**Vegetable wastes as an alternative to conventional feeds**

**for the livestock of Bangladesh**

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**A Report**

**By**

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**(MD. IMRAN AHMED)**

Roll No: 2007/47, Reg. No: 334

Internship ID: E-43, Session: 2006-2007

Submitted in partial of the requirement for the fulfillment of the degree of

Doctor of Veterinary Medicine (DVM)

**Approved as to style and content by**

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**Vegetable wastes as an alternative to conventional feeds**

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1. **Abstract**

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The study was undertaken during 16th July to 16th November 2012 to observe the chemical composition of different types of vegetable wastes available in Rangunia upazilla of Chittagong district, Bangladesh. Total 11 (6 vegetable peel/skin and 5 leaves) different types of feed samples were collected from the study areas. Chemical analyses of the samples were carried out in triplicate for moisture, dry matter (DM), crude protein (CP), crude fiber (CF), nitrogen free extracts (NFE), ether extracts (EE) and total ash in the animal nutrition laboratory, Chittagong Veterinary and Animal Sciences University, Chittagong, Bangladesh. Results indicated that, all samples had substantial amount of proximate components that might have been used as alternative feed resource for dairy cattle. Crude protein content in bottle gourd peel was 7.0 g/100g, pumpkin peel 16.5 g/100g, brinjal peel 12.3 g/100g, potato peel 13 g/100g, green banana peel 7g/100g, ripe banana peel 6.8g/100g, bottle gourd leaf 33.6 g/100g, bean leaf 28.2 g/100g, tiger’s claw leaf 18.4 g/100g, sal tree leaf 16.3 g/100g and pithraj leaf 15.3 g/100g. It could therefore, be inferred that, these vegetable wastes might be used as an alternative feed resource for dairy animals in scarcity of traditional feeds if available at cheaper price.

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**Key words:** Vegetable wastes, moisture, dry matter, crude protein, crude fiber, nitrogen free extracts, ether extracts and total ash

**2. Introduction**

The economy of Bangladesh is mainly based on Agriculture. Livestock plays a crucial role in the agricultural economy. About 36.0 percent of the total animal protein comes from the livestock products in our everyday life. Around 25 percent peoples of the country are directly engaged in livestock sector, and 50 percent peoples are partly associated in livestock production. The contribution of livestock sub-sector to the GDP was 2.95 percent, which was estimated about 17.32 percent to agriculture. The growth of GDP for livestock was 7.23 percent. Bangladesh has 24 million cattle, out of which 6 million are dairy cattle of local and crossbreds **(DLS, 2008).**

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; Haque, 2009)**. 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 commercial dairying. 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 wastes that could be used as potential unconventional feeds for livestock.

**3. Materials and Methods**

**3.1 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. Therefore, that place is selected as the study area for collection of sample.

**3.2 Collection of sample**

Samples were collected by using simple random sampling technique. Total 11 different types of unconventional feeds were selected randomly. Approximately 2000 grams of each sample were collected. Samples were wrapped up by polythene bag and preserved in the laboratory for chemical analysis.

**3.3 Preparation of sample**

Samples were subjected to grinder to make it homogenous powder. Later on, it was mixed properly and exposed to shade to cool down for sampling. Individual samples were identified by marker and subjected to chemical analyses.

**3.4 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 (1994).**

**3.5 Calculation of ME**

Metabolizable energy (ME) was calculated separately for all 11 different samples. Calculation was performed by using the mathematical formula as per **Lodhi et al. (1976).**

**3.6 Statistical analysis**

Data related to chemical composition of unconventional feeds were compiled by using Microsoft Excel 2007. Chi-square (χ²) test was performed to analyze the data by using SPSS 16.0**.** Statistical significance was accepted at 5 % level (P<0.05).

**4. Results and Discussion**

Chemical composition of these unconventional feeds 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/100g) of the unconventional feeds.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **English name** | **Scientific name** | **ME$** | **DM** | **CP** | **CF** | **EE** | **NFE** | **ASH** |
| Bean leaf | *Lablab purpureus* | 2510.4 | 18.8 | 28.2 | 15.7 | 3.5 | 41 | 11.6 |
| Bottle gourd leaf | *Lagenaria siceraria* | 2470.1 | 8.1 | 33.6 | 11.2 | 4.2 | 32.8 | 18.2 |
| Bottle gourd peel | *Lagenaria siceraria* | 2278.1 | 6.6 | 7.0 | 23.0 | 2.1 | 58.3 | 9.6 |
| Brinjal peel | *Solanum melongena* | 2231.2 | 10.5 | 12.3 | 26.8 | 1.6 | 52.7 | 6.6 |
| Green banana peel | *Musa sapieutum* | 2659.5 | 11.7 | 7.0 | 24.1 | 6.0 | 54.1 | 8.8 |
| Pithraj leaf | *Aphanamixis polystachya* | 2879.5 | 64.0 | 15.3 | 18.5 | 11.1 | 48.0 | 7.1 |
| Potato peel | *Solanum tuberosum* | 2594.4 | 16.3 | 13.0 | 12.5 | 0.9 | 64.6 | 9.0 |
| Pumpkin peel | *Cucurbita maxima* | 2704.8 | 13.3 | 16.5 | 14.8 | 1.9 | 62.2 | 4.6 |
| Ripe banana peel | *Musa sapieutum* | 2634.8 | 7.7 | 6.8 | 16.8 | 7.8 | 56.5 | 12.1 |
| Sal leaf | *Shorea robusta* | 2764.1 | 64.1 | 16.3 | 14.2 | 4.3 | 58.8 | 6.4 |
| Tiger's claw leaf | *Erythrina variegata* | 2715.5 | 71.6 | 18.4 | 16.1 | 6.0 | 51.4 | 8.1 |
| Level of sig. |  | \*\*\* | \*\*\* | \*\*\* | NS | \* | NS | NS |

$Metabolizable energy (Kcal/kg); DMDry matter; CPCrude protein, CFCrude fibre, NFENitrogen free extract, EEEther extract; NSNon-significant (P>0.05); \*Significant at 5 % level (P<0.5); \*\*\*Significant at 0.1 % level (P<0.001)

In present study ME, DM, CP, CF, EE, NFE, ASH were determined for some selected unconventional feeds to make a decision whether they could be suitable for an alternative supplement of traditional feed.

**4.1 Bean leaf (*Lablab purpureus*)**

Scientific name is *Lablab purpureus*. It is an annual or short-lived perennial dual-purpose legume. It belongs to the family Fabaceae and genus Lablab. grown in the tropics. The seed and immature pods can be used for human food **(Purseglove, 1968)** while the herbage is used as a feed supplement for ruminant grazing during the dry season **(Schaaffausen, 1963)**. Reports are however, limited on its use as a feed resource for monogastric animals. In present study, bean leaf contained 2510.4 Kcal/kg ME, 28.2 g/100g crude protein, 15.7 g/100g crude fibre, 3.5 g/100g ether extracts, 41 g/100g nitrogen free extracts and 11.6 g/100g ash. In a study *Lablab purpureus* had 76.4 g/100g dry matter in leaf and incase of stem it was 84.1 g/100g for rongai variety **(Karachi, 1997)**. Protein content was 25 g/100g for leaves and 11.88 g/100g for stems. [**Ajayi et al.**](http://www.feedipedia.org/node/1781) **(2009)** found 41.8 g/100g crude fiber 26.9 g/100g DM, 18.1 g/100g CP, 28.5 g/100g CF and 2.6 g/100g EE in bean leaf. **Aganga and Autlwetse (2000)** reported 16.4 g/100g CP for whole plant Lablab hay. The DMD for the leaf and stem was 64.4 g/100g and 44.2 g/100g respectively.

**4.2 Bottle gourd (*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/kg ME, 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 and bottle gourd leaf contained 2470.1 Kcal/kg ME, 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 could be an alternative feed source for livestock.

**4.3 Brinjal peel (*Solanum melongena*)**

The *Solanum melongena* is a member of the plant [family](http://en.wikipedia.org/wiki/Family_(biology)) [Solanaceae](http://en.wikipedia.org/wiki/Solanaceae). The plant bears a [fruit](http://en.wikipedia.org/wiki/Fruit) of the same name, commonly used in cooking. As a nightshade, it is closely related to the [tomato](http://en.wikipedia.org/wiki/Tomato) and [potato](http://en.wikipedia.org/wiki/Potato). It was domesticated in [India](http://en.wikipedia.org/wiki/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 (**re.indiaenvironmentportal.org.in/files/seralini-background.doc**). In present study, brinjal peel contained 2231.2 Kcal/kg ME, 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.

**4.4 Banana peel (*Musa sapientum*)**

Scientific name *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. **Akinyosoye (1991)** reported that 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/kg ME, 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. Ripe banana peel contained 2634.8 Kcal/kg ME, 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 ME 4383 Kcal/kg, DM 91.62 g/100g, CP 5.19 g/100g, CF 11.58 g/100g, EE 10.66 g/100g, Ash 16.30 g/100g, for green banana peel and ME 4593 Kcal/kg, DM 95.66 g/100g, CP 4.77 g/100g, CF 11.95 g/100g, EE 14.56 g/100g, Ash 14.58 g/100g, for ripe banana peel. Thus, properly processed banana peel could be a good source of unconventional feed for livestock **(Anhwange, 2008)**.

**4.5 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)**, hepatopro-tective **(Gole and Dasgupta, 2002)**, insecticidal **(Talukder and Howse, 1993)**, antibacterial, antifungal and immuno-suppressive **(Ghani, 2003)** activities. Leaves contain diter-pene 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/kg ME, 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.

**4.6 Potato peel (**[***Solanum***](http://en.wikipedia.org/wiki/Solanum)***tuberosum*)**

The potato is [starchy](http://en.wikipedia.org/wiki/Starch), [tuberous](http://en.wikipedia.org/wiki/Tuber) [crop](http://en.wikipedia.org/wiki/Crop_(agriculture)) from the [perennial](http://en.wikipedia.org/wiki/Perennial_plant) [*Solanum*](http://en.wikipedia.org/wiki/Solanum)*tuberosum* of the [Solanaceae](http://en.wikipedia.org/wiki/Solanaceae) family. Potato plants are herbaceous [perennials](http://en.wikipedia.org/wiki/Perennial) that grow about 60 cm high. During the peeling process, 30 to 40 % of the potatoes 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 peelcontained 2594.4 Kcal/kg ME, 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 to **Boyles (2004)** who found 85 g/100g moisture and also with **Mahmood et al. (1998)** who found 14.70 g/100g CP and 7.65 g/100g Ash.

**4.7 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 **(Chakravarty, 1982)**. 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/kg ME, 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.

**4.8 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**](http://www.feedipedia.org/node/1650)**)**. Sal seed leaves are used as roughage of medium to poor quality **(**[**Orwa et al., 2009**](http://www.feedipedia.org/node/1650)**)**. 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/kg ME, 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; Salo, 1965; 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 MJ/kg ME.

**4.9 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 **(Whistler and Elevitch, 2006)**. 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/kg ME, 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 **(Hegde, 1994)**.

**5. Conclusion**

Bangladesh has large livestock population. Feeding the draught animals as well as milch animals is the priority for rationing the available feed stuffs. The available feed stuffs 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 tradition feed.

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