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Nutritive Value of Major Feed Ingredients, Usually Browsed and Their Responses to Gayals (*Bos frontalis*) in the Hill Tract Area

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Abstract: Chemical composition and the rumen degradability of different types of tree twigs and leaves and shrubs usually browsed by the gayal were determined. Dumur (*Ficus hispida*) twigs contained the highest CP (170 g kg⁻¹ DM) and the whole Pahari Narish contained the highest ADF (451 g kg⁻¹ DM). The CP content of Gamari (*Gmelina arborea*) twigs, whole Rokygola plants, Bamboo (*Podocarpus nerifolia*) leaves and twigs or Alu (*Solanum tuberosum*) plant twigs ranged from 102 to 111 g kg⁻¹ DM, while their ADF contents ranged from 250 to 400 g kg⁻¹ DM. Pahari Kalmilata (*Convolvulus arvensis*) contained the lowest CP (57 g kg⁻¹ DM). The whole Lata (*Eupatorium odoratum*) contained the lowest ADF (181 g kg⁻¹ DM). The 48h degradability of Dumur, Gamari and Pahari Kalmi ranged from 611 to 677 g kg⁻¹ DM and of Furun (*Thysanolaena maxima*) pata and Pahari Kola (*Musa ornata*) pata ranged from 404 to 488 g kg⁻¹ DM. The lowest DM degradation at 48h was found with Bamboo leaves and twigs (258 g kg⁻¹ DM). A silage feeding trial on gayals showed that the daily fresh biomass intake of the Para (*Brachiria mutica*) and Napier (*Pennisetum purpureum*) silage was 6.85 and 6.54 kg/h when the browsing time of the animals was restricted to half of the control groups. Restriction of browsing and feeding of silage did not significantly ($p > 0.05$) change the daily live weight gains of the gayals fed the Napier and Para silage (439 and 347 g/d, respectively) from that of the control (422 g/d). Another feeding trial on gayals showed that the daily voluntary intake of roughage was 2.40 kg (DM/%LW) for group of stall feeding when the browsing time of the animals was restricted to 2 h/d. Restriction of browsing and feeding of available roughage did not significantly ($p > 0.05$) change the daily live weight gain of the gayals fed the available roughage (94 g/d) from that of the control (101 g/d).

Key words: Browsing, gayal, voluntary intake

Introduction

The gayals belonging to genus *Bos frontalis* are available in hilly districts of Bangladesh, north-eastern part of India and some hilly areas of Myanmar and Bhutan. It is one of a high priced zoo animals internationally and used to be sacrificed in muslim religious festivals in the hilly areas of Bangladesh and also in north-east India and Myanmar. The gayal-cattle hybrids are used as the work animals. The livestock breeders of Bhutan have produced profitable hybrid offsprings by crossing gayal bulls with Indian Siri cows (*Bos taurus*) called Jatsha and the male of which are excellent for drought power and the females are excellent for milk production (NAP, 1983). Moreover, their heavier live weight than indigenous cattle and browsing habits in the hill slopes are potentials for producing meat. They used to browse tree leaves or grasses on the hill slopes, tops and valleys and graze in the grass fields. Feed availability, the single most important hindrance for the development of livestock industry in Bangladesh could be explained in terms of its quantitative and qualitative deficiencies (BLRI, 1999). Availability of grasses depends mostly on topography, flooding pattern and salinity of the soil and also on the rainfall, humidity and photo-period of the area. In Bangladesh, year round green grass availability for large ruminants is about 1 kg/head/d (Tareque and Saadullah, 1988), which is mostly of agricultural weeds and from road side grasses. This amount is far below the minimum requirement of about 6 kg grasses per adult ruminant/d on a straw based diet (Chowdhury and Huque, 1997). Besides, the available grasses are very high in fibre (30 to 46% ADF), low in N (1.6 to 3.4%) and slowly degradable (only 42% at 48h of incubation) in the rumen (Chowdhury and Huque, 1997). As a result these grasses can not optimize the rumen environment in terms of microbial requirements of readily fermentable energy, rumen ammonia, vitamins and minerals (Chowdhury, 1997). The rain fed forest offers a huge amount of natural biomass during monsoon (June to November) which may be conserved to feed livestock. The growth performance of

improved fodder such as Napier and Para on hill slopes with gradient of about 40-45% were compared at different hill heights (Khan *et al.*, 2001). The green biomass of the grasses were preserved and evaluated as feed for gayals restricting their browsing habits. Shrubs and twigs locally called as furun, bamboo, katalata, dumur, gamari, pahari kalmilata and pahari kola grow naturally on the hill slopes and browsed by gayals other native farm animals. Information on their taxonomical identification and nutritive value as feeds for cattle are not available and considered to be important for screening and feeding of animals.

The present work was conducted with following objectives:

To determine the nutritive values of existing non-conventional or traditional forage species available in the hill tract area.

To study the performance of gayal fed with hilly leaves and shrubs or silage.

Materials and Methods

The experiment was conducted on hill tract area and their bases at the Bangladesh Livestock Research Institute (BLRI), Regional Station, Naikhongchari, Bandarban. Most of the hills have a variation in height from 50 to 100 m and slope of about 40 to 45%.

Evaluation of tree twigs and leaves or shrubs: Evaluation of the locally available tree twigs and leaves or shrubs usually browsed by the gayal were collected during 1995 and dried in the sun and packed to transfer the samples to the BLRI central nutrition laboratory for the analysis of proximate components, such as dry matter (DM), ash, organic matter (OM) and crude protein (CP), acid detergent fiber (ADF) and for determining the dacron bag degradability of DM. The proximate analysis was done following the method of AOAC (1970), while the ADF was determined according to the method of Georing and Van Soest (1970). Rumen degradability of the leaves and shrubs were determined by taking three grams of chopped samples into nylon bags, made of polyamide cloth tied to a

nylon tube for incubation up to 72 h. DM degradability was determined according to the method of Bhargava and Ørskov (1987). The data was analyzed using the exponential mathematical model described by McDonald (1981).

Feeding trial with gayals: Experiment-1 and 2 on feeding trial were conducted during 1995 (August to October) and 1999 (September to November), respectively.

Experiment-1: Nine gayals of about two years age and of average 212.0 ± 16.0 kg live weight were divided into three equal groups. The control group was kept on complete browsing (8h/d) and usually browsed leaves, shrubs and green grasses available on hill slopes, while the rest two groups were fed *ad libitum* either with Napier or Para silage restricting their browsing time to 4h/d. The experimental animals were given a basal dose (1% of the live weight) of a concentrate mixture containing wheat bran, rice bran, til oil cake, fish meal and salt mixed at a per cent of 50, 24, 20, 5 and 1 respectively.

Experiment-2: Eight gayals of about 2.5 to 3.0 years age with average 288.90 ± 44.03 kg live weight were divided into two equal groups. The control group was kept on complete browsing (8h/d) with leaves, shrubs, green grasses available on hill slopes, while the other group was fed roughage *ad libitum* such as straw, urea-molasses-straw, silage (straw with Napier and cowpea), green grass and allowed to browse 2h/d. The experimental animals were given a basal dose (0.5% of the live weight) of a concentrate mixture containing wheat bran, rice bran, til oil cake, fish meal and salt mixed at a per cent of 50, 24, 20, 5 and 1, respectively.

In both the experiments, the daily feed offered, and refused and the weekly changes in live weight were recorded to determine the differences in feed intake and live weight

changes in response to feeding the diets. The feeding trial was conducted for a period of 90 days. The animals were weighed by a digital balance and their individual cumulative weights were regressed against the days of experimentation and the slope of the regression line was considered as the daily live weight change in the animal.

Statistical analysis: The significant difference in sacco DM degradability of different shrubs and twigs were determined in an ANOVA of a simple design. Live weight gain responses in different experimental diets were analyzed in an ANOVA of a simple design.

Results and Discussion

The chemical composition and DM degradability of tree leaves and twigs and shrubs browsed by gayals are presented in Tables 1 and 2, respectively. Table 1 shows that dumur twigs contained the highest CP (170g kg⁻¹ DM) and the whole pahari narish contained the highest ADF (451 g kg⁻¹ DM). The CP content of gamari twigs, whole rokygola plants, bamboo leaves and twigs or alu plant twigs ranged from 102 to 111 g kg⁻¹ DM, while their ADF contents ranged from 250 to 400 g kg⁻¹ DM. Pahari kalmilata contained the lowest CP (57 g kg⁻¹ DM). The whole lata contained the lowest ADF (181 g kg⁻¹ DM).

Table 2 shows that the rate of DM degradation [®] ranged from 1.36%h to 7.66%h. The 'C' value of dumur twigs was 3.30% hour. The 48h degradability of dumur, gamari and pahari kalmi ranged from 611 to 677 g kg⁻¹ DM and of furun pata and pahari kola pata ranged from 404 to 488 g kg⁻¹ DM. The lowest DM degradation at 48h was found with bamboo leaves and twigs (258 g kg⁻¹ DM). Among the tree and shrub twigs and leaves collected, dumur was the best as cattle feed, when judged on their chemical composition and DM degradability in sacco.

Table 1: Chemical composition of shrubs and twigs usually browsed by gayal

Shrubs/twigs	DM (g/kg)	Chemical composition (g/kg DM)			
		OM	Ash	CP	ADF
Furun pata (leaves and twigs) (<i>Thysanolaena maximal</i>)	939	870	130	94.5	343
Bamboo (leaves and twigs) (<i>Podocarpus nerifolia</i>)	939	765	235	106	400
Dumur (twigs) (<i>Ficus hispida</i>)	885	744	256	170	314
Gamari (twigs) (<i>Gmelina arborea</i>)	941	915	85	111	263
Pahari Kalmilata (whole) (<i>Convolvulus arvenses</i>)	938	888	112	57	376
Pahari Kola (leaves) (<i>Musa ornata</i>)	937	886	114	96	-
Rokygola* (whole)	897	836	164	102	250
Pahari Narish* (whole)	921	897	103	135	451
Padurea pata* (twigs) Alu pata (leaves)	939	870	130	95	343
(<i>Solanum tuberosum</i>) Lata (whole)	931	924	76	109	317
(<i>Eupatorium odoratum</i>)	841	913	87	81	181

*Botanical name could not be identified

Table 2: In sacco, DM degradability of shrubs and twigs usually browsed by the gayal

Hours	Grasses								Significance	
	Furun	Bamboo	Katalata	Dumur	Gamari	Pahari Kalmi	Pahari Kola	SED	Level	
8	173	165	299	345	391	365	269	13.8	p < 0.001	
16	203	186	344	454	439	467	324	14.4	p < 0.001	
24	255	204	432	546	489	554	432	31.6	p < 0.001	
48	404	258	600	677	671	611	488	39.8	p < 0.001	
72	422	288	608	753	712	617	509	28.7	p < 0.001	
A	56	91	167	203	295	131	124	50.0	NS	
B	341	244	512	618	623	490	397	65.9	p < 0.001	
C	2.84	1.36	3.16	3.30	1.85	7.66	5.28	0.80	p < 0.001	
A+B	384	382	679	821	913	622	521	30.8	p < 0.001	

A = Water soluble fraction, B = Potential digestible fraction, C = Digestion rate and (A+B) = Extent of digestion, NS = non significant

Huque *et al.*: Nutritive value of feed, browsed by gayals

Table 3: Silage intake, initial and final live weights (LW) and live weight changes of the gayal kept on complete browsing or partially supplemented with Para (*Brachiria mutica*) or Napier (*Pennisetum purpureum*) silage.

Items	Diets			Significance	
	Browsing (B)	B + Napier	B + Para	SED	Level
Daily browsing (h)	8	4	4	-	-
Fresh silage intake (Kg/d)	-	6.54	6.85	0.59	NS
Initial live weight (kg)	231	220	220	96.1	NS
Final live weight (kg)	251	237	235	35.3	NS
Live weight gain (g/d)	422	439	347	91.0	NS

NS= not significant

Table 4: Feed intake and differences in initial and final live weight (LW) or in daily live weight gain of gayals confined in stalls or browsed on hill slopes

Item	Group of stall feeding	Group of complete browsing	Significance	
			SED	Level
Voluntary intake of roughage (kg DM/100kg LW)	2.40	-	-	-
Initial live weight (kg)	289.30	288.50	33.63	p > 0.05
Final live weight (kg)	298.30	297.40	35.25	p > 0.05
Live weight gain (g/d)	94	101	79.38	p > 0.05

The feeding trial with gayals: The first experiment, shows (Table 3) the live weight changes of gayals and the fresh biomass intake of Napier and Para silages. It shows that the intake of the two silages were 6.54 and 6.85 kg/d, respectively. There is no significant ($P > 0.05$) difference between the live weight changes of different groups of gayals, although the daily browsing time of the gayal in the two silage groups was restricted to half of that of the control. The live weight changes of the gayal in the control, Napier and Para groups were 422, 439 and 347 g/d, respectively. In the second experiment, (Table 4) the intake of the stall fed group was 2.40 kg DM/100 kg live weight. The live weight changes of the gayal in the stall-fed and complete browsing groups were 94 and 101 g/d, respectively.

Confined of gayals in stalls had no significant ($p > 0.05$) effect on daily live weight gains in the first and second experiment. The number of observations in each treatment were few. So it is difficult to draw definite conclusion about their performances based on the result.

Among the tree and shrubs twigs and leaves collected, *dumur* was the best as cattle feed, when judged on their chemical composition and DM degradability in sacco. The browsing habit of gayals may be restricted through the stall feeding either silage or locally available feedstuffs.

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