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HILLY GRASSES AND LEAVES: A PROMISING UNCONVENTIONAL FEED RESOURCE FOR LIVESTOCK

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ABSTRACT*:* The study was undertaken to find out the chemical composition of different hilly grasses and leaves available in Bandarban areas of Bangladesh. Total 10 different hilly grasses and leaves such as Bottle gourd leaf (*Lagenaria siceraria*), Castor bean leaf (*Ricinus communis*), Cogon grass (*Imperata cylindrica*), Dhol kolmi (*Ipomoea carnea*), Giant reed leaf (*Arundo donax*), Hilly grass (*Cynodon dactylon*), Pithraj leaf (*Aphanamixis polystachya*), Sal leaf (*Shorea robusta*), Shegun leaf (*Tectona grandis*) and Tiger's claw (*Erythrina variegata*) leaf were collected from study areas. Samples were collected, chopped and tested immediately for moisture content and remaining samples were sun-dried and processed using standard procedure. Chemical analyses of the samples were carried out in triplicate for Dry matter (DM), Crude protein (CP), Crude fiber (CF), Nitrogen free extract (NFE), Ether extract (EE) and Ash. Metabolizable energy (ME) was calculated mathematically for all samples by using standard formula. Results indicated that, crude protein content in Bottle gourd leaf was 33.6 g/100g, Castor bean leaf 21.0 g/100g, Cogon grass 8.4 g/100g, Dhol kolmi 26.3 g/100g, Giant reed leaf 8.6 g/100g, Hilly grass 6.8 g/100g, Pithraj leaf 15.3 g/100g, Sal leaf 16.3 g/100g, Shegun leaf 11.9 g/100g and Tiger's claw leaf 18.4 g/100g. In addition to crude protein, all samples contained substantial amount of crude fibre, nitrogen free extracts, ether extracts and ash. It could therefore, be inferred that, the hilly grasses and leaves might be used as an alternative to conventional feeds for livestock particularly during scarcity period.

Keywords: Hilly Grasses And Leaves, Metabolizable Energy, Moisture, Dry Matter, Crude Protein, Crude Fiber, Nitrogen Free Extracts, Ether Extracts, Ash.

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INTRODUCTION

Livestock is an integral part of the farm economics of Bangladesh. Bangladesh has a very high density of population considering the total land mass and the cultivable land. Livestock production depends upon several factors, such as health care management, breeding, nutrition etc. However, it is considered that the most important constraint to livestock development in Bangladesh is the shortage of feed and fodder (Rahman, 2011).

Bridging the gap between teeming population and food production is one of the important tasks of developing countries like Bangladesh. Expensive staple foods and policy constraints on food imports are the major factors worsening the food situation in developing countries (Weaver, 1994). Protein-energy deficiency has been recognized as the most common form of malnutrition in regions where people depend mainly on starch-based diets (Michaelsen and Henrik, 1998; Weaver, 1994). Livestock production, animal husbandry and maintenance of soil fertility play important role in rural development and in turn the economy of developing countries. Livestock nutrition is also one of the critical constraints to increase animal productivity in developing countries (ILRI, 1995) and perpetual gap persists between the demand and supply of digestible crude protein and total digestible nutrients to livestock in Asian continent (Singh et al., 1997).

Providing adequate good-quality feed to livestock to raise and maintain their productivity is and will be a major challenge to agricultural scientists and policy makers all over the world. Increase in population and rapid growth in world economies will lead to increase in demand for animal products. An increase of approximately 30 % in both meat and milk production is expected in the coming 20 years. At the same time, the demand for food crops will also increase. Future hopes of feeding the millions and safeguarding their food security will depend on the enhanced and efficient utilization of unconventional resources that cannot be used as food for humans, rather as feed for livestock.

The higher price and acute scarcity of conventional feed ingredients create problems to the profitable commercial dairy and poultry farming in Bangladesh. Therefore, attention is gradually being focused on cheaper alternative feeds, especially, those are available in our country but people are unknown to them. Therefore, present study was aimed to find out the nutritive values of hilly grasses and leaves that could be used as an alternative to conventional feeds for livestock particularly during scarcity period.

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MATERIAL AND METHODS

Study area

Most of the hilly grasses and leaves are available in the hills of Bandarban. Therefore, the current study was undertaken in hilly areas of Bandarban district.

Collection of sample

Samples were collected from the hills of Bandarban. Approximately 2000 grams of each sample was collected. Samples were wrapped up by polythene bag and sent to the Animal Nutrition Laboratory, Chittagong Veterinary and Animal Sciences University, Chittagong.

Preparation of sample

Fresh samples were cut into the smaller pieces of 1 cm sieve size and placed into the hot air oven for proper drying. The dried samples were subjected to grinding to make it homogenous powder. Later on, it was mixed properly and exposed to shade to cool down for sampling. Individual samples were kept in air tight polythene bag and identified by marker. Later on it was subjected to chemical analyses.

Analysis of sample

Chemical analyses of the samples were carried out in triplicate for dry matter (DM), crude protein (CP), crude fiber (CF), nitrogen free extract (NFE), ether extract (EE) and ash in the animal nutrition laboratory, Chittagong Veterinary and Animal Sciences University, Chittagong, Bangladesh as per AOAC (2006).

Calculation of ME

Metabolizable Energy (ME) was calculated from proximate components by using a standard mathematical formula as per Lodhi et al. (1976).

Statistical analysis

Data related to chemical composition of the hilly grasses and leaves were compiled by using Microsoft Excel 2007. Chi-square (χ^2) test was performed to analyze the data by using SPSS 16.0. Statistical significance was accepted at 5 % level ($P<0.05$).

RESULTS AND DISCUSSION

Chemical composition of the hilly grasses and leaves particularly Bottle gourd leaf, Castor bean leaf, Cogon grass, Dhol kolmi, Giant reed leaf, Hilly grass, Pithraj leaf, Sal leaf, Shegun leaf and Tiger's claw leaf for moisture, dry matter (DM), Crude protein (CP), Crude fiber (CF), Nitrogen free extracts (NFE), Ether extracts (EE) and ash have been presented in Table 1.

Table 1 - Chemical composition (g/100g DM) of the hilly grasses and leaves available in the hilly areas of Bandar ban, Chittagong

English name	Scientific name	ME	DM	CP	CF	NFE	EE	Ash
Bottle gourd leaf	*Lagenaria siceraria*	2470.1	8.1	33.6	11.2	32.8	4.2	18.2
Castor bean leaf	*Ricinus communis*	2201.8	24.2	21.0	25.0	43.1	1.6	9.3
Cogon grass	*Imperata cylindrica*	1591.1	32.0	8.4	41.2	42.3	1.1	7.0
Dhol kolmi	*Ipomoea carnea*	2493.4	19.3	26.3	13.0	49.8	0.2	10.7
Giant reed leaf	*Arundo donax*	2054.9	34.0	8.6	29.5	49.3	2.4	10.2
Hilly grass	*Cynodon dactylon*	1741.0	33.4	6.8	40.2	43.9	1.3	7.8
Pithraj leaf	*Aphanamixis polystachya*	2879.5	64.0	15.3	18.5	48.0	11.1	7.1
Sal leaf	*Shorea robusta*	2764.1	64.1	16.3	14.2	58.8	4.3	6.4
Shegun leaf	*Tectona grandis*	2323.8	34.6	11.9	26.2	49.5	4.3	8.1
Tiger's claw leaf	*Erythrina variegata*	2715.5	71.6	18.4	16.1	51.4	6.0	8.1
SEM	–	136.3	6.7	2.7	3.4	2.2	1.0	1.1
Level of sig.	–	***	***	***	***	NS	**	NS

ME=Metabolizable energy (kcal/kgDM); DM=Dry matter; CP=Crude protein; CF=Crude fibre; NFE=Nitrogen free extract; EE=Ether extract; SEM=Standard error of the mean; NS=Non-significant ($P>0.05$); **=Significant at 1% level ($P<0.01$); ***Significant at 0.1% level ($P<0.001$)

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Bottle gourd leaf (*Lagenaria siceraria*)

The local name of bottle gourd is Pani Lau and scientific name is *Lagenaria siceraria*. It is cultivated throughout our country. The fruits are eaten as vegetable. The fruits are cool and very useful to human health in summer season. Decoction of leaves mixed with sugar is given in jaundice. Warm juice of tender stem relieves earache (Vashista, 1974). The edible portion of immature fruit is about 84.0 g/100g. Bottle gourd with peel is good source of crude fiber, acid detergent fiber, hemicelluloses, iron, phosphorus, zinc than bottle gourd without peel (Milind and Satbir, 2011). Leaves contain cucurbitacin and extracts of the plant have shown antibiotic activity (Gorasiya et al., 2011). In present study, bottle gourd leaf contained 2470.1 kcal ME/kgDM, 33.6 g/100g crude protein, 11.2 g/100g crude fibre, 4.2 g/100g ether extracts, 32.8 g/100g nitrogen free extracts and 18.2 g/100g ash (Table 1). However, the result of the current study is contradictory with Gopalan et al. (2004) who found DM 12.0 g/100g, CP 2.0 g/100g, CF 1.0 g/100g, EE 6.0 g/100g, ash 2.0 g/100g. Thus bottle guard leaves and their wastes could be an alternative feed resource for livestock.

Castor bean leaf (*Ricinus communis*)

Castor bean (*Ricinus communis*) has been cultivated for centuries for the oil produced by its seeds. The Egyptians used to burn castor oil in their lamps more than 4000 years ago. Castor bean is cultivated all over the world on commercial scale including some advanced countries. Among these, India, China, Brazil, Ethiopia, Paraguay, Vietnam and Thailand are the major castor growing countries and account for 97.0% of the world's production (FAO, 2008). In present study, castor bean contained 2201.8 kcal ME/kgDM, 24.2 g/100g dry matter, 21.0 g/100g crude protein, 25.0 g/100g crude fibre, 1.6 g/100g ether extract, 43.1 g/100g nitrogen free extracts and 9.3 g/100g ash. The castor beans grown in India for castor oil production has high leaf-protein content but has not been processed because, although the immature leaves are safe to consume, a poisonous alkaloid 'ricin' combined with protein forms in the mature leaf. The nutritional values of leaf proteins have been investigated by different researchers (Waterlow, 1962; Duckworth and Woodham, 1961; Gerloff et al., 1965 and Rau et al., 1969). Similarly, leaf amino acid compositions have been studied by Gerloff et al. (1965) and Byers (1971).

Cogon grass (*Imperata cylindrica*)

The local name of cogon grass is Shon and scientific name is *Imperata cylindrica*. Cogon grass is a perennial, rhizomatous grass that grows from 2 to 4 feet in height. The leaves are about 1 inch wide, have a prominent white midrib, and end in a sharp point. Leaf margins are finely toothed and are embedded with silica crystals. The upper surface of the leaf blade is hairy near the base. The undersurface is usually hairless. The flowers are arranged in a silvery, cylindrical, branching structure, or panicle, about 3-11 inches long and 1½ inches wide. It is used for thatching the roofs of traditional homes throughout south-east Asia. It is planted extensively for ground cover and soil stabilization near beach areas and other areas subject to erosion. Other uses include paper-making, thatching and weaving into mats and bags. However, it's most common usefulness may be seen in its medicinal properties which include astringent, antipyretic, diuretic, tonic and styptic actions. It is used in traditional Chinese medicine. A number of cultivars have been selected for garden as ornamental plants. Young inflorescences and shoots may be eaten cooked, and the roots contain starch and sugars and are therefore easy to chew. Cogon grass is a valuable feed for cattle, goat and sheep. In present study, cogon grass contained 1591.1 kcal ME/kg DM, 32.0 g/100g dry

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matter, 8.4 g/100g crude protein, 41.2 g/100g crude fiber, 42.3 g/100g nitrogen free extracts, 1.1 g/100g ether extracts and 7.0 g/100g ash (Table 1). As an unconventional feed, cogon grass can be used as alternative feed resource for livestock in scarcity of traditional feeds.

Dhol kolmi (*Ipomoea carnea*)

Dhol kolmi (*Ipomoea carnea*) is herbaceous aquatic or semi-aquatic perennial plant of the tropics or subtropics. Leaves are flat and vary in shape depending on variety, from heart-shaped to long, narrow and arrow-shaped. Narrow leaves are 1-2.5 cm wide and 20-30 cm long. Broad leaves are up to 5 cm wide and 15-25 cm long. The leaves are very low in cholesterol. It is also a good source of protein, dietary fiber, phosphorus, vitamin A, vitamin C, riboflavin, niacin, vitamin B6, folate, calcium, iron, magnesium, potassium and manganese. Dhol kolmi is an excellent source of Vitamin A and Vitamin C. In many developing countries, the largest contribution of vitamin A intake comes from the provitamin a carotenoids in plant foods, which may contribute up to 82 g/100g of the total vitamin A intake, whereas the contribution from fish and meat is of minor importance, because these foods are expensive and/or are not accessible (Berg et al., 2000). Malaysians mostly consume green vegetables such as Chinese mustard leaves, Chinese kale, lettuce, spinach and swamp cabbage (Amin and Cheah 2003; Wen et al., 2010). In present study, Dhol kolmi contained 2493.4 kcal ME/kg DM, 80.7 g/100g moisture, 26.3 g/100g crude protein, 13.0 g/100g crude fibre, 0.2 g/100g ether extract, 49.8 g/100g nitrogen free extracts and ash 10.7 g/100g.

Giant reed leaf (*Arundo donax*)

Giant reed (Arundo donax) is a perennial rhizomatous grass which is widely diffused in subtropical and warm temperate regions. From its native area, probably Eastern Asia, it has been dispersed all over the world by humans who use it for multiple purposes such as roof thatching, reeds in woodwind instruments, sweeping materials, fishing rods etc. Its spontaneous and rapid growth allows A. donax to be considered as an invasive weed (Pilu et al., 2012). It is an erect, perennial, bamboo-like grass. In traditional medicine, it is utilized as a diuretic, sudorific and for dropsy treatment (Shamel, 1917; Gucel, 2010; Guarrera, 2007). A. donax has been used industrially to produce cellulose, paper and rayon. Giant reed leaf is abundantly available in the hilly areas of Bandarban. From the nutritional analysis, it contained 2054.9 kcal ME/kgDM, 34.0 g/100g dry matter, 8.6 g/100g crude protein, 29.5 g/100g crude fiber, 49.3 g/100g nitrogen free extracts, 2.4 g/100g ether extracts and 10.2 g/100g ash (Table 1). Only the hilly people use this leaf as feed for their domestic animals. It is a good source of protein. Thus giant reed leaf may be used as an alternative protein source for livestock.

Hilly grass (*Cynodon dactylon*)

Hilly grass is a kind of herb that contains fibers. It grows enormously in the hilly areas of Bandarban district. Generally local people of that region use it as feed for their domestic animals. In present study, hilly grass contained 1741.0 kcal ME/kg DM, 33.4 g/100g dry matter, 6.8 g/100g crude protein, 40.2 g/100g crude fiber, 43.9 g/100g nitrogen free extracts, 1.3 g/100g ether extracts and 7.8 g/100g ash (Table 1). It is a good source of vitamins and minerals. This grass is widely available in hilly areas, so this grass can be used as unconventional feed for livestock.

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Pithraj leaf (*Aphanamixis polystachya*)

It belongs to Meliaceae family. Scientific name is *Aphanamixis polystachya*. This is a large tree with bunches of rounded lobular fruits and glossy deep brown seeds, grows wild and planted in forests and roadsides all over the country (Ghani, 2003). The plant is extensively used in traditional system of medicine for various ailments in different Asian countries like spleen and liver complications, tumors, rheumatism. The plant is reported to possess antitumor (Rabi and Gupta, 1995), hepatoprotective (Gole and Dasgupta, 2002), insecticidal (Talukder and Howse, 1993), antibacterial, antifungal and immunosuppressive (Ghani, 2003) activities. Leaves contain diterpene alcohol and beta-sitosterol. Seeds yield polystachin, an alkaloid, a glycoside and a saponin (Ghani, 2003). In present study, the pitraj leaf contained 2879.5 kcal ME/kg DM, 15.3 g/100g crude protein, 18.5 g/100g crude fibre, 11.1 g/100g ether extracts, 48.0 g/100g nitrogen free extracts and 7.1 g/100g ash.

Sal leaf (*Shorea robusta*)

The sal (*Shorea robusta*) is one of the dominant tree species in tropical deciduous forests. The sal tree is a hardwood timber tree up to 30-35 m tall. The crown is spreading and spherical. Leaves are 20 cm long, simple, shiny and glabrous, delicate green, broadly oval at the base. Fruits are 1-1.5 cm large and ovoid (Orwa et al., 2009). Sal seed leaves are used as roughage of medium to poor quality (Orwa et al., 2009). The used leaves/plates are readily eaten by goats and cattle that roam the streets freely. In present study, Sal leaf contained 2764.1 kcal ME/kgDM, 16.3 g/100g crude protein, 14.2 g/100g crude fibre, 4.3 g/100g ether extracts, 58.8 g/100g nitrogen free extracts and 6.4 g/100g ash which is contradictory with the other investigators (Makkar et al., 1998; Sen, 1938) who found 11.3 g/100g CP, 27.4 g/100g CF, 3.2 g/100 EE, 3.9 g/100g NFE and 6.4 MJME/kg sal leaf.

Shegun leaf (*Tectona grandis*)

Shegun is the common name for the tropical hardwood tree. The English name of shegun leaf is teak leaf and scientific name is *Tectona grandis*. It is native to south and south east Asia, mainly Bangladesh, India, Indonesia, Malaysia, and Burma, but is naturalized and cultivated in many countries, including those in Africa and the Caribbean. Myanmar accounts for nearly one third of the world's total teak production. Teak is a large, deciduous tree that is used for animal feed. It has small, fragrant white flowers and papery leaves that are often hairy on the lower surface.

Teak leaves are four-sided branchlets; bear the very large leaves which are shield for three to four months during the latter half of the dry season. The leaves are shiny above and hairy below with vein network clear about 30 x 20 cm but young leaves up to 1.0 m long. The leaves yield the dye which is used to colour clothes. Teak is probably the best protected commercial species in the world. It was found that, 1g of teak leaf powder could remove 86.73% of cadmimum (II) from 50 ml aqueous solution (Acton, 2011). So it has antitoxic properties. In Indonesia, teak leaves are also used for producing mold starter culture (Lusas et al., 1989; Applewhite, 1989). In present study, teak leaf contained 2323.8 kcal ME/kgDM, 34.6 g/100g dry matter, 11.9 g/100g crude protein, 26.2 g/100g crude fiber, 49.5 g/100g nitrogen free extracts, 4.3 g/100g ether extracts and 8.1 g/100g ash (Table 1). It a good source of minerals and protein. Thus teak leaf may be an alternative feed resource for animals.

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Tiger's claw leaf (*Erythrina variegata*)

The foliage of *Erythrina variegata* makes an excellent feed for most livestock. A tree of average size, pruned three or four times a year, produces from 15 to 50 kg of green fodder annually depending on growing conditions. Legume trees offer a renewable and cheap source of feed protein for ruminant animals in smallholder farms in tropical regions. Erythrina species belong to a legume family that can be found throughout the tropics. The juice of fresh leaves from some Erythrina species is used in traditional medicine, where it is considered to be a sedative and an analgesic (Ratnasooriya and Dharmasiri, 1999; Deb et al., 2009). *Erythrina variegata* foliage has high crude protein content, 19 to 22 g/100g in dry matter (DM), and can be an excellent feed for most livestock (Kibria et al., 1994; Aregheore and Perera, 2004; Kongmanila and Ledin, 2009). Tiger's claw leaf contained 2715.5 kcal ME/kgDM, 18.4 g/100g crude protein, 16.1 g/100g crude fibre, 6.0 g/100g ether extracts, 51.4 g/100g nitrogen free extracts and 8.1 g/100g ash. The result is almost similar to (Kibria et al., 1994) who found CP ranged from 19-22 g/100g. Leaves normally contain 16 to 18 g/100g crude protein and have an IVDMD of 50 g/100g. The leaves have no known toxicity for cattle.

CONCLUSION

The results of this study indicated that the hilly grasses and leaves are good sources of carbohydrates, protein and energy. From review it was also evident that, the hilly leaves are a good source of Iron, Copper, Potassium and Manganese which may meet the recommended daily allowance. Adequate consumption of these plant leaves and grasses may help in preventing adverse effects of dietary deficiencies. Moreover, feeding these unconventional feeds may reduce pressure on the conventional feeds which will ultimately minimize production cost of livestock and their products and by-products.

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