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VEGETABLE PEELS: A PROMISING FEED RESOURCE FOR LIVESTOCK

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ABSTRACT: The study was undertaken to find out the chemical composition of different vegetable peels available in Rangunia, Chittagong, Bangladesh. Total 10 different vegetable peels i.e., Banana blossom (*Musa sapientum*), Bottle gourd peel (*Lagenaria siceraria*), Brinjal peel (*Solanum melongena*), Gram husk (*Cicer arietinum*), Green banana peel (*Musa sapieutum*), Green coconut peel (*Cocos nucifera*), Pea husk (*Pisum sativum*), Potato peel (*Solanum tuberosum*), Pumpkin peel (*Cucurbita maxima*), Ripe banana peel (*Musa sapientum*) were collected from the 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 extracts (NFE), Ether extracts (EE) and Ash. Results indicated that, crude protein content in Banana blossom was 13.8 g/100g, Bottle gourd peel 7.0 g/100g, Brinjal peel 12.3 g/100g, Gram husk 4.5 g/100g, Green banana peel 7.0 g/100g, green coconut peel 4.9 g/100g, pea husk 6.2 g/100g, Potato peel 13 g/100g, Pumpkin peel 16.5 g/100g and Ripe banana peel 6.8g/100g. In addition to crude protein, all samples contained substantial amount of crude fiber, nitrogen free extracts, ether extracts and ash. It could therefore be inferred that, the vegetable peels might be an alternative to conventional feeds for livestock of the developing countries.

Keywords: Ash, Crude Fiber, Crude Protein, Ether Extract, Moisture, Nitrogen Free Extract, Vegetable Peels.

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INTRODUCTION

The economy of Bangladesh is mainly based on Agriculture. Livestock plays a crucial role in the agricultural economy. About 36% of the total animal protein comes from the livestock products in our everyday life. Around 25% peoples of the country are directly engaged in livestock sector and 50% peoples are partly associated in livestock production. The contribution of livestock sub-sector to the GDP was 2.95% estimated to be 17.3% of agriculture. The growth of GDP for livestock was 7.2%. Bangladesh has 24 million cattle, out of which 6 million are dairy cattle of local and crossbreds (DLS, 2008).

Dairy animals are the key components of livestock. The majority of the dairy cattle are in the hands of smallholder dairy producers. The country has one of the highest cattle densities of 145 large ruminants/square kilo meter compared with 90 for India, 30 for Ethiopia, and 20 for Brazil (Karim, 1997). The numbers of dairy farms are estimated at about 1.4 million with an average herd size of 1-3 cows (Hemme, 2008). Dairying is a part of the mixed farming systems in Bangladesh (Saadullah, 2001) and a predominant source of income, nutrition and jobs (Miyan, 1996). Dairying is also considered a powerful tool to develop a village micro economy of Bangladesh (Shamsuddin et al., 2007) to improve rural livelihoods and to alleviate rural poverty. Nevertheless, the higher price and acute scarcity of conventional feeds are two major constraints to the profitable livestock production. Replacing traditional feeds to unconventional feeds can be beneficial for the farmer. Using shrub, tree leaves, tender shoots and twigs as fodder is a traditional practice in the villages.

Recently, there has been increasing recognition of the use of shrub and tree fodder as livestock feed (Saadullah, 1989). Therefore, current study was undertaken to find out the chemical composition of different types of vegetable peels that could be used as potential unconventional feeds for livestock.

MATERIAL AND METHODS

Study area

Rangunia is a sub-district of Chittagong. There are lots of small and large dairy farms in Rangunia. Small dairy farm owner mostly practicing the use of unconventional feed particularly vegetable peels. Therefore, Rangunia was selected as the study area for collection of sample.

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Collection of sample

Samples were collected by using simple random sampling technique. Total 10 different types of unconventional feeds were selected randomly. Approximately 2000 grams of each sample was collected. Samples were wrapped up by polythene bag and preserved in the laboratory for chemical analysis.

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 moisture, DM, CP, CF, NFE, EE and ash in the animal nutrition laboratory and PRTC laboratory in Chittagong Veterinary and Animal Sciences University, Chittagong, Bangladesh as per AOAC (2006).

Calculation of ME

Metabolizable energy (ME) was calculated separately for all 10 different samples. Calculation was performed by using the mathematical formula as per Lodhi et al. (1976).

Statistical analysis

Data related to chemical composition of unconventional feeds 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 vegetable peels particularly, moisture, dry matter (DM), crude protein (CP), crude fiber (CF), nitrogen free extract (NFE), ether extract (EE) and total ash contents in different samples have been presented in Table 1.

Table 1 - Chemical composition (g/100gDM) of the vegetable peels available in Rangunia, Chittagong.

English name	Scientific name	ME	DM	CP	CF	NFE	EE	Ash
Banana blossom	Musa sapientum	2185.7	8.9	13.8	27.4	44.7	3.9	10.2
Bottle gourd peel	Lagenaria siceraria	2278.1	6.6	7.0	23.0	58.3	2.1	9.6
Brinjal peel	Solanum melongena	2231.2	10.5	12.3	26.8	52.7	1.6	6.6
Gram husk	Cicer arietinum	1798.9	88.4	4.5	48.3	38.4	5.6	3.2
Green banana peel	Musa sapieutum	2659.5	11.7	7.0	24.1	54.1	6.0	8.8
Green coconut peel	Cocos nucifera	2863.2	12.0	4.9	30.2	56.8	1.8	6.3
Pea husk	Pisum sativum	1350.9	89.2	6.2	48.4	30.5	2.3	12.6
Potato peel	Solanum tuberosum	2594.4	16.3	13.0	12.5	64.6	0.9	9.0
Pumpkin peel	Cucurbita maxima	2704.8	13.3	16.5	14.8	62.2	1.9	4.6
Ripe banana peel	Musa sapientum	2634.8	7.7	6.8	16.8	56.5	7.8	12.1
SEM		148.1	10.4	1.3	4.0	3.4	0.7	1.0
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; NS=Non-significant ($P>0.05$); SEM=Standard error of mean, *=Significant at 5 % level ($P<0.5$); ***=Significant at 0.1 % level ($P<0.001$)

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Banana flower (*Musa sapientum*)

Banana flower (*Musa sapientum*) known as banana blossom or heart, is a wonder looking male, sterile flower of the banana plant. Banana flower, similarly to banana is an excellent source of potassium, vitamins A, C and E. According to research conducted by the Chinese Academy of Tropical Agricultural Sciences, banana flowers have tremendous nutritional values. This is a good source of fiber and protein. The flowers contain a class of phytochemical known as saponins. They also have antioxidant activity to reduce the risk of cardiovascular diseases. Banana flowers are an excellent source of flavonoids. These phytochemicals help prevent damage to DNA cells by neutralizing free radicals. They have cholesterol lowering, anti-inflamation, anticancer and anti-aging activities. In present study, banana flower contained 2185.7 kcal ME/kgDM, 91.1 g/100g moisture, 13.8 g/100g crude protein, 27.4 g/100g crude fibre, 3.9 g/100g ether extract, 44.7 g/100g nitrogen free extracts and 10.2 g/100g ash which is close to the result of Kanchana et al. (2005) who found 88.75 g/100g moisture, 21.01 g/100g crude protein, 20.315 g/100g crude fibre and 8.74 g/100g ash. Therefore, banana flower could be a promising feed resource for livestock.

Bottle gourd peel (*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 much 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 %. Bottle gourd with peel contains more crude fiber, acid detergent fiber, hemicelluloses, iron, phosphorus, zinc then bottle gourd without peel (Milind and Satbir, 2011). Leaves contain cucurbitacin B. Extracts of the plant have shown antibiotic activity (Gorasiya et al., 2011). In present study, bottle gourd peel contained 2278.1 kcal ME/kgDM, 7.0 g/100g crude protein, 23.0 g/100g crude fibre, 2.1 g/100g ether extracts, 58.3 g/100g nitrogen free extracts and 9.6 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 could be an alternative feed source for livestock.

Brinjal peel (*Solanum melongena*)

The *Solanum melongena* is a member of the plant family Solanaceae. The plant bears a fruit of the same name, commonly used in cooking. As a nightshade, it is closely related to the tomato and potato. It was domesticated in India from the species. Cows eating GM brinjal produced significantly (14.3%) more milk, almost as if they were treated by a light hormone in 42 days only. In present study, brinjal peel contained 2231.2 kcal ME/kgDM, 12.3 g/100g crude protein, 26.8 g/100g crude fibre, 1.6 g/100g ether extracts, 52.7 g/100g nitrogen free extracts and 6.6 g/100g ash.

Gram husk (*Cicer arietinum*)

Gram husk (Cicer arietinum) is frequently used in dairy ration because it is not only cheap but also abundant especially in Chittagong region. In present study, gram husk contained 1798.9 kcal ME/kgDM, 11.6 g/100g moisture, 4.5 g/100g crude protein, 48.3 g/100g crude fibre, 5.6 g/100g ether extract, 38.4 g/100g nitrogen free extracts and 3.2 g/100g ash. In another study, Sreerangarajua (2000) found 51.0 g/100g crude protein and 11.0 g/100g ether extracts in gram husk. The proximate composition of Bengal gram (*Cicer arietinum*) husk is

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comparable to that of cereal straw (Sen et al., 1978). It is one of the preferred feed ingredients in the diet of crossbred dairy cows in and around Bangalore, India. It is reported that gram husk contain some anti nutritional factors (Barry, 1989) particularly certain types of tannins. So gram husk can be cautiously used in ruminant ration.

Green banana peel (*Musa sapientum*)

Scientific name is *Musa sapientum*. This is a herbaceous plant of the family Musaceae. It is a fast-growing plant with a 3-5 m high stem and almost every part of it is usable. According to Leslie (1976), it is now cultivated throughout the tropics. The plant is cultivated primarily for its fruits and to a lesser extent for the production of fibre. The peel has been reported to be useful in making banana charcoal, an alternative source of cooking fuel in Kampala. Kudan (1973) reported that the peels in conjunction with other substances create a liniment for reducing acuteness of the arthritis and pains. The proportion of the banana which is wasted as peel is 18-20 % (Dividich et al., 1976). The nutritive value of ripe banana peel was slightly better than the almost ripe and green peel (Tartrakoon et al., 1999). In present study, green banana peel contained 2659.5 kcal ME/kgDM, 7 g/100g crude protein, 24.1 g/100g crude fibre, 6 g/100g ether extracts, 54.1 g/100g nitrogen free extracts and 8.8 g/100g ash.

Green coconut peel (*Cocos nucifera*)

The local name of Green coconut peel is Dab and scientific name is *Cocos nucifera*. Green coconut is one of the most nutritious of all fruits. The whole coconut tree may be utilized, but the main products are obtained from the fruit. Copra and oil, lauric acid, coconut milk, fiber, flour and coconut water are derived from immature fruit which is used in several application. The green coconut is truly one of nature's wonder. Every part of the coconut is used for some purpose. From this tree we can derive everything necessary to sustain life. It is a source of food and drink to nourish the body, medicine to maintain and restore health and materials to build shelter, clothing and tools to provide the necessities of life. That's why, it is called the 'tree of life' (Fife, 2005). Coconut shell-oil is used for external application in eczema, ringworm, chronic skin diseases (Khare, 2004). The coconut oil is also used as an emetic and as a purgative (Trivedi, 2006). It is very rare to use as animal feed in our country. It has good nutritive value. It is highly rich in carbohydrate. In present study it contained 2863.2 kcal ME/kgDM, 12.0 g/100g dry matter, 4.9 g/100g crude protein, 30.2 g/100g crude fiber, 56.8 g/100g nitrogen free extracts, 1.8 g/100g ether extracts and 6.3 g/100g ash (Table 1). A polysaccharide factor isolated from coconut water is found to be immunogenic and oil from coconut shell fiber antimicrobial (Khare, 2004). So, green coconut peel can be used as unconventional feed resource for livestock.

Pea husk (*Pisum sativum*)

Pea husk (*Pisum sativum*) in present study, contained 1350.9 kcal/kg ME, 10.8 g/100g moisture, 6.2 g/100g crude protein, 48.4 g/100g crude fibre, 2.3 g/100g ether extract, 30.5 g/100g nitrogen free extracts and 12.6 g/100g ash which is similar to FAO (2005) where the they found 93.7 g/100g dry matter, 6.7 g/100g crude protein, 38 g/100g crude fibre, EE 0.3 g/100g ether extracts and 5.0 g/100g ash. According to Gowda et al. (2004), pea husk contained 92.3 g/100g dry matter, 6.0 g/100g crude protein, 1.1 g/100g ether extracts, 42.6 g/100g crude fibre, 5.0 g/100g ash and 45.2 g/100g nitrogen free extracts. So, peas husk could be a potential and valuable feed for livestock as it is available throughout the whole country at a reasonable price.

Potato peel (*Solanum tuberosum*)

The potato is starchy, tuberous crop from the perennial *Solanum tuberosum* of the Solanaceae family. Potato plants are herbaceous perennials that grow about 60 cm high. During peeling process, 30 to 40 % of the potatoes

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and vegetables become waste. Waste generated by peeling commonly called peeling. Potato peels contain an array of nutritionally and pharmacologically interesting components such as phenolic compounds, glycoalkaloids, and cell wall polysaccharides, which may be used as natural antioxident, precursors of steroid hormones, and dietary fibre. The utilization of by-products also contributes to reduce amounts of wastes and thus to sustainable production (Schieber et al., 2003). In present study, potato peel contained 2594.4 kcal ME/kgDM, 13 g/100g crude protein, 12.5 g/100g crude fibre, 0.9 g/100g ether extracts, 64.6 g/100g nitrogen free extracts and 9 g/100g ash. The result is in close agreement with Mahmood et al. (1998) who found 14.70 g/100g CP and 7.65 g/100g ash.

Pumpkin peel (*Cucurbita moschata*)

The local name is mistikumra and scientific name is *Cucurbita moschata*. The fruits are edible and eaten as vegetable. Mature fruits of squash gourd are used as a table vegetable for baking in pies and for making jam and also livestock feed. The flesh is usually fine-grained and mild-flavored and thus suitable for baking. Besides these it is a source of Vitamin A and Vitamin C (Rahman et al., 2008). In present study, pumpkin peel contained 2704.8 kcal ME/kgDM, 16.5 g/100g crude protein, 14.8 g/100g crude fibre, 1.9g/100g ether extracts, 62.2 g/100g nitrogen free extracts and 4.6 g/100g ash. So, pumpkin peel is nutritionally sound and may be good feed for livestock.

Ripe banana peel (*Musa sapientum*)

Almost similar to green, ripe banana peel contained 2634.8 kcal ME/kg DM, 6.8 g/100g crude protein, 16.8 g/100g crude fibre, 7.8 g/100g ether extracts, 56.5 g/100g nitrogen free extracts and 12.1 g/100g ash. The result is inconsistent with Tartrakoon et al. (1999) who found 4383 kcal ME/kgDM, 91.62 g/100g DM, 5.19 g/100g CP, 11.58 g/100g CF, 10.66 g/100g EE and 16.30 g/100g ash for green banana peel and 4593 kcal ME/kgDM, 95.66 g/100g DM, 4.77 g/100g CP, 11.95 g/100g CF, 14.56 g/100g EE and 14.58 g/100g ash for ripe banana peel. Thus, properly processed banana peel could be a good source of nutrients for livestock (Anhwange, 2008).

CONCLUSION

Year round supply of sufficient feeds for livestock is the priority area for profitable livestock production. The available feed stuffs in Bangladesh are mainly crop residues, agro-industrial by-products and unconventional feed stuffs. The role of unconventional feeds in ruminant nutrition continues to increase. The utilization of unconventional feeds will not only benefit the milk and beef industry but also increase the economic return. Unconventional feed can also be used during the scarcity of traditional feed.

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