EFFECT OF SUPPLEMENTAL RUMEN BYPASS LYSINE AND METHIONINE ON DIGESTIBILITY AND EFFICIENCY OF NUTRIENTS IN GROWING JAFFRABADI HEIFERS

M.D. ODEDRA, K. RAVIKALA, A.R. BHADANIYA and A.P. GAJERA

Department of Livestock Production Management
College of Veterinary Science & Animal Husbandry, JAU, Junagadh-362001

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Corresponding Author : arbhadaniya@yahoo.co.in

ABSTRACT

An experiment was conducted to evaluate incorporation of rumen protected lysine (LYS) and methionine (MET) on nutrient efficiency, digestibility of nutrients and plane of nutrition in 18 Jaffrabadi buffalo heifers of an organized Farm. Animals (6 each) receiving either of the dietary treatments for 180 days, divided into 12 periods each of 15 days: T1- DCP requirement met through concentrate mixture alone, T2- DCP requirement met through cottonseed cake and concentrate mixture (50:50) and T3- DCP requirement met through concentrate mixture plus supplementation of rumen bypass LYS and MET @ 5.0 g and 2.5 g/day/animal, respectively. Intakes of CP, DCP and TDN were in linearly increasing order according to growth, but the intakes were not significantly ($P>0.05$) affected due to periods or treatments. The CP and DCP efficiency (kg/kg gain) was 1.68±0.23, 1.53±0.07, 1.50±0.07 and 1.27±0.17, 1.16±0.05, 1.17±0.06, respectively, for T1, T2 and T3 treatments. The corresponding values for TDN efficiency (kg/kg body weight gain) were 7.92± 1.01, 7.73±0.36 and 7.09±0.32 for T1, T2 and T3, respectively. The CP, DCP and TDN efficiency was neither affected significantly due to experimental rations nor with periods. Treatment effect on digestion coefficients of experimental rations for DM, EE, CF, CP, NFE and OM was non-significant ($P>0.05$). Though the DMI was at par, DCP, TDN intake and Nutrient intake per unit metabolic body weight were lower and so also DE, ME intakes compared to ICAR recommended levels. However, protein energy ratio was at par in all the experimental groups with ICAR levels.

KEY WORDS: Jaffrabadi heifers, Nutrients intake, Bypass methionine and lysine, growth efficiency.

INTRODUCTION

Jaffrabadi buffalo heifers, a heavy breed of Saurashtra region of Gujarat state (adult BW 650 kg) are bred at average body weight of 337 kg with age at first calving hovering around 50 to 55 months (Anonymous, 2011). Manipulation of growth rate to average rate of 500 g per day, can reduce the AFC to around 40 months (Bhatti *et al*., 2007). Nutritional management, a valuable tool that embodies concentrate feeding coupled with bypass amino acid feeding for making limiting amino acids available in lower gut, may provide desirable growth in Jaffrabadi heifers to attain required body weight for conception. Besides growth, digestibility and efficiency of nutrients are also expected to be enhanced (Socha *et al.,* 2005; Gaffar *et al.,* 2014), hence these were analysed to know the effect of feeding of protected lysine and methionine in Jaffrabadi buffalo heifers.

MATERIALS AND METHODS

Eighteen Jaffrabadi Heifers (15 to 21 months) of the Cattle Breeding Farm, Junagadh Agricultural University, Junagadh, selected were randomized and blocked into three groups of six each and were offered protein requirement (ICAR, 1998) through commercial concentrate mixture in T1, protein requirement split through commercial concentrate plus cottonseed cake (50:50) in T2, and commercial concentrate mixture supplemented with rumen bypass LYS and MET @ 5.0 and 2.5 g/animal/day (commercially procured, *Metipearl* and *Lysipearl*, Kemin Industry Asia Ltd.) in T3 treatment, respectively, besides routine seasonal green fodder @ 10 kg per animal and mature

pasture grass hay *ad. libitum*. Animals had free access to fresh, clean drinking water. The study last for 180 days, which was divided into 12 equal periods (P1 to P12) each of 15 days. Along with growth rate, the CP, DCP, TDN intake, their efficiency for growth, digestibility coefficients of nutrients of experimental rations and plane of nutrition met with in relation to ICAR recommendation were also worked out.

A digestion trial of seven days was conducted at the end of the experiment to know the effect of treatments on digestibility of feed and fodder. During the digestion trial, all the dung voided by individual heifers was collected manually, preserved for estimation of nitrogen in sulphuric acid and sampled for daily dry matter. Individual samples of feed, fodder and dung were pooled and analysed for proximate nutrients (AOAC, 1995). The data were then analyzed statistically.

RESULTS AND DISCUSSION

Nutrients Intake for Growth

The mean CP intake ranged from 654.54 ± 27.12 to 1016.47 ± 31.63 g/day across periods and treatments (Table 1). Mean CPI /day did not differ significantly (P>0.05) among different treatments. Intake of this nutrient during different periods increased linearly on higher side concomitant to growth in experimental heifers and hence the demand for more DM and CP. Overall average means of CPI among the treatments T1, T2 and T3 were 812.31 ± 33.61, 802.08 ± 34.15 and 840.75 ± 32.94 g/day, respectively, which did not differ significantly (P>0.05). Animals under T3 consumed 3.38 per cent and 4.60 per cent more CP than those in T1 and T2, respectively.

Table 1: CP, DCP and TDN intake of growing Jaffrabadi buffalo heifers during experimental period (n=6)

	T1	T2	T3	S Em	CD 5 %	CV %
CP Intake (g/day)						
P1	667.32±34.66	654.54±27.12	666.95±28.70	30.34	NS	11.21
P12	944.08±36.38	966.98±40.09	1016.47±31.63	36.21	NS	9.09
OVERALL	812.31±33.61	802.08±34.15	840.75±32.94	33.58	NS	10.05
DCP Intake (g/day)						
P1	502.62±26.11	496.14±20.56	518.15±22.29	23.11	NS	11.19
P12	711.08±27.40	732.97±30.39	789.70±24.58	27.56	NS	9.07
OVERALL	611.83±25.32	607.98±25.89	653.18±25.59	25.60	NS	10.05
TDN Intake (kg/day)						
P1	3.27±0.13	3.41±0.12	3.29±0.11	0.12	NS	8.86
P12	4.35±0.14	4.79±0.18	4.68±0.13	0.15	NS	7.99
OVERALL	3.83±0.13	4.06±0.15	3.98±0.13	0.14	NS	8.54

*Total experiment duration was six months, which was divided into P1-P12 periods, each of fortnights. Due to non-significant effect of treatments during different periods, the values of only first and last periods are given in table.

The DCP intake varied from 496.14±20.56 to 789.70± 24.58 g/day across all the periods and treatments (Table 1). DCP intake was not affected significantly (P>0.05) between treatments during any of the periods. Increased linear effect of intake in consonance with the growth of heifers as the experiment advanced was clearly appreciated. Overall means of DCP intakes for T1, T2 and T3 were 611.83±25.32, 607.98±25.89 and 653.18± 25.59 (g/day), respectively. Cottonseed cake fed group (T2) consumed 0.63 per cent and 7.43 per cent less DCP intake than T1 and T3.

The overall TDN intakes (kg/day) in T1, T2 and T3 were 3.83±0.13, 4.06±0.15 and 3.98±0.13, respectively (Table 1), the differences were non-significant (P>0.05). According to responses to

Table 2: CP, DCP and TDN efficiencies of growing Jaffrabadi buffalo heifers during experimental period

	T1	T2	T3	SEm	CD 5 %	CV %
CP Intake (kg/kg wt. Gain)						
P1	1.32±0.26	1.28±0.31	1.50±0.56	0.40	NS	71.09
P12	2.70±0.40	2.58±0.25	3.20±0.43	0.37	NS	32.03
OVERALL	1.68±0.23	1.53±0.07	1.50±0.07	0.14	NS	22.27
DCP Intake (kg/kg wt. Gain)						
P1	1.00±0.19	0.97±0.23	1.16±0.43	0.31	NS	71.70
P12	2.04±0.30	1.96±0.19	2.48±0.34	0.28	NS	32.09
OVERALL	1.27±0.17	1.16±0.05	1.17±0.06	0.11	NS	22.08
TDN Intake (kg/kg wt. Gain)						
P1	6.45±1.22	6.71±1.62	7.41±2.76	1.98	NS	70.72
P12	12.43±1.78	12.75±1.21	14.68±1.96	1.68	NS	30.98
OVERALL	7.92±1.01	7.73±0.36	7.09±0.32	0.65	NS	20.90

*Due to non-significant effect of treatments during different periods, the values of only first and last periods are given in table.

enhanced growth during different periods in linear fashions the increase in TDN intake over the periods was linear across all the treatments. It ranged from 3.27 ± 0.13 (T1) to 4.79 ± 018 (T2) kg/day.

Birthal and Parthasarathy (2002) opined that cottonseed meal had the disadvantage of low CYS, MET and LYS, with LYS being the first limiting amino acid. In T3 group of heifers on supplementation of bypass amino acids LYS and MET, higher growth rate was recorded than the other two groups. Higher growth demanded higher DMI and consequently higher nutrients intake (Birthal and Parthasarathy, 2002; Steinfield *et al*., 2007). Better performance of heifers under T3 might be due to the limiting effect of MET was nullified, since MET was the first limiting amino acid when growing calves had access to protein of microbial origin (Clark and Peterson, 1988). Besides MET or its analogues may act to supply greater microbial growth in rumen, from which heifers benefit both in terms of better amino acid uptake (McNamara, 2002). Mandal *et al.* (2002) observed that supplementation of MET and LYS increased TDN intake. Present experimental results are however not in agreement with them, but are in agreement with Jat *et al*. (2005). Similarly, Patel *et al*. (2009) also reported non-significant effect on TDN intake in bypass nutrients fed group. Gaffar *et al*. (2011) observed that the cows receiving Zinc MET had significantly ($P<0.05$) higher intake of DCP and TDN. Present observations are in agreement with them in that the intakes were higher than control groups, but not significantly. To sum up, experimental Jaffrabadi heifers showed positive growth during all phases of experiment and intake of CP, DCP and TDN were in linearly increasing order accordingly to growth, but the intakes were not significantly ($p> 0.05$) affected due to periods or treatments.

Nutrient Efficiency for Growth

The overall means of CP required (Table 2) were 1.68 ± 0.23, 1.53 ± 0.07 and 1.50 ± 0.07 (kg/ kg gain) for T1, T2 and T3. T3 group of heifers required 1 and 2 per cent less CP than T2 and T1, respectively, to gain 1 kg body weight. During different periods CP efficiency did not follow consistent trend due to differences in CP intake as well as the gain in body weight.

The mean DCP intake (g) required to achieve 1 kg growth is presented in Table 2. It followed similar pattern to that of CP efficiency with no clear cut trend due to difference in intakes as well as different

Table 3: Digestion coefficients (%) of nutrients in experimental ration of growing Jaffrabadi buffalo heifers

	T1	T2	T3	SEm	CD 5 %	CV %
DM	58.95±2.63	56.37±2.88	58.90±1.27	2.36	NS	7.05
EE	65.80±2.49	75.35±4.52	69.40±3.70	3.66	NS	9.04
CF	62.31±1.29	64.46±2.87	60.45±1.26	1.96	NS	5.43
CP	74.01±0.75	74.43±4.69	77.69±1.99	2.97	NS	6.82
NFE	54.72±4.39	49.28±4.67	54.00±1.53	3.80	NS	12.51
OM	62.71±2.88	61.08±3.24	62.02±1.03	2.57	NS	7.19

body weight gain over the periods. Period effect was non-significant (P>0.05). Overall average means of DCP required were 1.27 ± 0.17, 1.16 ± 0.05 and 1.17 ± 0.06 (kg/kg gain) for T1, T2 and T3, respectively. DCP efficiency was 8.5 per cent higher in T3 and T2 compared to control group. The TDN efficiency in growing Jaffrabadi heifers (Table 2) was not affected due to experimental rations or periods. Overall means for TDN efficiency (kg/kg body weight gain) was 7.92 ± 1.01, 7.73 ± 0.36 and 7.09 ± 0.32 for T1, T2 and T3, respectively. TDN efficiency in T3 was superior to T1 and T2 by 11.71 per cent and 9.03 per cent, respectively.

From the results it is evident that bypass nutrients had better nutrient efficiency than control group. However, it is interesting to note that T2 fed group buffalo heifers were also at par in terms of nutrient utilization. Inconsistency in growth rate as well as nutrients contents over different periods observed across the treatments was probably responsible for showing no clear-cut trends. MET and LYS are the first and second limiting amino acids, respectively, for synthesis of tissue of protein in growing ruminants (Merchen and Titgemeyer, 1992) and protein supplements, especially those high in UDP stimulated DMI to a greater extent than diets containing highly soluble N in the form of urea (Kalbande and Chainpure, 2001).

In the present experiment T1 comprised of commercial concentrate mixture containing NPN, 10 kg seasonal green forage and *ad. lib.* mature pasture grass hay. In T2 an oil seed cake rich in UDP (Cotton seed) replaced 50 per cent of concentrate mixture, while T 3 group of heifers received rumen protected LYS and MET. Looking to the treatment groups, rumen bypass amino acids group had better nutrient utilization compared to other two groups. Cotton seed cake fed group also had better nutrient utilization in comparison to control. Yadav *et al*. (2010) reported higher CP efficiency for growth in crossbred heifers receiving formaldehyde treated GN cake.

Gaffar *et al*. (2011) recorded improved feed efficiency in Friesian cows receiving Zinc MET as a supplement to control ration. Rogers *et al*. (1987) observed that LYS appeared to improve the utilization of MET in milch cows. Garg *et al.* (2007) studied the effect of feeding slow ammonia release and protected protein (SARPP) supplement and opined that the crop residues and dietary proteins could be utilized in a more efficient manner with SARPP.

Digestion Coefficients of Nutrients in the Experimental Rations

Digestion coefficients of experimental rations of growing Jaffrabadi buffalo heifers are given in Table 3. The differences in digestion coefficient of DM, EE, CF, CP, NFE and OM in T1, T2 and T3 rations were non-significant (P>0.05). McNamara (2002) opined that higher availability of methionine in the rumen increased fibre digestibility. However in the present experiment MET was made available in the lower gut by bypassing the rumen fermentation, where the effect of MET on fibre digestion was not pronounced. Overton *et al.* (1996) observed that feeding protein sources with low rumen degradability may not lead to metabolic digestibility in small intestines probably due to the UDP supplement might have resulted in shortage of rumen available nitrogen leading to increase microbial protein at duodenal level.

Wessels and Titgemeyer (1996) conducted experiment with rumen protected LYS and MET in steers and recorded that OM digestibility was similar in all the treatments. Protected lysine had no effect on digestibility of protein. Mandal *et al.* (2002) conducted an experiment on 10 Murrah buffalo calves in two groups maintained on with or without supplementation of protected LYS and MET. Though the growth rate was significantly higher ($P<0.05$) digestibility of DM, OM, CP, CF, ADF and NDF was similar in treated group to that of control group. Socha *et al.* (2005) conducted experiment on HF cows offering methionine and lysine in protected forms, which increased the supply at intestinal level depending upon dietary CP concentrate. Intestinal digestibility of the rumen degradable protein is very important for the supply of metabolisable protein.

In the present experiment results on digestion of nutrients indicated non-significant ($P>0.05$) effect on EE digestibility between T1, T2 and T3. Though the difference were non- significant ($P>0.05$), T2 had higher EE digestibility which might be due to higher EE content in the T2 ration, which also had higher CF digestibility (64.46 ± 2.87) compared to T1 (62.31 ± 1.29) and T3 (60.45 ± 1.26) due to higher cellulose digestibility of cotton seed cake. The CP digestibility was higher in T3 group (77.69 ± 1.99) compared to T1 (74.01± 0.75) and T2 (74.43 ± 4.69) though non-significant ($P>0.05$). This might be due to higher availability of amino acids in lower gut.

Plane of Nutrition

In the present experiment ICAR standards were adopted for arriving different nutrients intake. Though the DMI was at par with ICAR recommended levels, DCP and TDN intakes were lower and also DE, ME intakes. Nutrients intakes per unit metabolic body weight were also lower compared to ICAR recommended levels. However, protein energy ratio was at par in all the experimental groups with ICAR levels. The reason for lower intakes of nutrients might be due to higher intake of mature pasture grass hay which was lower in DCP and TDN.

Conclusions

Nutrients intake and their efficiency and digestibility of nutrients were at par in all the treatment groups, though the bypass amino acids added ration T3 recorded higher efficiency due to faster growth than other groups. Due to higher body weight, animals consumed higher content of mature pasture grass hay resulting in wider protein and efficiency ratio. Cottonseed fed group also had similar responses in terms of nutrient efficiency in comparison to bypass amino acids supplemented group, thereby suggesting its efficiency at par with bypass protein supplemented group.

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