DEVELOPING FEEDING MODULE FOR INCREASING MILK PRODUCTION IN MURRAH BUFFALOES (*BUBALUS BUBALIS*)

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ABSTRACT

Asia harbours more than 90% of world buffalo population, out of which India ranks first. The riverine buffalo (*Bubalus bubalis*) mainly found in the Indian subcontinent is primarily used for milk production and more than 57% of total milk production of country is contributed by buffalo. Therefore, this study was conducted for developing a sustainable feeding module for lactating buffaloes with available feed resources. A field survey was conducted in urban and peri-urban areas of Karnal, Kurukshetra and Yamunanagar districts of Haryana province of India to study the existing feeding practices for lactating buffaloes. Most of the buffaloes were observed deficient in both energy and protein. Therefore, a number of total mixed feed formulations were evaluated *in vitro* to screen the suitable formulation for practical ration preparation under field condition. A feeding trial was conducted for a period of 75 days on ten lactating Murrah buffaloes (BW, 502±12 kg; MY, 6.0±0.2 kg; Parity 2 to 4), divided into two groups of 5 each in a completely randomised block design with the most appropriate combination of complete feed mixture in comparison to conventional green fodder based feeding system. Although feed intake was lower, there was a trend in increase in nutrient digestibility with significant ($P<0.05$) increase in protein digestibility in buffaloes fed complete feed mixture. The nutrient density in terms of percent DCP and TDN of the diet of complete feed mixture were also improved. It was observed to increase ($P<0.05$) milk production of buffaloes with the feeding of complete feed mixture (Wheat straw, 3.7 kg; Concentrate mixture, 3.6 kg; Cotton seed cake, 0.8 kg and Maize fodder, 3.9 kg) with lowered cost of production. Therefore, it may be concluded that feeding of balanced complete feed mixture with available feed ingredients could improve the milk production, thereby; farmers may get more return from buffalo rearing.

Keywords: *Bubalus bubalis*, buffaloes, feeding module, complete feed mixture, digestibility, milk production

INTRODUCTION

Global population is expected to grow over 9 billion by the middle of the 21st century, while food demand is projected to increase by 70% by 2050 (FAO, 2006). Therefore, it is essential to

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produce sufficient food for the increased population. The rapid increase in demand for animal products, particularly in developing countries (Delgado *et al*., 1999) has thrown challenges to improve animal productivity through appropriate technologies. Climate change could have a significant impact on animal production by many ways including quality feed and fodder availability. Therefore, the price may increase with lower availability to farming community especially small scale socioeconomically poor farmers. Feeding of locally available feed resources would be the only way for sustainable animal production in developing countries (Devendra and Leng, 2011). However, poor utilization of feeds available locally limits the animal production in tropics. Therefore, strategic supplementation to locally available fibrous feed resources is an important aspect to improve animal productivity (Sharma *et al*., 2004).

Like other developing countries, crop-livestock farming is an integral part of food production system in India. Farmers usually fed green fodder and wheat straw with one or two concentrate feed separately as supplement for sustaining milk production from buffaloes. As animals remain deficient, the milk production is not increased to its potential. Therefore, the present study was sought to develop a feeding module for Murrah buffalo for increasing milk production with available feed resources.

MATERIALS AND METHODS

A survey of dairy farms of urban and peri urban areas of the districts of Karnal, Kurukshetra and Yamunanagar was conducted to assess the existing feeding system/practices and nutrient deficiencies (Kearl, 1982) of milch buffaloes. A number of economically viable balanced complete feed mixtures with suitable combinations of concentrate feed ingredients and wheat straw were computed and evaluated for their *in vitro* dry matter digestibility and gas production (Tilley and Terry, 1963). Based on *in vitro* screening and practical suitability, a complete feed mixture (CFM) containing required quantity of concentrate mixture and cotton seed cake with wheat straw and maize fodder was prepared to meet the requirement for maintenance and milk production (Kearl, 1982) and evaluated in comparison to conventional feeding (CON) of green maize fodder based diet with limited amount of wheat bran and cotton seed cake separately, in ten lactating Murrah buffaloes (*Bubalus bubalis*) at their second to fourth lactation (BW, 502±12 kg; milk yield, 6.0±0.54 kg/d) divided into two groups in a completely randomized block design.

The feeding trial was carried out for 75 days duration including the first 15 days for adaptation and subsequent 60 days for data recording. Daily allowance of complete feed mixture was offered once in the morning (06:00 h) during the time of milking. Milking was done twice daily (6:00 h and 15:00 h) and daily milk yield of individual buffaloes were recorded throughout the experiment. A digestion trial of 6 days duration was conducted towards the end of experimental feeding. Samples of feed offered and refused were collected daily. The daily feed intake and faecal output from individual buffaloes were recorded. Pooled samples (6 days for each animal) were ground and stored for chemical analysis.

All feeds and fodders of these areas as well as samples of feeds, residues and faeces were milled to pass through a 1 mm sieve and analyzed for proximate principles following the methods of the Association of Official Analytical Chemists (1995).

Neutral detergent fibre (NDF) and acid detergent fibre (ADF) were estimated by the methods of Van Soest *et al*. (1991). Milk samples were analyzed for total solids, total ash, total protein and fat content (ISI, 1961). The results obtained were subjected to analysis of variance in a completely randomized design and the significance of differences between the treatment means was determined using the student t-test by SPSS 17.0 software according to Snedecor and Cochran (1994).

RESULTS AND DISCUSSION

The survey results revealed that the dairy owners of urban and peri urban areas of these districts mostly maintain their buffaloes on green fodder based diet with limited supplementation of one or two concentrate ingredients like cotton seed cake, wheat bran, and mustard cake separately. Although the quality of feeds used by farmers were within the normal range (Table 1) for Indian feeds and fodder (Ranjhan, 2004), the production level of buffaloes remain less probably due to deficiency in both energy and protein (Kearl, 1982).

The intake of DM by experimental lactating buffaloes was within the normal range (Kearl, 1982), however, daily intake (kg) was increased significantly ($P<0.05$) in buffaloes fed conventional green fodder based diet (CON) than buffaloes kept on complete (Table 2) feed mixture (CFM). The increased intake by buffaloes (CON) may be attributed to higher intake of maize fodder in the ration (Lade *et al*., 2007). Although, complete feeding system Improvement in digestibility of nutrients (Table 2) with significant ($P<0.05$)

Table 1. Ingredients and chemical composition of concentrate mixture, cotton seed cake, wheat bran and maize fodder.

Constituents	Concentrate mixture	Cotton seed cake	Wheat bran	Maize green
Ingredients (kg)				
Maize grain	33.0	-	-	-
Groundnut cake, expeller	21.0	-	-	-
Mustard cake, expeller	12.0	-	-	-
Wheat bran	20.0	-	-	-
Rice polish	11.0	-	-	-
Mineral mixture	2.0	-	-	-
Common salt	1.0	-	-	-
Chemical composition (% DM)				
OM	92.3	95.5	92.3	92.3
CP	20.3	24.4	14.7	9.2
EE	6.2	7.5	4.5	2.3
Total Ash	7.7	4.5	7.2	9.7
CF	7.4	21.8	9.7	28.2

increase in protein digestibility could be associated with modulation of rumen fermentation by availability all nutrients for microbial fermentation and utilization in the rumen and post-rumen digestive tract. The nutrient density of composite diet was comparatively higher in CFM fed animals, which indicates relatively better plane of nutrition in buffaloes fed balanced complete feed mixture. The present results represent that all the experimental animals had enough nutrients (DCP and TDN) to meet the requirements for maintenance and milk production (Kearl, 1982) and better utilization of nutrients in CFM fed animals.The digestive interactions between the feeds, named associative effects, can modify the metabolic processes in the rumen, so that the response of an animal to a combination of feeds can differ from the balanced median values of its components considered individually. This kind of response can be synergistic or antagonistic with a possible impact in nutrient utilization by the animals. The associative effect of CFM supplementation on acceleration of digestibility and nutrient density of composite diet could be related to fulfilment of nutritional adequacy of fermentation due to supplementation of limiting nutrients, resulting stimulation of the rumen microbial activity (Saran *et al*., 2000; Dey *et al*.,

Table 2. Feed Intake, nutrient digestibility and plane of nutrition of buffaloes fed different dietary regimens.

Attributes	Treatments		SEM
	CON	CFM	
Intake (kg DM/ d)			
Concentrate mixture*	-	3.6	-
Wheat straw	1.0	3.7	0.83
Cotton seed cake	0.2	0.8	0.24
Wheat bran	2.8	-	-
Green maize	10.6	3.9	1.32
Total	14.6[b]	12.0[a]	0.67
Nutrient Digestibility (%)			
DM	63.31	64.84	1.83
OM	65.84	66.32	1.57
CP	66.44[a]	69.35[b]	1.94
EE	73.21	74.52	1.44
NDF	51.2	50.3	1.63
ADF	39.2	38.1	2.12
Nutrient density (%)			
DCP	10.67[a]	11.53[b]	0.22
TDN[+]	64.74	66.58	1.43

CON : Control diet; CFM : Complete Feed mixture.

[+]TDN calculated from DOM (1 kg DOM = 1.05 kg TDN; NRC, 1981).

[a,b] Mean bearing different superscript within a row differ significantly (P<0.05).

2014).

Although milk production (kg/d) was significantly (P<0.05) increased by feeding of complete feed mixture, the milk composition of buffaloes were similar (P>0.05), regardless of dietary treatments (Table 3). The increased milk production in CFM fed buffaloes could be attributed to optimum ruminal fermentation for better utilization of digested nutrients in synergy for synthesis of body tissues and milk production (Talpada *et al*., 2001; Lailer *et al*., 2005). The efficiency of milk production in terms of milk yield per unit feed intake was significantly (P<0.05) higher in CFM fed animals, depicting better conversion of nutrients. The cost-benefit analysis revealed higher economic return from milk production in buffaloes fed complete feed mixture.

Present study suggests that feeding of balanced complete feed mixture can provide all the nutrients in required quantity for increasing milk production in Murrah buffaloes than conventional green fodder based separate feeding, therefore, farmers may earn more money from buffalo farming.

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Table 3. Effect of feeding complete feed mixture on milk yield, milk composition and economics in dairy buffaloes.

Attributes	Treatments		SEM
	CON	CFM	
Milk yield			
Kg/d	5.8[a]	7.9[b]	1.1
EMP[1]	0.40[a]	0.66[b]	0.03
Milk composition (%)			
Fat	7.62	7.43	0.10
Protein	3.92	4.04	0.04
Total Ash	0.79	0.81	0.03
SNF	8.93	9.04	0.08
Total solids	16.55	16.47	0.06
Economics of feeding (Rs./d)			
Total cost of feed	93.8	108.6	-
Feed cost/kg milk yield	16.2	13.8	-

CON : Control diet; CFM : Complete Feed mixture.

[a,b]Mean values with different superscript within a row differ significantly (P<0.05).

[1]EMP, Efficiency of milk production (kg milk yield/ kg intake).

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