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EFFECT OF DIFFERENT FEED COMBINATIONS ON NUTRIENT INTAKE AND DIGESTIBILITY IN CROSS-BRED HEIFER

Vivek Pratap Singh, Mayank Dubey and Rajendra Kumar Pandey
Department of Animal Husbandry & Dairying, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, India

ABSTRACT
An experiment was conducted for a period of 360 days to study the nutrient intake, digestibility of feed as well as economics of replacement heifers fed different feed combinations of ration. Twenty four (Holstein Friesian × Sahiwal) and (Jersey × Sahiwal) cross-bred heifer calves of 4 to 6 month of age of 55.27 to 62 kg body weight were divided into four equal groups *viz*. T_1 (control), T_2, T_3 and T_4. The four groups of cross-breed heifers namely fed as T_1= Control (Farm ration), T_2= 50% Barley + 30% MC +10% AC + 8% WB + 2% MM, T_3= 50% Maize + 30% MC +10% AC + 8% WB + 2% MM and T_4= 50% Sorghum + 30% MC +10% AC + 8% WB + 2% MM, different feed combinations were made in order to judge the effect of different feeds on nutrients intake and its digestibility at different months. Significantly higher ($p<0.05$) nutrient intake (DM, CP, TDN and ME) was observed in the group T_3. The digestibility of nutrients (DM, OM, CP, EE, CF and NFE) were also significantly higher ($p<0.05$) in T_3 group. The total cost per heifer was highest in T_4 followed by T_3, T_2 and lowest in T_1 groups respectively.

KEY WORDS: Feed combination, nutrient intake, digestibility of nutrients, economics, cross-bred heifer.

INTRODUCTION

Limited feeding of a high-grain diet to growing cattle has been shown to have positive effects on cattle performance including decreased DMI, improved feed conversion and decreased cost of gain (Klinger *et al.*, 2007). Providing supplements with relatively high protein concentrations to ruminants consuming low-quality roughage has been shown to enhance roughage utilization and livestock performance (Gilbery *et al*., 2006). (DelCurto *et al.*, 1990) demonstrated that feeding cattle a supplement containing at least 22% crude protein increased both intake and utilization of low-quality forage. To optimize productivity it is necessary to provide the animals with quality feeds to meet nutrients requirement. Monitoring heifer growth is an important part of a sound dairy replacement program. When feeding dairy heifers, a farmer's goal is to feed a very digestible diet that will provide nutrients to keep dairy heifers healthy and allow them to grow faster, while spending less money on feed. The objective of this study was to determine nutrient intake and digestibility of nutrient in cross-bred heifer calves.

MATERIALS & METHODS

Experimental Animals and Diets

Twenty four HS (Holstein Friesian × Sahiwal) and JS (Jersy × Sahiwal) healthy female calves of 4 to 5 months of age were selected and divided into four groups (six in each group) *i.e*. T1= Control (Farm ration); T2= 50% Barley + 30% MC +10% AC + 8% WB 2% MM; T3= 50% Maize + 30% MC +10% AC + 8% WB 2% MM and T4= 50% Sorghum + 30% MC +10% AC + 8% WB 2% MM, respectively. The animals of various experimental groups were fed farm and self prepared ration comprising green fodder (MP chari, Maize, Cow pea and Berseem *etc*. depending on seasonal availability) and wheat straw as the dry roughage along with a balanced concentrate mixture and mineral (1.5 kg concentrate per animal/day from 4 to 6 months and 2.0 kg from 7 to 15 months of age) to meet the requisite nutritional requirements. The quantity of diet offered was calculated for each individual animal (dry matter basis). The experimental calves were similar in respect to size, health, body weight and age. Before the start of experiment all the animals were dewormed against internal and external parasites. The quantity of daily feed offered to each animal of the respective group and the residual left was recorded for a period of 360 days to calculate the average daily feed intake.

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, at seven, eleven and fifteen months of the experimental 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.

Statistical analysis

The data were statistically analyzed using GLM procedure of SAS (2003). Duncan's test (1955) was applied in experiment whenever to test differences. The following model was used:

$$Y = \mu + Ti + P_n + TP_{in} + e_{ins}$$

Where:

Y = observed trait
μ = overall mean
Ti = effect of i^{th} treatments (i^{th} = T_1, T_2, T_3)
e = random error
P_n = effect of n^{th} periods (n^{th} = 0, 30, 60)
TP_{in} = interaction between T_i and P_n

RESULTS & DISCUSSION

Nutrient intake

The average feed and nutrient intakes of cross-bred heifers fed different combinations of feed are shown in Table 1. It is evident from the table that the lowest DM intake was observed in animals fed diet T_1 and the highest value was recorded for diet T_3 (P<0.05). These results are in agreement with the reports of Umunna *et al.* (1980) who reported dry matter intake increase at higher protein level. Previous researchers reported that dry matter intake increased if protein levels are increased upto optimum levels (30%) for maximum gains (Beaty *et al.,* 1994). Increased CP intake with increasing CP levels in supplements in the present study corresponds well with other findings (Gilbery *et al.,* 2006). Krishna, (2000) reported that voluntary dry matter intake was higher (P<0.05) in the faunated group than in defaunated group. The results indicated that average daily intakes of DM, CP, TDN and ME were higher in animals received different combinations of feed compared with those given farm ration. There was no significant difference observed between both breeds on nutrients intake at different months (P>0.05) Table 2.

TABLE 1: Nutrients intake in crossbred heifer-calves

Treatment groups	DM intake Kg/d	DM intake % of BW	CP intake (g)	CP intake % of BW	TDN intake	ME intake
At 7 month						
T_1	2.27±0.04^{c}	2.52±0.00^{b}	508.67±5.97^{d}	0.563±0.002^{d}	1.48±0.031^{c}	5.91±0.112^{c}
T_2	2.49±0.03^{b}	2.52±0.01^{b}	614.17±4.31^{b}	0.626±0.002^{b}	1.87±0.023^{b}	7.30±0.082^{b}
T_3	2.67±0.05^{a}	2.57±0.01^{a}	734.17±8.60^{a}	0.707±0.002^{a}	2.15±0.068^{a}	8.33±0.251^{a}
T_4	2.44±0.07^{b}	2.54±0.01^{b}	587.67±11.80^{c}	0.609±0.004^{c}	1.88±0.077^{b}	7.33±0.279^{b}
At 11 month						
T_1	3.55±0.05^{d}	2.57±0.01^{b}	586.33±5.28^{d}	0.424±0.001^{c}	2.10±0.028^{c}	7.56±0.101^{c}
T_2	4.20±0.05^{b}	2.60±0.01^{ab}	714.33±5.09^{b}	0.442±0.001^{b}	2.51±0.029^{b}	9.02±0.108^{b}
T_3	4.49±0.06^{a}	2.62±0.01^{a}	843.83±6.33^{a}	0.492±0.002^{a}	2.82±0.023^{a}	10.15±0.086^{a}
T_4	3.93±0.11^{c}	2.59±0.02^{ab}	626.00±11.06^{c}	0.412±0.003^{d}	2.43±0.037^{b}	8.75±0.135^{b}
At 15 month						
T_1	4.95±0.05^{d}	2.63±0.00^{a}	732.50±5.12^{d}	0.389±0.001^{c}	3.05±0.018^{d}	11.01±0.068^{d}
T_2	6.10±0.04^{b}	2.65±0.01^{a}	910.50±4.50^{b}	0.394±0.001^{b}	3.59±0.034^{b}	12.94±0.120^{b}
T_3	6.45±0.07^{a}	2.65±0.01^{a}	1046.50±7.57^{a}	0.430±0.001^{a}	4.19±0.040^{a}	15.09±0.145^{a}
T_4	5.59±0. 11^{c}	2.63±0.01^{a}	797.16±11.28^{c}	0.275±0.002^{d}	3.29±0.064^{c}	11.84±0.230^{c}

Means with the same letter are not significantly different

TABLE 2: Effect of breed on intake of nutrients in crossbred heifer-calves

Breed	DM intake (kg/d)	DM intake % of BW	CP intake (g)	CP intake % of BW	TDN intake kg/d	ME intake Mcal/d
At 7 month						
B_1	2.48±0.06^{a}	2.54±0.01^{a}	613.58±25.43^{a}	0.625±0.015^{a}	1.84±0.82^{a}	7.19±0.298^{a}
B_2	2.45±0.05^{a}	2.53±0.01^{a}	608.75±24.57^{a}	0.628±0.015^{a}	1.86±0.079^{a}	7.25±0.286^{a}
At 11 month						
B_1	4.10±0.12^{a}	2.60±0.01^{a}	699.16±30.70^{a}	0.443±0.008^{a}	2.47±0.084^{a}	8.89±0.301^{a}
B_2	3.98±0.10^{b}	2.58±0.01^{a}	686.08±29.56^{a}	0.441±0.009 ^{a}	2.46±0.075^{a}	8.85±0.271^{a}
At 15 month						
B_1	5.83±0.19^{a}	2.64±0.01^{a}	877.58±37.20^{a}	0.395±0.006^{b}	3.57±0.136^{a}	12.87±0.492^{a}
B_2	5.72±0.16^{a}	2.64±0.00^{a}	865.75±35.39^{a}	0.398±0.006^{a}	3.49±0.124^{b}	12.57±0.448^{b}

Means with the same letter are not significantly different

Digestibility of nutrients

Data in table 3-4 revealed the effect of concentrate on digestion coefficient of the experimental ration fed cross-bred heifers at different months. Significance differences (P<0.05) were found regarding the digestibility of all nutrients as a result of feeding different feed combinations during digestion trails. In group T_3, overall digestibility of DM, OM, CP, EE, CF and NFE was significantly, (p<0.05) higher than the other groups at different months of age. In general, the digestibility coefficient of different feed nutrient was higher in (Holstein Friesian × Sahiwal) than JS (Jersy × Sahiwal) cross-bred heifers. Afzal *et al.* (2001) reported that high energy concentrate diets showed only a trend of greater N digestion, while Singh *et al.* (2007) reported significant differences regarding digestibility of DM, CP, EE and carbohydrate. Trishna *et al.* (2012) observed significantly higher (p<0.05) nutrient intake (DM, CP, DCP) was observed in the group supplied with urea treated wheat straw. The digestibility of nutrients were also significantly higher (p<0.05) in T group, Krishna, (2000) reported that digestibility of OM and CP was higher (P<0.05) in heifers fed sub optimal protein diet (67.62 vs 63.18 and 61.03 vs 52.99% respectively).

Cost economics

The total cost incurred through feed and labour were Rs. 20080, 20583.83, 21459.50 and 21891.50 in T_1, T_2, T_3 and T_4 groups, respectively. The cost of feeding per animal per day was calculated as Rs. 55.77 for Control group and Rs. 57.17, 59.60 and 59.97 for T_2, T_3 and T_4 groups,

respectively. The better cost of production was observed in the animals of T_3 group supplied with ration based on 50% Maize + 30% MC +10% AC + 8% WB + 2% MM, in the respect of digestibility and early puberty in cross-bred heifers.

TABLE 3: Effect of various feed on Digestibility of nutrients in crossbred heifer-calves

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 (%)
At 7 month						
T_1	65.20±0.44^{d}	74.89±0.62^{c}	76.74±0.87^{d}	64.86±0.29^{d}	55.04±0.64^{c}	68.29±.91^{c}
T_2	71.34±0.75^{b}	77.20±0.16^{ab}	80.21±0.86^{b}	68.81±0.58^{b}	58.49±1.38^{ab}	71.41±0.46^{b}
T_3	73.60±1.08^{a}	78.16±0.06^{a}	81.40±0.81^{a}	69.92±0.72^{a}	59.69±0.45^{a}	75.83±0.69^{a}
T_4	69.28±0.81^{c}	76.30±0.64^{d}	79.04±0.81^{c}	66.85±0.65^{c}	57.51±0.68^{b}	71.37±0.63^{c}
At 11 month						
T_1	64.95±0.24^{c}	74.19±0.73^{c}	75.68±1.33^{c}	64.16±0.85^{d}	60.98±0.51^{c}	71.60±0.54^{bc}
T_2	69.73±0.71^{b}	76.00±0.08^{ab}	79.15±0.95^{b}	68.38±0.41^{b}	63.86±0.47^{ab}	72.67±0.61^{ab}
T_3	72.23±0.12^{a}	77.21±.35^{a}	80.70±0.85^{a}	69.44±0.68^{a}	66.01±0.80^{a}	73.82±0.44^{a}
T_4	67.56±1.07^{b}	75.00±0.12^{bc}	78.43±0.87^{b}	66.30±0.57^{c}	63.07±0.46^{bc}	70.34±0.11^{c}
At 15 month						
T_1	62.36±0.86^{c}	73.02±0.16^{c}	76.01±0.37^{c}	62.59±0.61^{c}	59.38±0.76^{c}	65.63±0.22^{c}
T_2	68.62±1.78^{b}	74.62±0.39^{b}	78.30±1.19^{ab}	66.80±0.30^{ab}	60.98±0.89^{d}	67.94±0.29^{b}
T_3	70.57±1.29^{a}	75.90±0.48^{a}	79.82±0.69^{a}	67.21±1.09^{a}	62.76±0.48^{a}	70.44±0.60^{a}
T_4	67.16±0.45^{b}	73.98±0.06^{b}	77.15±1.10^{bc}	65.37±0.54^{b}	59.98±0.24^{bc}	64.05±0.11^{b}

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

TABLE 4: Effect of breeds on Digestibility of nutrients in different groups

Breed	Digestibility coefficient of DM (%)	Digestibility coefficient of OM (%)	Digestibility coefficient of CP (%)	Digestibility coefficient of EE (%)	Digestibility coefficient of CF (%)	Digestibility coefficient of NFE (%)
At 7 month						
B_1	70.65±1.89^{a}	77.01±0.56^{a}	80.19±0.98^{a}	68.18±1.19^{a}	58.48±1.04^{a}	72.41±1.51^{a}
B_2	69.10±1.65^{b}	76.27±0.83^{b}	78.51±1.00^{b}	67.05±1.03^{b}	56.90±0.99^{b}	71.05±1.58^{b}
At 11 month						
B_1	69.06±1.53^{a}	75.93±0.60^{a}	79.50±0.95^{a}	67.71±1.11^{a}	63.81±1.15^{a}	72.79±0.62^{a}
B_2	67.98±1.64^{b}	75.28±0.72^{b}	77.49±1.15^{b}	66.44±1.22^{b}	63.15±0.98^{a}	71.43±0.87b
At 15 month						
B_1	68.38±1.89^{a}	74.66±0.68^{a}	78.66±0.88^{a}	66.14±1.09^{a}	61.36±0.72^{a}	67.32±1.49^{a}
B_2	66.18±1.65^{b}	74.11±0.52^{b}	76.98±0.77^{b}	64.86±1.02^{b}	60.17±0.75^{b}	66.71±1.29^{b}

Means with the same letter are not significantly different.

CONCLUSION

From the experiment it may be concluded that supplementation of concentrate mixture, 50% Maize + 30% MC +10% AC + 8% WB 2% MM, enhanced nutrient intake, digestibility of feed and economically better for cross-bred heifers under subtropical environmental conditions of India.

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