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PROXIMATE COMPOSITION, AMINO ACID PROFILE AND PHYTOCHEMICAL SCREENING OF *LOPHIRA LANCEOLATA* SEEDS

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ABSTRACT

There are large varieties of legumes and oil seeds in tropical Africa which are part of traditional food systems but whose nutritional and economic values have not been completely determined and are far less exploited for both human and livestock utilization. The objective of this study was to evaluate ***Lophira lanceolata*** (false shea or meni oil tree) seeds with the aim of qualifying and quantifying chemical and biological information that might serve as a guide to exploit its potentials and benefits for human and animal nutrition .The chemical composition, amino acid profile and phytochemical screening of the lesser-known oil seed were carried out using standard methods. The seeds were found to contain 2.78% moisture, 29.89% crude protein, 8.43% crude fiber, 48.61% crude fat, 1.45% total ash. Total carbohydrate and caloric values were 11.62% and 637.21 kcals, respectively. Mineral analysis revealed the seeds to contain 311mg/100g of sodium, 518mg/100g of potassium, 30mg/100g of calcium, 82mg/100g of magnesium, 20mg/100g of zinc, 40mg/100g of iron and 290mg/100g of phosphorus. Amino acid analysis using technicon sequential multi-sample amino acid analyzer detected all the essential amino acids except tryptophan. The seeds are rich in three of the essential amino acids (EAA) (g/16g N)-, isoleucine (3.16), leucine (5.29) and lysine (4.39) with chemical scores of 75.2, 125.9 and 104.5%, respectively. The other amino acids compared well with the FAO reference proteins. Tyrosine appeared to be the most limiting amino acid with a chemical score of 19.14%. Phytochemical screening of the seeds indicated presence of some bioactive compounds such as saponins, tannins, alkaloids and trace amounts of anthraquinones. Based on results of this study, the lesser known and under- utilized oil seed***, L. lanceolata*** can be a potential source of edible and industrial oil as well as a source of protein, mineral element and energy supplements in livestock feeds. Further research can also reveal its potential for human consumption. The presence of some bioactive substances explains folk medicinal use of the plant.

Key words: Seeds, Composition, Amino acids, Phytochemicals

INTRODUCTION

*Lophira***,** tree of the *ochnaceae* family also known as Meni oil tree, false shea and locally called beung in Chamba language and *namijin kadanya* in Hausa language, grows in the dry zones as well as the moist evergreen forest of tropical Africa [1,2]. *Lophira lanceolata* is the commonest species in the dry savannah areas while *Lophira procera* is the species found in the forest zone of West Africa. Flowering is from December to February.

Almost all parts (bark, root bark, leaves, and leafy shoots) of the tree are used for various medicinal purposes. The leaves are also fed to livestock and used for traditional ceremonies [3, 4]. The fruit is bottle-shaped, bifid at the apex about 3cm long surrounded by persistent sepals, two of which are enlarged and wing-like. The seed of *L. lanceolata* contains from 25 to 30% shell and 70 to 75% kernel, the latter yielding by expression about 40 to more than 50% yellowish or cream colored semi solid fat [3]. The oil is used in some communities in Nigeria and some West African countries in cooking and as hair lotion and remedy for lice. The seeds are also consumed in some districts even though they have a bitter and astringent taste [3].

Plant seeds are important sources of nutrients and can serve as high quality dietary protein sources to meet nutritional requirements [5, 6]. One of the least expensive ways of increasing protein levels in the diets of low income families is by encouraging the consumption of local indigenous edible seeds especially legumes and oil-seeds which have been found to be rich in protein [7]. Such practice has great potential in ensuring adequate nutrient and energy intake by infants and children in poor settings where protein- energy- malnutrition (PEM) has continued to hamper optimal growth and development. The use of local indigenous food commodities to formulate local and home-based complementary foods is being practiced in many developing countries. Likewise, sustainable livestock production is dependent on the availability of various sources of nutrients that are required for the formulation of animal feed. Principal among these are protein and energy sources such as groundnut, soybeans and maize which are also important foodstuff for humans [8, 9]. Thus, there is competition for the limited common foodstuff and hence the high cost which is ultimately translated into high cost of animal protein. With increasing global demand for livestock products, research into locally available food with potential use as additional sources of protein and energy is imperative.

L. lanceolata possesses potential for utilization as animal feed as well as a source of human food. Presently, only the lipid extracted from the seed is used and constitutes about 40 – 50% w/w [3]. When the lipid is extracted, the cake is regarded as waste and thus discarded. Though the defatted cake could be a good source of protein, it is not being utilized as such. Available information and literature on the chemical composition of Lophira lanceolata seeds is limited and scanty [10, 11, 12]. This work was designed to chemically evaluate the seeds in order to assess their nutritional potential, and to warrant recommendation on the nutrient potential of the defatted cake generated during local processing and utilization.

MATERIALS AND METHODS

Sample Collection and Preparation

Fruits of *Lophira lanceolata* were obtained from local communities of Ganye in Adamawa State of Nigeria. Officials of the School of Forestry Jos, Plateau State, Nigeria, certified the authenticity of the sample. The shells were cracked open with slight pressure and the seeds separated from the pods by hand. Infested samples were discarded. The seeds were oven dried at 50-^{o}C overnight in a hot air circulating oven and then ground in a cyclone sample mill to pass through a 1mm sieve. The powdered sample was then transferred into an airtight labeled jar and kept in the refrigerator prior to analysis.

Proximate Analysis

The proximate composition of *Lophira lanceolata* seeds was determined according to the methods described by AOAC [13]. Energy value was calculated using the Atwater conversion factors [14].

Mineral Analysis

Sodium, potassium, calcium, magnesium, zinc and iron were determined with an automatic Atomic Absorption Spectrophotometer (Unicam Model 929, Unicam Cambridge, England). Total phosphorus was determined spectrophotometrically after incubation with Molybdo-vanadate solution [13].

Amino Acid Analysis

Amino acid composition was determined with Technicon Amino Acid Analyzer (TSM–1 Technicon Instrument Basingstoke, UK) using Norleucine as internal standard. Tryptophan was not detected.

Phytochemical Screening

Phytochemical screening of the seeds for saponins, tannins, cardiac glycosides, alkaloids, anthraquinones and flavonoids was carried out according to standard methods [15, 16].

RESULTS

The proximate composition of *L. Lanceolata* seeds is shown in Table 1, while the mineral content is in Table 2. Moisture content is low (2.78%) which falls within the range reported for most seeds and nuts [17, 18]. The crude protein content was high at 29.89%. This is comparable to some popular conventional sources of protein such as peanut (26.2%) [17,18]. The seed kernel is a rich source of fat with crude fat value of 48.61%.The oil obtained from the seed was a mixture of a semi-solid cream colored fat and a nearly colorless liquid at room temperature. When left standing, it separated out into two layers with the semi solid portion at the bottom and the liquid layer at the top, clear and distinct enough to be separated by direct decanting. The physical characteristic of the oil is indicative of a mixture of saturated and unsaturated fatty acids [12].

The percentage ash of 1.45% is similar to those reported for tree seeds and nuts [19, 20]. The total carbohydrates as well as the crude fiber content of *L lanceolata* seeds were quite low (11.62% and 8.43%, respectively). This is mainly attributed to the high protein and fat content.

The high caloric value (637.21kcal) is due to its high fat content. The mineral composition (Table 2) of the seed expressed in mg per 100g dry matter (DM) showed that it is rich in sodium, potassium and phosphorus and fairly rich in iron, magnesium, zinc and calcium.

Table **3** shows the amino acid composition of the seed along side the FAO reference value and their percentage chemical scores**.** *Lophira* seeds were found to be rich in the essential amino acids isoleucine, leucine and lysine, but limited in tyrosine, cystein and methionine. The other amino acids are present in moderate amounts. Tyrosine appears to be the most limiting amino acid. Phytochemical tests of the seeds (Table 4) indicated the presence of saponins, tannins, alkaloids and trace amounts of anthraquinones. Cardiac glycosides were not detected.

DISCUSSION

The most striking features of the chemical composition of *L lanceolata* seed are the comparatively high protein content and exceptionally high crude fat content. The protein content of the defatted meal was higher than the value (27.0%) reported by other workers [10]. This may be due to the differences in the soil and climatic conditions in which the plants were chosen to obtain the seed. It is also higher than those reported for some protein- rich foods such as cow pea seeds (22.5%) and lima beans (23.3%) [1]. It is, however, comparable with values obtained for *Balanites aegyptiaca* and *Ricinus communis (minor)* (33.09% and 32.88%, respectively) [20, 21]. The relatively high protein content suggests it is a potential cheap source of plant protein and could thus be used as protein supplement in livestock and poultry feed. This will subsequently translate into cheaper and affordable animal protein food for improved nutrition in sub-Saharan Africa where their cultivation is widespread. The high protein value of *lophira lanceolata* seeds could also be used to supplement low protein diets. It can be used in the formulation of complementary food for infants in poor and low income settings. The nutritional quality of a protein is dependent upon many factors among which are: the effectiveness of the test protein in meeting the amino acid requirements of a particular function and the degree of retention of the component amino acids during processing and essential amino acid (EAA) composition of the test protein. Compared to the FAO reference protein values [22], *L. lanceolata* seed is a good source of essential amino acids notably isoleucine, leucine, and lysine. The other amino acids are present in moderate amounts. Tyrosine is the most limiting amino acid. Presently, in developing countries, there is high interest and quest for establishing the potential for utilization of lesser-known and

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under exploited seeds in compounding of animal and human feeds and for oil extracting industries. The present work has shown that *L. lanceolata* seed is an excellent source of oil. With percentage oil content of 48.61%, it compares favorably with the richest oil producing legumes like soy beans and peanuts. This value also falls within the range of values reported for similar species [3, 11]. The seed is a potential source of edible oil as well as industrial raw material for the manufacture of soap and perhaps cosmetics. Its exploitation is, therefore, worth considering in this regard. However, the chemical quality parameters, fatty acid composition and possibly the presence of anti-nutritional factors of the oil will require further investigation to warrant definite recommendation. The high caloric value of the seed might also be due to its high fat content. This value falls within the caloric value reported for most oil seeds [23, 24].

The moisture and ash contents of the seed fall within the range reported for seeds of other fruits [17, 18]. The low moisture content is an index of stability, quality, shelf life and also high yields [19]. Mineral composition showed the seed to be a fairly good source of iron, potassium, sodium and magnesium. In fact, the results obtained for all the minerals analyzed were comparatively higher than those reported for some oil tree seeds [18, 19]. While the amount of iron is adequate enough to accommodate the limit advised for animal nutrition [25], calcium and zinc do not meet the FAO and WHO requirement per day [26].The low levels of some of these micronutrients may possibly be a reflection of the properties of the soil in which *L lanceolata* trees grow [27].

The presence of phytochemicals in the seed kernel suggests possible medicinal application. Different parts of the plant have earlier been indicated to be useful for various medicinal purposes [1, 12]. The occurrence of these phytochemicals may, however, serve as a limiting factor to the nutritional usefulness of the oil and protein-rich cake.

The presence of saponins and tannins particularly may be responsible for the bitter and astringent characteristics of the seeds. This may affect palatability and acceptability.

CONCLUSION

The data presented in this study suggest that there are many legumes and oil seeds in the tropics whose nutritional and economic values could be determined and exploited for use as human and animal feedstuff. *Lophira lanceolata* is a potential source of oil as well as a good source of protein supplement in livestock and human food particularly.

The presence of some bioactive substances would need further investigation to establish their effect on the animals as well as the medicinal potentials of the seeds. Furthermore, a process to eliminate undesirable characteristics of the seed kernel is necessary if the nutritional potential of the seed is to be fully realized and utilized.

Table 1: Proximate composition of *Lophira lanceolata* seed in g/100g dry matter

Nutrient	Value
Moisture	2.78±0.00027
Crude Protein	29.89±0.077
Crude Fiber	8.43±0.028
Lipids	48.61±0.126
Total Ash	1.45±0.018
NFE	11.62±0.019
Caloric Value (Kcal)	637.21±17.30

Values are means of three determinations ± SD

Table 2: Mineral Element Composition (mg/100g dm sample)

Mineral	Value
Sodium	311±24
Potassium	518±16.67
Calcium	30±1.5
Magnesium	82±2.67
Zinc	20±0.426
Iron	40±2.67
Phosphorus	290±0.67

Values are means of three determinations ±SD

Table 3: Amino Acid Profile of *Lophira lanceolata* Seeds g/16g N

Amino Acid	Value	FAO Ref.	%Chemical Score
Isoleucine	3.16	4.20	75.24
Leucine	5.29	4.20	125.95
Lysine	4.39	4.20	104.52
Methionine	1.03	2.20	46.82
Threonine	1.88	2.80	67.14
Phenylalanine	1.56	2.80	55.71
Valine	2.57	4.20	61.19
Tyrosine	0.48	2.80	17.14
Cysteine	0.82	2.00	1.00
Tryptophan	ND	1.40	
Arginine	3.95		
Histidine	0.98		
Alanine	3.69		
Serine	3.53		
Glycine	4.68		
Glutamic Acid	10.91		
Aspartic Acid	6.25		
Proline	1.63		

ND=Not detected

Table 4: Phytochemical composition of *Lophira lanceolata* seeds

Phytochemical	Presence
Saponins	Positive ++
Tannins	Positive ++
Cardiac glycosides	Negative - -
Alkaloids	Positive ++
Anthraquinones	Trace

'+' =present

'_'=absent

REFERENCES

1. **Ghogomu R, and BL Sondengam** Laphirones D and E: Two new cleaved bioflavonoids from *Lophira lanceolata*. J. Nat. Prod. 1989; **52(2)**:284-288; Mar-Apr.

2. **Hutchinson J and JM Dalziel** Flora of West Africa. Crown Agents for Oversea Government and Administration mill bank, London S.N. 1964; **1:** 10-18.

3. **Burkill HM** A review of Daziel's the useful Plants of West Africa. Royal Botanical Garden Kew, 1985:**1**.

4. **USDA, ARS** National Genetic Resources Program. Germplasm resources information;Network (GRIN) [Online Database]. National Germplasm Resources Laboratory, Beltsville, Maryland. URL:http://www.ars-grin.gov/cgi-bin/npgs/html/taxon.pl 401744 (29 July 2009).

5. **Perumal S, Klaus B and PSM Harinder** Chemical composition, protein fractionation, essential amino acid potential and antimetabolic constituents of an unconventional legume, Gila bean (*Entada phaseoloides Merrill*) seed kernel. J. Sci. Food, Agric. 2001; **82(2)**: 192-202.

6. **Escudero NL, Zirulnik F, Gomez NN, Mucciarelli SI and MS Gimenez** Influence of a protein concentrate from *Amaranthus cruentus* seeds on lipid metabolism. Expt. Biol. Med. 2006; **231**: 50-59.

7. **Sigh U, Rao VP, Subrahmanuam N and K Saxena** Cooking, chemical composition and protein quality of newly developed genotypes of pigeon pea (*Cajanus cajan L).* J. Sci. Food, Agric 1993; **61**: 395-400.

8. **Teguia A and AC Beynen** Alternative Feedstuffs for broilers in Cameroon. Livestock Research and Rural Dev. 2005; **17(3)**.

9. **FAO** United Nations Food and Agriculture Organization**.** Protein Source for the animal feed industry. Animal Production and Health Papers No 1, 2002.

10. **Eromosele IC and CO Eromsele** Studies on the chemical composition and physicochemical properties of seeds of some wild plants. Plant Foods for Human Nutrition 1994; **46**: 361-365.

11. **Kyari MZ** Extraction and characterization of seed oils. Int. Agro physics, 2008; **22**:139-142.

12. **Fariku S and MI Kidah** Biomass potentials of *Lophira lanceolata* fruit as a renewable energy resource. Afr. J. Biotech 2008; **7(3)**: 308-310.

13. **AOAC.** Official Methods of Analysis. Association of Official Analytical Chemists, Washington DC. 1990.

14. **Osborne DR and P Voogt (Eds)** In: Calculations of caloric value in the analysis of nutrients in foods. Academic Press NY 1978. pp 239-240.

15. **Sofowora AO** Medicinal Plants and Traditional Medicine in Africa. University of Ife Press 2nd Ed. 1993. pp 320.

16. **Trease GE and MD Evans** A text book of Pharmacognosy. 13th Ed. Builler Trindall and Canssel London 1989; pp 176-180.

17. **FAO** United Nations Food and Agriculture Organization. Food Composition Table for use in Africa Rome, Italy 1968.

18. **Oyenuga VA** Nigerian Feeds and Feeding stuff 3rd Ed. Ibadan University Press, 1968.

19. **Marangoni A and I Alli** Composition of the seeds and pods of the tree legume *Prosopis Juliflora.* J. Sci. of Food and Agric. 1988; **44**: 99-110.

20. **Bitrus Y** Studies into the Biochemical Composition of some lesser known and underexploited seeds in Northern Nigeria. M Sc Thesis, University of Jos, 1998.

21. **Samuel AL, Temple VJ and O Ladeji** Chemical and Nutritional Evaluation of the Seed Kernel of *Balanites Aegyptiaca.* Nig. J. Biotech 1997; **8**: 57-63.

22. **FAO** United Nations Food and Agriculture Organization. Amino Acid Content of foods. FAO, Rome 1970, 285.

23. **Osagie UA, Okoye W, Oluwayose BO and OA Dawudu** Chemical quality parameters and fatty acid composition of oils of some underexploited Tropical Seeds. Nig J.Appl. Sci. 1986; **4**:151-162.

24. **Temple VJ, Aliyu R and JD Bassa** The Chemical Composition of the seeds of two varieties of *Ricinus Communis.* West Afr. J. Pharm. Drug Research. 1991; **9**: 58-62.

25. **Underwood EJ** Trace elements in Human and Animal Nutrition. Academic Press, NY 1971.

26 **Okoye ZSC** Biochemical Aspects of Nutrition. Prentice Hall of India, New Delhi, 1992.

27. **Keay RWJ** Trees in Nigeria. A revised version of Nigerian Trees. Clarendon Press, Oxford. New York. 1989; 195-197

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