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Supplementation of maize-based concentrates and milk production in indigenous cows

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Abstract

The effect of feeding maize-based concentrates on milk yield in cows with cost-benefit analysis was done at smallholder farms in four districts of northern Bangladesh. Concentrate mixtures containing wheat bran, rice polish and sesame oil cake were supplied to 40 indigenous (*Desi*) cows (20 in Group A and 20 in Group B) for 30 days before intervened feeding. Cows were given 1 kg maize-based concentrates/100 kg body weight twice daily for a further 60 days after feeding intervention. Cows' body weight, milk yield and farm income were recorded before and after maze-based concentrate supplementation. Milk production is increased by 30% for Group A and 90% for Group B. The difference in milk yield before and after supplementation of maize-based concentrate in Group B was significant ($P<0.05$). The cows' average body weights in Group A increased by 4.7 kg and in Group B by 1.8 kg. In both groups, net income increased and the income increase in A was significantly ($P<0.01$) greater than in B. Maize-based concentrated feeding in cows led to better milk yield with good economic return. (*Bangl. vet*. 2009. Vol. 26, No. 2, 48–53)

Introduction

Dairying is an integral part of rural livelihoods especially for the landless and smallholder dairy farmers, and acts as an important economic activity in Bangladesh; it provides supplementary income, employment and nutrition to about 3.6 million households (Marks and Sultana, 2008). More than 80% of people are involved in rearing cattle, most of the cattle are nondescript indigenous Zebu-type animals (Khan, 2006). Productivity of such indigenous animals is low, which is an important constraint limiting the development of the dairy industry. The production level of these animals is far behind the stakeholders' expectations to make the industry competitive. The reason is poor genetic characteristics. Poor nutrition might be a second cause.

The total milk production of the country is 2 million tonnes per year, which is insufficient to meet existing demand in Bangladesh. Daily consumption is about 35 ml per capita, while 250 ml is recommended. Milk production costs are high due to high feed costs. There is limited access to milk marketing, processing costs are higher than in neighbouring countries and technology uptake has been minimal.

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Animals are mainly kept in stalls with limited grazing on the roadside, embankment slopes, seasonal fallow lands etc. Fibrous crop residues constitute an important source of feed for dairy cattle (Debnath *et al.*, 2003). Paddy (rice) straw is the main source of roughage among the crop residues. Green roughage and rice polish are also widely fed to cows under village conditions. Maize grain is now available due to an increase in production in recent years. Total maize production increased by 63% from 2001 to 2008 (Khaleduzzaman and Khandaker, 2009). Therefore, farmers can supply dairy cows with crushed maize in addition to rice polish, wheat bran, and oil cakes. But there is scant information regarding the proportion of ingredients in concentrate feeds and nutritional demand of cows with regard to milk production at village level. Many feed manufacturing companies are preparing concentrate feed mixtures and supplying large dairy farmers, but smallholders are unable to buy because of high prices. This study was undertaken to measure the effect of supplementary maize-based concentrate feeding on milk yield of indigenous cows under village conditions and the cost-benefit analysis.

Materials and Methods

Location and animals

This study was conducted in four districts of northern Bangladesh between April and June 2009. A total of 40 indigenous cows (10/district) were selected from 40 farms. Farms had a mean of 4.5 animals with 1.1 lactating cows. The age of the cows ranged from 4 to 5 years and their parity from 3 to 5. Body condition score (BCS) ranged between 2.5 to 3.0 and body weights from 110 to 160 kg. All animals had been lactating 2 to 4 months. The animals were in two groups: Group A (20 cows: 10 from Sirajgonj and 10 from Joypurhat) and Group B (20 cows: 10 from Gaibandha and 10 from Rangpur).

Experimental procedure

In both groups, the animals were fed basal roughages (straw and green grass) with concentrates (1 kg for 100 kg body weight) made of rice bran, wheat bran, sesame oil cake, molasses, common salt and vitamin-mineral premixes for 30 days before feeding intervention followed by 60 days fed basal roughages with concentrates only after replacing of wheat bran by maize grain after feeding intervention (Table 1).

The ingredients and chemical composition of traditional and test feeds are in Table 2. Concentrated feeds were given twice daily. One kg concentrated feed was provided per 100 kg body weight, and *ad libitum* water. The cows were milked twice daily with their calves at foot. Both groups were maintained under identical management.

Data collection and statistical analysis

Data were recorded for 30 days before feeding intervention and 60 days after maize-based concentrate supplementation. Daily milk yield was recorded.

Table 1. Composition of concentrate feeds before and after intervention

Ingredient (%)	Before intervention	After intervention
Maize (crushed)	-	25.0
Rice bran (polish)	50.0	40.0
Wheat bran	15.0	-
Sesame oil cake	25.0	25.0
Molasses	08.0	08.0
Salt	01.0	01.0
Vitamin-mineral premix	01.0	01.0

Table 2. Chemical composition (g/100 gm) of dietary feeds before and after intervention

	Before intervention	After intervention
Rice straw	38.2	38.2
Green grass	33.3	33.4
Maize crushed	-	7.2
Wheat bran	4.4	-
Rice bran (polish)	14.6	11.7
Sesame oil cake	7.2	7.2
Molasses	2.3	2.3
Salt	0.01	0.01
Vitamin-mineral premix	0.01	0.01
Chemical composition and nutritive value		
DM (g/100 g)	3.0	3.0
CP (g/ kg DM)	96.1	91.9
ADF (g/100 g)	43.7	42.6
NDF (g/100 g)	62.0	62.1
Ash (g/100 g)	13.6	13.1
ME (MJ/kg DM)*	8.6	8.8

* Estimated

Changes in net income before and after intervention were calculated to make the cost-benefit analysis, determined by the formula {Income from milk (milk production × milk price) – milk production cost (feed intake × feed cost)}. Body weight of the animals was estimated according to the Shaeffer's formula adopted by McNitt (1983):

$$\text{Body weight (kg)} = \frac{\text{Length (inch)} \times (\text{Girth in inch})^2}{660}$$

Where length = Point of shoulder to buttock, and girth = Circumference of chest just behind forelimb.

The basal roughage and concentrate supplements were analysed for proximate principles (AOAC, 2000) and fibre fraction was analysed as described by Goering and Van Soest (1970). The data were entered into Microsoft Excel work sheet (2003) and exported to SPSS (Version 10.0, 1999) for analysis. Descriptive statistics were computed and Paired *t-test* was done to detect the changes in milk production, body weight and net income per cow per day after supplementary feeding.

Results and Discussion

Initial milk production of the cows in group A was 3.6 ± 1.8 litres per cow per day and increased by 1.2 ± 0.2 litres after supplementation, an increase of 30%; however, the difference was not significant (P>0.05, Table 3). For group B, average milk production of the cows was 0.8 ± 0.4 litres per cow per day before supplementation and increased by 0.7 ± 0.1 litres after, an increase of 90%. The difference was significant (P<0.05, Table 3).

Table 3. Changes in milk production (L/d) and cows' body weight (kg) before and after feeding intervention

Group*	Before intervention (Mean ± SD)	After intervention (Mean ± SD)	P value
Milk production (L/d)			
A	3.8 ± 1.8	4.9 ± 1.6	0.38
B	0.8^{b} ± 0.4	1.6^{a} ± 0.4	0.03
Cow's body weight (kg)			
A	133.1 ± 14.7	137.8 ± 13.6	0.61
B	121.4 ± 13.1	123.2 ± 14.2	0.84

* Number of cows in each group = 20; [a, b] Values in the same row differ significantly (P<0.05)

In group A, Pabna type cows (special type of indigenous cows having higher genetic merit) had higher initial milk yield. Group B consisted of local indigenous cows and their initial milk yield was lower due to poor genetic merit. Milk production increased in both groups after maize-based concentrate supplement was fed. Similar findings were reported by Chandrasekharaiah *et al.* (2004) who used a ration based on finger millet straw with maize grain supplementation. Pathak and Pandey (1995) reported higher milk yield in crossbred cows fed with higher levels of maize grain along with *ad libitum* berseem fodder.

The type of carbohydrate and nitrogen included in the ration that influences milk production (Clark and Davis, 1980). Jilg and Hirsch (1996) showed that maize starch differs from other cereal starches such as barley and wheat in its degradation; 60% of maize starch being degraded in the rumen compared with 90% of barley and wheat starch (Sampath *et al.*, 1999). In the present experiment, wheat bran was replaced by maize grain, which is slowly degraded, to match energy requirements for the rumen microbes for better digestibility of roughage. Replacement of wheat bran with crushed maize enhanced the energy level, which could have contributed to higher milk production (Sampath *et al*., 1999). Sivaiah and Mudgal (1983) reported that the escape of 20-40% maize starch from rumen fermentation followed by its absorption in the lower tract increased milk production. However, the increase in milk yield was 60% greater in group B than group A, which indicates that local indigenous cows of Group B responded better to supplementary maize-based concentrate than indigenous Pabna type cows in Group A.

The body weights of the cows of both group increased after feeding maize concentrate (Table 3). The cows gained 4.7 and 1.8 kg on average in Group A and B, respectively. However, body weight was higher in Group A: this might be due to the type of cows. The result is similar to that of Debnath *et al*. (2003), who reported that average total body weight gain was 1.3 to 6.0 kg per cow during 91 days.

In Group A, farmers' net income/cow/day increased from 101.3 ± 57.8 to 128.8 ± 57.3 Taka (Table 4; 1$ = Taka: 69). For group B, the net income increased from 5.2 ± 4.1 to 13.5 ± 4.4 Taka/cow/day. The increase in net income was significantly greater in Group A (P<0.01, Table 4) than Group B. Net income increased in both groups. Milk yield was higher in Group B due to higher genetic merit. Milk price was higher in the area of Group A than B. The result of this study is comparable with Shamsuddin *et al*. (2009), who reported that community-based dairy veterinary services increased farmers' income by Taka: 524 to 1635 per cow per month. In the present study, however, only supplementary maize-based concentrate feeding was provided, whereas community-based dairy veterinary services included health care, feeding and training.

Table 4. Changes in farmers' net income (Taka)/cow/day following supplementary maize-based concentrate feed (1$ = Taka : 69)

Group*	Net income (N1) per cow per day before intervention (Mean ± SD)	Net income (N2) per cow per day after intervention (Mean ± SD)	Change (N2-N1) in farmers' net income (Mean ± SD)	P value
A	101.3 ± 57.8	128.8 ± 57.3	27.5[a] ± 8.0	0.003
B	5.2 ± 4.1	13.5 ± 4.42	8.3[b] ± 2.3	

* Number of cows in each group = 20; [a, b] Values in the same column differ significantly (P<0.01)

Conclusions

Maize-based concentrated feeding increased milk production and net income. The maize-based ration proved cost-effective in promoting milk production in small dairy farms.

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