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Evaluation of the Performance of Different Dairy Breeds Feeding Urea Treated Rice Straw Based Similar Diet

Md. Abdur Rashid, [1]Md. Shahadat Hossain, [2] M.H. Kawsar
Imam Training Academy, Islamic Foundation, Bangladesh
[1]Rural Poverty Elevation Foundation, Bangladesh
[2]Trainer, Rural Poverty Elevation Foundation, Bangladesh

Abstract: The objective of the investigation was to evaluate the performance of different dairy breeds offered same ingredient, same amount of concentrate mixture and almost same amount of roughage under farm condition. Nine mid-lactating cows of three different dairy breeds were grouped into 3 diet treatments according to their genotype, T_1 (Pabna breed), T_2 (Sindhi cross) and T_3 (Jersey cross). Average daily dry matter (DM) intake by the cows fed on T_3 diet (7.23) was slightly higher than that of cows fed on diet T_2 (7.20) or T_1 (7.18). T_3 treatment group showed higher ($p<0.01$) milk production (5.0) followed by T_2 (3.71) and then T_1 (2.78). The live weight gain (kg d^{-1}) was highest (0.232) in Jersey cross (T_3) and lowest (0.134) in Pabna cows (T_1). The difference of weight gain among different treatment groups was statistically significant. Specific gravity of milk of T_2 (1.031) and T_3 (1.031) groups were similar but non-significantly higher than T_1 (1.029). The production of total solids (g kg^{-1}) was higher in T_1 group (139.90) than other two groups but the difference was statistically non-significant. The cows of T_1 group produced significantly higher solids-not-fat (88.53 g kg^{-1}) in their milk than other two groups. Fat production by Pabna cows (T_1) was non-significantly about 4.7 and 8.2% higher than that of other two groups T_2 & T_3 respectively. Milk protein present in Pabna cows milk (38.10 g kg^{-1}) was comparatively higher than that of T_3 (37.78) or T_2 (37.57) cows. The energy value (3.57) of milk of Pabna cows was also non-significantly higher than that of T_2 (3.45) and T_3 (3.33). Lowest feed cost for per liter milk production (Tk. 6.10) was found in Jersey cross (T_3) and highest (Tk. 10.88) in Pabna cross (T_1). There was much difference in the values of per liter milk production among the treatment groups.

Key word: Breed, production, climatic condition,

Introduction

The ruminants particularly dairy cows of Bangladesh suffer from nutrient deficiency due to shortage of quality feed supply. This limits the productivity of these animals. The major source of roughage for livestock in the country is rice straw which is very poor in nutritive value, particularly protein. There are numerous reports that chemical and physical treatment of rice straw increases its nutritive value. In the past, work has been carried out to improve the nutritive value of rice straw and also on the production performance of dairy cows such as treatment of straw with urea (Ahmed *et al.*, 1982, Saadullah *et al.*, 1981; Hossain, 1981; Dutta *et al.*, 1990 and Reddy *et al.*, 1991), treatment with alkali (Ibrahim and Pearce, 1983) and ammonia (Itoh *et al.*, 1975; Sundstol *et al.*, 1978; Khan and Davis, 1980). as nitrogen source to increase the digestibility and crude protein content of the straw. Of these, urea treatment is considered to be the most suitable from the point of acceptability by the rural farmers of Bangladesh. Urea treatment has number of advantages: it increases nitrogen content of straw and palatability etc. DM intake also increases due to incorporation of urea in straw (Trung, 1998). Most of the researches with urea treatment were concentrated on its effect on growth and milk production of animals. Very limited work has been done with different breed characteristics on milk composition. Milk composition plays a vital role on the market price of milk. Milk fat is an essential factor of milk for the acceptability to man. Therefore a research work was undertaken to study the effect of feeding urea treated rice straw to different genotypes of cattle on their milk yield and composition.

Materials and Methods

Preparation of urea treated rice straw: Five liter fresh water was taken in a container and 100 g urea was dissolved in it. A quantity of 5 kg chopped (10-12 inch) rice straw was taken in a concrete manger and the above urea water was sprayed over the straw and mixed well. The straw was allowed to soak for two hours. During this time all the water was soaked by the straw. In this way required amount of straw was soaked in urea water daily in the morning and evening and fed to the animals as fresh.

Experimental Animals: Nine lactating cows of three different dairy breeds having more or less similar body weight were used in this experiment. The cows were divided into three groups T_1 (Pabna breed), T_2 (Sindhi cross) and T_3 (Jersey cross) on the basis of their genotype. All cows were mid-lactation. Before starting experiment the individual weight of cows were recorded.

Experimental diets and Feeding of the cows: All the cows were fed on urea treated rice straw & green grass (maize & sunhemp) together with concentrate mixture (Table 1). Fresh water was supplied *ad libitum*. The cows were deformed and adjusted for two weeks with experimental feeds before starting the experiment. The rations were supplied twice daily, one in the morning and another in the evening. Voluntary intake of feed was recorded through subtracting amount of left over from supplied amount of feed.

Analytical methods and Design of experiment: Dry matter (DM) and crude protein (CP) content of feeds were determined following the methods of A.O.A.C (1984). Fat content of the milk was determined by Babcock method as determined by Ling (1945). Formal titration method was used for estimation of total protein content in milk. Total solids and solids-not-fat contents were measured by technique of Eckles *et al.* (1951). Energy value of milk was determined according to MAFF (1984) using the following formula:

$EV_1 = 0.0386\ BF + 0.0205\ SNF - 0.236.$

Where
EV_1 = Gross energy value of milk sample (MJ/kg),
BF = Butter fat (gkg^{-1}),
SNF = solids-not-fat (gkg^{-1}).

Specific gravity of milk samples was determined according to Aggarwala and Sharma (1961).
The ME content of the diet and degradability value were collected from Scottish Agricultural Colleges Bulletin (1984). The statistical design followed was the Completely Randomized Design (CRD) (Steel and Torrie, 1980).

Results and Discussion

Composition of the feed ingredients of experimental diets are Shown in Table 2. It is quite clear that crude protein (CP) of untreated straw (3.3%) increased due to soaking in urea water (9.0%). This might be due to fixation of nitrogen in the straw, during treatment (Akbar, 1992). Average dry matter (DM) intake (kg/day) (7.23) by cows of T_3 group was slightly higher than that of cows of T_2 (7.20) & T_1 (7.18) groups. But T_2 group showed higher DM intake than that of T_1 (Table 4) The differences were not significant among the treatment groups. It might be due to the use of same feed ingredients in different treatment groups.
Milk yield (liter/d) by the cows of T_3 (5.0) or T_2 (3.71) was higher than milk yield by the cows of T_1 (2.78). T_3 treatment group showed higher milk production than T_2 when compared between them. Though milk production was high in T_3 group but it was found that ME intake was nearly similar in all groups. The differences of milk yield among treatment groups were statistically significant ($P<0.01$) (Table 4). The reason for higher production by the cows of T_3 (Jersey cross cows)

Table 1: Composition of the experimental diets (kg /d).

Ingredients	Diets					
	T_1		T_2		T_3	
	Fresh	DM	Fresh	DM	Fresh	DM
Treated Straw	7.98	4.11	8.04	4.13	8.14	4.19
Green grass	1.78	0.248	1.74	0.242	1.82	0.254
Wheat bran	1.50	1.35	1.50	1.35	1.50	1.35
Khesari bran	1.00	0.91	1.00	0.91	1.00	0.91
Fish meal	0.10	0.092	0.10	0.092	0.10	0.092
Til Oil cake	0.50	0.46	0.50	0.46	0.50	0.46

Table 2: Composition of feed ingredients of experimental diets (DM basis)

Ingredients	DM (g/kg)	*ME (MJ/kg)	*RDP (g/kg)	*UDP (g/kg)	CP (g/kg)
Treated straw	610	8	81	9	90
Green grass	139.6	10.5	144	36	180
Wheat bran	880	10.7	128	42	170
Khesari bran	900	10.8	169	91	260
Fish meal	890	11.1	260	390	650
Til Oil cake	900	11	176	94	270

RDP= Rumen degradable protein, UDP= Un- degradable protein. * = Scottish Agricultural Colleges Bulletin (1984).
CP = crude protein

Table 3: Nutrient requirement for different treatment groups on the basis of average milk yield obtained in this study and nutrient consumed by the cows.

Attributes	Treatment					
	T_1		T_2		T_3	
	requirement	consumption	requirement	consumption	requirement	consumption
ME(MJ)	47.10	66.32	49.69	66.51	55.31	67.04
RDP(g/d)	367.38	600.85	387.58	601.83	431.41	605.99
UDP (g/d)	13.59	196.32	58.26	197.03	116.06	197.35
CP (g/d)	380.97	797.17	445.84	798.84.	547.74	803.58

Table 4: Over all performance of different treatment groups.

Attributes	Groups			Level of significance
	T_1	T_2	T_3	
Dry matter intake (kg/d/cow)	7.18	7.20	7.23	NS
Milk yield (liter/d)	2.78^b	3.71^{ab}	5.0^a	**
Initial body weight (kg)	273.67	250.98	241.47	-
Final body weight (kg)	285.76	260.66	262.78	-
Body weight gain (kg/d)	0.134^b	0.207^a	0.232^a	*
Specific gravity	1.029	1.031	1.031	NS
Total solids (g/kg)	139.90	135.92	131.77	NS
Solids-not-fat (g/kg)	88.53^a	86.46^b	83.96^c	*
Fat (g/kg)	51.7	49.4	47.8	NS
Protein (g/kg)	38.10	37.57	47.78	NS
Energy value (MJ/kg)	3.57	3.45	3.33	NS
Cost per kg milk production (Tk.)	10.88	8.15	6.10	-

NS= Non significant. ($P>0.05$), * = Significant ($P<0.05$), ** = $P<0.01$

group and T_2 (Sindhi cross cows) group than T_1 (Pabna cows) group might be due to breed characteristics and also better utilization of feed nutrient (Gupta, 1987; Singh *et al.*, 1990). Cows of T_3 group had higher milk production than those of T_2 or T_1 and cows of T_2 group had also higher milk production than cows of T_1 group. ME requirements for 2.78, 3.71 and 5.0 liter milk production (including maintenance) per day per cow were 47.1, 49.69 and 55.31 MJ for T_1, T_2, & T_3 groups respectively (ARC, 1988), but cows of T_1, T_2, & T_3 groups consumed 66.32, 66.51 and 67.04 MJ per day which showed 40%, 33.8% and 21.2% more consumption than their requirement (Table 3). This result indicates that the intake of ME for milk production is high in Bangladesh for three types of milking cows used in this experiment. But ME intake was very high in Pabna cows than their requirement. The result obtained from this experiment agreed with Talukder (1990) who conducted an experiment with Pabna cows and found that ME intake for milk production was higher than the Agricultural Research council (ARC, 1988) requirement. In case of RDP. UDP and CP, cows of T_1, T_2, & T_3 groups showed higher consumption (g/d) than their requirement. This result indicates that the intake of ME, RDP, UDP and CP for maintenance and milk production is high in Bangladesh for every three types of milking cows used in this experiment. But intake was very high in T_1, (Pabna cows) than their requirement. The results obtained in this experiment agrees with Talukder (1990). Body weight gain (kg/d) was highest (0.232) in Jersey cross cow (T_3) followed by that of T_1 (0.134). The difference in weight gain among different treatment groups were statistically significant ($P<0.05$). The highest weight gain was found in T_3 (Jersey cross cow) and lowest in Pabna cows (T_1). It might be due to better digestion and utilization of feed by Jersey cross cow (T_3) followed by Sindhi cross cows (T_2) and then Pabna cows (T_1). This better digestion and utilization might be due to breed characteristics of Jersey cross and Sindhi cross (Khan and Devis, 1981).

Specific gravity of milk of T_3 or T_2 groups was slightly higher than that of T_1 group during the experimental period. The differences among the treatment groups were non significant. This result agreed with Ito (1966). Generally specific gravity of cows milk varies from 1.027 to 1.035 (Eckles *et al.*, 1951). Though the specific gravity of milk of the treatment groups was within normal range yet the causes of lower specific gravity (1.029) of milk of T_1 than that of T_3 or T_2 group might be due to lower milk production of T_1 and higher milk fat present in milk of T_1 group than T_3 or T_2 group. Because milk fat has lower specific gravity than whole milk. The production of total solids (gkg^{-1}) of the milk by T_1 (139.9) was non significantly higher than that of T_2 (135.92) or T_3 (131.77) Higher total solids content of Pabna cows (T_1) milk shows that the quality of this milk was superior to that of other two breeds. This result agreed with number of authors (Mishra and Nayak,, 1962, Hossain 1968). The higher total solids present in milk of T_1 group denoted that the cows have higher transformation capacity of total solids to the milk from their body. The cow of T_1 group secreted higher solids-not-fat (88.53 gkg^{-1}) in their milk than other two groups T_2 (86.46) and T_3 (83.96). The differences of solids-not-fat present in the milk among the treatment groups were statistically significant ($P<0.05$). The higher solids-not-fat present in the milk of cows of T_1 group might be due to higher fat (gkg^{-1}) present in the milk (Trofimov & Vladimirova, 1964). From Table 4, it is found that butter fat content in per kg milk of T_1 was higher about (2.3g) and (3.9g) than that of Sindhi cross cows (T_2) and Jersey cross cows (T_3) respectively but the difference among the treatment groups was not statistically significant. Pabna cows produced less milk than other breeds. So it might be a cause of high fat content in their milk. This result agreed with several authors, who reported that there was negative correlation between daily milk yield and its fat content (Asker *et al.*, 1950; Bayonmi, 1960; Kliesch *et al.*, 1960; Vanschoubroek, 1959; Butcher *et al.*, 1965; Smith *et al.*, 1966). Average milk protein values were slightly higher ($P>0.05$) for Pabna cows (T_1) milk than those of Jersey cross cows (T_3) and Sindhi cross cows (T_2). The reason could be that the more fat content in Pabna cows milk. The result of milk protein content of this experiment is nearly similar with work of Khan *et al.* (1987) The energy value of milk of Pabna cows was non significantly higher than that of other two treatment groups. This might be due to highest amount of fat and solids-not-fat content of the milk for the treatment group T_1 than T_2 & T_3. This result (3.57) was slightly higher than the result (3.28) observed by Talukder (1990). Lowest feed cost per Kg milk production (Tk. 6.10) was found in Jersey cross cow (T_3) and was highest (Tk.10.88) in Pabna cow (T_1). This might be due to the highest milk production through almost same amount and same cost of feed was consumed by T_3 group. It may be concluded that high yielding breed like Jersey cross cows are more suitable for farming system to gain more profit among the three breeds. But in village areas Pabna cows are suitable for rearing because village farmer can not apply scientific methods of rearing Jersey cross cows.

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