INTERNATIONAL JOURNAL OF ADVANCED BIOLOGICAL RESEARCH

www.scienceandnature.org

EFFECT OF FEED ADDITIVES ON DIGESTIBILITY OF NUTRIENTS AND BLOOD CONSTITUENTS OF CROSS BRED COWS

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ABSTRACT
An experiment was conducted with twelve crossbred cows Holestein Fresian X Sahiwal (HFXS) and Jersy X Sahiwal (JXS) nearly similar stage of lactation were selected to assess the effect of dietary incorporation of three feed additives mainly Ventrimin (A), Nutricell (B) and Performax (C). Animals were also divided into three groups (T1, T2 and T3) as uniformly as possible with regard to similar stage of lactation and were offered feed containing above feed additives. Average digestibility of nutrients and biochemical attributes of blood were the criteria employed for evaluation. Average digestibility of nutrients and blood attributes show the significant differences (P<0. 05) among the groups. Digestibility of DM, EE, NFE, OM, CP and CF were significantly improved in T3. The overall efficiency of feed additives on various blood constituents showed that the calcium content in the blood was highest in T_3, phosphorus content in T_1, total protein in T_2, SGOT and SGPT were found highest in T_3 group animals. It is concluded that supplementation of feed additives in the diet of crossbred cows give beneficiary effects on nutrient digestibility and blood constituents without any adverse effect on milk production and nutrient intake in cows.

KEY WORDS: Cross bred, feed additives, digestibility coefficient, blood.

INTRODUCTION

In India livestock producers depends on natural pasture and crop residues, mainly wheat and rice straw during the dry season, which are having low in digestibility of nutrients and also are usually imbalanced in essential nutrients, leading to low feed intake and poor performance. Feed additives and supplements have played a very important role in enhancing the performance of dairy animals especially in digestibility of essential nutrients in the body. Today they are necessary in any feed formulation and essential for the formulation of a balanced diet. Feeding animals with feed additives can improve utilization efficiency of the feeds, which results in increased digestion rate and better growth performance (Frizzo *et al*., 2010; Kawakami et al., 2010; Frizzo *et al*., 2011). The main and effective function of mineral feed additives in livestock to help in extreme cold and in high temperature maintaining their health and productive potential in winter and summer stress respectively. Performance of agricultural livestock can be improved by using Phytogenic feed additives (Mirzaei and Hari 2012). In view of the aforesaid, the present research work was planned at the dairy farm, Banaras Hindu University, Varanasi. The plan of work comprised finding out the effect of feed additives and their impact on digestibility of nutrients and blood profile in crossbred cows fed different feed additives based diets.

MATERIALS & METHODS

This investigation was undertaken to the digestibility of nutrients and blood parameters response in lactating crossbred cows on diet containing different feed additives at dairy farm, Department of Animal Husbandry and Dairying, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi. The trial was conducted on 12 crossbred cows Holestein Fresian X Sahiwal (HFXS) and Jersy X Sahiwal (JXS) nearly similar stage of lactation were selected from the herd maintained at the dairy farm. All the 12 crossbred cows were randomly divided into 3 groups with 4 animals in each group according to their milk production and body weight to maintain the similarity in the trial. Three feeding trial into three seasons i.e. summer, Rainy and winter was conducted for 120 days duration in one season. After one season of feeding, 7 days digestibility trial was conducted to know the effect of feed additives on digestibility of nutrients and blood parameters i.e. calcium content, phosphorus content, total protein, SGOT and SGPT in blood of crossbred cows.

Feeding management

The cross bred cows of all the groups were fed according to NRC feeding Standards (1985) and calculate the amounts of DM, DCP and TDN on the body weight basis and treatments applied as given below:

Group T_1-Concentrate mixture, roughages with feed additive-A (Ventrimin)
Group T_2- Concentrate mixture, roughages with feed additive-B (Nutricell)
Group T_3- Concentrate mixture, roughages with feed additive-C (Performax)

Digestion trial

Representative samples of feed, left over and faeces were subjected to chemical analysis for determination of crude protein, crude fibre, ether extract, ash and nitrogen free extract following the methods of (AOAC, 1990). A digestibility trial of 7 days duration, in the mid of the lactation trial, was conducted to determine the digestibility coefficient of dry matter, organic matter, crude protein, ether extract, crude fibre and nitrogen free extract. During digestion trial, the daily records of the feed intake, residue left and the faeces voided were maintained accordingly. The oven dried sample of feed offered, residue and faeces voided were analyzed for proximate principles.

Blood samples from the experimental cows were collected twice, at the start of the feeding period (December) and after 140 days on feed. Blood samples were always collected between 10 a.m. and noon in order to standardize time related variables which are known to influence certain blood components. All blood samples were taken from the jugular vein using vacutainer tubes in sterilized and vacuumized test tube without any anti-coagulant. The test tube containing blood was kept in slanting position at room temperature for serum collection. The serum was centrifuged and stored at 4^0 C in plastic vials in a refrigerator until analyzed. During analysis the serum, serum components like Calcium, Inorganic phosphorous, total protein, SGOT and SGPT were determined by colorimetric techniques in serum using kits from Diamond Diagnostica Company, Egypt and measured by spectrophotometer in the UV range (240nm).

Statistical analysis

Data were analyzed using the general linear model of the Statistical Analysis System (SAS 2002). Duncan's multiple range tests was used to separate treatment means. The response variables were analyzed using the statistical model:

$$Yijk = \mu + Pi + \alpha j + \beta (xijk - X.) + \epsilon_{ijk},$$

Where,

Yijk = dependent variable,
μ = overall mean,
Pi = the i^{th} parity effect (block),
αj = the j^{th} treatment effect,
β = the true common slope of the regression line,
X = The overall mean of the covariate,
ϵ_{ijk} = random effect.

RESULTS AND DISCUSSION

Digestibility of Nutrient

Data in Table.1 revealed the digestibility of nutrients in cross bred cows fed different feed additives. The significance differences ($P<0.05$) were found regarding the digestibility of all nutrients as a result of feeding different feed additives during digestion trails. Digestibility of nutrients of T_1 group was higher in Jersy x Sahiwal breed than Holestein Fresian x Sahiwal in respect of DC of DM, OM and NFE but DCs of CP, EE and CF were higher in Holestein Fresian x Sahiwal breed than Jersy x Sahiwal breed cows. The DCs of DM, CP, CF and NFE were higher in Holestein Fresian x Sahiwal breed than Jersy x Sahiwal breed but DCs of OM and EE were higher in Jersy x Sahiwal breed than Holestein Fresian x Sahiwal breed cows in T_2 treatment group. In T_3 treatment group the DC of DM was only higher in Jersy x Sahiwal group than Holestein Fresian x Sahiwal breed animals but the DCs of OM, CP, EE, CF and NFE all were higher in Jersy x Sahiwal breed than Holestein Fresian x Sahiwal breed cows. The overall efficiency of feed additives on digestibility of nutrients into experimental groups of cows were calculated in all three treatment groups during all three seasons of experiment trial and values expressed that the DC of DM was highest in T3 group followed by T_2 and T_1 groups. DCs of OM, CP and CF were also highest in T_3 followed by T_1 and T_2. The DCs of EE and NFE were highest in T_3 followed by T_2 and T_1 group animals. Astawa *et al.,* (2011) showed that the supplementation of vitamin-mineral in commercial feed did not increase the digestibility of DM, OM, CP and EE except for DM and OM digestibilities at 0.2 % supplementation ($P<0.05$). Sahoo *et al.,* (2009) observed higher digestibility of nutrients viz DM, OM, CP, EE, CF and NFE, which are similar to present study.

Seasonal variation due to breeds on digestibility of nutrients

In the present study, the digestibility coefficient of DM was highest in B_1 breed in winter season than rainy and summer season, respectively. In case of B_2 breed, also it was highest in winter season followed by summer and rainy season. The DC of OM for B_1 breed was higher in winter season followed by rainy and summer season However, the same pattern followed in B_2 breed with highest DC of OM in winters than rainy and summer season (Table 2). The DC of CP was also higher in winters in B_1 breed followed by summer and rainy season whereas, in B_2 breed, pattern was changed and the DC of CP was highest in summer followed by winters and rainy season. The DC of EE in B_1 breed was higher in summer followed by winter and rainy season. For B_2 breed the same pattern followed with higher DC of EE in summer followed by winter and rainy season. The DC of CF was also higher in summer followed by winter and rainy season in both B_1 and B_2 breeds. The DC of NFE in B_1 breed was highest in winter followed by rainy and summer season while in B_2 breed the DC of NFE was also highest in winters followed by rainy and summer season (Table.2). There was significant difference in the digestibility of nutrients between the breeds in different seasons ($P<0.05$). Gowda *et al.* (2004) studied the nutrient utilization in lactating CB cows fed diets supplemented with different minerals and the digestibility of major nutrients did not differ between the groups except for EE.

Overall feed efficiency of digestibility of nutrients

The overall efficiency of feed additives on digestibility of nutrients into experimental groups of cows was calculated in all three treatments during all three seasons of experimental trial and values given in Table-3. The DCs of DM, EE and NFE were highest in T3 group followed by T2 and T1 groups and the DCs of OM, CP and CF were also highest in T3 followed by T1 and T2 groups. The DCs of EE and NFE were highest in T3 followed by T2 and T1 groups. The results were significantly different in both breeds during all three seasons ($P<0.05$). Manda *et al.,* (2007) reported no significant difference in digestibility of DM, CP, EE and NFE between the groups

.**TABLE 1:** Seasonal effect of various feed additives on Digestibility of nutrients in crossbred cows

Treatment groups	Digestibility coefficient of DM (%)	Digestibility coefficient of OM (%)	Digestibility coefficient of CP (%)	Digestibility coefficient of EE (%)	Digestibility coefficient of CF (%)	Digestibility coefficient of NFE (%)
Summer Season						
T_1	61.55±1.13 [a]	62.95±0.57[a]	59.58±1.40[a]	60.78±0.22[a]	57.55±0.75[a]	69.74±0.70[a]
T_2	61.85±0.57 [a]	62.24±0.55[a]	60.16±0.69[a]	61.20±0.66[a]	57.15±1.04[a]	70.09±0.39[a]
T_3	62.97±1.30 [a]	62.87±0.37[a]	59.93±0.94[a]	60.72±0.20[a]	58.89±0.58[a]	70.77±0.38[a]
Rainy Season						
T_1	64.17±0.63 [a]	64.59±1.20[a]	61.34±0.46[a]	63.62±0.51[a]	60.08±0.56[a]	72.00±0.39[a]
T_2	63.93±0.86 [a]	65.51±1.80[a]	62.02±0.61[a]	63.99±0.25[a]	60.28±0.26[a]	71.69±0.26[a]
T_3	64.79±0.57 [a]	66.07±0.65[a]	62.80±0.78[a]	65.22±1.26[a]	60.21±0.58[a]	72.00±0.30[a]
Winter Season						
T_1	58.72±0.63[b]	62.61±0.32$_a$	62.38±0.25[a]	65.22±0.17[ab]	64.35±1.02[a]	67.26±0.85[a]
T_2	62.08±0.63[a]	62.16±0.76[a]	60.44±0.33[b]	65.73±0.51[a]	62.80±0.36[a]	67.22±0.42[a]
T_3	64.00±1.41[a]	62.52±0.41[a]	62.65±.33[a]	64.21±0.51[b]	63.24±1.11[a]	68.11±0.80[a]

Means within the same column, with the same letters are not significantly different (P<0.05)

TABLE 2: Seasonal variation due to breeds on digestibility of nutrients in different groups

Treatment groups	Season	Digestibility coefficient of DM (%)	Digestibility coefficient of OM (%)	Digestibility coefficient of CP (%)	Digestibility coefficient of EE (%)	Digestibility coefficient of CF (%)	Digestibility coefficient of NFE (%)
B_1	Summer	61.03±1.23[c]	62.21±0.46[c]	61.10±0.41[abc]	65.18±0.51[a]	64.13±0.70 [a]	67.96±0.62[c]
	Rainy	62.20±1.09[bc]	62.38±0.38[c]	60.26±2.83[bc]	60.70±0.35[b]	58.61±0.64[cd]	70.18±0.55[b]
	Winter	63.64±0.39[ab]	65.96±1.12[a]	62.86±0.52 [a]	64.22±1.05 [a]	60.29±0.38[b]	71.29±0.26[ab]
B_2	Summer	62.17±1.16[bc]	62.65±0.34[c]	61.87±0.37[ab]	64.92±0.34 [a]	62.79±0.68 [a]	67.10±0.47[c]
	Rainy	62.04±0.52[bc]	63.00±0.40[bc]	59.52±0.79[c]	61.10±0.29[b]	57.12±0.62[d]	70.22±0.29[b]
	Winter	64.95±0.56[a]	64.82±0.90[ab]	61.25±0.30[abc]	64.33±0.67 [a]	60.09±0.37[bc]	71.87±0.29[a]

Means within the same column, with the same letters are not significantly different (P<0.05)

TABLE 3: Overall feed efficiency of digestibility of nutrients into experimental groups of cows

Treatment groups	Digestibility coefficient of DM (%)	Digestibility coefficient of OM (%)	Digestibility coefficient of CP (%)	Digestibility coefficient of EE (%)	Digestibility coefficient of CF (%)	Digestibility coefficient of NFE (%)
T_1	61.48±0.80[b]	63.38±0.49[a]	61.10±0.57[a]	63.21±0.58[a]	60.66±0.94[a]	69.35±0.59[a]
T_2	62.62±0.46[ab]	63.30±0.77[a]	60.87±0.38[a]	63.64±0.72[a]	60.07±0.77[a]	69.67±0.59[a]
T_3	63.92±0.64[a]	63.82±0.54[a]	61.46±0.52[a]	63.38±0.71[a]	60.78±0.68[a]	70.29±0.56[a]

Means within the same column, with the same letters are not significantly different (P<0.05)

Biochemical attributes of blood

The effect of feed additives on various blood constituents into experimental groups of cows was determined in all three treatment groups during all the seasons of experimental trial and results showed that the calcium content in blood of animals was highest in T_3 group, using feed additive C followed by T_2 and T_1 groups animals. Phosphorus content in blood of animals was highest in T_1 group followed by T_2 and T_3 group animals. In total protein of blood T_2 group was highest followed by T_3 and T_1 groups. SGOT in blood was highest in T_3 group followed by T_2 and T_1. SGPT was highest in T_3 group followed by T_1 and T_2 group animals. Martyna *et al.,* (2006) also studied the effect of feed supplementation of a mineral mixture on contents of blood serum of crossbred cows; there was significant relationship between the protein and casein contents in blood and milk sample. Singh *et al.,* (2011) evaluated the mineral profile of feeds, fodders and animals in Orissa region and found the average serum Ca & P in blood of cows (6.91 $\pm$ o.13 mg/dl) and (3.25 $\pm$ 0.08 mg/dl), respectively.The comparison on various blood constituents made between two breeds B_1 and B_2 in different seasons, the observations are recorded and presented in Table-4. When we talk about the B_1 breed, the calcium content in blood was highest in rainy season followed by winter and summer season. In breed B_2 it was also highest in rainy season followed by summer and winter season, respectively. The phosphorus content in blood for B_1 breed was higher in winter season followed by rainy and summer season but in B_2 breed it was highest in summer followed by rainy and winter season. Total protein content in blood was higher during summer season followed by winter and rainy season in B_1 breed and in B_2 breed pattern was same, with highest protein content was found in summer followed by winters and rainy season. SGOT in B_1 breed was also highest in summer followed by winter and rainy season, respectively but in B_2 breed higher SGOT was found during winters followed by summer and rainy season respectively. SGPT in blood was higher in rainy season followed by summer and winter season in both B_1 and B_2 breeds.

TABLE 4: Seasonal effect of feed additives on various blood constituents in crossbred cows

Treatment groups	Calcium (mg/dl)	Phosphorus (mg/dl)	Total Protein (mg/dl)	SGOT(mg/dl)	SGPT (mg/dl)
Summer Season					
T_1	9.47±0.19a	6.34±0.38a	83.61±0.44a	14.26±0.34a	22.02±0.24a
T_2	9.79±0.23a	5.82±0.26a	84.80±0.58a	14.51±0.80a	21.07±0.28a
T_3	9.82±0.18a	5.83±0.17a	84.23±0.68a	15.55±0.37a	21.34±0.57a
Rainy Season					
T_1	8.99±0.12a	6.27±0.31a	84.01±0.48a	14.01±0.17a	18.26±0.71a
T_2	8.93±0.14a	5.82±0.12a	84.91±0.0.98a	15.28±0.56a	18.33±0.48a
T_3	9.14±0.02a	5.94±0.07a	85.24±0.55a	15.38±0.58a	18.86±036a
Winter Season					
T_1	9.04±0.14a	5.58±0.33a	85.69±0.63a	14.64±0.38a	20.12±0.93a
T_2	8.98±0.09a	6.06±0.06a	86.61±0.33a	15.38±0.51a	19.99±1.00a
T_3	8.99±0.06a	5.58±0.16a	85.96±0.57a	15.29±0.47a	20.49±0.56a

Means within the same column, with the same letters are not significantly different (P<0.05)

TABLE 5: Seasonal variation due to breeds on various blood constituents in different groups

Treatment groups	Season	Calcium (mg/dl)	Phosphorus (mg/dl)	Total Protein (mg/dl)	SGOT(mg/dl)	SGPT (mg/dl)
B_1	Summer	8.93±0.05b	5.50±0.18b	86.16±0.50a	15.48±0.40a	20.38±0.66a
	Rainy	9.78±0.12a	6.14±0.19a	83.92±0.54b	14.88±0.55a	21.63±0.31a
	Winter	9.16±0.02b	6.25±0.16a	84.25±0.55b	15.00±0.52a	18.60±0.45bc
B_2	Summer	9.08±0.09b	6.10±0.04a	86.01±0.37a	14.72±0.27a	20.01±0.65ab
	Rainy	9.60±0.20a	5.85±0.27ab	84.51±0.40b	14.66±0.41b	21.32±0.38a
	Winter	8.89±0.10b	5.77±0.10ab	85.19±0.56ab	14.78±0.39a	18.36±0.41c

Means within the same column, with the same letters are not significantly different (P<0.0

Results obtained on dairy farm in this study under controlled and unbiased conditions, have statistically analyzed results (to determine whether the differences are repeatable), and have been conducted under experimental designs that would be similar to field situations, are the economic payoff. Dairy farmers and nutritionists will take it to compare and measure responses. Several tools to evaluate responses on dairy farm include digestibility of nutrients or nutrient utilization and some biochemical attributes like blood profile of crossbred cows, which will allow critical evaluation of a selected additive. Higher feed efficiency and production potential of crossbred cows can be extracted by the regular use of mineral-vitamin additives in the feed.

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