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EVALUATION OF THE NUTRITIVE VALUE OF INDIAN SIRIS (*ALBIZIA LEBBECK*) FRUITS AND LEAVES AS A POTENTIAL FEED RESOURCE

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ABSTRACT

This study was conducted to compare the nutritive values of Indian siris (*Albizia lebbeck)* fruits and leaves. Samples used for the study was harvested within the premises of, Ahmadu Bello University, Zaria between the month of April and May 2018. Dried samples were milled and subjected to proximate, minerals and phytochemical analysis. The proximate analyses were done using the micro kjeldahl method for crude protein. Ether extract was determined by Soxhlet extraction. The determination of sodium and potassium was done by flame photometric detector (GC-PTFD) analysis. Whereas calcium, phosphorous and zinc, were performed using the innovative Agilent 4200 Microwave Plasma-Atomic Emission Spectrometer (MP-AES). The presence of anti-nutritional factors such as: Tannin, oxalates Saponin, Alkaloids and flavonoids were detected quantitatively. The proximate analysis revealed that the fruits is high in crude protein (18.33%) and crude fibre (23.26%) when compared with the leaves, with 7.13% CP and 4.81%CF. Ether extract content in the sample were 2.10% and 1.90% for fruits and leaves respectively. The higher crude fibre recorded for fruits may be due to the higher proportion of the pods in relation to the seeds. The ash content was relatively high for the fruits and leaves 8.68% and 6.58% respectively. NFE and calorific values (41.85%, 259.62 kcals/100g) for the fruits was relatively low as compared to (70.94% , 329.38kcals/100g) for the leaves, this is an indication that *Albizia lebbecks* fruits as well as the leaves are rich in energy and therefore could be used as a fodder for livestock as a source of energy. Calcium content in the samples were 73.00±0.018mg/g and 79.1± 0.019mg/g respectively, while the phosphorus content were 651.00 ± 0.110mg/g and 1113.0 ± 0.210mg/g. Calcium and phosphorous ratio (Ca:P) in this study was above 2:1 for both samples which may reduce the bioavailability of calcium and phosphorous within the gastrointestinal system. Potassium concentration obtained in this study was high for the fruits (450mg/g) and leaves (500mg/g). However, the sodium potassium ratio of 0.8 and 0.84 obtained in this study for both samples falls within normal range (1.00) of requirements for animals. Phytochemical screening revealed that the fruits and leaves contained moderate tannin level of 2.98% and 2.64% respectively. Saponin content in the fruit (5.36%) was relatively higher than in the leaves (2.97%). Alkaloid and flavonoids contents in the leaves (21.06% 24.14%) were higher than (2.13% and 11.06%) obtained for the fruits. This may be an indication that the leaves possess antioxidant and medicinal properties than the fruits. Therefore, it was concluded that *Albizia lebbecks* fruits and leaves are of high nutritional values.

Keywords: Indian siris, *Albizia lebbecks,* fruits, leaves, Nutritive value

INTRODUCTION

Good forage is the foundation for efficient livestock production. High quality forage and browse is essential as a source of vitamins, minerals and other nutrients.Shortage of qualitative feed resources for livestock due to seasonal variations in the sub-Saharan Africa such as Nigeria has necessitated research into

several non-conventional feed resources for possible incorporation into animal diets. According to Hassan *et al.* (2007) some Novel feedstuff has better feeding quality..*Albizia lebbeck* belong to the family Fabaceae, it is a tropical and subtropical tree.The genus Albizia is named after Filippo delAlbizzi, a Florentine nobleman who introduced a Julibiss into cultivation in 1749, while the species name (*lebbeck*) originate from Arabic name for this plant Laebach. *Albizia lebbeck* is also known as lebakh, daqn el- Basha, dignelbasha. Whereas the common name in English are: Woman's tongue, siris tree, East Indian Walnut, Acacia amarilla, fry wood lebbeck, Indian siris (Orwa *et al* ., 2009).The tree produces fragrant flowers with varying colours , greenish - yellow to white and several grey pods (10-30cm long; 2-5 cm in diameter). The seeds are round dark brown and moves freely in the pods when agitated by wind making rattling sound liken to women's chatter, hence called woman's tongue (Hassan *et al* 2005; Orwa *et al*., 2009; FAO 2010).*Albizia lebbeck* is hermaphroditic with bipinnate leaves. Flowers appear shortly after new leaves.Flowering occurs from September to October; mature pods remain on the tree for long periods. *Albizia lebbeck* is naturally found in Australia, Bangladesh, India, Indonesia, Malaysia, Myanmar, Nepal, Pakistan and Thailand, while the exotic species are found in Algeria, Angola, Benin, Chad,Niger, Nigeria, Tanzania, Zambia, Zimbabwe, Columbia, Ghana and Liberia (Orwa *et al* ., 2009).

ECONOMIC IMPORTANCE OF *ALBIZIA LEBBECK*

Medicinal uses

Albizia lebbeck is of great economic importance in herbal medicine because of its therapeutic values.It is considered a potent alexipharmic, and every part of it is prescribed for the treatment of bites and stings from venomous animals. It has been reported to have antibacterial, anti allergic, anti-dermatosis, anti-dysenteric and antioxidants properties. The leaves and seed is used in the treatments of ringworm, eye problems, gonorrhea, leucorrhoea and other genital diseases (Hassan *et al.,* 2005, Verma, *et al.,* 2011). Saponin from the pods and roots has spermicidal activity. The bark has alexiteric, and anti-helmintic properties and it is been used for skin cares such as itching , boils, ringworm and scabies and in the treatment of leucoderma, piles, excessive perspiration, inflammation, bronchial asthma and toothache . The seeds are aphrodisiac, astringent, and used as brain tonic as well as for treating gonorrhea, while the seed oil is applied topically to cure leucoderma . The flowers is used for cough, bronchitis and asthma. The pods have been reported to have antiprotozoan properties (Kumar *et al* 2007; Mohammad *et al.,* 2012; Muhammad *et al* 2013).

Agricultural uses

It has been reported that *Albizia lebbeck* is effective in controlling root rot, stem cankers, heart rot, spot fungi and also a wide range of insect pests such as leaf and bark feeding borers and defoiliators such as psyllids in Nigeria, the stripped mealy bug and Ferrishavirgata. The trees are also grown to provide shades in pastures and shelter for less shady plants. The tree is grown in some places primarily as fodder for camels, water buffalo and cattle. Kumar, *et al.*(2007) reported that it is a potential antioxidant and the nutritional value is comparable to other well-characterized, standard antioxidant systems in vitro. Immature pods are accepted readily by livestock but mature pods are less palatable. The pods contain saponin and are not eaten in large amounts by sheep, but cattle eat them readily (FAO 2010). However, pods can serve as moderate protein source. It is high in protein, cholesterol-free, high in dietary fibers, and low in saturated fat. The leaves are good fodder with average crude protein content of 17- 26%, 100kg of leaves yields 11-12 kg of digestible

protein and 37kg of digestible carbohydrates. Several researches had been conducted to determine chemical composition of whole seeds, leaves or pods, however, information on comparative evaluation of the nutritive values of seeds plus pods (fruits) versus leaves are lacking. Therefore, this study was conducted to evaluate the nutritive values of the of *Albizia lebbeck* fruits and leaves to ascertain its potential use in livestock ration formulation.

MATERIALS AND METHODS

Collection and Processing of *Albizia lebbeck* fruits and leaves

Matured fruits as collected while the leaves was collected separately within the premises of Ahmadu Bello University, Zaria. The collection was done between the months of April and May, 2018. The samples were sundried, after which the seed plus pod was pounded with pestle and mortar and then passed through a 2mm mesh - milling machine to obtained a homogenous sample. While the leaves were air dried at room temperature for 5 days before milling. The samples were stored in a polythene bag until when needed for laboratory analysis.

Evaluation of the nutrient content of *Albizia lebbeck* fruits and leaves

Proximate composition of the sample was done at the Biochemical Laboratory of the Department of Animal Science, Faculty of Agriculture, Ahmadu Bello University, Zaria.The determination of the mineral contents in *Albizia lebbeck* fruits and leaves were done at the Multi - users Laboratory in the Department of Chemistry, Faculty of Physical Sciences, Ahmadu Bello University, Zaria.

Proximate Analysis

The proximate analyses were done using the micro kjeldahl method of Association of Official Analytical Chemistry (A.O.A.C., 2012) for crude protein. Ether extract was determined by Soxhlet extraction, 5g of the samples was weighed into porous thimbles, 200ml of petroleum ether poured into a round bottom flask, a soxhlet extractor fitted into it and placed on the heating mantle for 6 hours. The extracted oil or fat was concentrated in a vacuum oven and weighed to the nearest 0.1mg. For ash content determination, 2g of the dried sample was weighed into three crucibles of known weights. The crucibles with their content were covered and placed in a muffle furnace and ignited for 24hours at 500^{o}C after which they were cooled in a desiccator and the crucible weighed with contents. These procedures were repeated until a constant weight for each crucible was obtained. Crude fibre determination was done by weighing 2g of the sample into a conical flask and adding 150mL of 1.25% H_2SO_4. The mixture was boiled gently for 30 minutes while maintaining a constant volume. The content in the beaker was filtered and the residue rinsed with hot distilled water until it was acid free. The material was scraped into a flask for base digestion by adding 200mL of dilute boiling 1.25% NaOH and allowed to boil gently for 30minutes while maintaining a constant volume. The mixture was then filtered, and the filtrate was washed thoroughly with hot distilled water until it was base free. The residue was rinsed once with 10% HCL and twice with industrial methylated spirit or ethanol. It was then dried in an oven at 105ºC and weighed before it was ignited in a furnace at 550ºC for 90 minutes then weighed again. The loss in weight of crucible and content after ignition was calculated as the crude fibre content. The moisture content was determined by weighing 2.0g of the powdered sample into 3 empty crucibles of known weight. After weighing the crucibles with their content, they were placed in an oven, dried at 105-110ºC for 24 hours, cooled in a desiccator containing silica gel as a drying agent and weighed. The procedure was repeated until a constant weight was obtained. The carbohydrate content (NFE) was determined as the difference obtained after subtracting total organic nitrogen, crude fat,

crude fibre, crude protein and ash content from the total dry matter. The calorific value was estimated using the formula: proposed by Atwater (1890) ; Halver (1976) using Rubner's factors of : Protein, 4.1Kcal/g, Fat 9.3Kcal/g, Carbohydrates 4.1Kcal/g)

Calorific value (Kcals/100g) = (crude protein x 4 kcals) + (Ether extract x 9 kcals) + (NFE x 4 kcals)

Determination of some mineral contents of *Albizia lebbecks* fruits and leaves.

The dried samples were grounded to fine powder using a porcelain mortar and pestle. Exactly 0.5g of the powdered samples were separately weighed and transferred into different beakers and to each 7.5ml concentrated HNO_3 and 2.5ml HCl were added and 100ml distilled water was added. The mixture was heated at 120^{o}Cfor 4 hours. About 20ml distilled water was added and the mixture filtered on Wattman40 filter paper into a 50ml capacity volumetric flask and more distilled water was added to make up the 50ml mark. The determination of sodium and potassium was done by flame photometric detector (GC-PTFD) analysis. whereas calcium, phosphorous and zinc, were performed using the innovative Agilent 4200 Microwave Plasma-Atomic Emission Spectrometer (MP-AES).The instrument was controlled using Agilent's unique worksheet-based MP Expert software, which runs on the Microsoft® Windows ® 7 operating system and features automated optimization.

Phytochemical screening of *Albizia lebbecks* Fruits and leaves

The presence of anti-nutritional factors such as: Tannin, oxalates Saponin, Alkaloids and flavonoids were detected quantitatively by the standard methods described by AOAC (2005) at the Biochemical laboratory of the National Research Institute for Chemical Technology (NARICT). Bassawa, Zaria. Kaduna State, Nigeria.

RESULT AND DISCUSSION

The quality of the browse plants used as feed resources in livestock diets is dependent on their chemical compositions and fibre fractions.Table 1 shows the proximate composition of *Albizia lebecks* fruits and leaves. The moisture content obtained was low (5.78 and 8.64%) respectively and in agreement with the report by Hassan *et al*. (2005) who reported that low moisture (<15%) is desirable for feed storage because high moisture contents encourages microbial growth. The crude protein content was higher for the fruits (18.33%) than 7.13% for the leaves. The low crude protein value recorded for the leaves in this study may be attributed to stage of maturity of the leaves at harvest. However, the value recorded for the fruits was above 7% crude protein requirement for ruminant animals which will provide ammonia required by rumen microorganisms to support optimum microbial activity as reported by Njidda (2010).And also, the value obtained for the fruits in this study was higher than (10% and 5.38) reported by Hassan *et al*. (2005) for the seeds and pod respectively. However, the value obtained was relatively lower than (27.3% ±0.001) which Muhammad, *et al.* (2010) reported for *Albizia* seed and 34.17%, 23.63% reported by Muhammad *et al* (2013) for seed and pods respectively and also disagreed with the findings of Chitra and Balasubramanian (2016) who reported 19.91±0.13 for the leaves. The differences observed in results of this study and other researchers could be due to variation in species of *Albizia lebecks* used, climatic and edaphic factors in the various locations. Crude fibre content in the samples were 23.26 % and 4.81% for the fruits and leaves respectively, the higher crude fibre recorded for fruits may be due to the higher proportion of the pods in relation to the seeds, for instance a whole pod may contain less than 5 seeds. The results was lower than 28.5± 0.01 reported by Muhammad, *et al.* (2010) for *Albizia lebecks* seeds and 26.82% reported by Chitra and

Balasubramanian (2016) for *Albizia lebecks* leaves. The crude fibre content of the fruits was higher than the range of 15-20% recommended for improved intake and production in finishing ruminant (Buxton, 1996) and the low(4.81%) value of crude fiber recorded for the leaves may be of positive effect on utilization of the leaves by non ruminant animals. However, the result of the fruits was higher than the dietary crude fiber levels recommended for formulation of concentrate diets for rabbits. Cheeke (1994), Aduku and Olukosi (2016) recommended dietary crude fiber level of 15-20% for rabbits Ether extract content in the samples was 2.10% and 1.9% respectively. These values fell below the range of 4-10% ether extract recommended by Campbell, *et al*. (2006).The ash content was relatively high 8.68% and 6.58%. The ash is an indication of the mineral elements contained in the sample and could be a potential source of dietary minerals in feed formulation. Both values obtained for the fruits and the leaves were within the range of 3.0 - 9.6% reported by Okoli, *et al.* (2001). Carbohydrate and calorific values (41.85%, 259.62 kcals/100g) for the fruits was relatively lower as compared to (70.94%, 329.38kcals/100g) for the leaves. The results obtained in this study indicates that *Albizia lebecks* seeds plus pod as well as the leaves are rich in energy and therefore could be used as a fodder for livestock as a source of energy. However, this result was lower than the values reported by Hassan *et al.* (2007). These author reported 397.36 and 350.72 kcals/100g for *Albizia lebecks* seeds and pods, respectively. Table 2 showed the mineral composition of *Albizia lebecks* fruits and leaves. The result of evaluation of mineral compositionis indication that the samples were very rich in mineral elements. Macro and micro elementsare necessary for normal physiological function, the deficiencyof which causes serious metabolic abnormalities and the increase of which leads to toxicity, The results obtained in this study is in consonance with the findings of Hassan *et al.* (2007) who gave a report that *Albizia lebecks* fruits are potential sources of minerals. Calcium and phosphorous ratio (Ca:P) for the fruits and leaves in this study is a reverse with the normal 2:1 ratio. The concentration of phosphorus is excessively higher than calcium concentration and as a result may reduce the bioavailability of calcium and phosphorous within the gastrointestinal system and also a contradiction against the general requirements of Ca:P in animal nutrition. The result also disagreed with the findings of Hassan *et al.* (2007) who reported that *Albizia lebecks* seeds and pods have Ca/P below 2:1. Potassium concentration obtained in this study was high for the fruits (450mg/g) and leaves (500mg/g) However, Khan, *et al* (2005) suggested that high producing ruminants may require above 1% of potassium level especially under heat stress condition. According to NRC (1989) Potassium help to maintain body weight and regulate water and electrolyte balance in the blood and tissues. However, the sodium potassium ratio (0.8 versus 0.84) obtained in this study is closer to the normal range (1.00) of requirements for animals, and in consonance with the report by Oyedeji *et al.* (2017) who reported that any diets with Na/K ratio above 1 has the tendency of increasing the risk of hypertension and cardiovascular disease(CVD)-related mortality. Table 3 showed the phytochemical contents of the samples. Phytochemicals are chemical compounds produced by plants generally to help them thrive competitors, predators or pathogens. The values obtained for tannin in this study were 2.98% and 2.64% for the fruits and leaves respectively. These values were moderate and may not result into any detrimental effect on ruminants and non ruminant animals. This is in line with the report by Barry (1983) who reported that safe tannin level for ruminants ranges between 2- 4% , > 5% may be toxic while > 9% may be detrimental. Monge, *et al.* (2007) proposed that broiler chicks could tolerate tannin up to 13.50g/kg without any compromise in nutrient

utilization. High tannin content in poultry diets is reported to cause a depression in feed intake, weight gain and poor feed efficiency, nutrient digestibility and palatability of the diet (Hassan, *et al*., 2005). oxalate content in the fruits (0.55mg/100g) and leaves (0.6mg/100g) is within tolerance level for livestock. This is in consonance with the findings of Rahman *et al*. (2013) who reported that <2.0% soluble oxalate is safe for ruminants and <0.5% for the non ruminant animals to avoid oxalate poisoning Saponin content in the fruits (5.36%) was relatively higher than in the leaves (2.97%). This is in consonance with the findings of Mohammad, *et al*. (2013), who reported high saponin content in the pods of *Albizia lebecks.* High concentration of saponin has been reported to cause hyper - cholesterolemia by binding to cholesterol, thereby making it unavailable for absorption (Soetan and Oyewole, 2009). Alkaloid and flavonoids contents in the leaves (21.06% and 24.14%) were higher than (2.13% and 11.06%) obtained for the fruits. This may be an indication that the leaves possess antioxidant and medicinal properties than the fruits. This observation is in agreement with the report by Mohammad, *et al.* (2013) who reported that total Phenolic and flavonoid content determination from herbal extracts are important in the determination of the antioxidant activity of medicinal plants. The result is also in consonance with the findings of Ahmad (2015) who reported that flavonoids acts as antioxidants and also that the antioxidants capacity of many flavonoids are stronger than those of vitamin C and E.

Table 1 Proximate Composition of *Albizia lebecks* Fruits and leaves

Parameters	**Fruits**	**Leaves**
Moisture (%)	5.78	8.64
Crude Protein (%)	18.33	7.13
Crude Fibre (%)	23.26	4.81
Ether Extract (%)	2.1	1.9
Ash (%)	8.68	6.58
NFE (%)	41.85	70.94
Calorific value (kcals/100g)	382.85	380.5

Table 2 Minerals Compositions of*Albizia lebecks* fruits and leaves

Parameters	Fruits (mg/g)	Leaves
Calcium	73.00 ± 0.018	79.1± 0.019
Phosphorous	651.00 ± 0.110	1113.0 ± 0.210
Potassium	450.00 ± 0.251	500 ± 0.331
Zinc	29.50.00 ± 0.018	9.7± 0.210
Sodium	360.00 ± 0.651	420 ± 0.776
Ca:P	0.112	0.071
Na:K	0.80	0.84

Values are expressed as mean ± standard deviation of two replicates

Table 3 Phytochemical Contents of *Albizia lebecks* Fruits and leaves

Parameters	Seed plus pod	Leaves	Ref.value
Tanin (%)	2.98	2.64	2-4%
Oxalate (mg/100g)	0.55	0.6	<2%
Saponin (%)	5.36	2.97	NA
Alkaloid (%)	2.13	21.06	NA
Flavonoid (%)	11.06	24.14	NA

NA= Not available

Conclusion and recommendation

This study indicates that *Albizia lebecks* fruits has higher crude protein content (18.33%) than the leaves (7.13%)and has the potential of meeting the crude protein requirement for ruminant animals and also provide the ammonia required by rumen microorganisms . Also, the crude fibre content of the fruits (23.26%) was higher than (4.81%) the value obtained for the leaves, thus the fruits may be a good roughage, therefore may improve the nutrients digestibility of the ruminants and pseudo ruminants. Therefore inclusion of the fruits in rabbit's diets may improve the motility of digesta in the rabbits gastro intestinal system. However, the Ca: P ratio obtained for both fruits and for the leaves is a reverse with the normal 2:1 ratio of calcium and phosphorus requirement of animals which may cause a reduction in the bioavailability of calcium and phosphorous within the gastrointestinal system. As a result of the excessively high phosphorus concentration in relation to the calcium concentration. The fruits contained higher level of antinutritional factors such as saponin, alkaloid and flavonoids, However, the high level of alkaloid and flavonoids is an indication of the antioxidants properties possessed by the *Albizia lebecks* plants. Therefore, it was concluded that *Albizia lebecks* fruits and leaves are of high nutritional values have significant antioxidant properties due to the high flavonoids content. However further research is recommended to establish the specific active components responsible for the antioxidants activities.

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