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# Effect of Rumen-Protected Methionine and Lysine Supplementation on Growth Performance of Crossbred Female Calves

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**ABSTRACT: The current study intends to evaluate the effect of rumen-protected methionine (RPM) and lysine (RPL) supplementation on the growth performance of crossbred (HF×Kankrej) female calves. For this study, twelve crossbred female calves were randomly allotted to two groups $T_1$ and $T_2$ based on their body weight for the period of 98 days. Calves in the $T_1$ group were fed basal TMR to meet the nutrient requirement as per ICAR (2013) standard and those in $T_2$ were fed basal TMR same as $T_1$ + 2 g/kg DM RPM and 6 g/kg DM RPL. The average biweekly and daily body weight gain was significantly ($p<0.05$) higher in the $T_2$ compared to the $T_1$ group. However, the total body weight gain was not affected between treatments. The DMI, CPI, DCPI and TDNI did not differ significantly between groups. The dietary treatments did not differ significantly with respect to feed conversion ratio (kg/kg gain). The cost of feeding (Rs/head/98d) was significantly higher in the $T_2$ group than the T1 due to the higher cost of RPM and RPL. However, the cost of feeding (Rs/kg gain) did not exhibit any significant difference between groups. The results of the present study indicate the importance of supplementing RPM and RPL to the basal diet which results in improvement in growth performance without affecting the cost of feeding.**

**Keywords:** Rumen protected methionine and Rumen protected lysine, Growth performance, Crossbred female calves.

## INTRODUCTION

In the Indian cattle feed industry, the primary protein sources are derived from plant origins, such as soybean cake, cottonseed cake, and mustard cake. However, these plant-derived sources have lower levels of lysine and methionine, which are essential amino acids needed for optimal growth and milk production in ruminant animals. It has been well-known that a growing animal requires enough protein with balanced amino acids (AAs). Methionine and lysine are the most limiting essential AAs in cattle raised in tropical conditions, which may be partially responsible for the poor performance of calves consuming forage diets (Cabrera *et al.,* 2000; Aranda *et al.,* 2001). To address this issue, the utilization of rumen-protected methionine and lysine is proposed. This approach aims to enhance the availability of methionine and lysine for absorption at the intestinal level, ultimately leading to improved production performance in terms of ruminant animal growth and milk yield. Supplementing the necessary amount of amino acids is thought to be crucial for sustaining growth performance in steers (Kamiya *et al.,* 2021). The average body weight of calves significantly improves with the supplementation of rumen protected methionine and lysine (Gavade *et al*., 2019). RPM and RPL also enhance the average daily gain (Montano *et al.,* 2019). The total weight gain and average daily body weight gain increase with the supplementation of bypass methionine and lysine supplementation in buffalo heifers (Gajera *et al.,* 2013). Hence Study has been planned to assess the effect of rumen protected methionine and lysine supplementation on growth performance and nutrient intake of crossbred female calves.

## MATERIALS AND METHODS

The experiment was conducted at the Livestock Research Station (LRS) and Animal Nutrition Research Station (ANRS) of Kamdhenu University in Anand, Gujarat. This experiment protocol was approved by the Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA), New Delhi after a recommendation by the Institutional Animal Ethics Committee (IAEC) with reference no. 377/LRS/2022.

The experiment was carried out on 12 crossbred (Holstein Friesian × Kankrej) female calves between 5 to 8 months of age. The experimental calves were kept under 1 week of adaption. Calves were randomly divided into two equal groups of six each, based on

body weight. During the experiment calves were dewormed before the start of the experiment.

Twelve female crossbred calves having six calves in each treatment were allotted to $T_1$ and $T_2$. Calves in the $T_1$ group were fed basal TMR to meet the nutrient requirement as per ICAR (2013) standard and those in $T_2$ were fed basal TMR supplemented with 2 g/kg DM rumen-protected methionine (RPM) + 6 g/kg DM rumen-protected lysine (RPL). The RPM and RPL were purchased from Kemin Industries.

All the calves were housed in an east-west-oriented pakka house with plenty of ventilation. All the experimental calves were fed on TMR in mash form to meet their nutrient needs as per ICAR (2013) standards. Individual feeding of all the female calves was followed. The TMR were prepared by blending individual feed ingredients (Table 1). TMR was offered ad libitum aimed to have refusals of 5 to 10%. The rumen protected methionine and lysine were fed top-dressed to calves of the $T_2$ group. The nutrient intake of all experimental calves was compared with their nutrient requirement as per ICAR (2013). The experimental calves were let loose daily for exercise in an open paddock, for two hours in the morning and one hour in the afternoon under controlled conditions during which they had free access to fresh, wholesome drinking water.

The daily feed intake was recorded for each experimental calf during the entire experimental period. The experimental calves were weighed biweekly for two consecutive days in the morning before feeding and watering during the entire experimental period using an electronic weighing balance. The average of the two observations was considered as the biweekly body weight. The biweekly body weight gain was calculated by the difference between weights recorded during the present and previous biweekly body weight data. Feed conversion ratio was calculated by biweekly dry matter intake (kg) divided by body weight gain (kg).

The data generated during the experiment was analyzed by a Completely Randomized Design as per Snedecor & Cochran (1994).

**Table 1: Ingredient Composition (%) of TMR offered to experimental calves.**

| Ingredients | Basal TMR |
|---|---|
| Nutri power (Concentrate mixture) | 45 |
| Wheat straw | 15 |
| Groundnut gotar | 28 |
| Green fodder ($NB_{21}$) | 10 |
| Mineral mixture | 01 |
| Salt | 01 |
| **Total** | **100** |

## RESULTS AND DISCUSSION

The values for the proximate composition of TMR offered to the experimental calves are presented here in Table 2. The TMR Contained 15.02% crude protein.

**Table 2.**

| Parameter | TMR |
|---|---|
| Crude protein (%) | 15.02 |
| Ether extract (%) | 03.01 |
| Crude fibre (%) | 21.41 |
| Nitrogen-free extract (%) | 44.32 |
| Total ash (%) | 10.02 |
| Organic matter (%) | 89.98 |

The average dry matter intake (DMI) of crossbred female calves in terms of kg/head/d, kg/100 kg BW and g/kg $W^{0.75}$ is shown in Table 3 and it did not differ significantly between $T_1$ and $T_2$ groups. Similar studies have reported no impact on DMI when Holstein dairy calves were supplemented with rumen-protected amino acids (Mazinani *et al.*, 2020), feedlot growing steers were supplemented with rumen-protected methionine and lysine plus dietary energetics (Montano *et al.*, 2019), or growing male calves were provided with rumen-protected methionine (Kandil *et al*., 2017).

**Table 3: Effect of rumen protected methionine and lysine supplementation on nutrient intake of crossbred calves.**

| Parameters | $T_1$ | $T_2$ | CD value |
|---|---|---|---|
| Daily dry matter intake (kg/head/d) | 5.07±0.26 | 5.24±0.32 | NS |
| Daily dry matter intake (kg/100 kg BW) | 3.24±0.04 | 3.09±0.04 | NS |
| Daily dry matter intake (g/kg $W^{0.75}$) | 114.33±1.18 | 111.10±2.05 | NS |
| Crude protein intake (kg/head/d) | 0.76±0.04 | 0.79±0.05 | NS |
| Crude protein intake (g/kg $W^{0.75}$) | 17.17±0.18 | 16.69±0.31 | NS |
| Digestible crude protein intake (kg/head/d) | 0.57±0.03 | 0.61±0.04 | NS |
| Digestible crude protein intake (g/kg $W^{0.75}$) | 12.85±0.14 | 12.88±0.24 | NS |
| Total digestible nutrient intake (kg/head/d) | 3.15±0.16 | 3.25±0.20 | NS |
| Total digestible intake (g/kg $W^{0.75}$) | 70.95±0.73 | 68.95±1.27 | NS |

The average CPI of crossbred female calves in terms of kg/head/d and g/kg $W^{0.75}$ is depicted in Table 2 and it did not differ significantly between $T_1$ and $T_2$ groups. The finding of the present study aligns with the experiment performed by Rajwade *et al.* (2019) in which they also did not find any significant difference in CPI with the supplementation of rumen protected methionine and lysine individually or in combination. The average DCPI of crossbred female calves (Table 2) also did not differ significantly between $T_1$ and $T_2$ groups. Similar findings were also reported by Gavade *et al*. (2019) in their study by supplementation of rumen protected methionine and lysine in crossbred calves. Moreover, the average TDNI of crossbred female

calves in terms of kg/head/d and g/kg $W^{0.75}$ (Table 2) did not differ significantly between experimental groups. These findings are consistent with the research conducted by Sai (2013), who also reported no discernible difference in average TDN consumption between crossbred calves supplemented with rumen-protected methionine and lysine and the control group.

**Table 4: Effect of rumen protected methionine and lysine supplementation on change in body weight**

| Parameters | $T_1$ | $T_2$ | CD value |
|---|---|---|---|
| Initial body weight (kg) | 116.93 ±6.05 | 124.67 ±2.88 | NS |
| Final body weight (kg) | 191.18[a] ±3.26 | 209.30[b] ±3.31 | 15.45 |
| Change in body weight (kg) | 74.25 ±7.06 | 84.63 ±3.46 | NS |

The final body weight and change in body weight after the experimental period are depicted in Table 4. The final body weight of experimental female calves under $T_2$ was significantly increased ($P<0.05$) compared to $T_1$. However, the total change in body weight gain was at par between the experimental groups.

**Table 5: Effect of rumen protected methionine and lysine supplementation on growth of crossbred calves.**

| Parameters | $T_1$ | $T_2$ | CD value |
|---|---|---|---|
| Average biweekly body weight gain(kg) | 10.61[a]±0.95 | 12.09[b]±1.34 | 1.25 |
| Average daily gain(kg) | 0.76[a]±0.07 | 0.86[b]±0.10 | 0.08 |

The average biweekly and daily body weight gain (Table 5) was significantly ($p<0.05$) higher in $T_2$ compared to $T_1$. The results of the present study are in agreement with those reported by Singh *et al.* (2015), who observed increased body weight in Haryana heifers when supplemented with rumen-protected methionine and lysine in their diet. Additionally, the results of this study are consistent with the findings of Gami *et al.* (2015) in Murrah buffalo calves, Torrentera *et al.* (2017) in growing Holstein calves and Kumar *et al.* (2018) in Murrah heifers, who noticed increased body weight gain with the supplementation of rumen-protected methionine and lysine. Overall, these findings emphasize the potential benefits of incorporating rumen-protected methionine and lysine into the diets of crossbred calves, leading to protein synthesis, which is fundamental for collagen formation and muscle development which improves body weight. Montano *et al.* (2019) also observed improved average daily gain with supplementation of methionine and lysine.

The cumulative feed consumption (kg/head/98 d) of crossbred calves in the $T_1$ and $T_2$ groups was 694.97±39.10 and 717.56±8.04, respectively. The feed consumption was statistically similar in treatment groups. However, the cost of feeding (Rs/head/98 d) was found statistically ($p<0.05$) higher in the $T_2$ group than in$T_1$ (Table 6). This finding was due to the higher cost of rumen-protected methionine and lysine. However, the cost of feeding (Rs/kg gain) did not exhibit any statistically significant differences between $T_1$ and $T_2$ (Table 7) due to higher gain by supplementation of RPM and RPL. Similarly, in research performed by Patel *et al.* (2012), the cost of feeding (Rs/head/day) was found significantly higher in buffalo heifers which were fed bypass protein compared to the control group. Patel *et al*. (2015) also did not find any significant difference in the average daily cost of feeding (Rs/animal) with supplementation of rumen-protected methionine and lysine in heifers. Contrary to our results, Movaliya *et al.* (2013) reported that supplementing rumen-protected methionine and lysine in Jaffarabadi heifers reduced the cost of feed (Rs/kg gain) significantly.

**Table 6: Effect of rumen protected methionine and lysine supplementation on feed conversion ratio of crossbred calves.**

| FCR (kg/kg gain) | $T_1$ | $T_2$ | CD value |
|---|---|---|---|
| DMI | 8.44±1.08 | 7.44±1.28 | NS |
| CPI | 1.27±0.16 | 1.12±0.19 | NS |
| DCPI | 0.62±0.18 | 0.56±0.19 | NS |
| TDNI | 5.24±0.67 | 4.62±0.80 | NS |

The Feed conversion ratio (kg/kg gain) is depicted in Table 6 and it was found that FCR in terms of DMI, CPI, DCPI and TDNI was not affected by rumen protected amino acids supplementation. These findings are consistent with a study conducted on Jafarabadi heifers by Gajera *et al.* (2013), which also reported no significant difference in FCR when supplementing bypass lysine and methionine in the diet. Contrary to our results, Singh *et al*. (2015) observed an improved FCR in heifers supplemented with rumen-protected methionine and lysine. Patel *et al*. (2015) also found that rumen-protected methionine and lysine supplementation can enhance the FCR.

**Table 7: Effect of rumen-protected methionine and lysine supplementation on cost of feeding of crossbred calves.**

| Parameters | $T_1$ | $T_2$ | CD value |
|---|---|---|---|
| Cost of feeding (kg/head/98d) | 11585.79[a] ±651.87 | 14493.76[b] ±134.06 | 1354.504 |
| Cost of feeding (Rs/kg gain) | 162.89 ±13.10 | 172.91 ±6.93 | NS |

## CONCLUSIONS

From the results obtained under the present study, it is concluded that the body weight gain (kg) was higher in crossbred female calves fed with standard protein basal diet supplementation with 2 g/kg DMrumen-protected methionine and 6 g/kg DM lysine without affecting feed intake and cost of feeding (Rs/kg gain).

## FUTURE SCOPE

The work regarding with or without reducing the CP content of the diet supplemented with limiting amino

acids in the rumen-protected form in growing calves is limited. So, more work should be conducted on growing calves needs to be studied. More and more new companies may be coming in the near future for the preparation of protected amino acids, so the cost of the products might be reduced in the near future and we reduced the cost of feeding.

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**Conflict of Interest** None.

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