Effect of Replacing Grain with Deoiled Rice Bran and Molasses from the Diet of Lactating Cows

L. C. Chaudhary, A. Sahoo*, Neeta Agarwal, D. N. Kamra and N. N. Pathak
Animal Nutrition Division, Indian Veterinary Research Institute, Izatnagar - 234 122 (U.P.), India

ABSTRACT : The effect of feeding concentrate mixture devoid of grain on the performance of crossbred dairy cows was studied. Twelve crossbred cows of first/second lactation were randomly distributed into two equal groups. The animals of group 1 were fed on a concentrate mixture containing 30% maize grain whereas, the cows of group 2 were offered a concentrate mixture where grain was completely replaced with deoiled rice bran (DORB) and molasses. Wheat straw was given *ad libitum* to the cows of both the groups. The feeding was continued for 112 days. The intake of dry matter, CP and TDN were similar in both the groups. Digestibility of DM, OM, EE, NDF and ADF were also comparable between the groups. The average daily fat corrected milk (FCM) yield was 7.70 kg and 7.43 kg in group 1 and 2, respectively. The chemical composition of milk (protein, fat and total solids) also remained unaffected. The animals of both the groups gained 9-10 kg body weight which indicates that both the diets were nutritionally adequate and grain can be successfully replaced with DORB and molasses from the diet to sustain about 6-7 kg FCM production. *(Asian-Aust. J. Anim. Sci. 2001. Vol. 14, No. 5 : 646-650)*

Key Words : Deoiled Rice Bran, Molasses, Crossbred Cows, Milk Yield, Nutrient Utilization

INTRODUCTION

Livestock farming is one of the main components of agriculture in India. Shortage in supply of animal feeds is very common in most of the developing countries. In spite of our self-sufficiency in cereal grain production for human consumption, there is little scope to provide grains and other good quality feed to livestock. The cost is another limiting factor for the use of these cereal grains in ration of animals. Therefore, most of the livestock farmers are increasingly depending upon the agricultural by products to meet the energy and protein requirements of the animals (Nawaz et al., 1993; Chowdhury, 1998). Deoiled rice bran (DORB) and molasses are the by products available in considerable quantity in most of the rice and sugar cane producing countries which can be used as animal feed (Osuji et al., 1995; Al-Jasser and Mustafa, 1996; Farrell and Martin, 1998). It is reported that acceptability and DM intake of animals were not affected due to inclusion of 30% DORB in concentrate mixture (Jaikishan et al., 1991). In buffaloes supplementation of 1000 g DORB resulted in better utilization of rice straw (Reddy, 1996). Singh et al. (2000) observed a significant ($p<0.01$) increase in DM intake by adult dry crossbred cows on free choice DORB along with restricted wheat straw. The nutritive value of DORB was however, observed to be quite low compared to wheat bran based ration. Indeed, dustiness is a problem for both animals as well as herdsman in the feeding of DORB based ration. Inclusion of molasses was observed to solve the problem of dustiness and also reversed decreased palatability to support higher DM intake in animals (Ranjhan, 1988). Cuban research emphasized the use of molasses in animal feeding system as an alternative to cereal grains as a means of intensifying animal production in the tropics (Preston, 1987). Therefore the present study was conducted to evaluate the diet where cereal grain was replaced with DORB along with small quantity of molasses for the lactating crossbred cows.

* Corresponding Author: A. Sahoo. Tel: +0091-581-442313, Fax: +0091-581-447284, E-mail: arta@ivri.up.nic.in.
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MATERIALS AND METHODS

Animals and Feeding

Twelve crossbred cows of first and second lactation were selected from a group of twenty-eight cows and were randomly distributed into two equal groups. Animals of group 1 were fed on concentrate mixture containing 30% maize grain while the maize grain was completely replaced with DORB and molasses from the concentrate mixture fed to animals of group 2. The ingredient composition of concentrate mixtures is given in table 1. Wheat straw was given *ad libitum* to all the animals. One kg of green maize was also given to each cow as an aid to meet the requirement of carotene and vitamin A. The concentrate was supplemented to above roughage based diet to meet the requirement for maintenance and milk production as per NRC (1989). The amount of concentrate for milk production was given at 0.6 kg (as fed basis) per kg milk produced over and above the maintenance requirement of individual animals. The daily requirement of concentrate mixture was divided into two parts and was offered at 0500 h and 1700 h

individually. Wheat straw was given once in the morning. Water was made available in the morning and evening. Milking was done twice a day at 0500 h and 1700 h. The experiment was continued for a period of 112 days starting from the date of parturition. Data on daily feed offered, residue left, daily milk yield and fortnightly live weight change prior to feeding and watering was recorded for individual cow during the entire period of experiment. Dry matter of concentrate and wheat straw was estimated at different periods, while that of green fodder was analyzed daily to arrive at DM intake of cows during the whole of feeding period.

Digestion trial

A digestion trial of 6 days collection was conducted to assess the nutrient utilization ability of the cows. During the trial total faeces voided, feed offered and residue left were recorded daily. A suitable aliquot of pooled faeces of each day was kept for dry matter estimation. The dry faeces of 6 days were pooled and were used for further analysis. For crude protein, a separate aliquot was pooled over the same period in a bottle containing dilute sulphuric acid.

Chemical analysis

The feed offered, residue left and faeces voided were analysed for dry matter (drying at 100℃ for 24 h), organic matter (ashing at 550℃ for 4 h), crude protein (Kjeltech Auto-analyzer) and ether extract (Soxlet extraction with petroleum ether) as per the methods described in AOAC (1980). The fiber fractions (neutral detergent and acid detergent fiber) were analyzed by modified method of Van Soest et al. (1991). Crude protein, fat and total solids in milk were also estimated (AOAC, 1980).

Statistical analysis

Data were analysed using t-test to test the significance of difference between the two treatment groups as described by Snedecor and Cochran (1968).

RESULTS AND DISCUSSION

Nutrient composition

The CP content of concentrate mixture fed to animals of group 1 and 2 was similar at 16.0 and 15.8%, respectively (table 1). Due to increase in the level of deoiled rice bran in concentrate mixture 2, the level of ADF and NDF was increased (Ranjhan, 1990) and the increased ash content was contributed by both DORB (Singh et al., 2000) and molasses (Ranjhan, 1990). The total diet provided similar CP (9.85%) and TDN (60%) but the DCP was numerically higher in group 1 (5.78% vs 5.15%) (table 2).

Intake and digestibility of nutrients

The intake and digestibility of nutrients showed non-significant difference between the groups (table 2). According to Malik et al. (1989) the intake and digestibility of DM reduced when the proportion of DORB was increased to 78% in the concentrate mixture 2, without affecting the total DM intake in animals. Addition of molasses might have improved the palatability of ration. Molasses at low level (20% in the DM) tends to be complementary in improving

Table 1. Physical and chemical composition of concentrate mixtures and wheat straw

Item	Conc. 1	Conc. 2	Wheat straw
Ingredient (kg/100 kg)			
Crushed maize	30	0	-
Deoiled rice bran	55	78	-
Ground nut cake	8	6	-
Mustard cake	4	3	-
Molasses	0	10	-
Mineral mixture	2	2	-
Salt	1	1	-
Chemical composition (%DM basis)			
Organic matter	88.9	86.3	88.5
Crude protein	16.0	15.8	3.2
Ether extract	2.8	3.0	1.5
NDF	73.1	78.0	83.6
ADF	16.6	18.4	51.4
Ash	11.1	13.7	11.5

Table 2. Intake and digestibility of nutrients and nutritive value of ration

Item	Group 1	Group 2	Significance
Nutrient intake			
DM (kg)	9.37±0.49	8.73±0.48	NS*
OM (kg)	8.31±0.43	7.62±0.42	NS
CP (g)	924±50	860±60	NS
EE (g)	204±13	200±13	NS
NDF (kg)	7.32±0.36	7.04±0.34	NS
ADF (kg)	3.12±0.14	2.97±0.16	NS
Digestibility of nutrients (%)			
DM	56.05±1.10	57.19±1.71	NS
OM	58.89±1.05	59.84±1.27	NS
CP	54.88±1.05	52.07±2.35	NS
EE	70.90±1.38	73.20±1.27	NS
NDF	59.87±1.24	62.33±2.53	NS
ADF	43.50±3.54	45.82±3.55	NS
Nutrient density (%)			
CP	9.85±1.07	9.86±0.63	NS
DCP	5.78±0.63	5.15±0.33	NS
TDN	60.28±0.88	6.43±0.91	NS

* Non-significant ($p>0.05$)

the utilization of crop residues based ration in ruminants (Preston, 1987; Ranjhan, 1988). Moran et al. (1983) reported marginal decrease in DM and OM digestibility when rice bran was only 20% of total DM intake, but digestibility of OM gradually increased and that of CF decreased with the increased level of rice bran in the diet. However, there was no change in nutrient digestibility by partial or complete replacement of deoiled groundnut cake and wheat bran with deoiled mustard cake and DORB in concentrate mixture (Jaikeshan et al., 1991). But there are reports where addition of DORB reduced the nutrient digestibility (Malik et al., 1989; Singh et al., 2000). Khalili and Huhtanen (1991) found increased digestibility of DM and OM in crossbred cattle fed on subtropical hay based diets upon molasses supplementation. Osuji et al. (1995) observed that higher amount of molasses depressed fiber digestibility, however, when 1 to 2 kg DM of molasses was fed the fiber digestibility was unaffected. In the present experiment molasses DM was less than 1 kg and this might be one of the reason that there was no difference in fiber digestibility between the groups.

Animal performance

The performance of cows is given in table 3. The pattern of bi-weekly DM intake and milk yield was depicted in figure 1. There was an initial increase in milk yield during the first 6 weeks of lactation which declined in the following weeks. This upward trend in milk yield was well supported by an increase in DM intake during the same period. However, the milk yield showed a steep decline in the next four weeks to stabilize at around 6.0 kg per day. Similar trend was also observed in earlier experiments (Pathak et al., 1998; Sahoo et al., 1999, 2000). The total DM intake accounted for more than 3.2% of body weight with roughage contributing to about 43%. A major part of dairy cow's response to a particular nutritional environment is the amount of food the cow elects to eat given the freedom to do so. Therefore, at *ad libitum* feeding of roughage (wheat straw) with a fixed amount of concentrate as supplement the cow eats to their maximum and exhibited no difference in intake of DM, CP and TDN between the groups. The animals of both the groups were in similar plane of nutrition. The intake of energy and crude protein was more than the requirement (NRC, 1989) for the said FCM yield and the extra nutrients consumed were reflected in the form of body weight gain in animals of both the groups (10.5 kg in group 1 and 9.6 kg in group 2). In milking cows live weight changes during lactation are affected by the plane of nutrition (Broster and Broster, 1984). According to Broster et al. (1993) live weight stabilizes at a level commensurate with plane of nutrition and at normal intake body reserves

Table 3. Lactational performance of cows

Item	Group 1	Group 2	Significance
Duration of experiment (days)	112	112	
Milk yield (kg)			NS*
Total milk yiend	769.3 ± 48.4	737.2 ± 50.2	NS
Average daily milk yield	6.87 ± 0.43	6.58 ± 0.45	NS
Average daily 4% FCM	7.70 ± 0.44	7.43 ± 0.50	NS
Body weight change (kg)			
Body weight after calving	343.4 ± 6.61	351.4 ± 18.5	NS
Body weight at end of experiment	353.9 ± 8.22	361.0 ± 18.1	NS
Change in weight	10.5 ± 4.91	9.60 ± 1.66	NS
Dry matter intake (kg/d)			NS
Concentrate	6.59 ± 0.14	6.62 ± 0.16	NS
Straw	4.67 ± 0.20	4.86 ± 0.10	NS
Green fodder	0.18 ± 0.00	0.18 ± 0.00	NS
Total	11.43 ± 0.13	11.66 ± 0.16	NS
Nutrient intake			
TDN (kg/d)	6.89 ± 0.18	7.05 ± 0.10	NS
CP (g/d)	1213 ± 7.5	1207 ± 12.8	NS
Chemical composition of milk (%)			
Protein	3.61 ± 0.09	3.49 ± 0.11	NS
Fat	4.82 ± 0.25	4.80 ± 0.10	NS
Total solids	13.10 ± 0.55	13.40 ± 0.43	NS

* Non-significant ($p>0.05$)

are re-established at the expense of milk production resulting in a decline phase after peak production. However, in early lactation, the cow is under homeorrhetic influences that promote milk production even at the expense of body reserves resulting in high production and a negative energy balance at peak production to low production and a positive energy balance in late lactation (Rothbauer, 1994).

The average daily 4% FCM yield was 7.70 and 7.43 kg in grain fed and grain-replaced group, respectively. An earlier study conducted on crossbred cows given complete diets containing straw, wheat bran, molasses and mineral mixture (40:40:17:3) shows that cows consumed sufficient nutrients to support about 8-10 kg milk/day (Pathak et al., 1997). Similar to milk yield the milk composition (protein, fat and total solids) was also unaffected due to the replacement of grain with DORB and molasses. No significant change in milk composition was also reported by earlier workers (Krishna Mohan et al., 1976; Bernard and McNeill, 1991; Cunningham et al., 1993) when high energy supplements was replaced with high fiber agro-industrial by-products. On the other hand, there were also reports of an increased milk fat response to increased dietary levels of soyhulls replacing grain or wheat bran in the ration of dairy cows (Nakamura and Owen, 1989; Weiss, 1995; Qingxiang meng et al., 2000).

From the results of the present experiment it is evident that grain can be replaced with DORB and molasses from the diet of lactating dairy cows producing about 6-7 kg milk.

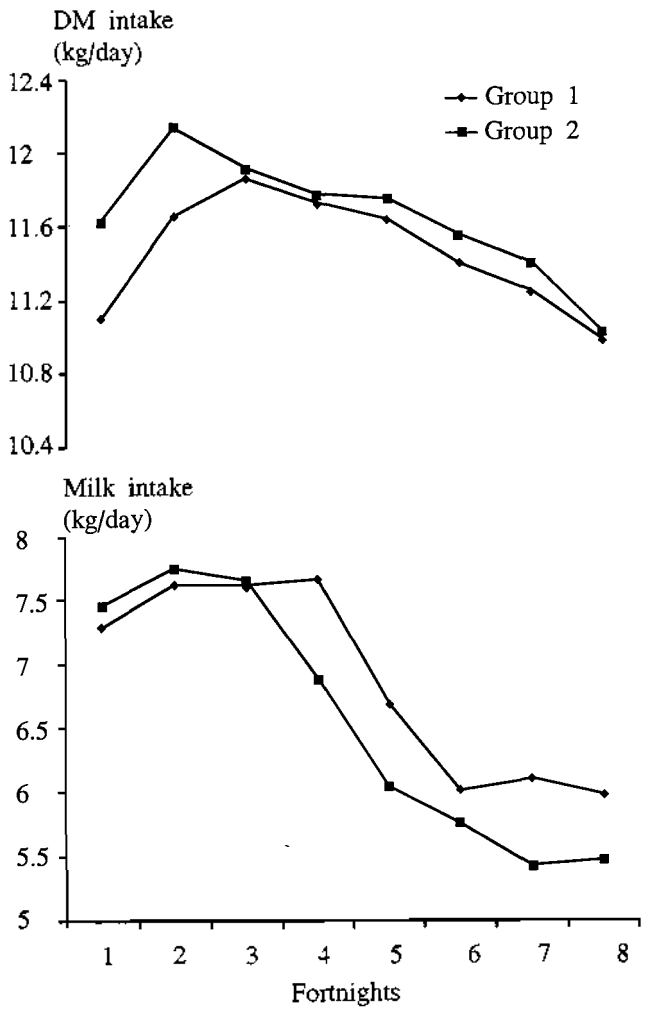

Figure 1. Fortnightly DM intake and milk yield in cows

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