Study of on-farm pre and post-natal feeding practices of Red Chittagong Cattle

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Abstract

The study was conducted with the objective to investigate prenatal and postnatal performances of Red Chittagong Cattle (RCC) cows in subsistence feeding and nutrition compared to those in improved feeding system. Twenty RCC cows with average initial live weight of 204.6 (±29) kg at their 2nd or 3rd parity and at about seven months of pregnancy were divided into two equal groups and assigned to two dietary treatments: one group was fed as per farmers' choice, while another was fed 25% higher metabolizable energy (ME) and crude protein (CP) than requirements through concentrates, according to ARC (2009). Cows in farmers' diet during last 50 days of pregnancy fed lower ME and CP (42.4 MJ and 445 g, respectively) than their daily requirements (43.5 MJ and 519 g, respectively), resulted in lower birth weight of calves compared to improved feeding (13.36 and 15.12 kg, respectively) where daily ME and CP intake was 57.77 MJ and 603 g. In first 60 days of lactation, cows under farmers' diet fed required amount of ME and CP (44.83 MJ and 471g, respectively) compared to requirement (42 MJ and 388g, respectively). However, cows in improved diet fed 1.28 and 1.42 times higher ME and CP (52.92 MJ and 563 g) than requirements, and produced higher milk (1.97 and 2.50 L/d; $P<0.05$) and daily gain (122 and 274 g/d; $P<0.01$), compared to that of farmers' diet cows. Therefore, it was concluded that diet of RCC cows in late pregnancy may be supplemented with CP in order to produce higher birth weight of calves. In case of lactating cows, a cost effective supplementation of concentrate mixture for increasing milk production and daily gain may be investigated by doing further research.

(**Key words:** Red Chittagong Cattle, nutrient requirement, daily gain and milk production, on-farm feeding and nutrition)

Introduction

The Red Chittagong Cattle (RCC) is considered as one of the important indigenous cattle genetic resources of Bangladesh. It is reared mainly by poor farmers in its habitats at Chittagong regions of the country and used for dairy, beef and draught purpose simultaneously. This cattle variety is unique due to its reddish coat, horns, hoofs, muffles, eye lashes and tail switch. Live weight, of adult male and female RCC is about 436 and 192 kg, respectively (Mostari *et al*., 2007). The lactation length of RCC under farm condition was reported as 238 days, and daily milk production as 2.24L (Mostari *et al*., 2007) which is significantly higher than local cows (1.63 L/d; Bhuiyan and Faruque, 1993). Compared to crossbred cows, milk fat content was also found higher in RCC milk (about 6 %; Akhter *et al*., 2004). In addition, owing to small body size, high disease resistance, and capacity to survive in poor feeding and management conditions, this cattle variety was stated to be suitable for poor smallholder farmers of the country (Islam, 2010).

However, study on feeding and nutrition status of pregnant RCC cows at subsistence

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farming system affecting their productive performance is limited. Due to qualitative and quantitative shortage of feeds and fodder in Bangladesh (Huque and Sarker, 2014), feeding of rice straw to RCC as basal diet with little concentrate supplementation - a common feeding practice of RCC farmers- may not be sufficient to meet the daily nutrient requirements either for maintenance or production. Dietary deficiency of nutrients, especially energy and protein, can cause poor productive and reproductive performance of RCC. Many important implications of prenatal nutrition of cows with their productive and reproductive performances has been noted (Ken Ziegler, 2009). Therefore, the study was undertaken with the objective to investigate prenatal and postnatal performances of RCC cows in subsistence feeding and nutrition compared to those in improved feeding.

Materials and Methods

Twenty RCC cows of 7 months pregnancy within 2 or 3 parities were selected at Latabania, Dolir Gopat, Fokirkhil and Notunhat villages under Satkania upazila of Chattogram district, and randomly assigned into two dietary groups, starting from March 15 to August 15, 2013. One group (T_1) was fed according to farmers' choice, while another group (T_2) received 25% above the requirements of metabolizable energy (ME) and crude protein (CP) according to ARC (2009), which was maintained through supplementing improved concentrate mixtures. Daily supply of roughages and their refusals were weighed and recorded. In farmers' choice group, quantitative daily supply of different concentrate ingredients was recorded. In improved feeding group, calculating nutrient deficiency of diet, a mixture of conventional concentrate ingredients was produced and its daily allowance was calculated so that intake of ME and CP was maintained at 25% above the actual requirements according to ARC (2009). This mixture of concentrate ingredients and daily allowances was updated fortnightly according to live weight (LW) of cows and requirements. During lactation, in addition to maintenance requirement, nutrient requirements for producing 3L milk daily were considered in formulating concentrate mixtures. A portable digital balance was used to take live weight of cows fortnightly. Nutrient intake of cows from roughage was calculated by subtracting refusal nutrients from fresh roughage nutrients supplied. Nutrient intake from concentrate was calculated by multiplying the amount consumed and their chemical composition; no refusals were found in case of concentrates. The chemical composition of conventional feedstuffs (roughage and concentrate) and average ingredient composition of concentrate mixtures of both farmers' choice diet and improved diet are presented in Table 1 and 2, respectively. Fresh and representative samples of feedstuffs used by different farmers were collected, kept in properly labeled airtight polyethine bags, and stored in deep freeze (-20 °C) until analysis. At the same time, representative samples of concentrate ingredients used according to either farmers' choice or improved feeding were sampled, collected in airtight polyethine bags and stored in deep freeze (-20°C) until analysis. At the end of trial, samples of different feedstuffs were thawed at room temperature,

pooled, mixed thoroughly and representative samples were produced. A portion of that was used to determine dry matter content by drying in an oven at 60° C for 48 h, while another portion was dried, milled by passing through 1 mm sieve of Willey mill and sent to laboratory for determining chemical composition at Animal Nutrition Laboratory of Bangladesh Livestock Research Institute, Savar, Dhaka, following the method of AOAC (2003). Data on LW gain of cows, birth weight of calves; milk yield and post-partum days were recorded and analyzed for Paired-Samples T Test to compare means using SPSS (11.5).

Table1. Chemical composition of roughage and concentrates fed to RCC cows

Feedstuffs	DM	OM	CP	ME *
	% fresh	% DM		MJ/ kg DM
Rice straw	91.88	85.35	3.85	5.38
Local grass	23.55	84.44	9.09	7.29
Rice polish (coarse)	91.28	90.77	7.70	7.72
Rice broken	88.2	96.52	8.50	13.6
Brinjal	7.62	98.86	17.77	-
Bean (green)	14.36	72.96	14.91	-
Bean pod (dry and broken)	85.81	97.78	7.72	-
Cluster of bean stem	14.04	88.3	44.75	-
Groundnut haulm	27.07	82.05	16.11	-
Concentrate ingredients				
Wheat bran	90.16	92.8	16.21	8.3
Rice polish (fine)	91.19	89.96	14.51	7.87
Maize flour	89.5	98.5	8.20	12
Mustard oil cake	91.79	89.3	31.50	20.58
Soybean meal	90.71	93.5	44.88	15

RCC, Red Chittagong Cattle; DM, dry matter; OM, organic matter; CP crude protein; ME, metabolizable energy; MJ, megajoule; *Calculated as per Kearl (1982).

Table 2. Average ingredient composition of concentrate mixtures (% fresh)

Name of ingredients (% fresh)	Dietary groups	
	Farmers' choice (T_1)	Improved feeding (T_2)
Rice broken	11.6 (±8.7)	-
Rice polish	85.1 (±10.8)	20.6 (±14)
Wheat bran	-	24.7 (±11.1)
Soybean meal	-	20.0 (±7.5)
Mustard oil cake (MOC)	-	19.1 (±6.3)
Maize flower	-	13.3 (±11.5)
DCP	-	1.2
Common salt	3.3 (±2.2)	1.0
Total	100.0	100.0

Values within parenthesis represent standard deviations of means.

Results and Discussion

Nutrient intake of pregnant RCC cows (7 months onward)

Prenatal requirement and intake of nutrients of cows during study period are given in Table 3. There was no significant difference (P>0.05) between treatment groups in respect of average LW (221 and 219 kg, respectively), metabolic LW (57.2 and 56.9 kg, respectively) and feeding periods (50 and 56 d, respectively). Similarly, daily requirements of ME and CP did not differ significantly (P>0.05). Total DM intake (5.20 and 5.82 kg, respectively), resulted from DM intake from roughage (4.37 and 4.61 kg/d, respectively; P>0.05) and concentrate of dietary groups (0.83 and 1.20 kg/d, respectively; P>0.05), did not differ significantly (P>0.05); it represented 2.38 and 2.69 per cent of LW of cows. However, total ME and CP intake (42.44 and 57.77 MJ/d; 445 and 603 g/d, respectively) differed significantly (P<0.05) due to the significantly different ME and CP intake (P<0.05) from concentrates (13.43 and 27.84 MJ/d; 134 and 279 g/d, respectively);

Table 3. Nutrient intake of pregnant RCC cows (7-9 months)

Parameters	Treatments		SEM	P values
	T_1	T_2		
Average LWduring trial (kg)	221	219	17.00	0.945
Metabolic LW (kg)	57.2	56.9	3.30	0.944
Prenatal feeding period (d)	50	56	8.03	0.471
Nutrient requirements				
ME (MJ/d)	43.5	43.9	2.60	0.878
CP (g/d)	519	521	33.61	0.975
DM intake				
Roughage (kg/d)	4.37	4.61	0.25	0.358
Concentrate (kg/d)	0.83	1.20	0.17	0.072
Total (kg/d)	5.20	5.82	0.21	0.057
% LW	2.38	2.69	0.16	0.094
g/kg$W^{0.75}$/d	91.4	103.2	4.70	0.043
ME intake				
Roughage (MJ/d)	29.01	29.93	1.37	0.525
Concentrate (MJ/d)	13.43	27.84	3.51	0.005
Total (MJ/d)	42.44	57.77	3.06	0.002
MJ/kg$W^{0.75}$/d	0.75	1.02	0.03	<0.001
Intake: requirement	0.98	1.33	0.07	0.003
CP intake				
Roughage (g/d)	311	325	14.28	0.371
Concentrate (g/d)	134	279	34.6	0.004
Total (g/d)	445	603	29.9	0.001
g/kg$W^{0.75}$/d	7.83	10.68	0.38	<0.001
Intake: requirement	0.86	1.17	0.07	0.006

RCC, Red Chittagong Cattle; LW, live weight; DM, dry matter; ME, metabolizable energy; CP, crude protein; T_1, cows fed according to farmers' choice; T_2, cows fed concentrate supplements to supply 25% more ME and CP than requirement (ARC, 2009); SEM, standard error of mean; P>0.05, not significant.

similar intake of ME (29.01 and 29.93 MJ/d, respectively) and CP (311 and 325 g/d, respectively) from roughage sources (P>0.05) were found. In terms of metabolic LW, both ME and CP intake in improved feeding group (1.02 MJ/kgW0.75/d and 10.86 g/kgW0.75/d, respectively) was significantly higher (P<0.05) than farmers' choice group (0.75 MJ/kgW0.75/d and 7.83 g/ kgW0.75/d, respectively). The resultant intake of ME and CP was lower than requirement of cows (0.98 and 0.86 parts of requirement) in formers' choice diet, whereas in improved feeding group, it represented 1.33 and 1.17 times of requirements. The relationship between LW gain of cows with ME or CP intake, irrespective of feeding systems, is presented in Figure 1. A strong significant correlation existed (n = 16, r = between ME intake and LW gain of cows {MJ ME intake = 0.046 × LW gain (g) +24.34; n, 16; r, 0.853; P<0.0005}. Relationship regarding CP intake and LW gain was also strongly significant {CP intake (g) = 0.483 × LW gain (g) + 252.4; n, 16; r, 0.884; P<0.0005}.

From these correlations, although sample size is very small, daily maintenance requirements of ME and CP of the experimental cows stood at 24 MJ/d and 252 g/d. Data on nutrient requirements of indigenous cattle at metabolic level is scarce; however, Huque *et. al*. (2005) reviewed that the daily maintenance requirement of ME and CP for native bull of 171 and 153kg live weight were 19.82MJ and 111g, respectively. Differences in sex, stage of pregnancy and LW might be the cause of higher maintenance requirement of the cows.

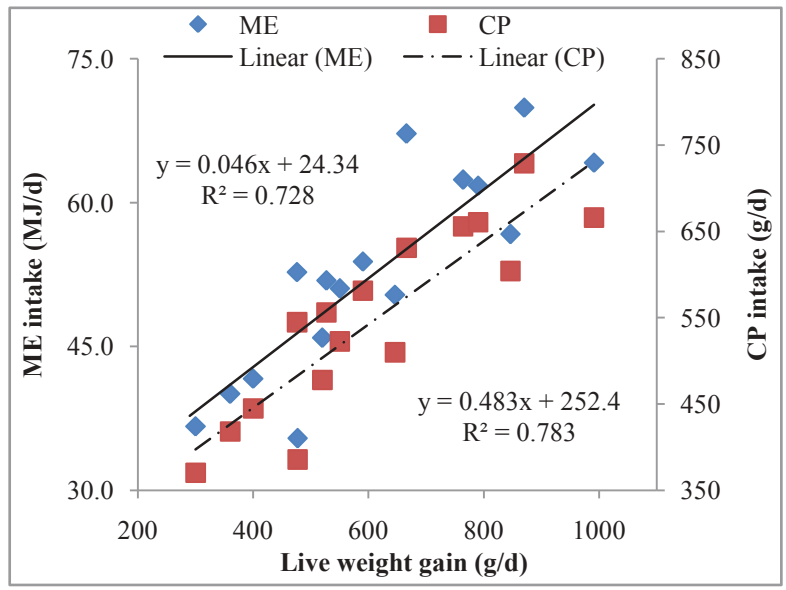

Figure 1. Relationship between live weight gain of pregnant RCC cows and their ME and CP intake

Effects of improved feeding on live weight change of cows and birth weight of calves

The effects of feeding on LW change of cows and birth weight of calves are presented in Table 4. The initial (209 and 200 kg, respectively) and final LW of cows (232 and 239 kg, respectively) was similar between dietary groups (P>0.05). Although LW gain of cows in improved feed feeding (681 g/d) was numerically higher than that in farmers' choice feeding (479 g/d), the values did not differ significantly (P>0.05). However, birth weight of calves, irrespective of sex, were found to increase significantly (13.36 to

15.12 kg; P<0.05) due to improved feeding practices.

In this study, difference in LW gain and birth weight of calves between dietary groups was 203 g/d and 1.76 kg, resulted from increased intake of ME and CP by 15.33 MJ and 158g, respectively. Asaduzzaman, *et. al.* (2012) reported 161 g/d gain of pregnant RCC cows and 10.95 kg of calf birth weight by 90 days prenatal feeding of 27.49MJ/d ME and 279g/d CP from conventional feeds. Difference in nutrient intake and length of prenatal feeding period might be the cause of this variation.

higher total DM intake (5.43 and 5.99 kg/d; P<0.01). Total DM intake in terms of per cent live weight was similar (2.76 and 3.10 kg, respectively; P>0.05), but it was different when expressed as per kg metabolic LW (103 and 116 g/d, respectively; P<0.05). Similarly, daily ME and CP intake of dietary groups from roughage was similar (36.43 and 35.75 MJ, and 385 and 377 g, respectively; P>0.05), but that from concentrate was significantly higher in improved feeding group (8.41 and 17.17 MJ, and 86 and 186g, respectively; P<0.010) which resulted in significantly higher total ME and CP intake (44.83 and 52.92 MJ, and 471 and 563 g,

Table 4. Live weight gain of RCC cows and birth weight of calves

Parameters	Treatments		SEM	P values
	T_1	T_2		
Initial live weight (kg)	209	200	17.86	0.637
Final live weight (kg)	232	239	16.90	0.713
Weight gain of cows (g/day)	479	681	85.84	0.051
Birth weight of calves (kg)	13.36	15.12	0.75	0.044

RCC, Red Chittagong Cattle; T_1, cows fed according to farmers' choice; T_2, cows fed concentrate supplements to supply 25% more ME and CP than requirement (ARC, 2009); SEM, standard error of mean; P>0.05, not significant.

Nutrient intake of early lactating RCC cows

Postnatal nutrient requirement and intake of RCC cows between treatment groups are given in Table 5. There was no significant difference (P>0.05) between treatment groups in respect of average LW (199 and 197, kg, respectively), metabolic LW (53 and 52 kg, respectively) and feeding periods (60 d). Daily requirements of CP and ME were also similar (P>0.05). DM intake from roughage was similar (4.87 and 4.82 kg/d; P>0.05), however, it was significantly higher from concentrate (0.56 and 1.17 kg/d, respectively; P<0.01) which resulted in significantly

respectively; P<0.01). The ME and CP intake with reference to metabolic LW also differed significantly (0.85 and 1.02 MJ/d, and 8.97 and 10.87 g/d, respectively; P<0.05). In farmers' choice diet, the intake of ME was equal to requirement (1.06 times) and that of CP was 1.21 times of requirement. In case of improved feeding, ME and CP intake was 1.28 and1.42 times higher than requirement. Compared to the requirements of cows in late pregnancy (43.5 MJ/d and 519 g/d; Table 3), the requirements in early lactation was less (42 MJ/d and 388 g/d; Table 5), which might help meet nutrient requirement of cows from farmers' choice diet.

Table 5. Nutrient requirement and intake of RCC cows during early lactation

Parameters	Treatments		SEM	P values
	T_1	T_2		
Average LW during lactation (kg)	199	197	11.99	0.830
Metabolic LW (kg)	53	52	2.39	0.826
Postnatal feeding period (d)	60	60	-	-
Nutrient requirements				
ME (MJ/d)	42	42	0.96	0.526
CP (g/d)	388	397	6.75	0.177
DM intake				
Roughage (kg/d)	4.87	4.82	0.12	0.678
Concentrate (kg/d)	0.56	1.17	0.05	<0.001
Total (kg/d)	5.43	5.99	0.15	0.005
% LW	2.76	3.10	0.19	0.105
g/kg$W^{0.75}$/d	103	116	5.45	0.048
ME intake				
Roughage (MJ/d)	36.43	35.75	1.57	0.673
Concentrate (MJ/d)	8.41	17.17	1.02	<0.001
Total (MJ/d)	44.83	52.92	2.35	0.007
MJ/kg$W^{0.75}$/d	0.85	1.02	0.06	0.025
Intake: requirement	1.06	1.28	0.06	0.007
CP intake				
Roughage (g/d)	385	377	17.92	0.678
Concentrate (g/d)	86	186	17.17	<0.001
Total (g/d)	471	563	31.84	0.018
g/kg$W^{0.75}$/d	8.97	10.87	0.72	0.027
Intake: requirement	1.21	1.42	0.08	0.025

RCC, Red Chittagong Cattle; LW, live weight; DM, dry matter; ME, metabolizable energy; CP, crude protein; T_1, cows fed according to farmers' choice; T_2, cows fed concentrate supplements to supply 25% more ME and CP than requirement (ARC, 2009); SEM, standard error of mean; P>0.05, not significant.

Effects of postnatal feeding on milk yield and postpartum heat period

Effects of feeding on LW gain, daily milk yield and postpartum heat period of cows are presented in Table 6. Initial LW of cows after calving (196 and 188 kg, respectively) and that after 60 days (203 and 205 kg, respectively) were similar (P>0.05). However, daily gain of cows (122 and 274 g/d, respectively; P<0.05) and milk yield (1.97 and 2.5 L/d, respectively; P<0.05) increased significantly due to improved feeding. Although postpartum heat period was not affected by diet (85 and 75 d, respectively; P>0.05), it was 10 days less in cows fed improved diet. Asaduzzaman *et. al*., (2011) reported that RCC cows during first 6 months of postnatal lose LW by 12g/d and produced 1.75 L/d milk without suckling (0.8-1.2 L/d; Roy *et al*., 2012) when fed ME and CP of 27.56 MJ/d and 281g/d against their requirements of 39.91 MJ.d and 465g/d, respectively. In this study, ME and CP intake of cows fed by farmers was above their requirements (1.06 and 1.21 times, respectively), and therefore, cows did not lose live weight. Significantly higher milk production in improved feeding group might be attributed to higher intake of nutrients.

Table 6. Live weight gain, milk yield and postpartum heat period of RCC cows

Parameters	Treatments		SEM	P values
	T_1	T_2		
Initial LW (kg)	196	188	11.96	0.564
Final LW (kg)	203	205	12.05	0.880
Weight gain of cows (g/day)	122	274	20.66	<0.001
Daily milk yield without suckling (kg)	1.97	2.50	0.23	0.046
Postpartum heat period (d)	85	75	6.41	0.149

RCC, Red Chittagong Cattle; LW, live weight; T_1, cows fed according to farmers' choice; T_2, cows fed concentrate supplements to supply 25% more ME and CP than requirement (ARC, 2009); SEM, standard error of mean; P>0.05, not significant.

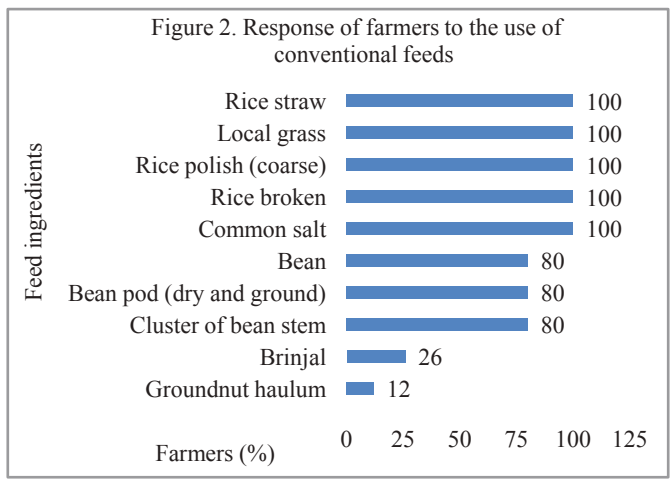

Figure 2. Response of farmers to the use of conventional feeds

On-farm feeds and feeding of RCC cows

Responses of farmers to available feed ingredients fed to RCC cows at study area during study period are presented in Figure 2.

As stated by RCC farmers, rice straw, local grass, rice polish (coarse), rice broken and common salt were fed to cows by all farmers. Bean (green), bean pod (dry and ground) and bean straw were utilized by 80% of farmers to feed RCC cows, particularly in production and harvesting seasons (February, March and April). Brinjal (26%) and groundnut haulm (12%) were also fed to RCC cows by some farmers during production season (February to April).

Conclusion

This study reveals that RCC cows at study areas received sufficient metabolizable energy (ME) during last 50 days of pregnancy and first 60 days of lactation (0.98 and 1.06 times of requirement). Crude protein (CP) intake during these pregnant days were 0.86 parts of requirement which resulted in lower birth weight of calves (13.36 kg), compared to calves from cows fed 1.33 and 1.17 times higher ME and CP than requirements (15.12 kg). Higher milk production along with higher live weight gain (from 1.97 to 2.50 L/d; 122 to 274 g/d, respectively) attributed to feeding cows with

1.28 and 1.42 times higher ME and CP than requirement in first two months of lactation. Therefore, it may be concluded that RCC cows in late pregnancy may be supplemented with concentrates rich in CP in order to produce higher birth weight of calves. In case of lactating cows, although ME and CP from farmers' diet is sufficient, a cost effective supplementation of concentrate for increasing milk production may be investigated by doing further research. Overall, a year round study on on-farm feeds and fodder availability, and nutrition of RCC cows with more replications in its habitats is required in order to maximize their prenatal and postnatal performances through improved nutrition.

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