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# Effects of Processing on Seeds of *Albizzia lebbeck*: Proximate Analysis and Phytochemical Screening

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**Abstract:** Experiments were conducted to evaluate the nutritive value and anti-nutritional factors present in differently treated samples of *Albizzia lebbeck* collected from five locations in the Main Campus of Ahmadu Bello University, Zaria. Analyses carried out for proximate composition of these seeds showed high percentages of crude protein and low percentages of crude fibre in the raw and boiled samples than in the toasted and traditionally roasted samples. Overall mean levels of crude lipid was low in all the treatments. As regards the phytochemical screening, tannin levels were negligible and not significantly different ($p \geq 0.05$) in all the treatments, while cyanogenic glycoside and phytic acid were low. Oxalate and saponin contents were high in the raw samples and in the other treatments appeared to show a trend on exposure to heat, reducing as the heat-time-exposure increased. The nutritional implications of the results are discussed.

**Key words:** *Albizzia lebbeck*, proximate analysis, phytochemical screening, anti-nutritional factors

## INTRODUCTION

The utilization of seed flours and plant proteins as functional ingredients in food systems continue to be of research interest especially on soybean, peanut, cottonseed and sunflower (Fagbemi *et al*., 2005). A debilitating factor to their usage is that feedstuffs of vegetable origin are as a whole lower in protein content when compared with animal meal. In addition, the presence of high amounts of carbohydrates and fibre present the nutritionist with problems that are generally not encountered with feedstuff of animal origin. Also, a major constraint to the use of legumes as animal feed especially in the raw form, is the presence of toxic and anti-nutritional constituents. These constituents when present in high quantities have different but adverse effects on animal performance including loss of appetite, reductions in dry matter intake and protein digestibility.

Cyanogenic glycosides impart a bitter taste, reduce palatability and cause toxicity. Phytates chelate several mineral elements, especially Ca, Mg, Fe, Zn and Mo and interfere with their absorption and utilization (Ologobo, 1980). Oxalates affect Ca and Mg metabolism (Oke, 1969) and react with proteins to form complexes which have an inhibitory effect on peptic digestion (Oboh, 1986). The saponins act on the cardiovascular and nervous systems as well as on the digestive system. Large doses of legume juices containing saponins cause distention of the rumen (Gestetner *et al*., 1966). Tannins prevent the intake of feed through astringency, cause enzyme inhibition and also reduce digestibility. They damage the mucosal lining of the digestive tract and alter the excretion of certain cations and increase the excretion of essential amino acids (Onwuka, 1983; Webmaster, 2006). This study was therefore designed to investigate the effects of processing on proximate composition and anti-nutritional factors inherent in *Albizzia lebbeck*.

## MATERIALS AND METHODS

**Seed collection:** Dry pods of *Albizzia lebbeck* were collected from trees in five locations in the Main Campus of Ahmadu Bello University, Zaria-Nigeria. They were thrashed in the bags with which they were collected and winnowed on a tray to get clear seeds by blowing air through in order to remove the chaff.

**Seed processing:** The *Albizzia* seeds were divided into eight portions and processed differently, a modification of Eyo (1999):-raw (T1), boiled for 15 min (T2), boiled for 30 min (T3), boiled for 1 h (T4), toasted for 1 h (T5), toasted for 2 h (T6), Toasted for 3 h (T7) and roasted Traditionally (T8).

The boiling was done with an aluminum pot using one part of the raw whole seeds to 10 parts of clean water on a gas burner for each processing that had to do with boiling. Traditional roasting was done by constantly stirring the seeds to prevent charring in a dry pot until browned. Toasting was done in an electric oven at 70°C for each processing that had to do with toasting.

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The boiled seeds were sun-dried while the roasted and toasted seeds were exposed to air in the laboratory to hasten cooling. The seeds were subsequently milled to obtain a homogeneous powder and stored in air-tight stoppered glassware before analysis was carried out.

**Chemical analysis:** The proximate composition (moisture, crude protein, crude lipid, crude fibre, ash and nitrogen free extract) of the seeds were determined using the standard methods of the Association of Official Analytical Chemists (A.O.A.C., 1980). The presence of oxalate (Oke, 1969), phytic acid (Wheeler and Ferrel, 1971), tannin (A.O.A.C., 1980), cyanogenic glycoside and saponin (A.O.A.C., 1984) were detected by standard methods. All chemical analyses were carried out in duplicate.

## RESULTS

The proximate composition of the raw and processed seeds of *Albizzia lebbeck* is presented in Table 1. The results obtained showed that the treatments that had higher crude protein levels and low fibre content were (T1- raw, T2- boiled 15 min, T3- boiled 30 min and T4-boiled 1 h).

The raw and heat-processed *Albizzia* seed samples contained some anti-nutritional factors as can be seen in Table 2. Cyanogenic glycoside, tannins and phytic acid were very low in quantity. Heat was also found to reduce certain anti-nutritional factors like oxalate and saponin but the levels of cyanogenic glycoside and tannins were not significantly different in raw and heat-processed samples. For instance, tannins in T1 (raw) were 0.002 mg $g^{-1}$, in T2- T4 (boiled) were also 0.002 mg $g^{-1}$, but in all the toasted samples were 0.003 mg $g^{-1}$ while in the roasted sample they were 0.002 mg $g^{-1}$.

## DISCUSSION

The investigations showed that the moisture content of *A. lebbeck* is lowest in T8 (roasted traditionally). The crude protein levels of the toasted and roasted seed samples were appreciably high, ranging from 29.73 (toasted 2 h) to 33.19 (roasted traditionally), however their higher fibre contents could pose a distinct deterrent to their use in monogastric diets. The highest crude protein was observed in the raw treatment, followed by the boiled samples. The raw and the boiled samples both had reduced crude fibre levels indicating that processing techniques has an influence on the levels of these proximate components. It may be that toasting and roasting denatures protein more than other forms of processing while raw state and boiling results in a preferable level of crude fibre. Heat processing, especially, moist heat have been reported to improve the digestibility of proteins by opening up of the protein structure through denaturation (Abbey and Berezi, 1988). This might explain why processing significantly ($p<0.05$) increased the protein level in the boiled samples.

Phytochemical screening of the seed showed the presence of saponins, oxalates and phytic acid which were reduced by heat processing methods, however, the

Table 1: Proximate composition of the raw and processed seeds of *albizzia lebbeck*

| | Treatments | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Composition | T1 | T2 | T3 | T4 | T5 | T6 | T7 | T8 | SEM |
| Moisture | 4.55b | 4.04c | 3.74e | 3.80de | 3.73e | 5.29a | 3.91cd | 2.47f | 0.0025 |
| Crude protein | 38.04a | 35.95b | 36.88ab | 35.90b | 30.55de | 29.73e | 31.52d | 33.19c | 0.2577 |
| Crude lipid | 5.66c | 6.53b | 6.87a | 5.70c | 5.44cd | 5.08d | 5.43cd | 5.39cd | 0.0113 |
| Crude fibre | 11.63g | 12.65f | 13.19e | 14.51d | 19.03a | 18.05b | 17.47c | 17.38c | 0.0272 |
| Ash content | 7.84a | 5.08b | 5.04b | 4.42de | 4.66cd | 4.85bc | 4.20e | 4.35e | 0.0055 |
| Nitrogen free Extract | 32.28e | 35.75c | 34.28d | 35.67c | 36.59b | 37.00ab | 37.47a | 37.22ab | 0.0351 |

Means with the same letter (s) along the rows are not significantly different at 5% using DMRT., SEM = Pooled standard error of mean calculated from residual mean square in the ANOVA test, T1-Raw, T2-Boiled 15 min, T3-Boiled 30 min, T4-Boiled 1 h, T5-Toasted 1 h, T6-Toasted 2 h, T7-Toasted 3 h, T8-Roasted Traditionally

Table 2: Levels of anti-nutritional factors in raw and processed seeds of *albizzia lebbeck*

| | Kreatments | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Anti-nutritional factors | T1 | T2 | T3 | T4 | T5 | T6 | T7 | T8 | SEM |
| Cyanogenic glycoside ( mg $g^{-1}$) | 0.11a | 0.13a | 0.13a | 0.13a | 0.09a | 0.09a | 0.09a | 0.09a | 0.0034 |
| Phytic acid ( mg $g^{-1}$) | 0.256a | 0.192b | 0.192b | 0.16c | 0.16c | 0.16c | 0.128d | 0.096e | 0.1203 |
| Oxalate ( mg $g^{-1}$) | 2.80a | 2.41b | 1.85c | 1.29d | 2.19b | 2.07c | 1.46d | 1.51d | 0.0031 |
| Saponin (%) | 18a | 9c | 7c | 4d | 16b | 15b | 14b | 14b | 0.0132 |
| Tannin ( mg $g^{-1}$) | 0.002a | 0.002a | 0.002a | 0.002a | 0.003a | 0.003a | 0.003a | 0.002a | 0.1320 |

Means with the same letter (s) along the rows are not significantly different at 5% using DMRT.,SEM = Pooled standard error of mean calculated from residual mean square in the ANOVA test., Key: T1 -Raw, T2-Boiled 15 min, T3-Boiled 30 min, T4-Boiled 1 h, T5-Toasted 1 h, T6 -Toasted 2 h, T7-Toasted 3 h, T8-Roasted Traditionally

levels of cyanogenic glycoside and tannin were low and not significantly affected by heat. Saponins are thermal sensitive. Shi *et al*. (2004) reports that portions of saponin dissolved in water are lost during soaking or blanching. Therefore, from the values obtained, this statement is in conformity as the raw sample was higher than the toasted and roasted samples. Also, the boiled samples were the least in concentration of the anti-nutritional factor. An option to enhance greater utility of feedstuff that may contain phytate is by boiling. From the results obtained from this study, boiling significantly reduced the levels of phytic acid in the samples. This finding agrees with Abu *et al*. (2005) who observed that boiling lima bean (*Phaseolus lunatus*) reduced the level of phytic acid in the seed samples. The levels of cyanogenic glycoside in all the samples were not significantly different ($p \geq 0.05$) however, they were all in the permissible level of 10-20 $mg^{-1}$ 100 $g^{-1}$ (Abu *et al*., 2005). A likely reason as to why the tannin levels were very low (0.002-0.003 mg $L^{-1}$) in all the treatments may have been due to the fact that not all tannins are extractable. Insoluble tannins are therefore not quantified. reported that insoluble tannins may have equal or greater biological activity than those that are more easily extracted. Another reason may have been due to the drying of the samples as drying reduces the solubility of tannins in feedstuff and, hence their ability to complex proteins (Hagerman and Klucher, 1986).

Anti-nutritional factors in most legumes prevent the digestion of proteins. The heat-moisture-time conditions of processing usually minimize concern for these use-limiting factors. Smith (1986) asserts that proper processing of feeds require precise control of moisture content, temperature and processing time. Adequate moisture during processing facilitates destruction of the anti-nutritional factors. Both over and under-toasting of feeds can result in a meal of lower nutritional quality. Under heating produces incomplete inactivation of the anti-nutritional factors and over-toasting can reduce amino acid availabilities. Therefore, digestibility is enhanced by cooking and thus the metabolizable energy value is increased.

Virtually all available ingredients of plant origin possess growth-inhibiting factors. They in most cases form a shied effect on the protein molecule thereby preventing the digestive enzymes from getting to them. This results in the passing out of all the proteinous molecules with the faeces undigested and hence making it unavailable for growth purposes (Eyo, 2003). These factors must be eliminated by special processing techniques to make them of maximum nutritional value. For instance, the toasting process in soybean meal manufacture destroys the urease enzyme. Also, much of the toxicity of the cyanogenic glycosides found in linseed and cassava is eliminated during processing of raw material (Cockerell and Holliday, 1975).

## CONCLUSION

The results of this study show that boiling significantly ($p<0.05$) increased crude protein levels and reduced crude fibre levels. Also, oxalate, saponin and phytates were significantly ($p<0.05$) reduced to tolerable levels in the seed flours sequel to processing, an indication that *A. lebbeck* has potentials to be utilised as a feed ingredient in the diets of culture animals.

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