Indian J. Anim. Nutr. 2020. 37 (2): 95-105
doi: 10.5958/2231-6744.2020.00017.1

Indian Journal of Animal Nutrition

Rhythmic Alterations in Physiological Response, Growth Performance and Blood Metabolites in Growing Hariana Cattle Fed on Ration Included with Different Levels of Corn Silage

Ashwani Kumar Verma[1], Muneendra Kumar[1*], Vinod Kumar[1], Raju Kushwaha[1], Shalini Vaswani[1], Avinash Kumar[1] and Yajuvendra Singh[2]

Department of Animal Nutrition, College of Veterinary Science and Animal Husbandry, DUVASU, Mathura 281 001, India

ABSTRACT

This study was conducted to determine the effect of green fodder replacement with corn silage on the physiological response, growth performance, and blood metabolites in summer exposed growing Hariana cattle. Eighteen growing Hariana cattle were randomly allocated into three groups (n=6) on body weight (130±3.0 kg) and age (14±1.5 months) basis. Experimental heifers either received a basal total mixed ration (TMR) devoid of corn silage ($S_{0\%}$) or were fed on TMR of which 50% ($S_{50\%}$) and 100% ($S_{100\%}$) green fodder were replaced with corn silage. Mean THI and RH values indicated that experimental heifers were in moderate heat stress. Replacement of green fodder with corn silage did not alter the physiological response of heifers during 90 d experimental periods. As the level of inclusion of corn silage increased, dry matter intake (DMI) and cost of feeding also increased ($P<0.05$) while average daily gain (ADG) was similar among all groups. Hematological attributes and plasma metabolites showed non-significant effect of green fodder replacement with corn silage. Although the green fodder replacement with corn silage increased cost of feeding but can be used as a best alternative during summer period by maintain the performance of dairy animals.

Key words: Blood metabolites, Corn silage, Green fodder, Hariana heifer, Haematology

INTRODUCTION

The feed itself accounts for 60 to 65% of the total cost of production in dairy cattle and the main determinant of production system profitability. Shrinkage of irrigated lands for fodder production, higher labour cost, and small landholdings further increases the cost of rearing of dairy animals. Out of the available dry matter, most of it is available in the form of agricultural by-products and dried grass which is of inferior quality. It is imperative to arrange sufficient good quality feed and fodder for efficient utilization of the genetic potential of the various livestock species and sustainable improvement in productivity. The only way to meet the increasing fodder needs of livestock is to look for alternative options of fodder. Among these, silage is one of them. Availability of nutritious fodder throughout the year can be maintained by converting green fodder into silage.

Silage is green succulent roughage preserved more or less in its original condition, with a minimum deterioration and minimum loss with respect of various nutritive constituents of fodders. Well-fermented silage is readily consumed by animals and may improve their health and production characteristics (Varadyova *et al.,* 2010). Recent findings on silage production indicate that it could replace the conventional fodder without any ill-effect on intake, efficiency, digestibility, and performance of dairy animals (Chaudhary *et al.,* 2014). In a well-managed system, where losses are low, the silage dry matter content and digestibility will be similar or slightly lower and crude protein content might be similar to parent fodder (Kaiser and Piltz, 2004). Preference for cereal green fodder including maize, sorghum, pearl millet, *etc.* for ensiling is due to more sugar content than protein, as sugar is utilized in the fermentation process to make lactic acid by

[*]Corresponding author; Email: muneendra82@gmail.com; [1]Department of Animal Nutrition, College of Veterinary Science and Animal Husbandry, DUVASU, Mathura 281 001; [2]Yajuvendra Singh; Department of Livestock Production Management, College of Veterinary Science and Animal Husbandry, DUVASU, Mathura 281001, India; Email: yuvi_only@rediffmail.com

microorganisms (Nazli *et al.,* 2019).

A major factor which affects the physiological response, feed intake, and performance of animal during summer stress is dietary composition. Therefore, a corollary to this concept exists in utilization of diets, suggesting that when different diets are fed to cattle, the analysis of physiological response, feed intake, performance measures, and blood metabolites should be able to differentiate between the efficiencies of the utilization of diet. Considering these facts, the present study was designed to investigate the effect of replacement of green fodder with corn silage on physiological response, feed intake, growth performance, and blood metabolites in growing Hariana cattle during summer season.

MATERIALS AND METHODS

The experiment was conducted in the Instructional Livestock Farm Complex (ILFC) of Veterinary University, Mathura (India). Mathura is situated at elevation 191 m above mean sea level, latitude and longitude position being 27° 303 N and 77° 413 E, respectively. The climate of Mathura is semi-arid, and temperature goes up to 45°C during the summer months.

To prepare the best quality silage, maize fodder was used in this study. Fodder harvest was performed at a height of 5 cm above the ground when the moisture content of maize fodder was in the range of 70-75%. Silage was prepared in bunker silo having a dimension of 20 m×10 m. The whole fodder was chopped into 2-3 cm pieces by using tractor operated forage chopper (Ensiladeria JF4Max, NB Maquinas Ltd., Brazil). Chopped material was filled in the silo and compressed with a tractor fitted with a labeler. For adequate compaction and perfect anaerobic condition, the chopped fodders were covered with two layers of polythene sheets (0.2 mm thickness) followed by a layer of sand and tires. After 60 d of ensiling, the silo was opened from one end and silage samples were collected in a zip lock polythene pack from the core area of the opened portion of the filled bunker silo. Collected silage samples were used for evaluation of nutrients content, and physical and chemical characteristics (Table 1). Silage samples were analyzed for moisture content (by using

Table 1. Nutrient composition and characteristics of corn silage

Attribute	Amount, g/kg DM or as mentioned
Nutrient composition	
DM	270
OM	958
CP	83
EE	31
CF	359
Ash	42
AIA	28
NFE	485
NDF	461
ADF	285
ADL	27
Total CHO	844
NFC	383
Ca	1.5
P	1.9
Physical characteristics	
Temperature, ºC	32
Aroma	Slightly acidic and fruity smell
Colour	Brownish yellow
Structure/texture	Loose and soft, non- viscous/firm
Moldiness or sliminess	Absent
Chemical characteristics	
pH value	4.37
Lactic acid (g/100g DM)	7.35
BC, ml of acid	8.94
NH_3-N (g/100 g DM)	0.13
Acetic acid, g/kg DM	24.39
Propionic, g/kg DM	3.60
Butyric, g/kg DM	0.92
Valeric acid, g/kg DM	0.18
Isovaleric acid, g/kg DM	0.36
TVFAs, mM/100 g DM	29.45
WSC, g/kg DM	168.0
Flieg index	84.20

toluene distillation method, Method 925.04), crude protein (CP; Method 4.2.08), ether extract (EE; Method 920.85), total ash (Method 923.05), and acid insoluble ash (AIA; Method 923.03) contents by following protocol of AOAC (2005). Neutral detergent fibre (NDF), acid detergent fibre (ADF) and acid detergent lignin (ADL) were determined as per the method of Van Soest *et al.* (1991). The total carbohydrate (total CHO) and non-fiber carbohydrate (NFC) content were determined by using the equation of Sniffen *et al.* (1992) and Detmann and Valadares Filho (2010), respectively. Ca and P content were determined by titration method (Talpatra *et al.,* 1940) and spectrophotometric method (AOAC, 2005), respectively.

Physical characteristics were evaluated by following guidelines of Horiguchi and Takahashi (2007). The temperatures of the core, lateral and apical parts of the working face of silage were measured by mercury in glass clinical thermometer (Qingdao Dacon Trading Co. Ltd., Shandong, China). The pH in the silage extract before stabilizing with 5% meta-phosphoric acid was measured by using a pH meter (Systronics pH System-361, India). The estimation of lactic acid in silage samples was done as per the modified method of Barnett (1951). Buffering capacity (BC) was determined by the hydrochloric acid-sodium hydroxide method of Playne and McDonald (1966). NH_3–N content was measured in the extract by phenol-hypochlorite assay (Weatherburn, 1967). Volatile fatty acid (VFA) content was determined with gas chromatography-mass spectroscopy (GC-MS; 5975C VL MSD with Triple-Axis Detector, Agilent Technologies India Pvt. Ltd, with 30 m×320 µm×0.25 µm capillary column, condition: column temperature 130 °C, injection temperature 220 °C) fitted with flame ionization detector (FID). The concentration of WSC in silage sample was determined by method according to McDonald and Henderson (1964). To assess the quality of silage after ensiling for 60 days, Flieg index by means of the pH values and DM content was calculated (Kilic, 1986).

Animal care procedures were approved (approval number, 121/IAEC/18) and conducted under the established standard of the Institutional Animal Ethics Committee (IAEC), constituted as per the article number 13 of the Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA) rules laid down by the Government of India. A total 18 growing Hariana heifers were selected from the cattle herd maintained at LFC, DUVASU, Mathura. All heifers were housed in a well-ventilated shed having the proper arrangement for individual feeding and watering without having access to the other animal's diet. Deworming of all the experimental animals were done before the start of the experiment by oral administration of Fentas bolus (Intas Pharmaceuticals Pvt. Ltd., India) at the dose level of 10 mg/kg body weight. Animals were let loose every fortnightly for exercise. Selected heifers were randomly assigned into three groups (n=6) on body weight (130±3.0 kg) and age basis (14±1.5 months). Heifers were either fed on basal TMR that consisted of compounded concentrate: available green fodder: wheat straw in proportion of 40: 40: 20 ($S_{0\%}$) or TMR of which 50% green fodder (DM basis) was replaced with corn silage ($S_{50\%}$) and TMR of which 100% green fodder (DM basis) was replaced with corn silage ($S_{100\%}$). Ingredients and nutrients composition of TMR fed to animals in different groups are presented in Table 2. TMR was prepared daily by hand mixing and offered at 0900 h in all tests. The calves were fed the TMR in such an amount that at least 5% refusals were left daily per animals. Fresh drinking water was offered *ad libitum* twice daily at 0800 h and 1700 h.

The experimental calves were monitored daily for DMI and fortnightly for growth performance. The samples of TMR offered and ort left were dried in a hot air oven at 60°C till a constant weight was attained and ground in a Wiley mill to pass a 1-mm sieve. Processed samples were pooled animal wise and stored at the dry place. Samples of TMR offered and ort left were analyzed for nutrient composition by following methodology as mentioned in silage preparation and quality evaluation section.

Peripheral blood samples were collected in heparinized vacuutainer tubes (BD Franklin, USA) by venipuncture of jugular vein at 0, 30, 60 and 90 days of experiment. A fraction of blood samples were used for analysis of red blood cells (RBCs) count, white blood cells (WBCs) count, haemoglobin (Hb) concentration, packed cell volume (PCV) or haematocrit (HIT) value, mean corpuscular volume (MCV), mean cell haemoglobin (MCH), and mean corpuscular hemoglobin concentration (*MCHC*) by using automatic analyzer (Celltac alpha CM, Nihon, Kohden, Pvt. Ltd, Surat, India). The remaining amount of blood samples were centrifuged at 3000 rpm for 30 min to separate the plasma from packed blood cells. Plasma samples were stored at –20°C until further analysis of aspartate aminotransferase (AST), alanine aminotransferase (ALT), alanine phosphatase (ALP) activity, and plasma Ca and P content by using automated biochemical analyzer (BS-120 Chemistry Analyzer, Shenzhen Mindray Biochemical Electronics Co. Ltd.).

Microclimatic data, *viz.*, dry bulb temperature (Cdb) and wet bulb temperature (Cwb) in degree Celsius, were recorded at 0700 and 1400 h with dry and wet bulb hygrometer (Zeal, UK) every day during experimental period and THI was calculated by using the following equation (McDowell *et al.,* 1976).

$$THI = (0.72 \times Cdb + Cwb) + 40.6$$

Daily relative humidity (RH) was calculated by

Table 2. Ingredients and nutrients composition of TMR fed during feeding trial (g/kg DM basis or as mentioned)

Attribute	Group		
	$S_{0\%}$	$S_{50\%}$	$S_{100\%}$
Ingredients composition			
Berseem fodder	400	200	0
Corn silage	0	200	400
Wheat straw	200	200	200
Mustard oil cake, solvent extract	128	128	128
Ground barley grain	104	104	104
Gram chuni	80	80	80
Wheat bran	80	80	80
Micronutrient mixture[β]	8	8	8
Nutrients composition			
DM	598.9	622.7	646.5
CP	167.4	147.0	126.6
EE	31.7	30.4	29.2
Ash	88.7	78.8	68.9
NDF	467.6	475.9	484.2
ADF	252.6	259.4	266.2
ADL	44.2	44.0	43.7
Total CHO	712.2	743.8	775.3
NFC	244.6	267.9	291.1
Ca	11.1	11.3	11.5
P	4.4	7.4	10.3
ME, Mcal/kg DM	2.24	2.25	2.26

[β]Micronutrient mixture consisted (kg^{-1}) of 700,000 IU of vitamin A, 70,000 IU of vitamin D_3, 250 mg of vitamin E, 190 g of Ca, 90 g of P, 50 g of Na, 19 g of Mg, 1.2 g of Cu, 9.6 g of Zn, 1.5 g of Fe, 6.0 g of Mn, 325 mg of I, 150 mg of Co, 10 mg of Se.

the difference of dry bulb temperature and wet bulb temperature.

Respiration rate (RR) of the animals was recorded by observing flank movement and one inward and outward movement was counted as one respiration and recorded/minute. To record the pulse rate (PR), coccygeal artery was palpated and recorded/ minute. Immediately after recording pulse rate, rectal temperature (RT) was recorded using mercury in glass clinical thermometer (Qingdao Dacon Trading Co. Ltd., Shandong, China), inserted 7 cm in the rectum for at least 2 min and the rectal mucosa was in contact with the bulb of the thermometer.

Data of the study were subjected to analysis of variance using the General Linear Model (GLM) procedure of the Statistical Software Package (SPSS for windows, V21.0; Inc., Chicago, IL, USA). The effect of green fodder replacement with corn silage on performance, feed efficiency measures and blood metabolites were tested using the following model:

$$Yijk = \mu + Ti + Tj + (T \times D)ij + eijk$$

Where; *Yijk* is dependent variable, μ is overall mean of the population, *Ti* is mean effect of the treatment, *Dj* is mean effect of day of sampling (j=0, 30, 60 and 90 days of dietary treatment), *(T×D)ij* is effect of the interaction between treatment and period and *eijk* is unexplained residual element assumed to be independent and normally distributed. Individual animals were used as the experimental unit for all data. The pair-wise comparison of means was carried out using "Tukey's honest significant difference (HSD) test". Significance was determined at $P<0.05$ and the values are presented in the tables. Error bars in figures depict standard error. The data were also analyzed for correlation coefficient (r) and coefficient of variation (CV). Cost of feeding of silage as the replacement of green fodder was calculated at the end of 90 d study period.

RESULTS AND DISCUSSION

In the present study, corn silage was well preserved as indicated by their high lactic acid content and low pH value, NH_3-N content and butyric acid content. Ensilaged maize fodder retained their physical characteristics and silage smells slightly acidic and fruity, appeared brownish-yellow with loose and soft and non-viscous texture. Core silage temperature in the bunker was 32°C which was slightly higher than ambient temperature. Flieg points calculated by means of the pH values and DM content also denoted a very good quality of prepared corn silage. The DM content and values of other nutritive constituents were within ranges reported previously by NRC (2001) for typical corn silage. The corn silage prepared in the present study had a DM concentration of 270 g/kg fresh silage which was near the optimum stage of maturity at harvest as reported by Phipps *et al.* (2000), Keady *et al.* (2002b) and Keady *et al.* (2007). Fisher and Lessard (1987) reported that the DM, CP and ADF contents were 32.5, 8.0 and 27.0% for corn silage which was in accordance with the findings of the present study. The pH of silage is one of the simplest and quickest ways of evaluating its quality, as silage properly fermented will have a much lower pH as acids such as formic acid (Wang *et al.,* 2009), acetic acid (Queiroz *et al.,* 2013) and propionic acid (Mills and Kung, 2002) can quickly decrease pH at the beginning of ensiling. Kung and Stoke (2001) also reported pH values in the range from 3.7- 4.2 for maize silage. Similar results were obtained by Church (1991), Etman *et al.,* (1994), McDonald *et al.,* (1995), and Sheperd and Kung (1996). Above cited studies reported that pH values for maize silage ranged from 4.2-4.5.

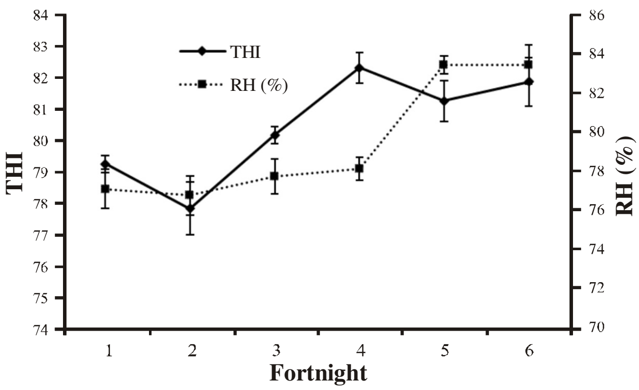

Fig. 1. Mean THI and RH recorded during experimental period

Lactic acid is the most abundant acid, around 75% of the total acids contained in silage. In high quality corn silage, it ranged between 4-7% (Seglar, 2003). The lactic acid content of the silage of the present study was within the optimum range. Langston *et al.* (1958) stated that high quality silage is characterized by low NH_3-N concentration. The NH_3-N and VFAs content of the corn silage in the present study felled within the range observed by Sheperd and Kung (1996). In the present study, prepared corn silage had a Flieg index of 84.20, characterized by a typical very good fermentation quality (Moselhy *et al.,* 2015). Mafakher *et al.* (2010) studied the chemical composition and quality characteristics of corn, sunflower, and corn-sunflower mixture silages and found highest Flieg index (103.01) and the best pH value (3.66) for corn silage compared to other silages.

The present study was conducted between the months of May to July. As the days of experimental period proceeded, THI and RH also increased (Figure 1). Mean THI and RH values during 90 days of the experimental period were 80.48 and 79.52 %, respectively. Thus, the heifers were in moderate heat stress. Researchers stated 25 °C ambient temperature as the upper critical temperature and 72 as the upper critical THI (Bernabucci *et al.,* 2002; NRC, 2005).

As the level of inclusion of corn silage increased numerical values of RR, PR, and RT also increased but

Table 3. Feed intake, growth performance, and blood metabolites of animals fed TMR containing different levels of corn silage

Attribute	Groups			SEM	P value	$r^{¥}$	CV^{β}
	$S_{0\%}$	$S_{50\%}$	$S_{100\%}$				
Physiological response, feed intake and growth performance							
Respiration rate, min^{-1}	15.79	16.17	16.34	0.643	0.692	0.218	0.114
Pulse rate, min^{-1}	59.88	60.52	60.98	0.941	0.502	0.029	0.059
Rectal temperature, ºF	100.15	100.78	101.12	0.227	0.994	0.284	0.026
DMI, kg/d	4.33^{a}	4.93^{ab}	5.16^{b}	0.16	0.032	0.217	0.298
ADG, g/d	618.52	620.74	633.33	19.50	0.950	0.048	0.344
Hematological parameters							
RBCs count, 10^6/µl	8.52	8.95	8.20	0.49	0.424	0.157	0.068
WBCs count, 10^3/µl	13.95	13.97	14.67	1.03	0.912	0.098	0.029
Hb, g/100 ml	9.90	10.22	9.64	0.38	0.576	-0.106	0.029
PCV, %	32.44	33.80	32.12	1.37	0.686	-0.038	0.027
MCV, fl	38.32	36.37	39.48	1.08	0.424	0.157	0.041
MCH, pg	11.50	10.96	11.88	0.33	0.184	0.249	0.070
MCHC, g/100 ml	30.03	30.15	30.10	0.21	0.768	0.031	0.002
Blood biochemical parameters							
ALT (IU/L)	6.01	5.73	6.12	0.23	0.247	0.060	0.033
AST (IU/l)	25.62	25.73	26.05	0.79	0.896	0.094	0.009
De Rittis Index	4.31	4.56	4.32	0.20	1.000	0.028	0.013
ALP (IU/l)	27.54	26.44	28.49	1.23	0.150	0.128	0.037
Ca (mg/100 ml)	10.17	9.38	10.09	0.35	0.672	-0.031	0.044
P l (mg/100 ml)	5.53	5.40	5.80	0.23	0.762	0.113	0.036

De Rittis Index calculated as ratio of AST and ALT, SEM, standard error of mean; ^{a,b}mean with different superscript in a row differs significantly (P<0.05), $^{¥}$greater (r>0) or lower (r<0) than zero value of Pearson square correlation coefficient showed positive or negative correlation whereas, zero (r=0) value showed no correlation between treatment and attributes, $^{\beta}$coefficient of variation.

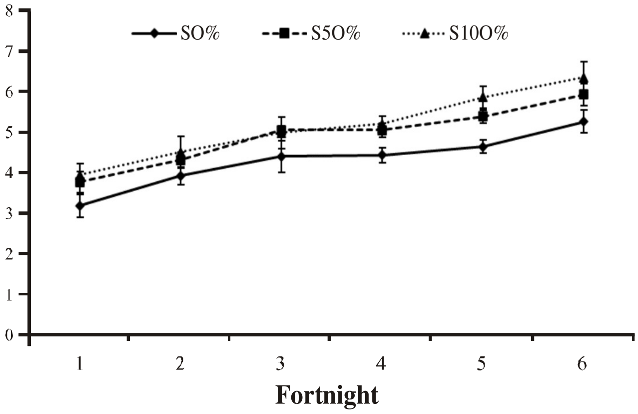

Fig. 2. Effect of green fodder replacement with corn silage on DMI

statistical analysis showed non-significant impact of rreplacement (Table 3). Physiological variables showed weak positive correlation with treatment. No information is available regarding the effect of replacement of green fodder with corn silage on physiological response of dairy animals. Numerically lower RR, PR, and RT in cows receiving TMR with higher green fodder proportion than those receiving TMR with higher corn silage proportion indicated cooling effect of green fodder (Singh, 1997). Roughage diets, which are lower in ME density and NDF content; appear to contribute less to metabolic heat load. Different proportions of green fodder in the ration can alter fibre quality, quantity, dietary vitamin A levels, dietary β-carotene levels and some dietary intake of minerals. These factors have several marked effects on digestion and physiological response of dairy animals (Van Soest, 1994).

Statistical analysis of data revealed that the replacement of green fodder with corn silage affected daily DMI significantly ($P<0.05$) and intake was reported highest in $S_{100\%}$ group (Table 3; Figure 2). Although the DMI increased with an increased level of inclusion of corn silage but ADG was similar among all three groups. Green fodder replacement with corn silage showed a positive correlation with DMI and ADG.

It is perhaps predictable that the substitution of green fodder by maize silage would cause a positive effect on voluntary forage intake without altering cattle

Table 4. Cost economics of replacing green fodder with corn silage

Attributes	Group		
	$S_{0\%}$	$S_{50\%}$	$S_{100\%}$
DMI, kg/d	4.33	4.93	5.16
ADG, g/d	618.52	620.74	633.33
Parts of concentrate mixture in TMR, g/kg DM	400	400	400
Parts of berseem fodder in TMR, g/kg DM	400	200	0
Parts of corn silage in TMR, g/kg DM	0	200	400
Parts of wheat straw in TMR, g/kg DM	200	200	200
Cost of concentrate mixture, INR/kg DM	23.19	23.19	23.19
Cost of berseem fodder, INR/kg DM	16.67	16.67	-
Cost of corn silage, INR/kg DM	-	18.52	18.52
Cost of wheat straw, INR/kg DM	7.22	7.22	7.22
Cost of TMR, INR/kg DM	17.39	17.76	18.13
Total cost of TMR intake, INR/animal/d	75.24	87.56	93.50
Cost of gain, INR/kg gain/d	118.49	135.54	140.18
Cost difference, INR/d	-	12.32	18.26
DMI difference, kg/d	-	0.600	0.830
ADG difference, g/d	-	11.00	32.00

INR, Indian rupees.

performance due to their high palatability. There are several examples in the literature where maize silage inclusion has stimulated voluntary forage intake (Hameleers, 1998; Mulligan *et al.,* 1999), although this is generally accompanied by little or no effect on the performance of dairy animals. Keady *et al.* (2007) offered grass silage either as the sole forage or in addition to maize silage in continental cross beef steers and found that the inclusion of corn silage in the diet increased DM intake. The corn silage intake was higher than cattle fed with fresh Napier grass (Siddque *et al.,* 2015) and Napier grass silage (Bureenok *et al.,* 2012). Juniper *et al.* (2005) replaced different levels of grass silage with corn silage in the basal diet of Simmental × Holstein-Friesian steers and found that the forage DM intake increased linearly with the increased level of inclusion of maize silage. The linear intake response to forage substitution observed in the current experiment has also been reported previously with dairy cows (O'Mara *et al.,* 1998; O'Kiely and Moloney, 2000; Phipps *et al.,* 2000). El-Ayouty *et al.* (2000) also found that up to 100 % of maize silage can be fed to rabbits without affecting the growth performance. Fazaeli *et al.* (2006) observed non-significant effect of inclusion of different levels of corn and sorghum silage on body weight gain of yearling male calves. Thus, the results suggest that corn silage has the potential to replace green fodder in the diets fed to growing cattle. Low feed intake and similar gain in the heifers of green fodder fed group might be due to better metabolizability of ration than corn silage fed groups.

In the present study, hematological attributes showed non-significant effect of the replacement of green fodder with corn silage (Table 3). Effect of green fodder replacement with corn silage showed a weak positive correlation with RBCs count, WBCs count, MCV, MCH, and MCHC and weak negative correlation with Hb content and PCV value. CV for haematological attributes in different groups ranged between 0.2-7.0%. Information pertaining to the variability of hematological parameters in animals fed on varying levels of corn silage is scanty. The hematological attributes reported in the present study were within the range reported earlier (Singh, 2016; Singh, 2019) in growing indigenous cattle. Amuda and Okunlola (2018) also found that PCV and Hb concentrations in the blood did not differ among West African Dwarf Sheep fed on different levels of ensiled maize stover. However, there were significant ($P<0.05$) differences in RBC and WBC concentration between the dietary treatments such that it was highest in the diet with more ensiled maize stover.

No significant differences in the ALT, AST, De Rittis index, ALP, and plasma Ca and P were observed among $S_{0\%}$, $S_{50\%}$ and $S_{100\%}$ groups. Data on AST, ALT and ALP concentrations were within normal physiological limits and corroborate to those reported by Sharma *et al.* (2014) and Singh *et al.* (2016) in healthy indigenous heifers. Plasma ALT, AST, De Rittis index, ALP, and P concentration showed weak positive correlation and plasma Ca levels showed a weak negative correlation with treatment. CV for blood biochemical attributes in different groups ranged between 0.9-4.4 %. Chen *et al.* (2015) also observed no difference in serum concentrations of ALT and AST among treatments having different proportion of forage. Little and Manston (1972) compared corn silage and alfalfa hay as forages for dairy cattle and found slightly higher P and slightly lower Ca in the blood of the corn silage fed cows, but were within physiological range.

Cost of feeding increased with the increased level of inclusion of corn silage (Table 4). Cost difference denoted that 12.32 and 18.26 INR/d required more in $S_{50\%}$ and $S_{100\%}$ groups, respectively than $S_{0\%}$ group while heifers were gaining at the similar rate. Higher cost economics for replacement of green fodder with corn silage was due to less metabolizability of corn silage than green fodder.

Cost economics for replacement of green fodder with corn silage was due to less efficiency of corn silage utilization than green fodder. Bose *et al.* (2014) observed lower total feed cost in more efficient calves than less efficient calves over the course of the 52 day feeding period in Murrah buffalo calves.

CONCLUSION

Results of the present study demonstrate that prepared corn silage was well preserved and of very good quality. Replacement of green fodder with corn silage increased feed intake and cost of feeding while growth performance was similar. Replacement of green fodder with corn silage did not exert any effect on physiological response, hematological attributes, and blood metabolites. Corn silage can be used as an alternative to high quality green fodder during scarcity period without affecting performance of dairy animals.

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Received on 28-07-2020 and accepted on 12-08-2020