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Research Paper

Haemato-Biochemical Alterations and Effect on Milk Production in Sugarcane Top Fed Cattle

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ABSTRACT
To alleviate feed and fodder shortages and make animal production viable and economical, ruminants get the majority of their dietary need from native grasses, crop residues and industrial by-products. Sugarcane tops, soyabean crop residue, wheat and paddy straw are among the most common crop residues fed to cattle. Sugarcane top is a major by-product of the sugar industry. Sugarcane tops is utilised as roughage due to its low protein level, low mineral content and low nutritional digestibility. In SCT fed cattle mean haemoglobin was 8.67 ± 0.18 g/dl, PCV (25.28 ± 0.57 %), TEC (5.15 ± 0.11 x 10^9 /µL), serum calcium (7.20 ± 0.16 mg/dl) and phosphorus (4.29 ± 0.09 mg/dl) significantly lowered ($p<0.01$) than SCT not fed cattle. Mean BUN (18.76 ± 0.49 mg/dl) and creatinine (0.99 ± 0.54 mg/dl) did not show any significance compared to the SCT not fed cattle (healthy control group). The effect of SCT feeding in the milch animals was significant decrease (9.21 ± 0.27 lit./day) in milk production by 19.07 % as compared to before SCT feeding (11.38 ± 0.27 lit./day).

Keywords: *Sugarcane top, cattle, haemato-biochemical, milk production*

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I. INTRODUCTION

Livestock plays an important role in Indian economy. About 20.5 million people depend upon livestock for their livelihood. Livestock contributed 16 % to the income of small farm households, as compared to an average of 14 % for all rural households. India has large livestock resources, which contributes 4.11 % GDP and 25.6 % of total Agriculture GDP (Annual Report, 2019-20). There is a 10 % deficit of dry fodder, 33 % shortage of green fodder and a 35 % shortage of concentrates (Ramachandra *et al.*, 2007). Ruminants receive the majority of their dietary needs from native grasses, crop residues and industrial by-products to mitigate feed and fodder shortages and to make animal production viable and economical (Bodare *et al.*, 2020). In India, sugarcane is the most important commercial crop, which is grown over 2.57 % of its gross cultivated land. Globally, India is the second largest producer of sugarcane after Brazil, accounting for around 25 % of global production. Sugarcane farming occupied around 7.5 % of the country's rural population and provided 10% of agricultural GDP in 2010-11 (Solomon, 2016). Sugarcane top is a major by-product of the sugar industry. It is often highly palatable and voluntary ingestion is beneficial when chafed and fed. Sugarcane tops are poor quality roughage, lacking in protein and minerals and the feed has low energy and fat, which may be the principal constraint to milk production (Leng and Preston,1988).

II. MATERIALS AND METHODS

The blood and serum samples collected from lactating cattle receiving sugarcane tops (SCT) 50 % or more than 50 %, in their daily feed intake. Total of 100 sugarcane top fed lactating cattle from Satara, Sangli, Kolhapur and Pune districts of Western Maharashtra, were randomly examined and screened for haemato-biochemical estimations. The collected data was analyzed statistically by using standard statistical methods. Haematological analysis were carried out within 24 hours of collection of the blood sample. The haematological parameters such as haemoglobin (g/dL), PCV (%), TEC (10^9 /µl), TLC (10^3 / µl) and Differential Leucocyte Count including Neutrophils (%), Band neutrophils (%), Lymphocytes (%), Monocytes (%), Eosinophils (%) and Basophils (%) were estimated by using automated haemo-analyzer (Abacus junior vet 5, Diatron MI PLC, Hungary). The serum samples were analysed for biochemical parameters such as calcium, phosphorus, BUN and creatinine level by using Biochemistry Analyzer (Erba CHEM-7, Transasia bio-medicals Ltd., India). The record of milk production was collected from the farmers before and after feeding of sugarcane tops.

III. RESULTS AND DISCUSSION

The sugarcane top fed cattle revealed a significant ($p<0.01$) low level of the mean Hb, PCV and TEC as compared to SCT not fed cattle. The mean total leukocyte count was significantly higher in SCT fed cattle as compared to SCT not fed cattle. The mean neutrophil count in SCT fed cattle did not significantly differ from that of SCT not fed cattle, as shown in Table no.1.

There was a significant ($p<0.01$) low level of lymphocytes in SCT fed cattle compared to SCT not fed cattle. In comparison to the healthy control (SCT not fed) cattle, the eosinophils, basophils and monocytes did not show any significant differences, in cattle fed with SCT, results are depicted in Table no.1. The present findings are in accordance with the findings recorded by Musale (2016), Digraskar *et al*. (2010), while Dhoot *et al*. (1995) reported non-significant changes in Hb and PCV in oxalate poisoning. Bajaj *et al.* (2011) recorded the leukocyte count increased ($p<0.01$) from 9.68 to 16.92 x $10/mm^3$ and significantly decrease in PCV from 31.80 to 26.67 %. Elevated TLC count has also been reported by Singh *et al*. (1995) corroborating the present findings. Reduced cell energy metabolism could be the cause of decreased haemoglobin and total erythrocyte count (Knight and Walter, 2003) and depressed haemopoietic activity due to oxalate toxicosis. Leucocytosis observed in the current study may be attributed to body's response to oxalate content in SCT.

Serum biochemical estimation of sugarcane top fed cattle revealed significant ($p<0.01$) lower values of serum calcium and phosphorus as compared to the SCT not fed cattle. In [1]comparison to healthy control (SCT not fed) cattle, the serum creatinine and blood urea nitrogen did not differ significantly in SCT fed cattle, as shown in Table no.2.

Several authors (Dhoot *et al*., 1995; Knight and Walter, 2003; Radostits *et al*., 2007; Bajaj *et al*., 2011; Ambore, 2017) reported a drop in blood calcium levels in cattle fed oxalates-containing feed/diet. The present study observed decreased serum phosphorus level, similar findings were also recorded by Bajaj *et al.* (2011) while Rahman and Kawamura (2011) and Abdul Aziz (2008) found phosphorus were within the normal level in animals consuming oxalate containing feed. Change in the calcium-phosphorus ratio may be due to the oxalate, in many fodder crops, react with calcium to form insoluble calcium oxalate, which reduces calcium absorption (Patel *et al.*, 2013).

Hypocalcaemia occurs when unadapted animals consume an excessive amount of oxalate-containing plants particularly during drought condition and the rumen's capacity to detoxify all of the ingested oxalates is exceeded (Botha *et al.*, 2009). Calcium content in serum was reduced in the animals fed sugarcane-based ration. Ca % reduced as the sugarcane % in the diet increased (Dhage *et al*., 2009). Symptoms of toxicity not adverted by animals even after feeding on high oxalate-containing forage, but calcium bioavailability may decrease with increasing oxalate levels in the ration (Rahman and Kawamura, 2011).

The serum BUN and creatinine values recorded within the normal range in the present study are in accordance with the findings by Abdul Aziz (2008) who also observed urea values within the normal levels. Ruminants, according to Lincoln and Black (1980), may tolerate more oxalate in their diet than other animals because they can detoxify oxalate in the rumen, preventing soluble oxalates from being absorbed. When the rumen's ability to metabolise soluble potassium and sodium oxalates is exhausted, the oxalates are absorbed into the circulation where they form insoluble calcium and magnesium oxalates that precipitate in the kidneys and induce renal failure by increasing serum creatinine and BUN levels. Non-significant changes observed in BUN and creatinine in the present study might be due to adaptation of animals to SCT, an oxalate containing crop residue, the oxalate content in SCT might be detoxified in rumen itself and not crossed the renal threshold.

The effect of SCT feeding in the milch animals was significant decrease in milk production by 19.07 % as compared to before SCT feeding, as shown in Table no.3. In the present investigation, decreased milk production was attributed to the chelating effect of oxalate on calcium, which resulted in less availability of calcium required for milk production because oxalate binds to and forms insoluble compounds with some essential minerals such as calcium, iron, zinc and magnesium. Oxalate also prevents mineral absorption (Rahman *et al*., 2013; Ambore, 2017). Absorption of oxalate into the blood; binds to circulating calcium and forms insoluble calcium oxalate leading to low amount of calcium due to which decrease the milk production (Kreiselmeier, 2015). There was the shortage of amino acids and long chain fatty acids in a sugarcane top diet responsible for low milk production (Behera *et al*., 2005). Because Ca is excreted from the body through the milk, lactating ruminants may be more susceptible to oxalate toxicity than non-lactating ruminants (Rahman *et al*., 2013).

Sugarcane and its by-products also low in fat and when they are fermented in the rumen the volatile fatty acid profile is extremely low in propionic acids leading to low milk production (Leng and Preston, 1988).

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