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STUDY ON EFFECT OF RICE GRUEL ON GROWTH PERFORMANCE OF CATTLE

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The rice gruel was compared with molasses as source of readily fermentable energy for their effectiveness on the physiology of the rumen and the growth performance of growing calves with mean age of 20 months and mean body weight of 193.3± 12.01 Kg. At the end of the 60 days feeding trial, no significant differences could be found between the two groups in the gain in body weight. . The pH of the rumen liquor peaked 12 h post feeding among both groups receiving rice gruel or molasses; while lowest pH value was attained at 20 h among the group receiving the rice gruel, and at 16 h post feeding among the calves groups receiving molasses. The bacterial population (cell x1010) ranged from 5.2 to 8.1 in the rice gruel group and was higher (range between7.3 to 9.7) in the Group consuming molasses. II with respective peak counts at 12 h and 20 h. The rumen protozoal count behaved in a similar manner to that of rumen bacteria. In conclusion, similar effectiveness of rice gruel and molasses as fermentable energy source. Rice gruel can replace molasses as energy source under situation when molasses are not available.

Key words: Rice gruel, molasses, weight gain, rumen metabolites, cattle

Livestock plays an indispensable role in the traditional agriculture and largely subsistence economy of Bangladesh (Huq, 1997) and is recognized as an integral component of rice based agricultural production system. The economy of the country largely depends on agriculture. Livestock being one of the four components of agriculture (such as crops, livestock, fisheries and forestry) which plays a vital role in the national economy, contributing about 6.5% of gross domestic products (GDP) and 13% of total foreign exchange earnings (GOB, 1991). The feed is the most expensive input within any livestock production system (Cruz *et al.*, 2009) which accounts for 60-70% of the total production cost (Bulbul and Hossain, 1989). Since there is scarcity of lands in Bangladesh, the production and availability of livestock feed is very less than the demand and therefore the price is high. On the other hand rice straw is mostly available throughout the year due to rice based agriculture of Bangladesh Livestock feed provides the basic nutrients required for animal production, including energy, protein & amino acid as macro nutrients, as well as minerals, vitamins and other micro nutrients (FAO, 1983). Hence, rice straw is the main energy source for ruminants comprising over 60% of the dietary energy supply in Bangladesh (Jackson, 1981).

Works in the laboratory of Bangladesh Livestock Research Institute, Savar, Dhaka, on the supplementation of rice straw with graded levels of common grasses, *Leucaena* foliage, wheat bran or rice mill feed, clearly demonstrate that the low level of energy and readily fermentable N for the rumen and low amino acids and volatile fatty acids for the animal provided by rice straw are among the primary limitations to ruminant production in this country. Accordingly, it is common practice to add urea and molasses to rice straw based diet to up - grade the quality of the feed (Huque and Talukder, 1994; Huque and Chowdhury, 1998). This practice is not always possible due to poor distribution channel and high cost of molasses. Furthermore, supplementation of other high energy source is impractical.On the other

hand, every household and residential educational institutes (e.g. CVASU, BAU, DU etc.) of Bangladesh produce a considerable amounts of rice gruel, during the cooking of rice, containing a considerable amount of soluble starch material. Traditionally it has been used in the cattle diet as a drink with water.

Though some works have been carried out with rice gruel on cattle to assess the rural beef fattening program with traditional feeding practices (tethering, grazing and tree leaves with rice straw), no concise work has been done to evaluate the rice gruel as one of the m ajor sources of energy after replacing the molasses. Keeping this view in mind, the present study was designed to investigate the possibility of rice gruel as a non-conventional feed resource compared to other expensive energy sources (molasses) on growth performance of native growing cattle.

The aims of the study were:

To explore the possibility of incorporating rice gruel (kitchen waste) in the ration and

To assess its effectiveness on rumen microbes and on growth performance of cattle.

MATERIALS AND METHODS

Sampling site and quantity of rice gruel

Rice gruel was collected from the hostel dining of Chittagong Veterinary and Animal Sciences University (CVASU) in large calibrated plastic buckets at noon and night for a period of five days. The measurement was done in the unit-litre per head per day. It was calculated by using the underlying formulas:

Production of rice gruel (litre per student per day)

$$= \frac{\text{Production of rice gruel (noon+night) of a day}}{\text{Number of total borders of that day}}$$

Mean production of rice gruel (litre per head per day) $= \frac{\text{Total production of rice gruel / 05 days}}{\text{No of students x No of days}}$

Chemical analysis of rice gruel

Rice gruel was collected by using a simple random sampling technique for chemical analysis on three consecutive days. The collected samples (1000 ml) were allowed to cool to room temperature. The samples were analyzed in triplicate for dry matter (DM), ash and nitrogen (N) according to 71 Association of Official Analytical Chemist (AOAC, 2005).Organic matter (%) was calculated by subtracting the dry matter (%) from ash (%).

Growth trial

Selection of animals:

The growth trial consisted of six healthy calves of both sexes with mean age of 20 ± 2 months and with mean body weight of 193.3 ± 12.01 Kg.The animals were divided into two groups, with allocation of two males and one female in each group.

Feeding treatment design:

Required amount of roughage and concentrate feed was offered to the cattle on the basis of their individual body weight. Fresh and clean drinking water was offered to all animals round the day as an *ad-lib*

Table 1: The composition of the concentrate mixture

Item No.	**Feed ingredient**	**Amount (%)**	
		Group I	Group II
1	Wheat bran	24.5	24.5
2	Rice polish	17.0	17.0
3	Broken rice	05.0	05.0
4	Maize	13.0	13.0
5	Molasses	0.00	02.0
6	Pea bran	20.5	20.5
7	Soybean meal	07.0	07.0
8	Til oil cake	08.5	08.5
9	Salt	01.5	01.5
ME Kcal/kg		1872.28	1920.28
CF%/kg		6.7015	6.7015
N%/kg		2.10	2.43

Table 2:Daily amount of feed served

Group	Animal no.	Sex	Body weight (Kg)	Concentrate feed (kg)	Grazing (hours)	Straw(Kg)	Rice gruel (liter)
I	1	Male	200	4.0	3	4	4.0
	2	Male	210	4.2	3	4.2	4.2
	3	Female	170	3.4	3	3.4	3.4
II	4	Male	220	4.4	3	4.4	-
	5	Male	210	4.2	3	4.2	-
	6	Female	180	3.6	3	3.6	-

basis. The concentrate ration was offered to both the groups of cattle at 9.00 am daily (once in a day). The concentrate mixture of group II contain 2% molasses whereas in group I was kept blank and was compensated by supplying rice gruel to the group I animals at the rate of 2litres/ 100 kg body weight (once in a day).

Concentrate mixture and rice straw were supplied at the rate of 2% of live weight per day in both groups. Only in group I supplied rice gruel at the rate of 2 liters/100 kg body weight instead of giving molasses.

Measurements of growth performance (Body weight gain): The body weight of animals was recorded at baseline and at the end of the trial by using digital weighing scale.

Examination of ruminal fluid: Rumen liquor was collected from all calves by means of rumenocentesis to evaluate the effectiveness of rice gruel in comparison to molasses on the microbiological counts and chemical composition of rumen liquor. Immediately after collection, the rumen fluid was transported from the collection site to the laboratory in a thermo flask to prevent the changing of temperature.

Assessment of different characteristics of rumen fluid: The color, consistency and odor of individual animal's ruminal fluid was examined organoleptically.

Assessment of morphological and organoleptic characteristics of the rumen fluid: The pH of the rumen liquor was measured using portable digital pH meter (pen type).

Assessment of protozoal motility of rumen liquor: Aliquots (0.5 ml of) strained rumen liquor (SRL) was transferred to a clean glass slide and was covered with a cover slip. The movement of protozoa was examined under low power of microscope immediately.

The movement of protozoa was graded as follows:

++++ = Very rapid movement, whole mass is moving.

+++ = Rapid movement, very large population of protozoa showing their motility.

++ = Moderate movement, less number of protozoa is moving moderately.

+ = slow movement, very few protozoa showing their slow movement.

0 = No movement, all the protozoa are dead.

Protozoa count in Rumen Liquor: Total protozoa in rumen liquor was determined as per Hasanuzzaman *et al.* (2011) by following formula:

Total protozoa per ml of SRL = {(Average No. of protozoa count per field) x (Microscopic magnification) x (Dilution factor (10^6))}

Total bacterial count in rumen liquor: Estimation of total ruminal bacteria was determined as per Hasanuzzaman *et al.* (2011) by following formula:

Ruminal bacteria per ml of SRL = (Average number of bacteria per field x microscopic factor (1000) x dilution factor (10^6).

Statistical analysis

The software program SAS and SPSS were used to analyze data of this study at 5% level of significance.

RESULTS AND DISCUSSION

From the table 3 it can be said that, the amount of rice gruel production of different 05 days (where the days were randomly selected for calculation of production) was

Table 3 presents the production of rice gruel per student per day.

Table 3: Production of rice gruel (RG) per student per day in litre

Days	Production of rice gruel in liter (noon + night)	No of borders	Production of rice gruel/ head/day in liter	Mean production of RG/ head/day in liter $\pm SEM$
1	30	215	0.139	0.165 ± 0.01
2	30	203	0.147	
3	32	175	0.182	
4	33	186	0.177	
5	30	166	0.180	

Table 4: Chemical analysis of rice gruel

Item	Sample number	Dry matter (g/100g of fresh sample)	g/100g of dry matter	
			Organic matter	Nitrogen
Rice gruel	1	4.20	99.88	0.68
	2	4.00	99.80	0.72
	3	4.10	99.92	0.55
Mean ± SEM		4.10± 0.06	99.87± 0.04	0.65±0.05

Samples of rice gruel were analyzed three times for dry matter (DM), organic matter (OM) and nitrogen (N) according to AOAC (2005).

closest to each other. Here the mean production of rice gruel was 0.165±0.041 liter/head/day.

The following table 5 shows the mean and standard deviation of weight gains of 2 groups of cattle in repeated observation (Day 0, Day 15, and Day 60). The mean weight gain was higher in the cattle group that was fed the molasses than that was fed the rice gruel.

From the below table (Table-5) it is found that the mean of weight gain (in different days) between two treatment groups did not differ significantly (p value=0.2137). Table 6 presents the result of repeated measures analysis of variance (ANOVA) with two factors. Sphericity is an important assumption of a repeated measures ANOVA. The Mauchly's test of sphericity showed the variances of the differences between all possible pairs of groups were equal (Mauchly's criteria=0.36, p-value=0.655). The following ANOVA table shows that treatment had no significant effect but the weight gain for different ages was significantly different.

Graphical presentation shows the marginal mean of weight gain for treatment across different age and marginal mean of weight gain for age across different treatment.

Examination of ruminal fluid

Rumen liquor was collected at 0, 4, 8, 12, 16, 20 and 24 h of post feeding for one (01) day from each animal of both groups.

Table 5: Consecutive body weight gain of cattle groups (kg)

Dietary Group	**Day 0 (initial weight)**	**Day 15**	**Day 60 (Final weight)**
Group I (Rice gruel)	193.33±20.82	197.33±21.78	211.67±22.19
Group II (Molasses)	203.33±20.82	209.67±21.73	228.0±22.11

Table 6: Repeated measures analysis of variance with two factors

Parameters	**SS**	**DF**	**MS**	**F-value**	**P-value**
Treatment	389.967249	1	389.967249	1.75	0.317
Age	4816.666667	1	4816.666667	21.60	0.043
Age*Treatment	368.166667	1	368.166667	1.65	0.328
Error	446.000000	2	223.000000		

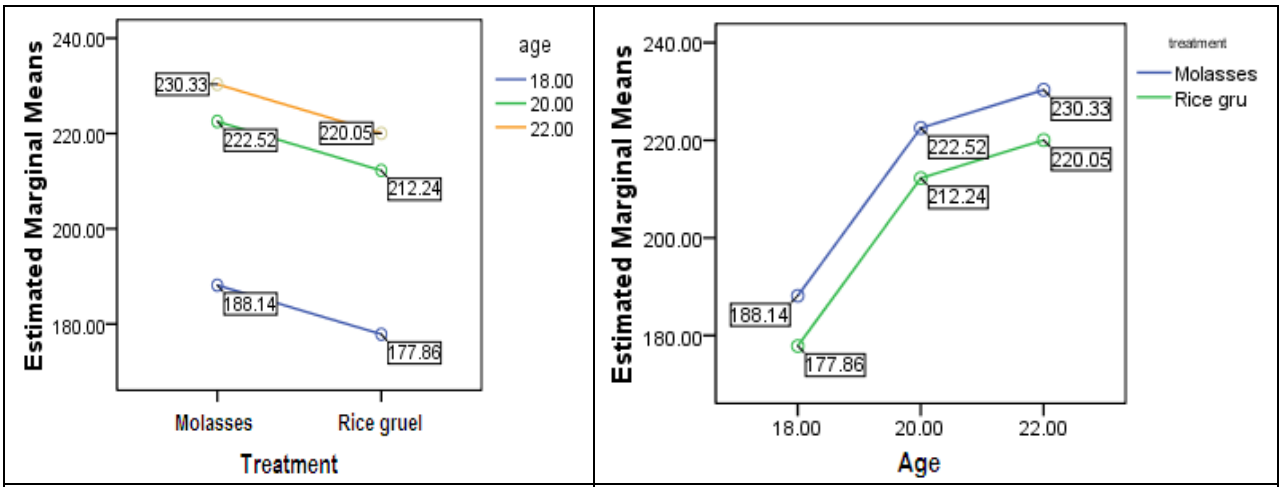

Fig. 1a. Treatment across different age | Fig. 1b. Age across different treatment

Figure 1: Marginal mean of weight gain for treatment vs age and age vs treatment

Table 7: Effect of diet and time on various rumen liquor parameters in cattle

Parameter	Group	Hours of post feeding						
		0 h	4 h	8 h	12 h	16 h	20 h	24 h
Color	G-I	Grey	Grey	Greenish	Grey	Grey	Grey	Grey
	G-II	Grey	Grey	Grey	Greenish	Grey	Grey	Greenish
Odor	G-I	Aromatic	Aromatic	Aromatic	Aromatic	Aromatic	Aromatic	Aromatic
	G-II	Aromatic	Aromatic	Aromatic	Aromatic	Aromatic	Aromatic	Aromatic
Consis-tency	G-I	Viscous	Viscous	Viscous	Viscous	Viscous	Viscous	Viscous
	G-II	Viscous	Viscous	Viscous	Viscous	Viscous	Viscous	Viscous
Protozoal motility	G-I	++++	++++	+++	++++	++++	++	+++
	G-II	++++	++++	+++	++++	++	++	++

++++ = very rapid, +++ = rapid, ++ = moderate movement of rumen flora

Characteristics of rumen fluid

pH: The pH values of all the experimental groups founded are showed in figure 2.

The color of ruminal fluid of animals was found greenish or grey. The odor of ruminal fluid was found aromatic in all groups of animals. The consistency of ruminal fluid was found viscous in all groups. Motility was within the range of very rapid to moderate. The quality of color, odor, consistency, motility and pH were within the physiological limit as supported by Radostits, *et al.* (2000).

Protozoal count:

The protozoal count of the rumen fluid from two different samples was done and the result found is shown in the figure 3.

Bacterial count:

The bacterial count of the rumen fluid of the experimental groups was performed and the results found are shown in the figure 4.

The bacterial population (cellx10^{10}) in case of rumen bacteria was ranged from 5.23$\pm$0.25 to 8.47$\pm$0.15 and 7.33$\pm$0.5 to 9.67$\pm$0.15 per ml of SRL in G-I and G-II diets respectively. The bacterial populations attained a peak level at 12 h and 20 h of post feeding and lowest values

found at 8 h and 4 h of post feeding in G-I and G-II diets respectively. The population of bacteria was higher in G-II diet might be due to the positive balance of energy in rumen where molasses was used. These results were supported by Rekha *et al.*, (2006), Thakur (2006) and Chandanshive *et al.*, (2007).The rumen protozoal population

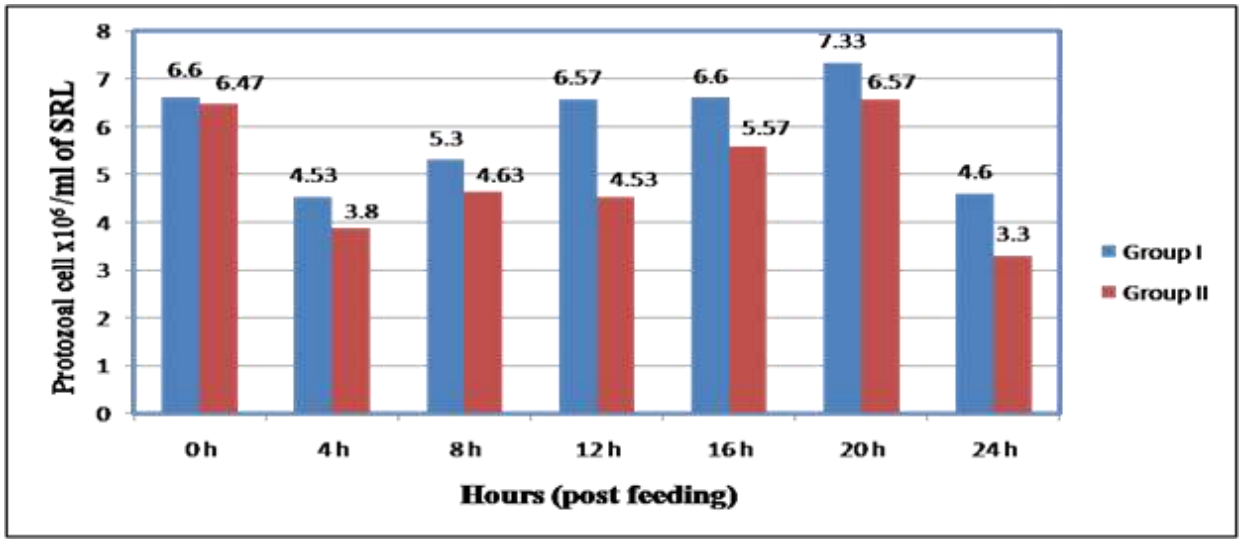

Fig 3: Protozoal cell count at different post hour of feeding

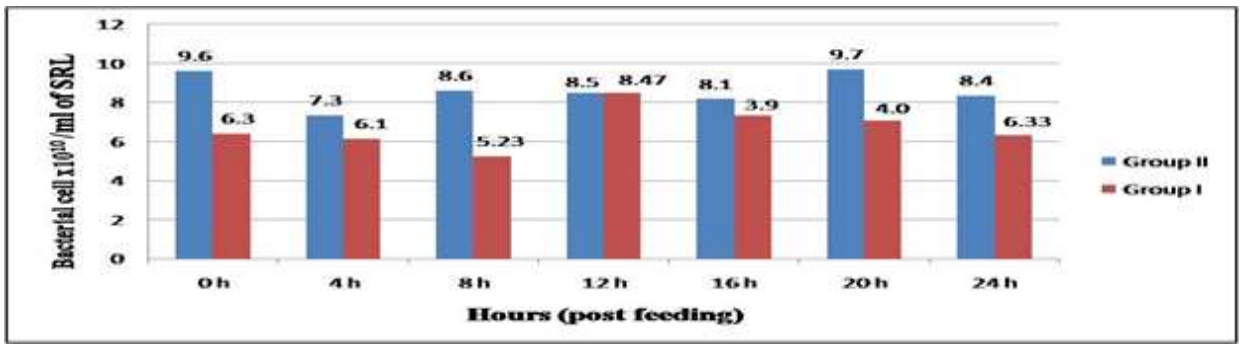

Fig 4: Bacterial cell count at different post hour feeding

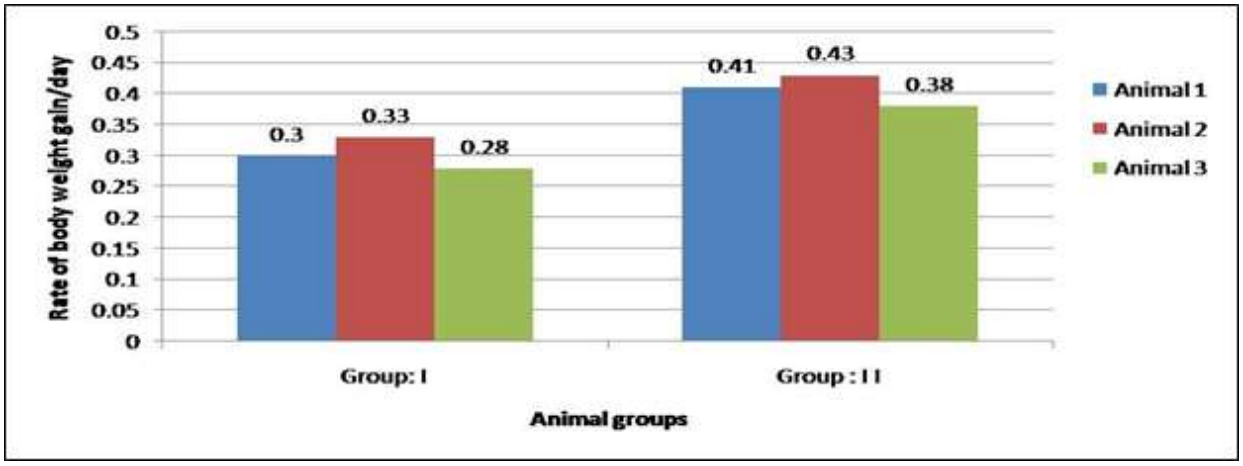

Fig 5: Rate of body weight gain/day (kg) in different animals

(cellx10^6) ranged from 3.30±1.05 to 6.57±1.07 and 4.53±0.5 to 7.33±0.5 per ml of SRL, respectively in G-I and G-II diet and being highest at 20 h of post feeding in both G-I and G-II diet. The protozoal movement was greater in G-I diet than G-II diet may be due to positive balance of readily fermentable diet (Radostits, *et al.*, 2000).

Rate of body weight gain (kg) of experimental animals:

In Fig 5, it is clear that the rate of body weight gain/day of the animals belongs to Group I were 0.3, 0.33 and 0.28 respectively and the animals belongs to Group II were 0.41, 0.43 and 0.38 respectively. Here, in case of both Groups, rate of live weight gain of female animal was lower than male. The result of live weight gain is closer to the findings of Nissanka *et al.*, (2010) but higher than the findings of Pandya *et al.*, (2009).

CONCLUSION

This study was conducted at CVASU cattle farm with the aim of observing the possibility of using rice gruel as a source of readily fermentable energy in compared to molasses in cattle for a period of 60 days. Here higher live weight gain was observed in G-II as compared to G-I where the values were found as 406.67±14.53 and 303.33±14.53 gm, respectively. The rumen liquor pH varied from 5.4±0.35 to 7.3±0.46 in Group I and 6.3±0.90 to 7.87±0.42 in Group II with highest value at 12 h in both groups and lowest value at 20 h and 16 h of post feeding in G-I and G-II, respectively. The bacterial population (cellx10^{10}) per ml of SRL ranged from 7.33±0.50 to 9.67±0.15 in G-I and 5.23 ±0.25 to 8.47±0.15 in G-II with peak level at 20 h and 12 h in G-I and G-II diets, respectively and lowest value found at 4 h and 8 h of post feeding in G-I& G-II diets, respectively. The protozoal populations (cellx10^{6}) per ml of SRL ranged from 4.53±0.50 to 7.33±0.50 in G-I and 3.30 ±1.0 to 6.57±1.70 in G-II being highest at 20 h of post feeding in both G-I& G-II diets and lowest at 4 h and 24 h of post feeding in G-I & G-II diets, respectively. From the above results it can be said that rice gruel was less effective than molasses as fermentable energy source, however in situation where molasses is not available or costly, rice gruel does appear to have a place as readily fermentable energy source. Additionally rice gruel diet ensured a bit better rumen metabolites for growth and multiplication of rumen bacteria, protozoa because their number was slightly higher than molasses.No substantial conclusion could be drawn from a short term study, however, rice gruel in cattle farm would be beneficial for production. The protein supplement should be maintained in such cases to maintain the P/E ratio of the rumen. No definitive conclusion could be drawn from the study due to the limited sample size and the short duration of feeding period. However, it is a pilot-study, hence, the results are not applicable and further investigation is needed.

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