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# NUTRITIVE VALUE OF SAWDUST

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**ABSTRACT:** *The present study was undertaken to observe the chemical composition of different types of sawdust available in the urban and peri-urban areas of Chittagong, Bangladesh. Twenty different types of sawdust from different plants were collected from study areas. Chemical analyses of the samples were carried out in triplicate for moisture, dry matter (DM), metabolizable energy (ME), 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, there were no variations ($P>0.05$) in the DM, EE and TA contents of the sawdust samples. However, ME, CP, CF and NFE content differed ($P<0.01$) significantly from one sample to another. DM content varied from 91.6 to 97.4 g/100g, ME content varied from 535.9 to 1756.7 kcal/kg, CP content varied from 1.8 to 3.5 g/100g, CF content varied from 39.5 to 74.0 g/100g and NFE content varied from 12.5 to 47.1 g/100g. It could therefore, be inferred that, sawdust currently available in the local market widely varies in chemical composition.*

ORIGINAL ARTICLE

**Key words:** *Sawdust, Dry Matter, Metabolizable Energy, Crude Protein, Crude Fiber, Nitrogen Free Extracts, Ether Extracts, Total Ash*

## INTRODUCTION

The higher price and acute scarcity of conventional feed ingredients are two major constraints to the profitable commercial dairy and poultry farming. The feed cost alone accounts 60-70% of the total production cost. Computing feed with conventional feed ingredients hardly permits profitable poultry production (Bulbul and Hossain, 1989). Therefore, attention is gradually being focused on cheaper alternative feed resources, specially, crop residues and industrial by-products to sustain livestock industry. The use of unconventional feed resources along with other strategies may reduce pressure on the demand for conventional feed ingredient and promote achievement of feed security for dairy and poultry sector.

Sawdust or wood dust is a by-product of cutting, grinding, drilling or pulverizing wood with saw or other tool. It is composed of fine particles of wood. It could also be derived from certain animals, birds and insects which live in wood, such as the woodpecker and carpenter ant. Wood residues contain 70 to 80% total carbohydrate (Keith, 1976). Millions of fibrous materials like saw dust is wasted away every year from industrial sites like sugar mills and saw mills. Sawdust has been fed satisfactorily to ruminants as a roughage substitute in all concentrate rations (Marion et al., 1959; Anthony and Cunningham, 1968; Anthony et al., 1969; Dinius et al., 1970; Slyter and Kamstra, 1974; McCartor et al., 1972; Sowande, 2002). Therefore, dairy farmers who have scarcity for forages, straw and stover, may consider feeding of hard wood saw dust and wood shavings to a limited amounts. Previous studies indicate that, the inclusion of 5-15% sawdust in maize based diets for cattle was found to maintain better rumen function irrespective of few cases for bloat and liver lesions and less ruminal perakaratosis.

Sawdust is abundant throughout the whole year in developing countries. Utilization of sawdust may reduce the cost of conventional livestock feeds since it does not compete with human being. However, the problem associated with sawdust is its higher lignin content. Recent studies show that, *in vitro* dry matter digestibility (IVDMD) of sawdust by rumen microorganisms has been improved by alkali treatment (Wilson and Pigden, 1964). *In vivo* dry matter digestibility has also been improved by alkali and acid treatment of sawdust (Mellenberger et al., 1971). Therefore, the present study was aimed to investigate the chemical composition of sawdust available as saw mill by products in the urban and peri-urban areas of Chittagong, Bangladesh.

## MATERIALS AND METHODS

### Study area

Most of the saw mills are located in Pahartali, Khatungongja and Nasirabad areas of Chittagong metropolitan. Therefore, these places were 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. Twenty sawdust samples of different plants were selected randomly. Apporximately 500 grams of sawdust were collected as for individual plant. Samples were wrapped up by polythene bag and preserved in the laboratory for chemical analysis.

**Preparation of sample**

Samples were subjected to grinder to make it homogenous powder (60 mesh). Later on, it was mixed properly and exposed to shade to cool down for sampling.

**Analysis of sample**

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 as per AOAC (1994).

**Data analysis**

Data related to chemical composition of sawdust were compiled by using Microsoft Excel 2007. Chi-square ($\chi^2$) test was performed to analyze the data by using SPSS 16.0 (Winer et al., 1991). Statistical significance was accepted at 5% level ($P<0.05$)

## RESULTS

Detailed chemical composition of sawdust collected from different species of tree has been presented in Table 1 and Table 2. Results indicated that, DM, EE and TA content did not differ significantly ($P>0.05$). Minimum, maximum and mean values for DM were 91.6, 97.4 and 94.1 respectively (Table 2). Minimum, maximum and mean values for EE were 0.6, 2.0 and 1.4 respectively. Minimum, maximum and mean values for TA were 0.3, 7.6 and 1.8 respectively. ME content differed significantly ($P<0.01$). Minimum, maximum and mean values for ME were 535.9, 1756.7 and 1208.2 kcal/kg respectively. CP content differed significantly ($P<0.01$). Minimum, maximum and mean values for CP were 1.8, 3.5 and 2.4 respectively. CF content differed significantly ($P<0.01$). Minimum, maximum and mean values for CF content were 39.5, 74.0 and 56.5 respectively. NFE content differed significantly ($P<0.01$). Minimum, maximum and mean values for NFE were 12.5, 47.1 and 32.2 respectively.

**Table 1 - Chemical composition of individual sawdust (N=20)**

| Local name | Scientific name | Nutritive value (g/100g) | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | DM | ME* | CP | CF | NFE | EE | TA |
| Dewa | *Artocarpus lakoocha* | 94.6 | 1652.9 | 2.8 | 43.5 | 46.0 | 1.0 | 1.3 |
| Silkoroi | *Aibizia procera* | 94.6 | 1005.4 | 1.9 | 65.0 | 25.0 | 2.0 | 0.7 |
| Akasmoni | *Acasia auriculiformis* | 92.6 | 939.5 | 1.9 | 65.0 | 23.0 | 2.0 | 0.7 |
| Arjun | *Terminalia arluna* | 96.8 | 1563.9 | 2.2 | 49.0 | 43.9 | 1.0 | 0.7 |
| Jam | *Syzygium cumini* | 97.4 | 960.9 | 2.6 | 66.0 | 25.2 | 1.0 | 2.6 |
| Jalpai | *Elaeocarpus floribundus* | 97.4 | 1559.0 | 1.8 | 49.0 | 41.9 | 2.0 | 2.6 |
| Bael | *Aegle marmelos* | 96.4 | 1161.9 | 2.2 | 60.0 | 32.6 | 0.6 | 1.0 |
| Raintree | *Samania samun* | 95.2 | 736.9 | 2.5 | 70.0 | 19.4 | 0.6 | 2.7 |
| Mahagony | *Swietenia mahagony* | 95.0 | 1611.7 | 2.5 | 46.0 | 44.6 | 1.2 | 0.7 |
| Deshi gab | *Diospyros peregrine* | 94.0 | 1295.4 | 1.9 | 55.0 | 33.8 | 2.0 | 1.3 |
| Deshi tatul | *Tamarindus indica* | 92.4 | 615.0 | 2.4 | 66.0 | 15.8 | 0.6 | 7.6 |
| Amm | *Magnifera indica* | 93.0 | 967.5 | 3.5 | 63.0 | 24.5 | 1.0 | 1.0 |
| Jambura | *Citrus grandis* | 91.6 | 624.9 | 2.4 | 72.0 | 15.2 | 1.0 | 1.0 |
| Kadam | *Anthocephalus chinensis* | 91.6 | 535.9 | 2.4 | 73.5 | 12.5 | 1.0 | 2.2 |
| Kathal | *Artocarpus heterophyllus* | 92.0 | 1674.3 | 2.1 | 39.5 | 45.1 | 2.0 | 3.3 |
| Sagun | *Tecna grandis* | 93.6 | 1631.5 | 2.2 | 44.0 | 43.7 | 2.0 | 1.7 |
| Eucalyptus | *Eucalytus teritocornis* | 94.0 | 1644.7 | 2.2 | 44.0 | 44.1 | 2.0 | 1.7 |
| Sisso | *Swietenia sissoo* | 94.0 | 1616.7 | 2.2 | 44.0 | 45.5 | 1.0 | 1.3 |
| Shimul | *Boxbax ceiba* | 93.4 | 608.4 | 2.6 | 74.0 | 14.5 | 1.0 | 1.3 |
| Chalta | *Dillenia indica* | 93.0 | 1756.7 | 2.6 | 41.0 | 47.1 | 2.0 | 0.3 |

$^{DM}$Dry matter; $^{ME}$Metabolizable energy $^{CP}$Crude protein, $^{CF}$Crude fibre, $^{NFE}$Nitrogen free extract, $^{EE}$Ether extract; $^{TA}$Total ash *kcal/kg

**Table 2 - Mean chemical composition of different types of sawdust (N=20)**

| Parameters | Minimum | Maximum | Mean | SD | SE | Sig. |
|---|---|---|---|---|---|---|
| DM (g/100g) | 91.6 | 97.4 | 94.1 | 1.80 | 0.40 | NS |
| ME (kcal/kg) | 535.9 | 1756.7 | 1208.2 | 437.3 | 97.8 | ** |
| CP (g/100g) | 1.8 | 3.5 | 2. 4 | 0.39 | 0.09 | ** |
| CF (g/100g) | 39.5 | 74.0 | 56.5 | 12.1 | 2.71 | ** |
| NFE (g/100g) | 12.5 | 47.1 | 32.2 | 12.7 | 2.85 | ** |
| EE (g/100g) | 0.6 | 2.0 | 1.4 | 0.57 | 0.13 | NS |
| TA (g/100g) | 0.3 | 7.6 | 1.8 | 1.6 | 0.36 | NS |

$^{DM}$Dry matter; $^{ME}$Metabolizable energy $^{CP}$Crude protein, $^{CF}$Crude fibre, $^{NFE}$Nitrogen free extract, $^{EE}$Ether extract; $^{SD}$Standard deviation, $^{SE}$Standard error; $^{NS}$($P>0.05$); **($P<0.01$)

## DISCUSSION

Saw dust is a good source of dietary fibre for cattle (Anthony and Cunningham, 1968; Anthony et al., 1969; Cody et al., 1968; El-Sabban et al., 1969; El-Sabban et al., 1971; Marion et al., 1959; McCartor et al., 1972; Slyter and Kamstra, 1974), goat (Mellenberger et al., 1971), sheep (Dinius et al., 1970; Harpster, 1980), rabbit (Bederkar et al., 1984; Omole and Onwudike, 1981; Radwan, 1994), broiler (Abdelsamie, 1983; Oke and Oke, 2007) and quail (Savory and Gentle, 1976). Like conventional ingredients, sawdust contains ME, CP, CF, NFE and TA to substantial amounts (Keith, 1976; Oke and Oke, 2007; Radwan, 1994).

Radwan (1994) conducted an experiment on different types of sawdust and reported 2.53% crude protein, 0.76% ether extract, 60.26% crude fibre, 24.53% nitrogen-free extracts and 0.80% crude ash. In another experiment, Oke and Oke (2007) obtained 0.88% crude protein, 1.47% ether extract, 67.61% crude fibre and 0.64% crude ash in Ogea sawdust. These observations are in close agreement with present study.

Requirement of fibre for normal physiological functions of cattle, buffalo, goat, sheep and rabbit are well established. However, actual need and mode of utilization of fibre for poultry is controversial (Davis and Briggs, 1947). Generally, it is assumed that, excessive dietary fiber in poultry ration reduces feed efficiency, growth and egg production. However, the presence of fiber appears beneficial under certain critical cases. It was evident that, cannibalism could have been prevented by incorporation of extra fiber in poultry diet (Sheehy, 1939; Bearse et al., 1940). These study indicates that, fiber materials are not merely a source of dietary fibre, rather, in true sense, they contain effective extra nutrients essential for normal gut functioning.

Davis and Briggs (1947) used a purified source of cellulose and added to a complete diet. Results indicated that, addition of cellulose up to 15%, significantly improved growth rate. However, the exact reason for the increased growth obtained by feeding cellulose was not clear. It was assumed that hydrolysis of cellulose in the digestive tract may have contributed to a marginal extents as a growth stimulant other than simply a source of glucose derived from breakdown of cellulose (Davis and Briggs, 1947). Enzymes and other metabolites of microbiological origin might also be responsible. In fact, a wide range of microorganisms reserve the capacity to metabolize cellulose inside the gut (Baker, 1942; Hungate, 1944) and the decomposition products derived from cellulose breakdown may act as growth stimulant.

In another study, rations containing screened sawdust did not physically injure the gastrointestinal lining nor exhibit any toxic effects. Twenty-five percent sawdust was found to be the most desirable level for roughage substitution; higher levels occasionally induced impaction of digesta. Voluntary regulation of feed intake at a level comparable with Morrison's recommendation for feeding beef calves was accomplished with feeds containing 35% sawdust (Cody et al., 1968).

Addition of sawdust up to 15% to the rabbit diets had no detrimental effect on growth (Radwan, 1994). Similarly, incorporation of sawdust up to 15% did not affect feed intake. However, as the level exceeded, intake decreased gradually due to poor palatability of the diet. Similar results were obtained by other investigators (Hoover and Heitmann, 1972). In another study, addition of sawdust up to 8 g/100 did not exhibit any lethal effect (Oke and Oke, 2007).

Despite many advantages, Sibbald et al. (1960) reported a significant decrease in apparent digestible nitrogen due to incorporation of increased dietary fibre. The abrasive nature of fibre and greater volume of digesta could have caused an increase in metabolic nitrogen excretion (Hegde et al., 1978). The change in protein utilisation as a result of dietary fibre treatments may have caused changes in carcass composition. An increase in abdominal fat pad thickness associated with high fibre diets of equal energy content was found in laboratory trial.

Birds usually attempt to satisfy energy demand from voluntary intake. Therefore, increased feed consumption is usually associated with increased dietary fibre (Sibbald et al., 1960). Dietary fibre adversely affects growth rate and food conversion of birds (Abdelsamie, 1983). Similarly, high dietary fibre derived from sawdust resulted increased relative length and weight of intestine and also length of caeca (Abdelsamie, 1983; Savory and Gentle, 1976). However, this is not clear, whether fibre naturally available in foodstuffs would exert similar effects while they are in sawdust. In another study, equal concentrations of cellulose and sawdust had markedly different effects on gut morphology (Savory and Gentle, 1976).

## CONCLUSION

Sawdust is a vital source of fibre for livestock. A wide range of in vivo and in vitro studies speculate that, livestock can utilize fibers available in sawdust. Additionally, it contains crude protein and ether extracts which may be used for poultry and livestock as well. Present study reveals that the quality of sawdust may vary from species to species. Therefore, it could be suggested that, sawdust should be incorporated with conventional feedstuffs at an optimal margin after laboratory analysis. However, it needs to explore more intensive studies in future to investigate sustainable methods for inclusion of this useful fibre in livestock diets.

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