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EFFECT OF FEEDING SLOW AMMONIA RELEASE AND PROTECTED PROTEIN SUPPLEMENT IN LACTATING COWS AND BUFFALOES

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ABSTRACT

Feeding trials using slow ammonia release and protected protein supplement (SARPP) were conducted on lactating crossbred cows (n=24) and buffaloes (n=24). Animals were divided into three groups of eight each, based on milk yield, fat percentage and stage of lactation. In addition to basal ration, animals in groups I, II and III were fed 1.0 kg untreated rapeseed meal containing 50 g untreated urea, 1.0 kg treated meal containing 50 g untreated urea and 1.0 kg treated meal containing 50 g treated urea, respectively. In cows, the level of blood urea-N (mg/dl) was 12.23, 12.29 and 11.63, whereas, level of allantoins (mmol/litre) in urine was 7.94, 9.31 and 13.85 in groups I, II and III, respectively. The average milk yield (kg) and fat (%) in three groups of cows were 9.67 & 4.30, 10.61 & 4.56 and 11.05 & 4.58, respectively. In buffaloes, the level of blood urea nitrogen (mg/dl) was 10.33, 10.48 and 9.64 and the level of allantoins (mmol/litre) in urine was 2.35, 3.03 and 5.23 in groups I, II and III respectively. The average milk yield (kg) and fat (%) in three groups of buffaloes were 6.46 & 6.64, 7.42 & 6.81 and 7.70 & 6.86, respectively. The present study suggested that SARPP is promising feed supplement for increasing milk yield in cows and buffaloes.

Key words: Slow ammonia release, Protected protein, Blood urea nitrogen, Allantoin, Cow, Buffalo.

INTRODUCTION

Usually, protein is treated to improve availability of rumen-undegraded dietary protein to animal system. For efficient growth of rumen micro flora, fermentable nitrogen is provided by urea. However, urea is rapidly hydrolyzed to ammonia and the rumen microbes are not able to utilize this ammonia efficiently for microbial protein synthesis. As a result, a significant part of nitrogen is lost through urine in the form of urea. Thus, it was felt necessary to develop a Slow Ammonia Release and Protected Protein (SARPP) supplement, in which dietary urea and proteins are simultaneously treated, to ensure efficient utilization of urea by the rumen microbes by slowing down its break-down and dietary proteins by treatment to prevent degradation in rumen. Consequently, to improve net availability of amino acids from treated urea and protein meal could be significantly higher for increasing milk production. In view of this, detailed study was undertaken on SARPP supplement in cattle and buffalo.

MATERIALS AND METHODS

Slow ammonia release from urea and protection of protein meal: To optimize the level of formaldehyde with urea, an *in vitro* study was conducted using different levels of formaldehyde (HCHO 40% *w/v*), at different hours of incubation period. Treated urea was incubated with strained rumen liquor (SRL) for different hours (2, 6, 24 and 48 hrs). Levels of ammonia nitrogen (mg/dl) were measured in SRL at 2, 6, 24 and 48 hrs of incubation, and compared with that of untreated urea, at 2 hours of incubation.

Rapeseed meal was treated with formaldehyde in a sealed chamber, for formation of complexes to resist degradation in the rumen. Treated rapeseed meal was tested for degree of protein protection using *in vitro* rumen incubation procedure. (Scott and Ashes, 1993). Slow Ammonia Release and Protected

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Protein (SARPP) supplement was developed with simultaneously treating rapeseed meal and urea, its feeding on the level of blood urea nitrogen, urinary allantoins, milk quantity and quality, in cows and buffaloes was studied.

Laboratory analysis: The chemical composition of feeds and fodder (Table 1) was carried out as per AOAC (2005). Feeds and fodder were also analyzed for NDF, NDIN, ADF, ADIN, cellulose, hemi-cellulose and acid detergent lignin as per the Goering and Van Soest (1970). The data were analyzed statistically (Snedecor and Cochran, 1976). To ensure, whether or not SARPP supplement is a source of slow release ammonia in the rumen, levels of blood urea nitrogen and allantoins in urine were measured in all the three groups. Milk samples were drawn weekly and were analyzed for fat and protein contents.

Feeding trials in lactating cows and buffaloes: A feeding trial was conducted on 24 lactating crossbred cows (9-11 kg milk/head/day), for 12 weeks period. Cows were divided into three groups of 8 each, based on milk yield, fat per cent and stage of lactation. Each animal in all the three groups was fed similar basal ration, comprising 12 kg green maize fodder and 5 kg paddy straw per day. Cattle feed (1) was given according to level of milk production, to meet the maintenance and production requirements (NRC, 2001). Another similar feeding trial was conducted on 24 lactating buffaloes (6-8 kg milk/head/day), for 12 weeks period. Each buffalo in all the three groups was fed similar basal ration, comprising 15 kg green jowar fodder and 6 kg bajra straw per day. Cattle feed (2) was given according to level of milk production, to meet the maintenance and production requirements (Kearl, 1982). In additional to basal ration, animals in group I were fed 1.0 kg untreated rapeseed meal containing 50 g untreated urea, animals in group II were fed 1.0 kg treated meal containing untreated urea and animals in group III were fed 1.0 kg treated meal containing treated urea (SARPP supplement) daily. Feed was offered twice daily in the morning and evening and animals were accessed to *ad-lib* clean drinking water.

RESULTS AND DISCUSSION

Milk yield and composition: Chemical composition of feeds and fodder offered to animals 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. Daily milk yield in all the three groups is shown in Table 2. In cows, average daily milk yield was 9.67, 10.61 ($p<0.05$), 11.05 ($p<0.01$) kg, fat 4.30, 4.56 ($p<0.05$), 4.58 ($p<0.05$) per cent and protein 3.21, 3.36, 3.37 per cent for the groups I, II and III, respectively. In buffaloes, the daily average milk yield in kg was 6.46, 7.42 ($p<0.05$), 7.70 ($p<0.01$), fat % 6.64, 6.81 ($p<0.05$), 6.86 ($p<0.05$) and protein % 3.41, 3.53, 3.56 for the groups I, II and III respectively. There is an increase in daily milk yield, fat and protein per cent in SARPP fed group, as compared to other two groups.

Significant improvement in milk yield and composition on feeding protected protein was also reported earlier in crossbred cows and buffaloes (Garg *et al.* 2007, Garg 2009; Walli, 2009) due to the increase supply of amino acids at the tissue level. The improved supply of amino acids in the presence of sufficient metabolizable energy, improve the protein-energy balance and create balance of precursors for milk synthesis thereby increase milk production.

Blood urea nitrogen : On feeding SARPP supplement, blood urea nitrogen (mg/dl) was significantly low (11.63 & 9.64; $p<0.05$), as compared to group I (12.23 & 10.33) and group II (12.29 & 10.48) (Table 2). Comparatively lower BUN levels indicated that the urea from SARPP supplement was utilized more efficiently for microbial protein synthesis in the rumen.

Allantoins in urine: On feeding SARPP supplement, level of allantoins (mmol/litre) in urine of cows was significantly higher (13.85; $p<0.01$) as compared to group I (7.94) and group II (9.31; $p<0.05$). In buffaloes, the level of allantoins in urine was 2.35, 3.03 and 5.23 ($p<0.01$) mmol per litre in groups I, II and III, respectively (Table 2). SARPP supplement increase level of allantoins in the urine and higher microbial protein synthesis in the rumen. It has been earlier reported that level of allantoins in urine is an indicator of microbial protein synthesis in the rumen (Chen *et al.* 1990). Subsequent studies of Liang *et al.* (2003) and Thanh *et al.* (2003) confirmed the same observation.

TABLE 1: Chemical composition (% on DM basis) of feeds and fodder fed during trials.

Particular	Green maize fodder	Green Jowar fodder	Paddy straw	Bajra straw	Cattle feed (1)	Cattle feed (2)
Crude protein	3.65	4.76	2.12	4.63	20.46	21.44
Ether extract	0.55	0.64	0.34	0.85	2.74	2.86
Acid detergent fibre	41.85	39.55	52.97	51.69	13.87	12.32
Acid detergent insoluble nitrogen	1.13	1.12	0.85	1.21	0.66	0.74
Neutral detergent fibre	63.24	66.23	74.48	77.09	22.31	23.46
Neutral detergent insoluble nitrogen	2.22	2.34	1.42	2.65	0.95	1.31
Acid detergent lignin	5.64	4.45	4.21	6.63	1.32	1.52
Cellulose	32.71	32.62	42.31	42.26	9.09	7.03
Hemi-cellulose	21.39	26.68	21.51	25.40	8.44	11.14
Silica	3.50	2.48	6.45	2.80	3.46	3.77

TABLE 2: Effect of feeding SARPP supplement on milk production, composition, BUN and allantoins in urine.

Particular	Cow			Buffalo		
	Group – I	Group – II	Group – III	Group – I	Group – II	Group – III
Milk yield (kg)	9.67	10.61*	11.05**	6.46	7.42*	7.70**
Fat (%)	4.30	4.56*	4.58*	6.64	6.81*	6.86*
Protein (%)	3.21	3.36	3.37	3.41	3.53	3.56
Blood urea nitrogen (mg/dl)	12.23	12.29	11.63*	10.33	10.48	9.64*
Allantoins in urine (mmol/litre)	7.94	9.31*	13.85**	2.35	3.03	5.23**

*$p < 0.05$; **$p < 0.01$

Operational health and safety aspects: Formaldehyde can be used as a feed additive to protect proteins from ruminal degradation, to preserve silages, to maintain animal feeds or feed ingredients free of salmonella, to control fungi and to improve the handling characteristics of oilseeds and meals, and animal fat pre-mixes (FDA, 2004). For treatment of protein meal and urea, level of formaldehyde was used not > 1.0 per cent. After two days of incubation, formaldehyde level in protein meal was detected below 2 ppm. So, handling of treated protein meal and urea is not a serious problem in the production of SARPP supplement, or from animal and consumer health hazard point of view.

CONCLUSION

The present study indicated that SARPP supplement is a promising feed supplement for increasing milk production in cows and buffaloes, with little cost and could be more useful for the countries having deficiency of quality feed resources.

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