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SHORT COMMUNICATION

Effect of Sodium Sesquicarbonate Supplementation on Blood Biochemical Parameters and Antioxidant Activity in Lactating Karan Fries Cattle

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ABSTRACT

In the present research, the impact of sodium sesquicarbonate (NaSC) on the blood biochemical and the function of antioxidant enzymes in lactating crossbred cattle were examined. At the start of the experiment, 24 lactating crossbred cattle were randomly distributed in four groups, namely control, T_1, T_2 and T_3 on the basis of milk yield, body weight, parity and days in milk. Whilst cows in control group received no supplement, diets of cows in groups T_1, T_2 and T_3 were supplemented with NaSC at 0, 1, 1.5 and 2, respectively. All the cows were reared under similar environmental conditions, and feeding was done as per ICAR (2013) for the entire duration of 120 days. Blood samples were obtained initially at 0 days and then at monthly interval for assessing blood biochemical and antioxidant status. The results of the experiment showed that sodium sesquicarbonate supplementation appeared to increase plasma glucose, but no substantial difference was discovered by statistical analysis. Blood metabolites and antioxidative activity were not influenced by NaSC supplementation and were within the normal range. Thus, it can be concluded that sodium sesquicarbonate supplementation had no detrimental effect on blood metabolites and antioxidant activity.

Key words: Buffer, Sodium sesquicarbonate, Concentrate, Biochemical parameters, Antioxidant enzymes

During early lactation, cows often are in negative energy balance because feed intake is reduced during the period. Thus, diets containing high proportion of readily fermentable carbohydrates are needed to be fed to meet the demand for energy and nutrients to support milk production (Plazier *et al.,* 2008). However, feeding of high concentrate diet with small quantities of effective fibre often can disturb the rumen function resulting in metabolic disorders, the most common of which is sub-acute rumen acidosis (SARA). In order to overcome this problem buffers are added in diets containing higher proportion of concentrates (Cabrita *et al.,* 2009; Bouguin *et al.,* 2018). Sodium sesquicarbonate, commonly known as Trona, is a natural mineral ore found on earth. It has higher buffering ability than sodium bicarbonate, commercially mined and is available at a lower price than sodium bicarbonate, which is a refined derivative of trona. The objective of the present study was to evaluate the impact of supplementation with sodium sesquicarbonate on the biochemical parameters of the blood and the antioxidant status of lactating KF cows.

This experiment was conducted at Livestock Research Centre of NDRI, Karnal. Twenty-four Karan Fries cows were selected from the herd after approximately 25±5 d of post calving and divided into four groups on the basis of milk yield, body weight and parity. In order to meet their nutrient requirements, all cows were provided feed and fodder to meet their nutrient requirements as per ICAR (2013) feeding standards. The animals were fed with Institute grown sugargraze along with concentrate mixture. All animals were on a similar dietary schedule, except that different sodium sesquicarbonate was supplemented at 0, 1, 1.5 and 2 percent of DMI in groups control, T_1, T_2 and T_3, respectively. The samples of feeds offered to animals i.e. concentrate mixture and green fodder, residues left and dung voided were analyzed for proximate principles *viz.* dry matter (DM), crude protein (CP), ether extract (EE) and total ash as per standard procedure of AOAC (2005). Neutral detergent fibre (NDF), acid detergent fibre (ADF), acid detergent lignin (ADL),

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hemicellulose and cellulose were estimated by the method of Van Soest *et al.* (1991). Estimation of truly digestible non-fibrous carbohydrates (tdNFC), truly digestible CP (tdCP), truly digestible NDF (tdNDF), truly digestible fatty acids (tdFA) and total digestible nutrients (TDN) were done according to (NRC, 2001). Detailed chemical composition of sugargraze and concentrate has been presented in Table 1.

Blood samples (about 8 ml) were collected in sterile heparinized vacutainer (BD Vacutainer TM, UK) tubes from jugular vein puncture, posing minimum disturbance to the animal. Samples were taken before the start of experimental feeding and thereafter at monthly intervals. Immediately after collection, tubes were gently rolled between the palms for 1 min and then kept in an ice bucket and transported to the laboratory. The samples were centrifuged at 3000 rpm for 15 minutes and plasma was decanted and stored at -20°C for further analysis. Estimation of biochemical parameters (plasma glucose, total protein, albumin, triglycerides and cholesterol) was done with the help of diagnostic kit purchased from Recombigen Laboratories Pvt. Ltd. New Delhi, India. From freshly drawn blood samples RBC hemolysate was prepared for estimation of antioxidant enzymes i.e. SOD, GPx and catalase. Blood sample was collected in ACD (@1.5mL/10mL of blood) in 2.0 ml Eppendorf tube on ice. Assessment of enzymatic activity of SOD, catalase and GPx was done within three days after collection of blood using spectrophotometer with the help of the procedure described by Madesh and Balasubramanian (1998), Aebi (1984) and Paglia and Valentine (1967), respectively. Data obtained were analyzed using the general linear model procedure of Statistical Package for the Social Sciences (SPSS for Windows, V21.0; SPSS Inc., Chicago, IL, USA). The pair-wise comparison of means was carried out using "Tukey's honest significant difference (HSD) test". Significance was set at $P<0.05$.

Data pertaining to mean values of haemato-biochemical parameters are presented in Table 2. There were no variations in plasma concentration of protein,

Table 1. Proximate composition of the feed ingredients used during the experiment

Parameters	Sugargraze	Concentrate
Dry matter	28.00	89.56
	on % DM basis	
Crude protein	10.20	19.53
Neutral detergent fibre	58.65	26.37
Acid detergent fibre	37.29	12.38
Ether extract	1.29	3.74
Ash 8.64	11.22	
Neutral Detergent insoluble CP	5.30	1.94
Acid Detergent Insoluble CP	1.14	0.69
Hemicellulose	21.40	13.99
Cellulose	21.00	6.40
Acid detergent lignin	7.75	2.32
Total carbohydrates	79.87	65.51
Truly digestible non-fibre carbohydrates	26.00	40.26
Truly digestible CP	9.70	19.25
Truly digestible FA	0.30	2.74
Truly digestible NDF	24.8	13.13
Total digestible nutrients	54.10	71.81

Table 2. Effects of different levels of sodium sesquicarbonate on blood biochemical parameters and antioxidative status in lactating crossbred cattle

Parameters	Treatments†			
	C	T_1	T_2	T_3
	Blood metabolites			
Total Protein, g/dl	7.03±0.15	7.19±0.15	7.30±0.16	7.10±0.16
Albumin, g/dl	3.61±0.04	3.63±0.06	3.65±0.05	3.68±0.09
Triglyceride, mg/dl	6.54±0.22	6.48±0.25	6.59±0.28	6.37±0.23
Glucose, mg/dl	65.74±1.37	65.26±1.38	66.30±1.17	69.67±1.12
Cholesterol, mg/dl	176.59±4.35	177.78±3.48	177.96±4.18	176.08±3.50
GPx, NADPH oxidized/g Hb/min	21.26±0.90	21.63±1.00	22.47±0.66	21.17±0.86
S.O.D, U/mg Hb	43.44±1.33	46.48±1.47	44.68±1.68	47.32±1.66
Catalase, μmoles of H_2O_2 consumed /min/g Hb	169.43±1.80	173.03±2.52	172.21±2.06	174.82±2.03

†Diets of the cows of groups C, T_1, T_2, T_3 and T_4 were supplemented with sodium sesquicarbonate at 0, 1.0, 1.5 and 2.0%, respectively

albumin, cholesterol and triglycerides due to supplementation of different levels of sodium sesquicarbonate. However, plasma glucose levels showed an increasing trend with the increased level of supplementation. Our findings are consistent with Bougouin *et al.* (2018), who also documented no improvement in blood biochemical parameters due to supplementation of sodium bicarbonate at 1 % in lactating cows fed high concentrate diet. Tripathi *et al.* (2004) also did not observe any impact of supplementation of sodium bicarbonate up to 2.25% on different biochemical parameters of lamb fed hay and concentrate based diet. Cabrita *et al.* (2009) published similar results, which showed that there was no impact of dietary buffer supplementation on blood biochemical parameters. Contrary to our findings, Escobosa *et al.* (1984) reported that blood glucose in the treatment group that was supplemented with dietary buffer (1.7% of DMI) was around 20 % higher compared to the control group.

SOD, catalase and GPx have been used as biomarkers of antioxidant status in the current research. Data pertaining to activities of SOD, catalase and GPx are presented in Table 3. Perusals of the data revealed no influence of different levels of NaSC supplementation on antioxidant parameter during the entire period of feeding trial. This was in the expected line because neither the animals were in any stressful situation nor the amount of supplement was too high to trigger any adverse effects. Thus, it can be concluded that supplementation of sodium sesquicarbonate upto 2 % of did had no adverse impact on blood biochemical and antioxidant parameters in early lactation crossbred cows.

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