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Effect of Rumen Protected Amino Acids and Fish Meal on Feed Conversion Ratio of Murrah Buffalo Heifers

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A B S T R A C T

Eighteen Murrah buffalo heifers were randomly distributed into three treatment groups each having six heifers on the basis of age and body weight i.e. T_1 (control group, fed with conventional ration), T_2 (fish meal supplementation by replacing conventional concentrate) and T_3 (with 10 g commercial bypass Lysine per animal per day + 2 g commercial bypass Methionine per animal per day) for 90 days. The amount of concentrate mixture was given to each group in such a way that the experimental rations remain iso-proteinaceous. The results of the study revealed that after first fifteen days average daily weight gain were 622.22, 677.78 and 666.67 g/d in T_1, T_2 and T_3, respectively. The data shows that after 60 days there was significantly higher ($P<0.05$) gain in T_2 treatment which was similar to T_3 as compared to control T_1. The average daily gain then followed similar trend till the end of experiment. Average daily weight gains at the end of experiment, for the corresponding groups were 677.78, 844.44 and 777.78 g/d, respectively. Statistical analysis of data revealed that there was no significant difference in the dry matter intake among the different treatments. Overall DMI after 90 days was found to be 6.99, 7.04 and 7.02 kg/day in T_1, T_2 and T_3 respectively. After first fifteen days FCR values were 10.86, 10.86 and 9.63 in T_1 (control), T_2 and T_3, respectively. The results shows that after 60 days FCR values were significantly differ ($P<0.05$) in T_2 and T_3 treatments as compared to control T_1. The FCR values then follow similar trend till the end of experiment. The FCR values at the end of experiment, for T_1, T_2 and T_3 treatments were 11.83, 9.48 and 10.26, respectively.

Introduction

Provision of nutrients in balanced form and required amounts is essential to meet the productive targets in livestock. Among nutrients, protein plays a pivotal role in growth, production and reproduction of farm animals. However, nature and level of dietary protein determine the supply of both physiologically and dietary essential amino acids in animals. In ruminants, protein requirements are two fold; to support the anaerobic ecosystem in the rumen and to meet the animal needs. However, because of ruminal anaerobic fermentation, a portion of dietary protein is degraded in the rumen

(RDP) and the rest escape from ruminal degradation (RUP). The RDP is used to support the growth of anaerobic bacteria and thus profile of microbial protein along with the nature of RUP determines the availability of dietary and physiologically essential amino acids in ruminants. Generally, the requirements of high producing animals for dietary essential amino acids are increased from those supplied by the microbial and escaped protein pool. Thus the dietary supplementation of rumen protected protein and amino acids are recommended to support the physiological and productive needs of livestock for amino acids (Ali *et al.,* 2009). Protein supplement that are naturally high in rumen un-degradable protein, used mainly in ruminant diets is fish meal. Fish meal contains high levels of available Lysine and Methionine which are deficient in plant protein supplements (Lall, 1991). Fishmeal protein is high in biological value, provides twice the Lysine and four times the Methionine to the small intestine (Blauwiekel *et al.,* 1992).

As we are aware of the importance of the buffalo, proper rearing of buffalo heifers as a future milk producer, which will eventually replace the old herd, so it is necessary to have better feeding management. But raising young heifer was one of the most often neglected jobs on the dairy farms. Unfortunately, in many part of India farmers considers buffalo heifer to be unproductive and hence they do not feed them properly. How a heifer develops into her potential for milk production depends upon how well we raise and manage her (Alam *et al.,* 2012). Nutrition draws the greatest attention because lack of proper nutrition can reduce the reproductive efficiency. There is need to improve the animal production through better feeding and husbandry management at all stage of buffalo life especially at growing stage of heifers. Keeping in view the above facts, the present investigation was conducted to explore the effect of rumen protected Methionine, Lysine and fish meal supplementation on feed conversion ratio in Murrah buffalo heifers.

Materials and Methods

The present investigation was conducted at the Buffalo Research Center of Department of Livestock Production Management, College of Veterinary Sciences, Lala Lajpat Rai University of Veterinary and Animal Sciences, Hisar. Prior approval was taken to conduct the present investigation by the Institutional Animal Ethics Committee. Eighteen Murrah buffalo heifers of nearly same age and body weight were randomly distributed into three treatment groups each having six buffalo heifers following Completely Randomized Design (CRD) in such a manner that average body weight and age of each experimental group was almost similar. The initial average body weight of buffalo heifers in three treatment groups were 224.33, 223.83 and 223.33 kg, respectively and differences in initial body weight were non-significant. The details of different treatments are presented in table 1.

During the experimental period, the animals were given green fodder and concentrate mixture to meet their protein and energy need for growth as per ICAR (Ranjhan, 1998) feeding standard. The amount of concentrate mixture was given to each group in such a way that the experimental ration remains isoproteinaceous. The quantity of different feeds given to each group was adjusted at fortnightly intervals so that the overall DCP requirements of heifers were met according to the change in body weight. Animals were given *ad lib* fresh water throughout the experimental period. Before formulation of rations, the feed ingredients were analyzed (AOAC, 2005) for proximate composition (Table 2). Based upon the proximate composition of feed ingredients, the ration for the different experimental groups of animals

was formulated. The composition of the experimental diet of different treatment groups and proximate chemical composition is presented in (Table 3).

Observation recorded

Feed intake

All the animals were fed roughage and concentrate individually. The animals were given weighted quantity of feed and fodder daily as per computed ration. Daily feed intake during the experimental period was determined on the basis of feeds and fodder offered and left over and data were compiled on fortnightly basis.

Body weight gain

Experimental animals were weighted (kg) just before starting the actual experiment and thereafter at fortnightly intervals using standard platform weighing balance (Avery, capacity 1000 kg). The body weights were recorded in the morning before providing any water or feed to the animals. These body weights were used for determining the growth rate and also for the purpose of the computing the ration for the animals.

Feed conversion ratio (FCR)

On the basis of feed and fodder consumption, dry matter (DM) consumed by the animals were estimated. For the calculation of FCR, feed intake per kg body weight gain was calculated.

Statistical analysis

The data were analyzed statistically using standard methods (Snedecor and Cochran, 1994). The data were expressed as Mean ± SE and were analyzed by one-way ANOVA using general linear model of SPSS version 20 and Duncan's multiple range tests was applied to test the significance. Significance was declared when P value is less than 0.05 (Duncan, 1955).

Results and Discussion

Dry matter intake (kg/day)

Mean daily dry matter intakes (kg/d) during the experimental period are given in table 4 and with Figure 1. Overall DMI after 90 days was found to be 6.99, 7.04 and 7.02 kg/day in T_1, T_2 and T_3 respectively. Statistical analysis of data revealed that there was no significant difference in the dry matter intake among the different treatments.

Socha *et al.,* (2005), Lara *et al.,* (2006) and Lee *et al.,* (2012) observed that there was no effect of Lysine and Methionine supplementation on DM intake kg/d in dairy cows. Ahmed *et al.,* (2016) also reported no significant difference for DMI between control and treatment groups fed Lysine and Methionine supplemented ration in Nili-Ravi buffaloes. Also, Gajera *et al.,* (2013) witnessed the similar results in Jaffrabadi buffalo heifers. Similarly, Sai *et al.,* (2014) repoted no differences in average DM intake by supplementation of bypass Methionine and Lysine in the ration of crossbred calves.

Findings of Hussein and Jordan (1991) in growing finishing lambs and Davenport *et al.,* (1990) in crossbred beef calves reveal similar results i.e. feeding fish meal as a source of protected amino acids did not show any improvement in DMI.

Average daily gain (ADG)

Average daily weight gain (g/day) by growing Murrah buffalo heifers under different treatments has been presented in table 5 and with Figure 2. After first fifteen days average daily weight gain were 622.22, 677.78 and 666.67 g/d in T_1, T_2 and T_3, respectively.

Table.1 Details of different treatments

S. No.	Group	Treatment
1.	$T_{1\ (Control)}$	Seasonal green fodder + wheat straw + conventional concentrate mixture
2.	T_2	Seasonal green fodder + wheat straw + conventional concentrate mixture + fish meal
3.	T_3	Seasonal green fodder + wheat straw + conventional concentrate mixture + 10 g commercial bypass Lysine per animal per day + 2 g commercial bypass Methionine per animal per day

Table.2 Chemical analysis of feed ingredients (on DM basis)

Ingredients	DM	CP	CF	EE	Ash	OM	NFE
Wheat straw	94.27	1.78	35.31	1.04	12.49	87.51	49.38
Green sorghum	24.92	7.45	26.82	3.4	10.7	90.3	51.63
Wheat	91.61	10.89	2.77	3.15	2.23	97.77	80.96
Barley	93.32	9.55	7.88	1.74	4.96	95.04	75.87
Groundnut cake (GNC)	93.47	40.23	9.43	9.05	8.9	91.1	32.39
Mustard cake	93.46	35.62	8.33	6.25	6.83	93.17	42.97
Fish meal	89.97	45.8	1.81	11.4	27.07	72.93	13.92
Wheat bran	92.86	13.86	11.83	1.01	4.12	95.88	69.18

Table.3 Ingredients of concentrate mixture (kg) and its chemical composition (on DM basis)

Sr. no.	Ingredient	T_1 (kg)	T_2 (kg)	T_3 (kg)
1.	Barley	25	25	25
2.	Wheat	10	12	10
3.	Ground Nut Cake	20	13	20
4.	Mustard Cake	10	10	10
5.	Wheat Bran	32	33.5	32
6.	Fish Meal	0	3.5	0
7.	Bypass Methionine	0	0	*
8.	Bypass Lysine	0	0	**
9.	Mineral Mixture	2	2	2
10.	Salt	1	1	1
	Total	100	100	100
*** supplemented @ 2 g/ animal/day **supplemented @ 10 g/ animal/day**				
Chemical composition (% DM basis)				
1.	Dry matter (DM)	90.46	90.17	90.67
2.	Crude protein (CP)	24.51	24.88	24.66
3.	Crude fiber (CF)	6.31	6.49	6.12
4.	Ether extract (EE)	5.07	5.02	5.59
5.	Ash	7.41	7.77	7.91
6.	Organic matter (OM)	92.59	92.23	92.09
7.	NFE	55.70	55.84	55.72

Table.4 Average dry matter intake (kg/day) of experimental Murrah heifers at fortnightly intervals

Fortnight	Treatments		
	T_1	T_2	T_3
1	6.09 ± 0.02	6.12 ± 0.04	6.13 ± 0.06
2	6.34 ± 0.04	6.36 ± 0.04	6.35 ± 0.04
3	6.82 ± 0.06	6.84 ± 0.06	6.83 ± 0.06
4	7.13 ± 0.10	7.19 ± 0.06	7.17 ± 0.09
5	7.67 ± 0.05	7.79 ± 0.02	7.76 ± 0.07
6	7.89 ± 0.05	7.95 ± 0.06	7.92 ± 0.03
Over all	6.99 ± 0.11	7.04 ± 0.11	7.02 ± 0.11

Values are means ±standard errors

Table.5 Average daily body weight gain (g) of experimental Murrah buffalo heifers at fortnightly intervals

Fortnight	Treatments		
	T_1	T_2	T_3
1	622.22 ± 88.89	677.78 ± 150.47	666.67 ± 62.06
2	644.44 ± 99.88	733.33 ± 66.67	788.89 ± 58.16
3	744.44 ± 52.82	800.00 ± 51.64	788.89 ± 31.82
4	655.56^{b} ± 52.82	811.11^{a} ± 40.06	777.78^{ab} ± 37.18
5	666.67^{b} ± 45.54	833.33^{a} ± 50.52	788.89^{ab} ± 43.60
6	677.78^{b} ± 40.06	844.44^{a} ± 32.96	777.78^{ab} ± 32.96
Over all	668.51^{b} ± 26.22	783.33^{a} ± 30.55	764.81^{a} ± 18.87

Values are means ±standard errors
The means in a row with different superscripts differ significantly between the treatments (P<0.05)

Table.6 Mean feed conversion ratio (DMI/kg body weight gain) of experimental Murrah heifers at fortnightly interval

Fortnight	Treatments		
	T_1	T_2	T_3
1	10.86 ± 1.53	10.86 ± 1.53	9.63 ± 0.96
2	11.06 ± 1.67	9.09 ± 0.94	8.35 ± 0.80
3	9.38 ± 0.62	8.72 ± 0.56	8.74 ± 0.42
4	11.17^{a} ± 0.77	8.98^{b} ± 0.46	9.29^{b} ± 0.33
5	11.75^{a} ± 0.72	9.41^{b} ± 0.53	9.88^{b} ± 0.53
6	11.83^{a} ± 0.68	9.48^{b} ± 0.34	10.26^{b} ± 0.38

Values are means ±standard errors
The means in a row with different superscripts differ significantly between the treatments (P<0.05)

Fig.1 Dry matter intake (kg/day)

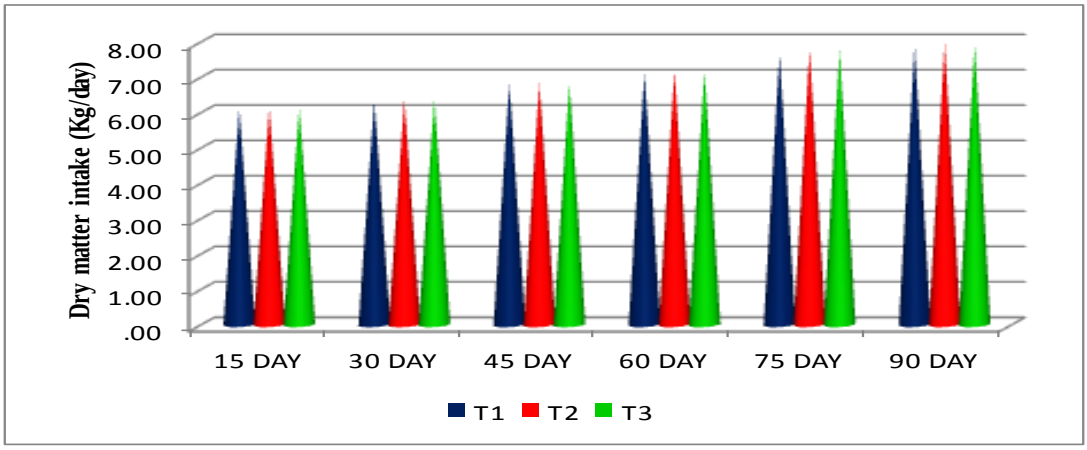


Fig.2 Average daily body weight gain (g)

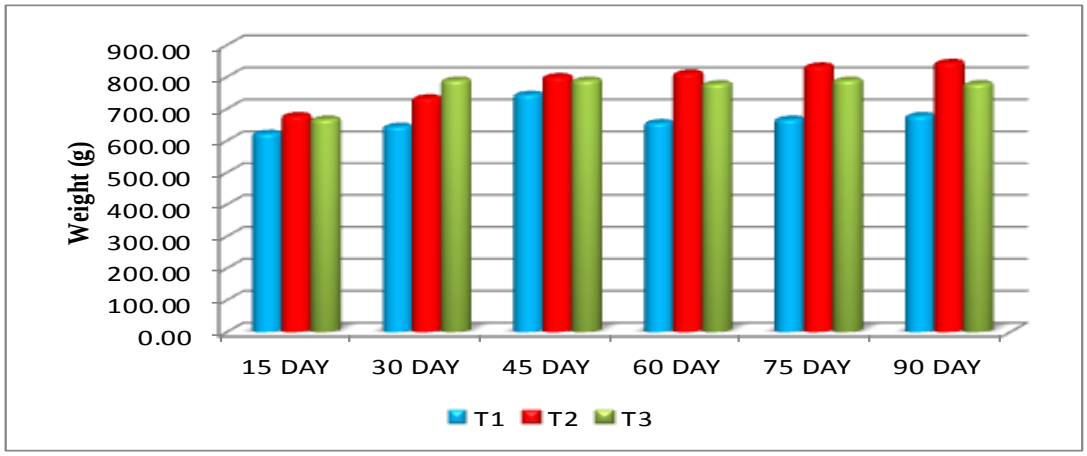
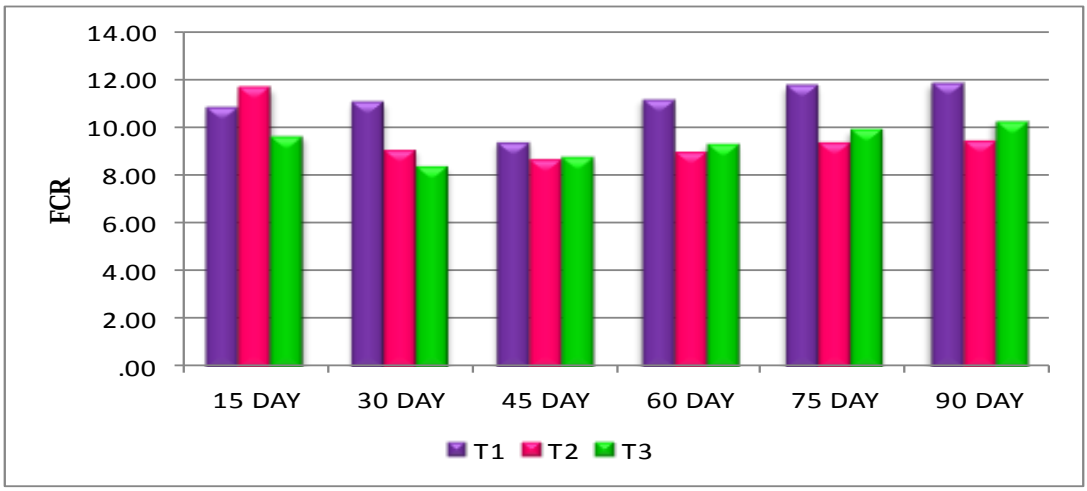


Fig.3 Feed conversion ratio



The data did not show any significant increase in average daily weight gain among the different treatments up to 45 days but after 60 days there was significantly higher ($P<0.05$) gain in T_2 treatment which was similar to T_3 as compared to control T_1. The average daily gain then followed similar trend till the end of experiment. Average daily weight gains at the end of experiment, for the corresponding groups were 677.78, 844.44 and 777.78 g/d, respectively.

Overall, average daily body weight gain under three treatments during the whole experimental period was 668.51, 783.33 and 764.81 g/d, in T_1, T_2 and T_3 groups, respectively. The overall, average weight gain was significantly ($P<0.05$) higher in T_2 and T_3 treatments as compared to those of T_1.

Zerbini and Polan (1985) and Davenport *et al.,* (1990) reveal similar results that feeding fish meal as a source of protected amino acids significantly increased average daily weight gain in calves. Similarly Rocha *et al.,* (1995) reported that group of Brahman bulls fed with fish meal had significantly higher average daily gain as compared to control group.

Alam *et al.,* (2012), Ortigues *et al.,* (1990) and Calzadilla *et al.,* (1992) observed that daily weight gain of heifers was significantly higher when basal diet was supplemented with fish meal. Gajera *et al.,* (2013) in the group of Jaffrabadi buffalo heifers and Sai *et al.,* (2014) in the group of crossbred calves, reported higher daily weight gain in treatment group supplemented with bypass Methionine and Lysine in the ration over that of control group.

Feed conversion ratio (FCR)

Minimum requirement of nutrient per kg gain along with the optimum growth rate resulting into economic rearing of animals is a desirable feature of livestock production. For the calculation of FCR, feed intake per kg body weight gain was calculated. The average data for dry matter required per kg gain in weight at fortnightly interval have been presented in table 6 and with Figure 3.

After first fifteen days FCR values were 10.86, 10.86 and 9.63 in T_1 (control), T_2 and T_3, respectively. The results did not show any significant difference in FCR values among the different treatments up to 45 days but after 60 days FCR values was significantly differ ($P<0.05$) in T_2 and T_3 treatments as compared to control T_1. The FCR values then follow similar trend till the end of experiment.

The FCR values at the end of experiment, for T_1, T_2 and T_3 treatments was 11.83, 9.48 and 10.26, respectively.

Present findings are in agreement with the previous findings of Sai *et al.,* (2014) where they reported that percent feed efficiency in crossbred calves was higher ($P<0.05$) in treatment group supplemented with bypass Methionine and Lysine in the ration over that of control group. Yadav (1993) found that requirement of DM per kg gain was less by the female Murrah buffalo calves by feeding of yeast culture fortified with protected protein (Nutri-Sacc). Addition of fish meal (FM) to the diets of beef calves increased feed efficiency when compared to control diets (Davenport *et al.,* 1990). Zinn and Owens, (1993) reported, increased feed efficiency by incorporation of FM in the ration of steers.
Present study suggested that feeding of fish meal and rumen protected Methionine and Lysine to Murrah buffalo heifers have significant effect on feed conversion ratio. The possible reason may be improved nutrient absorption, efficient gut micro-flora and better digestibility in fish meal and rumen protected Methionine and Lysine.

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