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Effect of Feeding Rumen Protected Protein on Milk Production in Lactating Buffaloes

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ABSTRACT

Feeding trial using bypass protein supplement was conducted on 16 lactating buffaloes for 8 weeks. Buffaloes yielding 8-9 kg milk per animal per day were divided into two groups of eight each, based on milk yield, fat percentage and stage of lactation. The animals in both the groups were fed standard ration, comprising 12 kg green maize fodder and 5 kg paddy straw. Concentrate mixture was given according to their level of milk production. In addition to the basal ration, animals in control group were fed 1.0 kg untreated sunflower meal (*Helianthus annuus*; UDP 33 % of CP) and in experimental group 1.0 kg protected sunflower meal (UDP 75 % of CP). Average increase in milk yield (kg), fat and protein percent in experimental group was 0.80, 0.40 and 0.20 respectively. Through increase in milk yield and fat percent were significantly ($P<0.05$) higher, no significant effect was observed on level of protein percent in milk by feeding protected protein. Average net daily income increased by Rs.14.49 on feeding 1.0 kg protected sunflower meal in lactating buffaloes.

Key words: Bypass protein, Undegradable protein, Rumen degradable protein, Sunflower meal.

INTRODUCTION

In India, buffaloes account for about 60 per cent of the total milk production. Moreover, buffalo milk has a much higher fat content, approximately 6-8 per cent

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relative to 3.5-4.5 per cent in cow milk. This poses additional constraints in relation to optimizing the nutritional components of supplements to sustain milk quality and quantity in buffaloes. Thus, a more effective and efficient use of existing feedstuffs is required to improve the overall productivity of ruminants (Garg *et al.*, 2001).

In view of the high energy cost in developing countries and the potential to significantly increase the neutral detergent insoluble nitrogen (NDIN) and acid detergent insoluble nitrogen (ADIN) contents of heat treated protein meals, it is considered that formaldehyde treatment of meals provides the most economically viable approach to optimize the RDP/UDP without changing the NDIN/ADIN. These by-pass protein meals enhance the post ruminal supply of critical amino acids (Prasad and Reddy, 1998) and increase protein conversion, reduce feeding costs and improve feed conversion efficiency. However, there is a need to concentrate on this need based research under varied animal production systems for best use of available protein. Thus, an attempt was made to study the effect of feeding formaldehyde treated sunflower meal on quantity and quality of milk in lactating buffaloes.

MATERIALS AND METHODS

A feeding trial was conducted on 16 lactating buffaloes, yielding 8-9 kg milk per animal per day. Animals were divided into two groups of 8 each, based on milk yield, fat per cent and stage of lactation (30-40 days post-calving). Animals in both the groups were fed standard ration daily, comprising 12 kg green maize fodder and 5 kg paddy straw. Concentrate mixture was given according to level of milk production, to meet the maintenance and production requirements (NRC, 1989). The chemical composition of feeds and fodder was carried out as per AOAC (1995). Feeds and fodder were also tested for NDF, NDIN, ADF, ADIN. cellulose, hemi-cellulose, acid detergent lignin as per Goering and Van Soest (1970). In addition to basal ration, animals in the control group were fed 1.0 kg untreated sunflower meal and in experimental group 1.0 kg protected sunflower meal Protected and unprotected sunflower meals were analyzed for critical amino acids by ion-exchange chromatography (Connell *et al.*, 1987).

Sunflower meal was treated with formaldehyde in sealed chambers where it underwent formation of complexes, resisting degradation in the rumen (Ashes *et al.*, 1995). The protein was tested for degree of protection using *in vitro* rumen incubation procedure. Known quantity of feed material was incubated for 24 hours in strained rumen liquor, anaerobically at 38°C. The protein degradation was measured by analyzing ammonia nitrogen level in strained rumen liquor, at the end of incubation (Gulati *et al.*, 1999). The degree of protein degradation was 67 and 25 per cent of CP in untreated sunflower meal and treated sunflower meal, respectively.

Unprotected or protected sunflower meal was fed to milch buffaloes for a period of eight weeks. The milk yield of individual buffaloes was recorded in the morning and evening. The milk samples were analyzed for fat (ISI, 1977) and protein (ISI, 1961) contents. Milk yield (kg), fat and protein percent were recorded in both the groups, for a period of eight weeks. The data were analyzed statistically (Snedecor and Cochran, 1968).

RESULTS AND DISCUSSION

Chemical composition of feeds and fodder offered to animals and the account of daily DM intake during the trial period is shown in Table 1. The protection (UDP) of untreated sunflower meal was 33 per cent of CP, while that of treated sunflower meal was 75 per cent of CP. The nitrogen fraction associated with fibre i. e. neutral detergent insoluble nitrogen (NDIN) and acid detergent insoluble nitrogen (ADIN) is a measure of the quality of protein in treated feeds (Nakamura *et al.*, 1994). Analysis of feeds and fodder revealed that the NDIN and ADIN contents were very low. Thus, cell wall bound nitrogen level was non-significant in all the feeds and fodder offered to animals during trial period. It also revealed that there was no significant difference between treated and untreated sunflower meal particularly in NDF, NDIN, ADF and ADIN contents. Since animals were fed similar ration, there was no significant difference in daily DM intake in the two groups.

Level of critical amino acids available for absorption in protected and unprotected sunflower meals are given in Table 2. Lysine and methionine are reported to be the most limiting amino acids for milk production (Schwab, 1995; Xu *et al.*, 1998). Approximately 0.95 g of methionine is present in one litre of milk. On feeding one kg unprotected sunflower meal, methionine availability would be only 0.52 g, whereas, from one kg protected sunflower meal, it will be 1.31 g. Thus, availability of limiting amino acids increased significantly on protection.

Account of daily milk yield in control and experimental groups is shown in Table 3. The daily average milk yield was 8.5 ± 0.15, 9.3 ± 0.14 kg, fat 6.7 ± 0.05 and 7.1 ± 0.06 % and protein 3.5 ± 0.01, 3.7 ± 0.02 % for the control and experimental groups, respectively. Increase in milk yield (kg) and fat per cent were significantly ($P < 0.05$) higher in experimental group (Garg *et al.*, 2002a,b,c). Increase in protein percent was not significantly different on feeding 1.0 kg treated sunflower meal. Significant effect of feeding treated protein meals on growth and milk production have been demonstrated by other workers as well (Hamilton *et al.*, 1992; Kunju *et al.*, 1992; Atwal. *et al.*, 1995; Sampath *et al.*, 1997; Garg, 1998 and Santos *et al.*, 1998; Gulati *et al.*, 2002). An increase in daily net income by Rs. 14.49 per animal was evident as a consequence of feeding 1.0 kg protected meal (Table 3).

Table 1. Chemical composition (% DM basis) of feeds and fodder and account of daily DM intake during the trial

Particulars	Maize green	Paddy straw	Cattle feed	Untreated SFM*	Treated SFM	Total DM intake (kg/day)
Chemical composition						
OM	92.16±0.01	82.81±0.02	89.25±0.01	90.36±0.01	90.32±0.01	
CP	6.86±0.01	3010±0.01	21.46±0.11	31.50±0.10	31.50±0.11	
EE	0.61±0.00	0.40±0.00	2.37±0.00	0.27±0.00	0.25±0.00	
NDF	61.72±0.14	72.05±0.13	23.54±0.14	47.36±0.11	47.30±0.10	
ADF	38.61±0.12	51.12±0.12	16.10±0.10	35.11±0.13	34.62±0.11	
ADL	4.21±0.01	2.04±0.00	4.43±0.01	9.96±0.02	9.84±0.01	
Cellulose	32.62±0.02	40.67±0.03	6.64±0.11	10.40±0.04	10.21±0.22	
Hemi-cellulose	23.11±0.13	20.84±0.12	7.44±0.12	12.25±0.11	12.68±0.10	
Silica	2.44±0.01	6.80±0.00	2.73±0.00	0.14±0.00	0.13±0.00	
NDIN	1.81±0.00	1.41±0.00	1.10±0.00	1.81±0.00	1.80±0.00	
ADIN	0.90±0.00	0.62±0.00	0.82±0.00	1.42±0.00	1.43±0.00	
Daily DM intake (kg)						
Control	2.56±0.00	4.66±0.01	4.51±0.00	0.92±0.00	-	12.65±0.01
Experimental	2.53±0.01	4.64±0.00	4.52±0.01	-	0.92±0.00	12.61±0.01

*Sunflower meal

Table 2. Level of critical amono acids (g/kg) available for absorption from bypass protein feed

Critical amino acids	Untreated SFM*	Treated SFM
Cysteine	0.73	1.84
Methionine	0.52	1.31
Isoleucine	1.33	3.32
Leucine	2.02	5.06
Phenylalanine	1.25	3.12
Lysine	1.14	2.85
Histidine	0.67	1.69
Arginine	2.34	5.85

*Sunflower meal

Table 3. Daily average milk yield, composition and economics on feeding untreated or treated protein meal supplement

Particular	Control (Untreated SFM)	Experimental (Treated SFM)
Milk yield (kg)*	8.5±0.15 (7.8 - 8.9)	9.3±0.14 (8.0 - 9.9)
Fat (%)*	6.7±0.05 (6.4 - 6.9)	7.1±0.06 (6.6 - 7.4)
Protein (%)	3.5±0.01 (3.3 - 3.6)	3.7±0.02 (3.4 - 3.8)
[1]Cost of milk (Rs)	92.22	107.4
Cost of SFM (Rs/kg)	5.5	6.2
Increase in gross income/animal/day (Rs)		15.19
Net increase in daily income (Rs)		14.99

[1]@ Rs. 10.85 and 11.55 per kg of milk for the control and experimental group, respectively

*Significant $P<0.05$; SFM: sunflower meal; Figures in parentheses denote the range

CONCLUSION

The feeding of 1.0 kg treated sunflower meal in the ration of dairy buffaloes yielding 8.0-9.0 kg of milk is expected to increase protein conversion, reduce the cost of milk production and generate higher profits.

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