upper
RBC Count ( $\times 10^6$ /cmm)	6.27 $\pm$ 0.21	5.97 $\pm$ 0.17	0.203	-0.83	0.18
WBC count ( $\times 10^3$ /cmm)	12.02 $\pm$ 0.81	11.84 $\pm$ 0.71	0.864	-1.99	2.36
Lymphocytes (%)	40.97 $\pm$ 2.31 <sup>a</sup>	50.55 $\pm$ 1.45 <sup>b</sup>	0.001**	-15.09	-4.06
Monocytes (%)	6.93 $\pm$ 0.42	7.23 $\pm$ 0.45	0.629	-1.55	0.95
Granulocytes (%)	52.10 $\pm$ 2.26 <sup>a</sup>	42.23 $\pm$ 1.53 <sup>b</sup>	0.001**	4.36	15.39
Haemoglobin (g/dL)	8.35 $\pm$ 0.24	8.10 $\pm$ 0.15	0.567	-1.04	0.58
PCV (%)	29.80 $\pm$ 0.96	29.23 $\pm$ 0.89	0.663	-3.23	2.08
Platelets ( $\times 10^3$ /cmm)	388.15 $\pm$ 33.82	314.60 $\pm$ 59.06	0.287	-64.22	211.32

\*\* Means differ significantly ( $p \leq 0.01$ )

Table 1: Comparison of haematological parameters (Mean $\pm$ SE) in SARA positive and negative dairy cattle

A significant reduction in lymphocyte percentage was also observed ( $p \leq 0.01$ ). A strong negative correlation was obtained between rumen liquor pH and granulocyte count in blood ( $p \leq 0.01$ ) (Fig. 1 and 2).

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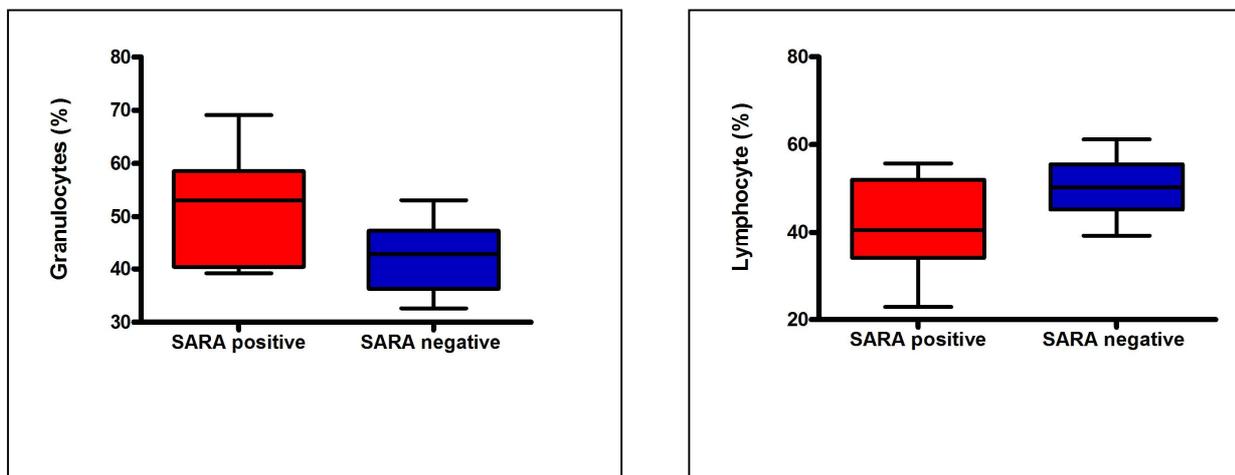


Figure 1 and 2: Box and whiskers showing comparison of differential granulocyte and lymphocyte count (%) of SARA positive and negative dairy cattle

While examining the differential leukocyte count, granulocytes count of SARA positive cattle was found to be significantly higher ( $p < 0.01$ ) than that of SARA negative group with Mean  $\pm$  SE values  $52.10 \pm 2.26$  per cent and  $42.23 \pm 1.53$  per cent respectively. Figure 1 clearly indicates the significant granulocytosis among SARA positive animals. In contrast SARA negative cattle showed a significant lymphocytosis which is clearly indicated in figure 2.

## IV. DISCUSSION

Total leukocyte count and differential granulocytic counts were higher in SARA affected cattle as in the finding made by Gozho *et al.* (6), while some other scientists reported a strong negative correlation between rumen pH with total leukocyte count in SARA (7). Increase in TLC can be attributed to increase in granulocyte count. The results, however, are in line with those of Ganesella (9) who reported a higher than normal TLC for cows with ruminal acidosis. In one report (10), a stress like leukogram with marked leukocytosis and alterations in the ratio of neutrophils/lymphocytes. As suggested in previous studies (11, 12), an increase in the cortisol level during stress causes an increase in the TLC.

There is an increase in mean values of total erythrocytic count and haemoglobin concentration in blood samples from SARA positive cattle. This observation is in line with that of Shah *et al.* (13), who reported an increase of total erythrocyte count and haematocrit values in ruminal acidosis attributed to haemoconcentration following reduced blood pH. Similar observations were made by earlier workers (7, 10).

The results of this study indicate that variations in the pH of rumen contents alter blood parameters and may be useful for the tentative diagnosis of SARA in dairy cattle. In many cases of ruminal pH, monitoring would be useful to prevent outbreaks of acidosis that will cause serious economic losses.

## V. CONCLUSION

Results of the present study indicate that significant alterations occurred in haematological parameters due to a lower ruminal pH. Leukocytosis with granulocytosis could be a result of haemoconcentration, chemotactic response due to an ongoing inflammatory process and also due to cortisol mediation resulting from stress. Increase in TEC, haemoglobin concentration and PCV could be possibly due to haemoconcentration following systemic acidosis. It is concluded that haematology could be employed as an indirect screening tool for SARA in dairy herd with proper correlation with other manifestations and data on feeding and management.

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