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Proximate and Phytochemical Composition of African Mahogany (*Afzelia africana)* seed and African mesquite (*Prosopis africana)* pod

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ABSTRACT: Fabaceae is a plant family rich in protein which may either be consumed along with other food items directly or used as supplements in livestock feed. Seeds of *Afzelia africana* (sm) as well as pods of *Prosopis africana* (Guill. & Perr.) were collected from the main campus of the University of Ilorin and analyzed for their proximate and phytochemical compositions. The proximate analysis carried out on the roasted *A. africana* gave a Protein content of 20.78%, Fat value of 4.69%, Ash content of 3.62%, fibre content of 8.25%, Moisture content of 8.72%, Carbohydrate content of 53.94% while the unroasted *A. africana* gave a Protein content of 19.68%, Fat value of 6.09%, Ash content value of 2.26%, Fibre content of 8.79%, Moisture content of 10.65% and Carbohydrate content of 52.53%. *P. africana* pod had a protein content of 7.62%, Fat value of 6.86%, Ash content of 3.9%, Fibre content of 3.28%, Moisture content of 5.62% and carbohydrate 72.72%. The phytochemical analysis of *A. africana* seeds and *P. africana* pods revealed the presence of Alkaloids, Tannins, Saponins, Cardiac glycoside, Flavonoids terpenoids and phenols. These two plants are rich in both nutritional and phytochemicals which are of benefits to both humans and livestock.

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Afzelia africana seed has been reported to contain rich amount of nutritional compounds like protein, crude fibre, ash content and lipid (Obun *et al.;* 2006). Raw seeds of Afzelia may also contain anti-nutritional factors that may not enhance performance of chicken when included in the meal. However, roasted Afzelia seed supported growth of Chicken (Ayanwale *et al.;* 2007). .Roasting apart from being a conventional method of detoxifying legumes grains among rural dwellers account for increase in the nutritional compositions of *A. africana (*Adebayo, 2013). Ppresence of biologically and pharmacologically active non-nutritive compounds that contribute to the flavor, colour and other characteristics of plant parts are discovered through phytochemical screening (Oloyede, 2005 and Onyechi, 2013).

Trees of *Prosopis africana* are common in the middle belt and northern parts of Nigeria. The pods do not split open when dry. The ripe pods were hand -picked or harvested by shaking off the ripe pods from the tree branches (Helen *et al.;* 2007). *Prosopis africana* is a multipurpose tree of great economic value among the rural communities in the guinea savanna of Nigeria. The leaves and stems are used for treating tooth aches. The fruits (pods) are used as fodder for ruminant animals (Amusa *et al.;* 2010). In the middle belt states of Nigeria, fermented *Prosopis africana* seeds are popularly used as food seasoning. It is a source of low cost protein. Gels that could be used for pharmaceutical tablet formulation is obtained from *Prosopis africana* gum. The endocarp gum of *Prosopis africana* seed contains high content of various sugars (Tajudeen *et al.,* 2011). The objective of this paper is to report the proximate and phytochemical composition of African mahogany (*Afzelia africana)* seed and African mesquite (*Prosopis africana*) pod.

MATERIALS AND METHODS

The seeds of *Afzelia africana* and *Prosopis africana* used for this study were collected from the Department of plant biology premises and the Botanical Garden of University of Ilorin respectively. Seeds of *Afzelia africana* were cleaned and divided into two equal portions. A portion was crushed and grounded raw while the second portion was roasted over hot sand and thereafter crushed, grounded into fine powder and packed in a sample bottles. The pods of *Prosopis africana* were crushed and grounded into fine powder after extracting the seeds that were

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embedded in the pod. These samples were packed in sample bottles and coded as NRA for non-roasted *Afzelia africana* seed, RAS for the roasted *Afzelia africana* seed, and PAP for *Prosopis africana* pod. These samples were taken to the Department of chemistry laboratory in the University of Ilorin for phytochemical screening and proximate analysis of the samples. Proximate and phytochemical analysis were carried out by adapting standard methods earlier used by Ayoola *et al.;* (2008), Ejikeme *et al.;* (2014) and adapted by Ezeonu and Ejikeme, (2016); Umeaku *et al.; (*2018) ; Manzo *et al.;* 2017) and others.

Moisture Determination: About 2g of the sample was added into a crucible of a known weight (W_1) to give (W_2) and oven dry at 105ºC until constant weight was obtained (W_3). Percentage moisture content (% MC) was calculated using the formular: (Umeaku *et al.;* 2018)

$$\% \text{ MC} = \frac{W2-W3}{W2-W1} X \frac{100}{1}$$

Determination of ash content: Two grams of the sample was added into a previously weighed dry crucible (W_1) to give (W_2) and heated in the furnace at 550ºC for 3 hours and to a final weight (W_3) (Ayoola *et al.;* (2008). The percent ash (% Ash) is calculated as:

$$\% \text{ Ash Content} = \frac{W3-W1}{W2-W1} X \frac{100}{1}$$

Determination of Fat and oil: Two grams of the sample was added into a previously weighed dry flask (W_1) to give (W_2) extracted using organic solvent and evaporated in the oven at 105ºC. The final weight (W_3) was taken. Percentage fat and oil was calculated as (Umeaku *et al.;* 2018):

$$\% \text{ fat and oil} = \frac{W3-W1}{W2-W1} X \frac{100}{1}$$

Determination of crude Fibre: The weight (W_1) of the chaff from the extraction was recorded and transferred in to a beaker. Water and NaOH were added and boiled for 30 minutes, filtered and the residue acidified in a beaker, boiled for 30 minutes, filtered again and residue generated was transferred into a crucible and weighed (W_2). This new weight (W_2) was oven dried at 105ºC. The residue was transferred into a furnace and ash at 550ºC. The weight of the crucible and the content was taken and recorded (W_3), (Ayoola *et al.;* 2008 and Umeaku *et al.;* 2018).

$$\%\text{fibre} = \frac{W3-W2}{W1} X \frac{100}{1}$$

Determination of crude protein: Digestible flask was added 0.5g of the sample and digested with H_2SO_4 and Selenium powder. The sample produce was diluted and 5 ml of 40% NaOH was added and distillated into a conical flask containing 10ml of boric acid, bromocresol green and methyl red. The mixture generated after distillation was titrated against hydrochloric and titre value recorded. (Umeaku *et al.;* 2018)

% Nitrogen= Titre value x Molarity of acid used x Atomic mass of Nitrogen.

% protein=%N x Factor 6.25 (Umeaku *et al.;* 2018 and Madandola *et al.;* 2018)

Carbohydrate content: %carbohydrate =100-(%moisture content +% Fat and oil content +%Ash +%Fibre +%Protein).

*Test for alkaloids: Mayer`s test:* Addition of one mil of Mayer`s reagent to 1ml of the sample produced whitish or cream coloured precipitate which indicates the presence of alkaloids (Harborne, 1984, Ayoola *et al.;* (2008 and Manzo *et al.;* 2017)

Test for Tannins: Braymer`s test was used to determine the presence of tannins. Two ml of the sample was mixed with distilled water and two to three drops of 5% Ferric chloride ($FeCl_3$). Appearance of brownish green or dark-blue coloration indicates the presence of tannins (Ayoola *et al.;* 2008 and, Manzo, 2017)

Test for Cardiac glycoside: Keller- Kilani Test is used. Five ml of the sample was treated with 2 ml of glacial acetic acid containing one drop of Ferric chloride solution. This was underplayed with 1 ml of concentrated H_2SO_4. A brown ring at the interface indicates a deoxysugar characteristic of cardenolides. (Dix *and Keller 1929,* Trease and Evans, 1989 and Ayoola *et al.;* 2008*)*

Test for Flavonoids: One cm^3 of 10% NaOH was added to 3 cm^3 of the sample. A yellow colouration indicates presence of flavonoids.

Test for Saponins: Two grams of the sample was boiled in 20 ml of distilled water in water bath and filtered. When about 10 ml of the filtrate is mixed with 5 ml of distilled water shaken vigorously. A persistent stable froth indicates the presence of Saponins (Manzo, 2017)

Test for Phenol: Two drops of 5% of $FeCl_3$ was added to $1cm^3$ of the sample. A greenish precipitate indicates the presence of phenol (Awe and Sodipo, 2001 and Ayoola *et al.;* 2008)

Test for Terpenoid: Salkowski Test was used. Five ml of the sample was mixed in 2 ml of chloroform after which 3 ml of concentrated H_2SO_4 was carefully added to form a layer. A reddish brown colouration at the interface indicates the presence of terpenoids. (Ayoola *et al.;* 2008)

RESULTS AND DISCUSSION

Table1 shows that roasted seeds of *A. africana* contain higher amounts of ash, crude protein and carbohydrate (3.62, 20.78 and 53. 94 %) respectively than its non- roasted seeds (2.26, 19.68 and 52.53 %). Increase in both carbohydrate and crude protein contents of roasted *A. africana* seed will make them more adequate and relevant for both human and livestock diets. High carbohydrate content makes this seed to be important as energy yielding seed. These results are in accord with the earlier reports of Ayanwale *et al.; (2007)* and Adebayo and Ojo (2013) who also observed increase in proximate composition of roasted *A. africana* seeds. However, moisture, fat/ oil as well crude fibre contents (10.65, 6.09 and 8.79 %) were higher in non-roasted seeds which make unroasted seeds to potentially store higher energy than roasted seeds. Ash, fat /oil and carbohydrate (3.90, 6.85 and 72.72 %) were higher in *P. africana* pod than those of roasted and non-roasted seeds of *A. africana*. Increase in both carbohydrate, fat and oil in the pod of *P. africana* will make the pod a ready source of energy supply when supplemented in livestock diets. These observations agree with the report of Ajiboye, (2009) who reported that *Prosopis africana* pods are among the earliest leguminous feeds known to man and still serve as a valuable source of carbohydrate and protein for many desert dwellers. Phytochemical compositions of non-roasted *A. africana* seed and *P. africana* pod show that *P. africana* pod contains higher amounts of tannins and saponin than the amounts in non-roasted seeds of *A. africana* (Table 2). Presence of phytochemicals in the seed of *A. africana* and pod of *P. africana* were also in agreement with the earlier reports of Ajiboye (2013), Igwenyi, (2014) and Onyechi, (2013) who variously reported similar results in these species as well as other indigenous seeds. The presence of these phytochemicals in the seeds makes them to be of therapeutic and health importance.

Table 1: Proximate compositions of roasted and non-roasted seeds of *Afzelia africana* and *P. africana* pod

Composition %	*A. africana* Roasted seeds	Non-roasted seeds	*P.africana* pod
Moisture	8.72	10.65	5.62
Ash	3.62	2.26	3.90
Fat and oil	4.69	6.09	6.86
Crude protein	20.78	19.68	7.62
Crude fibre	8.25	8.79	3.28
Carbohydrate	53.94	52.53	72.72

Table 2: Phytochemical composition of *Afzelia africana* non-roasted seed and P. *africana* pod

Phytochemicals	*A. africana*	*P.africana*
Alkaloids	++	++
Tannins	+	++
Saponin	+	++
Cardiac glycoside	+	+
Flavonoids	++	++
Terpenoids	+	+
Phenol	+	+

+ = present, ++ = present in high quantity

Conclusion: Results of this study have shown that seed of *A. africana* and pod of *P. africana* are rich in proximate compositions as well as phytochemicals. Roasted seeds of *A. africana* contain higher amounts of ash, crude protein and carbohydrate than its non-roasted seeds. *P. africana* pod contains higher amounts of Ash, fat /oil and carbohydrate than those of roasted and non-roasted seeds of *A. africana*. The proximate and phytochemical compositions of the seed of *A. africana* as well as the pod of *P. africana* make them to be of high medicinal and health importance.

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