



Effect of Dietary Supplementation of Rumen Protected Methionine and Lysine on Nutrient Utilization and Growth Performance in Sahiwal Female Calves

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ABSTRACT

An experiment was conducted to evaluate the effect of supplementation of rumen protected methionine (RPM) and rumen protected lysine (RPL) individually and in combination on nutrient utilization and growth performance in twenty Sahiwal female calves. Sahiwal female calves having age groups of 7 to 12 months and between 80 to 111 kg body weights were randomly allotted into four groups of five animals in each, viz., T1 (basal diet), T2 (basal diet with RPM 5 g/d), T3 (basal diet with RPL 15 g/d) and T4 (basal diet with RPM 5 g plus RPL 15 g/d) their body weight for 90 days. The results revealed that intake of DM and CP were similar amongst all four groups. Digestibility of nutrients was also similar amongst the groups while average daily gain was found to be better in supplemented groups.

Keywords: Sahiwal calves, nutrient utilization, growth parameter, RPM, RPL

Calves form the future of dairy herd and raising of calves is the most difficult operation in a dairy farming enterprise, which requires a great deal of managerial skill, application and constant attention. In India, calves are generally maintained with a little amount of concentrate and poor quality roughage, lead to poor growth rate and puberty gets delayed due to undernutrition. It has been known from decades that animals require amino acid for the synthesis of tissue, regulatory, protective and secretory proteins and that there are hundreds of these proteins that must be synthesized every day (Wu *et al.*, 2006). It has been found that growing animal requires a balanced amount of protein as well as amino acids. Methionine and lysine are the most limiting essential amino acids in cattle raised under tropical conditions which may be partially responsible for the inferior performance of calves consuming forage based diets (Cabrera *et al.*, 2000; Aranda *et al.*, 2001). Methionine and lysine are the first two limiting amino acids in most dietary situation (NRC, 2001; Doepel *et al.*, 2004; Lapierre *et al.*, 2006; Benefield *et al.*, 2009). Lysine and methionine are considered to be co-limiting amino acid required for optimum growth and

milk synthesis in dairy cattle (Nichols *et al.*, 1998; Socha *et al.*, 2005).

This inferior performance may likely results from the low availability of lysine and methionine from rumen undegradable protein. This may be insufficient to meet the requirement of these amino acids for proper growth and deficiency of these amino acids may result in inefficient use of dietary protein for protein deposition. Due to limited referential data of RPM and RPL on Sahiwal calves, has been studied in this experiment.

MATERIALS AND METHODS

Twenty Sahiwal female calves having age groups of 7 to 12 months and between 80 to 111 kg body weight were selected from the herd of pure breed Sahiwal cows maintained at Bull Mother Experimental Farm (BMEF) of the College of Veterinary Science & Animal Husbandry, Anjora, Durg and Government Cattle Breeding Farm (CBF), Anjora, Durg of the Directorate of Veterinary Services, Raipur, (Govt. of C.G.), and were randomly allotted into four groups of five animals each following

completely randomized design. The initial age and average body weight of Sahiwal female calves in four treatment groups were 10.41 ± 0.73 , 10.15 ± 0.83 , 10.12 ± 0.43 and 10.08 ± 0.87 months and 95.8 ± 7.4 , 95.2 ± 4.6 , 95.2 ± 2.5 and 95.4 ± 2.9 kg respectively, and difference in age and body weight were non-significant. The details of different treatment groups are presented in Table 1.

Table 1: Details of different treatment groups

Sl. No.	Group	Treatment
1	T1 (control)	Basal diet (concentrate mixture + berseem hay)
2	T2	Basal diet with 5g RPM /d
3	T3	Basal diet with 15 g RPL/d
4	T4	Basal diet with RPM 5g+RPL 15 g/d

During the experiment, the animals were given concentrate mixture (Table 2) and berseem hay (basal diet) in the ratio of 60:40 to meet their protein and energy requirement for growth as per ICAR 2013. Animals were given *ad lib* fresh water throughout the trial. The concentrate feed and berseem hay were analysed (AOAC, 2005) for proximate and fibre (Van Soest *et al.*, 1991) composition (Table 3).

Table 2: Ingredient composition of calf grower (concentrate mixture)

Sl. No.	Ingredients	Parts
1	Yellow maize	15
2	De oiled rice bran	26.5
3	Ground nut cake	10
4	Soya de oiled cake	10
5	Rapeseed de oiled cake	8
6	Sunflower de oiled cake	5
7	Rice polish	7
8	Broken rice	6
9	Molasses	10
10	Salt	1.5
11	Mineral mixture	1
Total		100

The calves were weighed at fortnight interval. A metabolic trial was conducted during experimental period of 7 days collection period to determine the nutrients digestibility and Nitrogen, Calcium and Phosphorus balance in calves. Commercially available rumen protected methionine

(MetiPEARL™) and lysine (LysiGEM™) of Kemin Industries, Inc. were used as dietary supplementation for the source of methionine and lysine, respectively.

Table 3: Chemical composition of concentrate, berseem hay and total mix feed (% on DM basis)

Particulars	Calf Grower	Berseem Hay	Total mix feed*
DM	90	89	89.40
CP	20	13	15.80
CF	7.80	26	18.72
EE	0.79	1.30	1.10
TA	10.91	13.54	12.48
NFE	60.50	46.16	51.90
Ca	1.50	2.03	1.82
P	0.80	0.28	0.49
NDF	27.80	38.50	33.9
ADF	14.24	29.50	23.40

* calculated from chemical composition (as above).

Statistical Analysis

The results obtained during this study were analyzed by Complete Randomized Design (Snedecor and Cochran, 1994) for analysis of variance and significance of differences among the groups were also analysed by Duncan's multiple range test.

RESULTS AND DISCUSSION

Dry Matter (kg/day) and crude protein (g/day) Intake

The effect of dietary supplementation of RPM and RPL individually and in combination on average DMI (kg/day) and CPI (g/day) by calves in various treatment groups is presented in table 4 and 5, respectively. Overall average DMI after 90 days was found to be 3.47 ± 0.18 , 3.48 ± 0.18 , 3.52 ± 0.17 and 3.55 ± 0.18 kg/d in T1, T2, T3 and T4 group, respectively. While CPI was found to be 548.61 ± 27.89 , 549.92 ± 28.74 , 557.12 ± 27.43 and 561.13 ± 27.88 g/d in T1, T2, T3 and T4 group, respectively. Statistical analysis revealed no significant difference in the dry matter intake and crude protein intake. Observations were found similar with Lara *et al.* (2006), Broderick and Muck (2009) and Lee *et al.* (2012) in cows, Sai *et al.* (2014) in crossbred

Table 4: Effect of dietary supplementation of rumen protected methionine and lysine on average DMI (kg/day)

Period (Days)	Treatment groups				P value	Sig.
	I (Control)	II (RPM-5g/d)	III (RPL-15g/d)	IV (RPM 5g + RPL-15g /d)		
0-15	2.90 ± 0.03	2.88 ± 0.05	2.97 ± 0.02	2.98 ± 0.02	0.086	NS
15-30	3.07 ± 0.03	3.09 ± 0.02	3.12 ± 0.03	3.13 ± 0.04	0.485	NS
30-45	3.36 ± 0.04	3.35 ± 0.03	3.40 ± 0.03	3.44 ± 0.04	0.287	NS
45-60	3.70 ± 0.03	3.71 ± 0.03	3.76 ± 0.03	3.79 ± 0.04	0.187	NS
60-75	3.81 ± 0.03	3.83 ± 0.03	3.86 ± 0.04	3.88 ± 0.04	0.375	NS
75-90	3.99 ± 0.03	4.02 ± 0.03	4.03 ± 0.03	4.06 ± 0.04	0.511	NS
Overall	3.47 ± 0.18	3.48 ± 0.18	3.52 ± 0.17	3.55 ± 0.18	0.987	NS

Table 5: Effect of dietary supplementation of rumen protected methionine and lysine on average CPI (g/day)

Period (Days)	Treatment groups				P value	Sig.
	I (Control)	II (RPM-5g/d)	III (RPL-15g/d)	IV (RPM 5g+ RPL-15g /d)		
0-15	458.09±5.21	454.41±8.22	469.58±3.42	471.37±3.91	0.086	NS
15-30	484.94±4.57	488.63±3.83	493.69±5.07	495.48±7.11	0.485	NS
30-45	532.98±5.90	531.61±4.78	539.43±5.51	545.98±6.86	0.287	NS
45-60	582.65±4.73	584.54±5.33	591.68±4.70	597.66±6.47	0.187	NS
60-75	601.24±4.76	604.61±5.26	610.51±5.98	613.78±5.92	0.375	NS
75-90	631.75±4.08	635.75±4.79	637.86±4.09	±6.85	0.511	NS
Overall	548.61±27.89	549.92±28.74	557.12±27.43	561.13±27.88	0.987	NS

calves, Singh *et al.* (2015) in Hariana heifers and Kumar *et al.* (2018) in Murrah heifers.

Average daily gain (ADG)

Average daily weight gain (g/d) by Sahiwal female calves under different treatment group has been presented in table 6. Overall ADG after 90 days was found to be 366.67±7.70, 388.89±10.56, and 427.67±13.72 and 484.44±16.03 g/d in T1, T2, T3 and T4 group, respectively. T4 group resulted in significant higher (P<0.01) growth rate in each fortnight interval due to rumen protected methionine plus lysine supplementation. Increase in growth rate might be due to improved assimilation of metabolisable amino acid in body tissue.

Observations were recorded similar with Gajera *et al.* (2013) in Jaffarabadi heifers, Singh *et al.* (2015) in Hariana heifers, Odedra *et al.* (2016) Jaffarabadi buffalo heifers, Sai *et al.* (2016) in Karan-Fries calves, Gami *et al.* (2017) in Murrah calves and Kumar *et al.* (2018) in Murrah heifers.

Nutrients digestibility

The results of digestibility coefficient of different nutrients are presented in table 7. In the present study, digestibility coefficient (%) of DM, CP, CF, EE, NFE, OM, NDF and ADF was found non-significant difference amongst the control and different treatment groups. Similar results were also found by Donkin *et al.* (1989) in cows supplemented with RPM and RPL and Obeidat *et al.* (2008) in lambs supplemented with RPM.

Balance study

Nitrogen (N), Calcium (Ca) and Phosphorus (P) balance was estimated during the metabolic trial and retention % are summarized in Table 7. In the present study, Retention % for Nitrogen, Calcium and Phosphorus was found to be non significant amongst the control and different treatment groups. The present findings were similar to those of Krober *et al.* (2000), Sun *et al.* (2007) on supplementation of methionine and lysine and Obeidat *et al.* (2008) to lambs supplemented with RPM.

Table 6: Effect of dietary supplementation of rumen protected methionine and lysine on weight gain (g/day) in calves

Period (Days)	Treatment groups				P value	Sig.
	I (Control)	II (RPM-5g/d)	III (RPL-15g/d)	IV (RPM 5g+ RPL-15g /d)		
0-15	353.33±13.33 ^b	346.67±13.33 ^b	373.33±16.33 ^{ab}	413.33±13.33 ^a	0.018	*
15-30	340.00±22.11 ^b	373.33±16.33 ^b	400.00±21.08 ^b	480.00±13.33 ^a	0.003	**
30-45	386.67±13.33 ^b	386.67±38.87 ^b	433.33±14.91 ^{ab}	493.33±33.99 ^a	0.046	*
45-60	360.00±16.33 ^b	413.33±24.94 ^{ab}	446.67±38.87 ^{ab}	480.00±38.87 ^a	0.042	*
60-75	386.67±24.94 ^b	400.00±29.81 ^b	453.33±44.22 ^{ab}	520.00±24.94 ^a	0.037	*
75-90	373.33±16.33 ^c	413.33±38.87 ^{bc}	457.33±23.06 ^{ab}	520.00±13.33 ^a	0.005	**
Overall	366.67±7.70^c	388.89±10.56^c	427.67±13.72^b	484.44±16.03^a	0.000	**

Mean values bearing different superscript (a, b, c) in row differ significantly * (P<0.05), ** (P<0.01)

Table 7: Effect of RPM and RPL supplementation on nutrient digestibility and N, Ca, P retention %

Parameters	Treatment groups				P value	Sig.
	I (Control)	II (RPM-5g/d)	III (RPL-15g/d)	IV (RPM 5g+ RPL-15g /d)		
Digestibility of nutrients (%)						
DM	60.06±1.69	58.22±2.18	59.14±1.25	60.82±0.66	0.574	NS
CP	69.52±0.92	68.10±1.21	68.18±1.46	70.07±1.04	0.577	NS
CF	50.28±1.46	49.42±2.72	51.13±3.42	53.90±1.72	0.619	NS
EE	64.17±1.73	62.16±2.37	63.62±1.05	64.70±0.46	0.704	NS
NFE	58.71±2.22	56.40±2.30	57.27±0.47	58.66±0.80	0.719	NS
OM	58.98±1.79	57.09±2.15	58.01±1.26	59.71±0.67	0.674	NS
NDF	53.75±1.84	52.51±2.29	53.68±1.66	55.95±0.75	0.583	NS
ADF	44.77±2.78	42.93±2.87	44.57±1.41	46.24±1.13	0.769	NS
Retention %						
N	58.14 ± 0.27	58.17 ± 1.11	54.10 ± 2.56	56.62 ± 1.26	0.535	NS
Ca	74.96 ± 1.22	74.88 ± 0.44	75.77 ± 2.10	75.08 ± 1.04	0.900	NS
P	29.33 ± 3.33	28.96 ± 3.01	30.19 ± 1.86	30.23 ± 6.10	0.961	NS

CONCLUSION

The supplementation of RPM and RPL in combination in the ration of Sahiwal female calves significantly improved (P<0.01) their live body weight gain.

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