

*Original Research***Nutritive Value of Leguminous Tree Leaves as a Protein Source for Ruminant Feed****P. Chitra***

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Abstract

The study was conducted to evaluate the nutritional value of indigenous leguminous tree leaves at Forest College and Research Institute Campus, Mettupalayam in the sylvan surroundings of Jakanarai Reserved Forest. It is located in the foot hills of Nilgiri hills about 38 km north of downtown Coimbatore, in the Indian state of Tamil Nadu. The leaves of Indigenous leguminous fodder tree species i.e. *Acacia nilotica*, *Albizia lebbek*, *Dalbergia sissoo*, *Erythrina indica* and *Hardwickia binata* were selected and identified for analyzing the proximate composition and structural constituents. The mean values for proximate composition i.e. dry matter (DM), crude protein (CP), crude fiber (CF), ether extract (EE) and total ash (TA) in leguminous tree leaves ranged were 27.94 - 42.21%, 9.86 - 23.46%, 17.81 - 28.16%, 3.34 - 6.17%, 6.86 - 9.92% of DM respectively. The mean values from the crude fiber fractions i.e. Neutral Detergent Fibre (NDF), Acid Detergent Fiber (ADF), Acid Detergent Lignin (ADL) and hemicellulose and cellulose content of the foliages varied from 36.30 - 56.13%, 25.97 - 38.86%, 10.05 - 13.20%, 10.32 - 17.94%, 15.92 - 28.78% of DM respectively. The ranking order of these tree species on the basis of CP content was *Erythrina indica* > *Albizia lebbek* > *Acacia nilotica* > *Dalbergia sissoo* > *Hardwickia binata*. It is concluded that moderate to high CP values of *Dalbergia sissoo*, *Acacia nilotica*, *Albizia lebbek*, *Erythrina indica* foliages are potential source of protein for ruminant feed and *Hardwickia binata* tree leaves mainly used for supplement of fodder for ruminants.

Key words: Leguminous Tree Fodder, Proximate Composition, Crude Fibre Fractions, Ruminant Feed

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Introduction

Availability of feed containing imbalanced chemical composition and metabolizable energy is major handicap in ruminant production the world over. There is a great need to feed the ruminant animals with balanced feed to improve the production of milk and meat. Several tree species could be effective sources

of providing fodder nutrition during normal as well as scarcity periods (Reddy, 2006). Area under fodder production is continuously reducing due to competition with cash crops. The ever increasing demand of cereal grains for human consumption coupled with reduction in land for fodder cultivation is decreasing the nutrient supply to ruminants. Thus, there is great need to explore alternate feed resources which do not compete with human feed (Raghuvansi *et al.*, 2007). Ensuring optimal nutrition for ruminants has been a major challenge to many farmers in India due to the increasing cost of commercial feed and fluctuations in quality and quantity of forage, leguminous tree leaves used as an alternative protein sources for ruminant nutrition that can benefit resource-poor farmers during periods of summer.

Fodder tree leaves are rich in protein, soluble carbohydrates, minerals and vitamins. Supplementation of tree leaves have positive impact on ruminal microbial growth and digestion, resulting in improved animal growth and enhanced productivity in ruminants (Tessema and Baars, 2004). Fodder tree leaves are very relishing to small ruminants especially goats. Protein content of leguminous fodder tree leaves is usually high compared with that of mature grasses. The protein is digested in the rumen to provide ammonia and amino acids for microbial protein synthesis. Feed containing less than 8 per cent crude protein are considered deficient and they cannot provide the minimum ammonia levels required. All leguminous fodder trees leave have high protein content and may be used as an adequate protein source for livestock nutrition. The present study was to find out the nutrient content of indigenous leguminous fodder trees in Forest College and Research Institute campus, Mettupalayam.

Materials and Methods

Study Area

The study was conducted in the Forest College and Research Institute, Mettupalayam in the sylvan surroundings of Jakanarai Reserved Forest. It is situated over a sprawling expanse of 200 ha of reserved forest and located in the foot hills of Nilgiri hills about 38 km north of downtown Coimbatore, in the Indian state of Tamil Nadu. It has an elevation of 314 m (1033 feet) with a longitude of 11° 19' N, latitude of 77° 56' E. The climate is tropical and the average annual rainfall is 751 mm. The mean maximum and minimum temperature are 32.2° C and 23.2° C respectively. The vegetation is characterized by scattered trees and shrubs with less dense continuous grass cover.

Collection and Preparation of Samples

Leaves of *Acacia nilotica*, *Albizia lebbek*, *Dalbergia sissoo*, *Erythrina indica* and *Hardwickia binata* were collected from Forest College and Research Institute Campus, Mettupalayam during January 2016. Twenty indigenous fodder trees, four from each species were harvested. Each tree was sampled from five sites (east, west, north, south and canopy) and fresh leaf samples of two kilogram were collected from

each tree species. The fresh leaves were cleaned to remove any visible surface contaminants e.g. pest eggs, bird droppings, dust and soil deposits and then weighed. The collected leaf samples were dried separately in hot air oven at 65° C for 24 hrs and then ground to pass a 1mm sieve in wiley mill and then stored in air tight polythene bags at room temperature making composite sample from each tree. All the sample of tree leaves was collected within one week to minimize chemical analysis effects of sampling time on nutrient composition.

Chemical Analysis

Proximate composition such as crude protein (CP), ether extract (EE), crude fibre (CF) and total ash (TA) were analysed by standard methods (AOAC, 2012). The fibre fractions viz. Neutral Detergent Fiber, (NDF), Acid Detergent Fiber (ADF) and Acid Detergent Lignin (ADL) were determined by Van Soest *et al.* (1991). Dry matter content was determined by drying the sample at 105°C in hot air oven till the constant weight. Ash content was measured after igniting sample in a muffle furnace at 550° C for 4 hrs to burn all the organic matter and leftover was weighed as ash.

Results and Discussion

The quality of the indigenous tree leaves used as a fodder are decided based upon the proximate composition values and fiber fraction analysis. The proximate composition values of different indigenous leguminous tree species are summarized in Table 1.

Table 1: Proximate composition of leguminous fodder tree species (% on DM basis)

Tree Species	Dry Matter (DM)	Crude Protein (CP)	Crude Fiber (CF)	Ether Extract (EE)	Total Ash (TA)
<i>Acacia nilotica</i>	32.63 ±0.17	14.39 ±0.12	22.19 ±0.11	5.62 ±0.09	6.86 ±0.06
<i>Albizia lebbeck</i>	38.31 ±0.15	19.74 ±0.11	24.02 ±0.13	3.34 ±0.06	8.47 ±0.07
<i>Dalbergia sissoo</i>	27.94 ±0.17	13.42 ±0.09	19.92 ±0.17	3.72±0.17	9.92 ±0.17
<i>Erythrina indica</i>	32.13 ±0.18	23.46 ±0.12	17.81 ±0.14	5.97±0.11	8.54 ±0.08
<i>Hardwickia binata</i>	42.21 ±0.21	9.86 ±0.09	28.16 ±0.17	6.17±0.13	8.92 ±0.15

Dry matter (DM) is the actual amount of feed material leaving water and volatile acids and bases if present. In this study revealed that DM content of different indigenous leguminous tree species varied from 27.94 - 42.21 per cent. CP content of tree leaves varied from 9.86 - 23.46 per cent. The highest CP value was observed in *Erythrina indica* tree leaves followed by *Albizia lebbeck*, *Acacia nilotica*, *Dalbergia sissoo*, *Hardwickia binata* respectively. Differences in CP contents between leaves of different trees are probably due to differences in protein accumulation in them during growth and also the stage of the growth of leaves. Similar findings were reported by Chandra and Mali (2014) and Cheema *et al.* (2014).The crude protein content of *Albizia lebbeck* was slightly higher value as that reported by Atiya *et*

al., 2011. Alam and Djajanigra (1994) reported that rumen degradation is affected if the level of CP in feed is less than 10%. In this study revealed that CP value of all these leaves were higher than 10% except *Hardwickia binata*. This is an indication of the potentiality of these leaves as a good protein supplement, which may help in substituting costly concentrate protein supplying feed stuffs like Groundnut oil cake, Gingelly oil cake etc. Generally protein rich tree leaves can serve as a source of protein supplement for low quality diets in ruminants and small ruminants.

CF content of tree leaves varied from 17.81- 28.16 per cent. The highest CF value was observed in *Hardwickia binata* followed by *Albizia lebbeck*, *Acacia nilotica*, *Dalbergia sissoo*, *Erythrina indica* respectively. EE level of tree leaves varied from 3.34 - 6.17 per cent. The highest EE value was observed in *Hardwickia binata* followed by *Erythrina indica*, *Acacia nilotica*, *Dalbergia sissoo*, *Albizia lebbeck* respectively. TA content of tree leaves varied from 6.86 - 9.92 per cent. The highest TA value was observed in *Dalbergia sissoo* followed by *Hardwickia binata*, *Erythrina indica*, *Albizia lebbeck*, *Acacia nilotica*, respectively. The fiber fraction values of different indigenous tree species are summarized in Table 2.

Table 2: Crude fiber analysis of indigenous tree species (% on DM basis)

Tree Species	Neutral Detergent Fibre (NDF)	Acid Detergent Fibre (ADF)	Acid Detergent Lignin (ADL)	Hemi Cellulose	Cellulose
<i>Acacia nilotica</i>	47.39 ±0.21	29.91 ±0.13	13.20 ±0.11	17.48 ±0.11	16.71±0.14
<i>Albizia lebbeck</i>	42.15 ±0.16	30.24 ±0.19	12.86 ±0.17	11.91 ±0.14	17.38±0.13
<i>Dalbergia sissoo</i>	52.72 ±0.17	31.25 ±0.18	12.27 ±0.08	21.47 ±0.18	18.98±0.11
<i>Erythrina indica</i>	44.25 ±0.82	28.87 ±0.23	12.19 ±0.14	15.38 ±0.23	16.68±0.12
<i>Hardwickia binata</i>	50.64 ±0.28	34.21 ±0.23	15.85 ±0.21	16.43 ±0.13	18.36±0.15

Ruminants such as cattle, goat and sheep have a compartmentalized stomach, which enables them to regurgitate their cud. The microbial population in the rumen also enables the fermentation of forages and the synthesis of protein. The cell wall analysis is a good indicator for predicting nutritional worth of fibrous feed resources, because, voluntary dry matter intake and dry matter digestibility are dependent on cell wall constituents, especially NDF, ADF and lignin. NDF and ADF values are most common measure of fiber used for animal feed analysis and it measures the structural components in plant cells (hemicellulose, cellulose, lignin and pectin).

Plant cells can be divided into less digestible cell wall (hemicellulose, cellulose, lignin and pectin) and mostly digestible (starch and sugar) cell contents. Cellulose and hemicellulose digested by micro organism in animal's rumen (cattle, sheep and goat) hind - gut fermentation (horses, rabbits and Guinea pigs). NDF, ADF and ADL values indicates structural components in plant cells. NDF value is a good indicator of the bulkiness of forage and used to predict the amount of forage intake by the animal. NDF

values increases dry matter intake generally decreases in the animal. ADF content indicates the potential production energy. Increase in ADF indicates a reduced energy, i.e. reduced quality.

In this study reported that NDF values of leguminous tree leaves varied from 42.15 – 52.72 per cent. The highest NDF value was observed in *Dalbergia sissoo* followed by *Hardwickia binata*, *Acacia nilotica*, *Erythrina indica*, *Albizia lebbek* respectively. NDF value is a good indicator of the bulkiness of forage and used to predict the amount of forage intake by the animal. NDF values increases dry matter intake generally decreases in the animal. ADF values of leaves varied from 28.87 - 34.21 per cent. The lowest value was observed in *Erythrina indica* followed by *Acacia nilotica*, *Albizia lebbek*, *Dalbergia sissoo*, *Hardwickia binata* respectively. ADF values indicate highly indigestible fibre portion. Increase ADF value indicates decrease the digestibility of forage and nutrient availability in animals. Lignin is the indigestible fibre portion. As lignin content increased in forage that reduced the digestibility and feed intake of animal and also affect the performance of animal. ADL values of leaves varied from 12.19 - 15.85 per cent. The highest value was observed in *Hardwickia binata* followed by *Acacia nilotica*, *Albizia lebbek*, *Dalbergia sissoo*, *Erythrina indica*, respectively.

The variation in the proximate composition and cell wall constituents observed in the present study from reported values (Chandra and Mali, 2014 and Cheema *et al.* (2014). Sharma *et al.*, 2000 reported that the differences in species of tree leaves selected or time and stage of collection of tree leaves. The variations in the chemical composition of tree leaves could be attributed to the differences in stage of growth, proportion of young and mature leaves and also with localities (Reddy *et al.*, 2009). In addition to seasonal changes, environmental factors such as fire, substratum and amount of tree cover also influence nitrogen content.

Conclusion

It is concluded that moderate to high CP values of *Dalbergia sissoo*, *Acacia nilotica*, *Albizia lebbek*, *Erythrina indica* foliages are potential source of protein for ruminant feed and *Hardwickia binata* tree leaves mainly used for supplement of fodder for ruminants.

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