EFFECT OF DIFFERENT LEVELS OF DIETARY CRUDE PROTEIN AND UNDEGRADABLE PROTEIN ON THE ECONOMICS OF MILK PRODUCTION OF CROSSBRED COWS

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Among the various nutrients, protein forms the most significant and costliest constituent of the dairy ration. Various studies have shown that feeding of undegradable protein (UDP) sources at various levels improved the production performance of medium and high producing animals. Since the UDP supplements are expensive, it is not economical to include them in dairy rations especially for low producing animals. Non protein nitrogen (NPN) is a cheaper source of nitrogen and is equally good as preformed protein. Urea is the cheapest and most commonly used NPN source, which is degraded completely in the rumen. So a combination of UDP and NPN substance like urea can be equally effective and economical in dairy rations.

The present study was undertaken to assess the economics of milk production by the inclusion of urea as a readily degradable protein source in the concentrate mixture with two levels of crude protein (CP) and UDP for crossbred cows during early lactation.

Materials and Methods

Eight crossbred cows within 20 days of lactation as uniform as possible with regard to their age, parity, body weight and milk yield were selected from the University Livestock Farm and Fodder Research and Development Scheme (ULF & FRDS), College of Veterinary and Animal Sciences, Mannuthy, Thrissur.

The animals were fed four isocaloric concentrate mixtures (T_1, T_2, T_3 & T_4) with 17 per cent and 20 per cent CP having 28, 39.15, 26.46 and 40 per cent of CP as UDP, respectively, on dry matter(DM) basis. The calculated total digestible nutrients(TDN) content of the four concentrate mixtures was 70.0, 69.24, 70.26 and 68.98 per cent, respectively (Table 1). All the four dietary treatments contained one per cent urea as source of rumen degradable protein(RDP).

The feeding trial was conducted in a switch over design. Each treatment was given for a period of three weeks, with an adaptation period of one week in between the treatments, the total feeding experiment being for 15 weeks. The concentrate mixture and paddy straw were fed at the ratio of 70:30 of daily dry matter. The daily DM intake and milk yield were recorded through out the experiment. Cost per kg milk production for the four treatments was calculated from cost of feed, total milk production and quantity of feed consumed by cows in each treatment group. Total cost of feed for different dietary treatments was calculated from the cost of feed ingredients fixed by the

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Proximate analysis of the four concentrate mixtures and paddy straw was carried out as per standard procedure (AOAC, 1990). The results obtained were analyzed by the method for switch over design (Snedecor and Cochran, 1985).

Results and Discussion

Chemical composition

The CP level in the four concentrate mixtures were 16.93, 17.37, 19.92 and 19.92 per cent, respectively and that of paddy straw was 5.20 per cent (Table 2). The CP content of the four rations formulated with concentrate and roughage in the ratio of 70:30 of the total dry matter intake was 13.41, 13.71, 15.50 and 15.50 per cent, respectively. As per National Research Council (NRC, 1971) a CP level of 13 to 14 per cent of dry matter of a complete ration is sufficient to meet the requirement of lactating cows unless the production is too high.

The four concentrate mixtures (16.93, 17.37, 19.92 and 19.92 per cent CP) used in this feeding trial contained calculated UDP levels as 28, 39.15, 26.46 and 40 per cent of CP and RDP levels as 72, 61.85, 73.54 and 60 per cent of CP, respectively, on DM basis. The UDP and RDP contents of the four concentrate mixtures were calculated using the published UDP content of the ingredients (Ensminger *et al.*, 1990). Coconut cake was added as UDP supplement to the second and fourth dietary treatments to increase the UDP level from 25 to 40 per cent of CP. NRC (1989) recommended 36.6 to 43.3 per cent UDP and 49.8 to 74 per cent RDP of ration CP of ration for 400 kg cows producing 7 to 13 kg milk per day. In the present study, all the diets appeared to provide sufficient RDP from urea and groundnut cake to meet the needs of ruminal micro-organisms for amino acids, ammonia nitrogen and peptides for protein synthesis.

Dry matter intake

The dry matter intake (DMI) of the animals as per cent of their body weight in the four groups were also similar and were 3.03, 3.01, 3.00 and 3.03, respectively (Table 3). All the diets were consumed readily and feed refusal was rare. The total concentrate mixture consumed by animals of the four groups were 1380.80, 1353.40, 1374.00 and 1382.80 kg and that of paddy straw were 597.50, 603.75, 608.75 and 610.25 kg, respectively. The inclusion of urea at different CP or UDP levels

Table1. Ingredient composition and calculated nutrient content of the four concentrate mixtures given to the experimental animals, kg

Ingredient	T1	T2	T3	T4
Yellow maize	50.5	44.0	42.0	39.5
Groundnut cake	10.5	4.0	19.0	11.0
Coconut cake	0.0	29.5	0.0	36.5
Wheat bran	35.0	18.5	35.0	9.0
Urea	1.0	1.0	1.0	1.0
Salt	1.0	1.0	1.0	1.0
Shell grit	2.0	2.0	2.0	2.0
Nutrient content (calculated)				
CP, per cent	17.06	17.21	20.04	19.95
RDP, per cent	12.33	10.41	14.77	11.98
UDP, per cent	4.73	6.80	5.27	7.97
TDN, per cent	70.60	69.24	70.26	68.98
Calcium, g%	0.72	0.75	0.74	0.77
Phosphorus, g%	0.65	0.53	0.58	0.51

Table 2. Chemical composition of the four concentrate mixtures and paddy straw fed to experimental animals*, % DM basis

Parameter	Concentrate mixtures				Paddy straw
	I	II	III	IV	
Dry matter	88.82 ± 0.30	89.38 ± 0.41	89.03 ± 0.27	89.60 ± 0.57	90.41 ± 0.64
Crude protein	16.93 ± 0.08	17.37 ± 0.09	19.92 ± 0.14	19.92 ± 0.11	5.20 ± 0.13
Ether extract	5.52 ± 0.45	6.32 ± 0.28	4.31 ± 0.39	6.08 ± 0.57	1.77 ± 0.32
Crude fibre	8.78 ± 0.55	9.07 ± 0.72	10.84 ± 0.72	8.27 ± 0.56	31.88 ± 0.78
Total ash	10.11 ± 0.74	7.78 ± 0.34	10.21 ± 0.07	8.38 ± 0.55	17.02 ± 0.48
NFE	58.66 ± 1.05	59.46 ± 0.36	54.72 ± 1.03	57.35 ± 1.45	44.13 ± 0.58
AIA	3.24 ± 0.17	2.11 ± 0.16	3.34 ± 0.26	1.85 ± 0.35	12.99 ± 0.33
NDF	28.63 ± 0.84	30.24 ± 0.75	28.06 ± 0.46	30.67 ± 0.84	71.48 ± 0.66
ADF	13.29 ± 1.18	14.68 ± 1.4	16.89 ± 1.42	16.23 ± 0.77	48.58 ± 1.06
ADL	6.03 ± 0.59	6.62± 0.82	5.34 ± 0.94	5.78 ± 0.94	4.49 ± 0.99
Calcium	0.98 ± .096	1.08 ± 0.12	1.08 ± 0.115	1.02 ± 0.04	0.23 ± 0.04
Phosphorus	0.43 ± 0.02	0.47 ± 0.018	0.48 ± 0.02	0.47 ± 0.02	0.26 ± 0.14

* Average of six values

Table 3. Economics of milk production of animals maintained on the four experimental rations

Parameter	T1	T2	T3	T4
Total concentrate mixture consumed, kg	1380.80	1353.40	1374.00	1382.80
Total straw consumed, kg	597.50	603.75	608.75	610.25
Total feed consumed, kg	1978.30	1957.15	1982.75	1993.05
Dry matter intake (DMI) per 100 kg body weight	3.03	3.01	3.00	3.03
Total milk produced in 84 days, kg	1562.40	1627.90	1508.64	1631.24
Feed intake per kg milk produced, kg	1.27	1.20	1.314	1.22
Cost of one kg concentrate mixture, Rs	7.01	8.51	7.61	9.50
Cost of one kg paddy straw used, Rs	2.77	2.77	2.77	2.77
Total cost of feed, Rs	11334.00	13190.00	12142.00	14827.00
Cost per kg milk produced, Rs	7.25	8.10	8.05	9.09

* *Calculated using the rate contract values fixed for feed ingredients by College of Veterinary and Animal Sciences, Mannuthy, for 2004-'5*

did not show any marked influence on the dry matter intake of the animals. Sannes *et al.* (2002) observed no difference in the DMI, milk yield or microbial protein yield between rations containing urea and soyabean as protein supplement.

Economics of milk production

The total dry matter intake of the animals of the four groups was 1978.30, 1957.15, 1982.75 and 1993.05 kg, respectively (Table-3). The total milk produced in 84 days by the animals given the four dietary treatments were 1562.40, 1627.90, 1508.64 and 1631.24 kg, respectively. Although the milk production was higher in animals fed high UDP diets (T_2 and T_4) statistical analysis of the data revealed a non significant difference ($P > 0.05$). The lack of any significant effect of levels of CP or its degradability in the ration on milk production indicates that 13.41 per cent CP in the ration with 28 per cent of protein supplemented as UDP was sufficient to meet the protein requirement of crossbred cows in early lactation. Also it was observed that within each level of protein consumption, increase in UDP level from 25 to 40 per cent tendered to increase the milk yield even though the difference was not significant.

High protein and high UDP concentrate mixture was (T_4) the costliest and the low protein and low UDP concentrate mixture (T_1) was the cheapest among the four concentrate mixtures. The cost of concentrates mixture per kg for T_1, T_2, T_3 and T_4 was Rs. 7.01, 8.51, 7.61 and 9.50, respectively. The cost of production per kg milk produced was Rs. 7.25, 8.10, 8.05 and 9.09, respectively, for the four dietary treatments. Ally (2003) observed that even though the milk production was higher in animals receiving 42.9 per cent UDP than 26.6 per cent, the cost of production of one kg milk was also higher in this group, making it non - economical.

Claypool *et al.* (1980) reported that cows fed 16 per cent CP rations had highest return over feed cost than those fed 19 per cent CP ration while, Roffler and Thacker (1983) observed that returns above feed cost were greater for the 16.5 per cent CP ration compared with 13.5 per cent CP ration.

The present study revealed that urea can be included economically in the 17 and 20 per cent CP concentrate mixture at two levels of degradability of 28 and 40 per cent without affecting the production performance of crossbred cows in early lactation.

Summary

A study was conducted with crossbred cows to assess the effect of urea as a source of rumen degradable protein on the cost of milk production in early lactation. Eight crossbred cows within 20 days of lactation were selected as uniformly as possible with regard to their age, parity, body weight and milk yield from ULF & FRDS, Mannuthy. They were allotted to the four dietary treatments in a switch over design. The four concentrate mixtures contained 16.93, 17.37, 19.92 and 19.92 per cent CP and 70.60, 69.24, 70.26 and 68.98 per cent TDN, respectively. The four concentrate mixtures had 28, 39.15, 26.46 and 40 per cent of CP as UDP, respectively, on DM basis. The milk yield was not affected ($P > 0.05$) by the levels of CP or degradability in the ration indicating that 13.41 per cent CP in the ration with 28 per cent of protein supplemented as UDP was sufficient to meet the protein requirement of crossbred cows in early lactation. Within each level of protein consumption, increase in UDP level from 25 to 40 per cent tended to increase the milk yield even though the difference was not significant. The cost per kg concentrates mixture for T_1, T_2, T_3 and T_4 was Rs. 7.01, 8.51, 7.61 and 9.50, respectively. The cost of production per kg milk produced was Rs. 7.25, 8.10, 8.05 and 9.09, respectively, for the four dietary treatments. The present study revealed that urea can be included economically in the 17 and 20 per cent CP concentrate mixture at two levels of degradability of 28 and 40 per cent without affecting the production performance of crossbred cows in early lactation.

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