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Comparative Studies of the Nutritional and Phytochemical Constituents of African oil baen (*Pentaclethra macrophylla Benth*) and African bean (*Anthonotha macrophylla*) for Human Consumption

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Abstract The powdered crude sample of African Bean (Opagha in Yoruba Language) (*Anthonotha macrophylla*) and African oil bean (*Pentaclethra macrophylla* Benth) were subjected to nutritional, phytochemical and mineral analysis using standard experimental procedures to see whether *Anthonotha macrophylla*, a totally neglected plant seed in west Africa, could serve as close substitute to African oil bean, usually used for human consumption due to its nutritional value. The nutritional composition of *Anthonotha macrophylla* revealed the presence of carbohydrates (62.600±0.01%) ,moisture content (9.50±0.01%) ,ash content (3.55±0.01%), crude fat (1.60±0.02%), crude fibre (2.30±0.01%), crude protein (20.30±0.01%) and Vitamin C was 52.017±0.01 mg/100g while the Phytochemical evaluation revealed the presence of alkaloids (6.40±0.01), tannins (0.350±0.02), saponins (1.96±0.01), oxalate (1.582±0.01) and phytate (4.325±0.01) in g/100g and the mineral contents in mg/kg of *Anthonotha macrophylla* were sodium (241.00), potassium (178.50), magnesium (1075.00), iron (19.00), calcium (35.00), manganess (13.00), cupper (59.00) and Zinc (71.00) respectively. Also, the nutritional composition of African Oil bean (*Pentaclethral macrophylla* benth) revealed the presence of carbohydrates (8.125±0.01%), moisture content (13.250±0.01%) ,ash content (2.70±0.01%), crude fat (46.10±0.01%), crude fibre (6.50±0.01%), crude protein (22.575±0.01%), and the Vitamin C content was 67.941±0.01 in mg/100g while the phytochemical analysed revealed the presence of alkaloid ((11.24±0.01), tannins (0.950±0.02), saponin (3.20±0.01), oxalate (1.387±0.01), and phytate (1.174±0.01), all in g/100g and the mineral content in mg/kg were sodium (457.00), potassium (8700.00), magnesium (6100.00), iron (72.00), calcium (64.00), manganese (45.00) copper (not detected), and zinc (24.00)in mg/kg respectively. African bean has very high percentage of carbohydrates, which reveals its high calorific value than African oil bean, this show that after proper fermentation, it can be utilized as food. The phytochemical parameters of African bean according to this study are lower than that of African oil bean, which is commonly consumed as food.

Keywords Nutritional, Phytochemical, African Oil Bean, Opagha Bean, Minerals, Toxic, Leguminoseae, anti-nutritional

Introduction

Plants and their seeds are of great importance as food and to the health of individuals and the society. The medicinal value of these plants lies in some chemical substances that produce a definite physiological action on the human body [1]. However, the usefulness of some plant seeds as food may be limited due to a probably to adverse effect of processing operations (cooking and fermentation) on its total nutritive content and as well as the presence of anti-

nutritional and toxic factors. Some of the studies which have been therefore undertaken in the resent times have shown that the properties that responsible for the reduction in the nutritionally of cooked and fermented oil bean seed samples from the raw sample are linked to the presence of anti-nutritional factors [2].

The proximate composition of some plant seeds reveal their nutritional values, that is, their importance in human diet, but the seed coat polyphenolics can reduce the nutritional values [3]. The term “Phytochemicals” refers to a wide variety of compounds produced by plants. They are found in fruits, vegetables, beans, grains and other plants. Scientists have identified thousands of Phytochemicals, although only a small fraction have been studied closely. Some of the more commonly known Phytochemicals include Ascorbic acid (vitamin C), folic acid and vitamin E to mention but a few [1]. Some Phytochemicals have either antioxidants or hormone-like actions. There is some evidence that a diet rich in fruits, vegetables, and whole beans or grains reduces the risk of certain types of cancer and other diseases, and researchers are looking for specific compounds in these foods that may account for the benefits effect in humans [4]. Available scientific evidence does not support claim that taking phytochemicals supplements is as helpful as consuming the fruits, vegetables, beans and grains from which they are taken [4]. Phytochemicals are promoted for the prevention and treatment of many health conditions, including cancer, heart disease, diabetes, and high blood pressure. There is some evidence that certain phytochemicals may help prevent the formation of potential carcinogens (substances that cause cancer), block the action of carcinogens on their target organs or tissue, or act on cells to suppress cancer development. Many experts suggest that people can reduce their risk of cancer significantly by eating more fruits, vegetables, and other foods from plants that contain phytochemicals [4]. There are several major groups of phytochemicals. Tannin is a good anti-oxidant, but it reduces the digestibility of legume protein [5]. The polyphenols include a large subgroup of chemicals called flavonoids. Flavonoids are plant chemicals found in a broad range of fruits, grains, and vegetables. They are being studied to find out whether they can prevent chronic diseases such as cancer and heart disease [4]. The is flavones found in foods and supplements such as soy products, red clover, garbanzo beans and licorice, and the lignans found in flaxseed and whole grains may mimic the actions of the female hormone estrogen. These estrogen-like substances from these plant sources are called Phytoestrogens. They may play a role in the development of and protection against some hormone-dependent cancers such as some types of breast and prostate cancer [4].

Other polyphenols (including some flavonoids) act as antioxidants. These are thought to rid the body of harmful molecules known as free radicals, which can damage a cell's DNA and may trigger some forms of cancer and other diseases [4]. These compounds are commonly found in vegetables such as broccoli, brussels sprouts, cabbage, and cauliflower and in teas. Grapes, egg plant, red cabbage, and radishes all contain anthocyanidins—flavonoids that act as antioxidants and may protect against some cancers and heart disease [4]. Phytochemicals, in the amounts consumed in a healthy diet, are likely to be helpful and are unlikely to cause any major problems. Some people assume that because phytochemical supplements come from "natural" sources, they must be safe and free from side effects, but this is not always true. Many Phytochemical supplements, especially when taken in large amounts, have side effects and may interact with some drugs. Some of these interactions may be dangerous. Also, relying on the use of Phytochemicals alone and avoiding or delaying conventional medical care for cancer may have serious health consequences [4]. The nutritional composition comprises of moisture content, crude fibre, crude protein, crude fat, ash content, total carbohydrates, vitamins and minerals. The proteins are low in sulfur-containing amino acids. Some rare amino acids including dicarboxilic acids have been found in oil beans seeds [6]. The oil bean seeds are a good source of edible oil. The oil has a pleasant aroma and bunt taste possibly due to the presence of alkaloid. Oakenful and Sidhu, 1989 [6] also reported that the unfermented seed oil contains about 75% saturated fatty acids and 26% unsaturated fatty acids. The fatty acid content varies from 2,7 to 4.8%. Oil bean are good source of calcium and phosphorus and contain vitamins such as Thiamin, Riboflavin and niacin [6]. Stachylose, galatose, fructose are the major sugars in oil bean seeds, saponin makes up 2.1% also in oil bean. Saponin yield oleanolic acid, glucose, arabinose and rhamnose on hydrolysis [8].

Plant protein provides non-essential and essential amino acids which are building blocks for protein synthesis in animals. Protein function for the replacement and turnover of body protein in adult and also for the growth of infant and children [8]. The nutritional quality of protein can be determined basically in two ways; the protein is

completely hydrolyzed and its amino acid composition measured and compared with that of egg and milk protein as standard. The amount of essential amino acid and its digestibility gives the nutritional value of protein. Although arginine is normally made by the liver as a step in the synthesis of urea, children cannot make arginine fast enough to support urea Synthesis and the synthesis of body protein [8]. When protein is produced within a country, it should be produced near the places where it is needed most. Suggestion has been given with the aim for solving "world problem" [9]. Other ways to cope with limited protein supply have been also been suggested, they include the use of green leaves protein supplements [10] and vegetable protein mixture with complementary amino acid patters [11]. In the tropics, leaf protein concentrate are feasible protein supplement and the leaf protein become necessary in the treatment of acute malnutrition [11]. The major nutritional protein problem is one of protein calorie malnutrition which occurs when the quality of food ingested does not meet protein requirement or when the available protein were quite adequate but not utilized correctly due to insufficient quantity calories [10]. The latter is common form of protein calorie malnutrition. Even in poor countries their protein needs are met, if the diet consumed adequately meets the calorific requirement but if the calorific qualities are obtained largely from roots and tubers, protein malnutrition may occur [10]. As explained by Haslam, 1983 [12], mineral is an inorganic nutrient which are needed by the body are basically minerals and vitamin. Minerals are grouped as "Major Element" that are required in large amount in the diet, these elements include calcium, phosphorus and magnesium. Also **"**Trace Element" that consist of Iron, Iodine, Zinc and many others. They are needed in only milligram or microgram quantities.

Inorganic elements have many functions serves as electrolytes in maintaining water balance in the vascular system and tissue, act as the prosthetic groups of enzymes and as component of bones and teeth, calcium play an important role in the coagulation of blood, the proper functioning of the heart and nervous system and normal contraction of muscles. Its most important function however is to aid formation of bones and teeth. It is therefore, important that growing children should have sufficient supply of calcium. The chief sources of calcium are milk, cheese, eggs, green vegetables, gland and fruits. Sodium, potassium and chlorine occurred as ions in the body fluid. Potassium is mainly found in the intracellular fluids while sodium is found in the extracellular fluids [12]. Sodium and potassium with other salt work together to regulate the acid base balance. Potassium is required for enzyme secretion. Manganese are needed for normal bone structure, reproduction, normal functioning of central nervous system, it is also a competent of some enzyme. The chief source is nuts, whole grains, vegetable and fruits.

The aim of this research is to reveal safe consumption of *Anthonotha macrophylla*, which is closely related to African oil bean (*Pentalcethra macrophylla benth*), because it has been in recent times given limited attention in terms of its utilisation as food like the African oil bean due to the believe that opagha bean has some toxic chemical substance, which are sinister to human health. The objectives of this project work was carried out to compare the nutritional and phytochemical parameters of these closely related leguminous seeds (African bean and Afican oil bean), that could suggest the optimum utilization of the African bean (Opagha) in Nigeria as the close substitute for African oil bean. To achieve this objectives, the project is aimed at the following; to determine the nutritional composition, to determine the Phytochemical composition, of these two legumineous seeds (African bean and African oil bean) and to compare their results with each other in order to negate general believe that african seed has low nutritional value and toxic for human consumption.

Materials and Methods

Collection and identification of plant material: The seed of African Bean (Opagha) (*Anthonotha macrophylla*) was bought from "Oja Oba"market in Owo town, Owo local government area, and African Oil Bean (*Pentaclethra macrophylla benth*) was bought from Ogbese market in Ogbese town, Akure North Local Government Area, all in Ondo state.

Preparation of plant sample: The epicarp of dried African bean (*Anthonotha macrophylla*) and African Oil Bean (*Pentaclethra macrophylla benth*) samples were manually dehulled and the seeds were chopped into pieces and sundried for a period of two weeks, reduced to fine powder with the aid of a mechanical grinder to pass through 40

mesh sieve to increase the surface area for proper analysis. The milled powder samples were collected and stored in glass jars, tightly covered and kept for analysis.

Figure 1: Diagram Showing whole beans and endosperms of Opagha bean (Anthonotha macroohylla) (upper one) and African Oil Bean (Pentaclethra macrophylla benth) (lower one)

Nutritional and Phytochemical Composition: All the parameters for determination of nutritional composition were followed from the method adopted by AOAC, 2000 and phytochemicals by Harbone J.B., 1973.

Results & Discussion

The results from the tables revealed some differences in the nutritional, phytochemical and mineral composition of African bean (*Anthonotha macrophylla*) and African oil bean (*pentaclethral macrophylla benth*). The moisture content of African oil bean (13.25±0.01) in g/100 g is higher than that of African bean (9.50±0.01) in g/100g, and since the higher moisture content contributes to food spoilage, it shows that the storage capacity of Opagha bean is higher than the African oil bean. The ash content of Afrian bean (3.55±0.01) in g/100g is a little higher than that of African Oil Bean (2.70±0.01) in g/100g. This indicates the increase in the mineral composition in African bean than African Oil Bean. The crude fat of African bean (1.60±0.02) in g/100g is far lower than that of African Oil bean (46.10±0.01) in g/100g. This shows that African Oil bean is an Oily seed. The Crude fibre of African bean (2.450±0.01) in g/100g is lower than that of African Oil bean (6.50±0.01) in g/100g recorded in this study. This indicates that the digestabiliy of African Oil bean is greater than African bean if they are well prepared for meal. The crude protein of African bean (20.300±0.01) in g/100g is a little lower than that of African Oil bean (22.575±0.01) in g/100g. but however, the African bean could still be compared as a good source of protein compared to other legumes. The carbohydrates of the African bean (62.600±0.01) in g/100g is greater than the African Oil bean (8.125±0.01) in g/100g. Since the carbohydrates content of African Bean is greater than both values reported for African oil bean in this work, it depicts that African bean has higher calorific values than African oil bean when consumed as food. The Phytate of African bean (0.433±0.01) in g/100g is lower than that 0f African Oil bean (1.174±0.01) in g/100g, while both have very close values for Oxalate, African bean (1.582±0.01) in g/100g and African Oil bean (1.394±0.01) in g/100g . The Alkaloid content of African bean (6.400±0.01) in g/100g, saponin (1.960±0.01) in g/100g and Tannin (0.350±0.02) in g/100 g are lower than that of Afican Oil bean Alkaloid (11.240±0.01) ing/100g, Saponin (3.200±0.01) in g/100g and Tannin (0.950±0.02) in g/100g. These also indicates that the believe postulated for the toxic nature of African bean is not true due to the fact that most of the Phytochemical analyzed for both samples revealed African oil bean, which is mainly consumed is higher than African bean. The ascorbic acid composition of African Oil bean (67.941±0.01) in mg/100g is higher than that of African bean (52.017±0.001) in mg/100g. It reveals that the anti-oxidant level in terms of ascorbic acid content is

more in the African Oil bean than African bean. The mineral composition 0f both samples in mg/kg from the results revealed that African oil bean has the values of Na (457.00) in mg/kg, K (8700.00) in mg /kg, Mg (6100.00) in mg /kg, Fe (72.00) in mg /kg, Ca (64.00) in mg/kg and Mn (45.00) in mg/kg are higher than that of African bean *(Anthontha mavrophylla)*, Na (240.00) in mg/kg, K (178.50) in mg/kg, Mn (1075.00) in mg/kg, Fe (19.00) in mg/kg, Ca (35.00) in mg/kg, Mn (13.00) in mg/kg. However Zinc value in African Bean (71.00) in mg/kg is higher than what was recorded in African oil bean (24.00) in mg/kg. High concentration of Copper was recorded in African bean (59.00) in mg/kg while the content in African oil bean was below the instrument detection limit. These show that the mineral quality of African oil bean could be consumed better than that of African bean.

Table 1: Nutritional Composition of Opagha bean and African oil bean

Parameters	Sample A	Sample B
%Moisture content	9.500±0.01	13.250±0.01
%Ash content	3.550±0.01	2.700±0.01
%Crude fat	1.600±0.02	46.100±0.01
%Crude fibre	2.450±0.01	6.500±0.01
%Crude protein	20.300±0.01	22.575±0.01
%Carbohydrates	62.600±0.01	8.125±0.01
Ascorbic acid(mg/100g)	52.017±0.01	67.941±0.01

±Mean values of duplicate analysis

Note: **Sample A**= African Bean. **Sample B**= African Oil bea

Table 2: Phytochemical Composition of African bean and African oil bean

Parameters (g/100g)	Sample A	Sample B
Phytate	0.433±0.01	1.174 ±0.01
Oxalate	1.582±0.01	1.387 ±0.01
Alkaloid	6.400±0.01	11.240 ±0.01
Saponin	1.960±0.01	3.200 ±0.01
Tannin	0.350±0.01	0.950 ±0.02

±Mean values of duplicate analysis

Note: **Sample A**= African Bean. **Sample B**= African Oil bea

Table 3: Mineral Composition of African bean and African oil bean

Mineral	Sample A	Sample B
Sodium (Na)	241.000	457.000
Potassium (K)	178.500	8700.000
Magnesium (Mg)	1075.000	6100.000
Iron (Fe)	19.000	72.000
Calcium (Ca)	35.000	64.000
Manganess (Mn)	13.000	45.000
Copper (Cu)	59.000	N D
Zinc (Zn)	71.000	24.000

(mg/kg)=Unit in milligram/kilogram N D= Not detected

Note: **Sample A**= African Bean. **Sample B**= African Oil bea

Conclusion

The proximate composition in table 1 for African bean (*Anthonotha bacrophylla*) and African Oil Bean (*Pentaclethra macrophylla benth*) reveal their nutritional values. African oil bean (*Pentaclethra macrophylla benth*) and African bean (*Anthonotha Macrophylla*) are good source of protein due to high protein content recorded in this study. In addition, African oil bean has high percentage of crude fat which can be employed in soap making or probably test for its biofuel efficiency. The carbohydrates content of African bean is very high, which shows that it

has a higher calorific value than African oil bean. The Phytochemical parameters in table 2 (phytate, oxalate, saponin and tannin) are not too high beyond human consumption for the two beans, but they must be properly cooked to reduce the alkaloid level. The mineral composition in table 3 of both samples are good compliment for a good diet, though that of African oil bean is valuable in this respect. From the result of this study, It could be stated that African bean (*Anthonotha macroohylla*) can be used for feeding both human and animals. African bean has very high percentage of carbohydrates, which reveals its high calorific value than African oil bean, this show that after proper fermentation, it can be utilized as food. The phytochemical parameters of African bean according to this study are lower than that of African oil bean, which is commonly consumed as food.

References

[1]. Edioga and Gomina (2000), The medicinal values and chemical composition of some bean seeds: J Food Sci Vol 66,288-290.

[2]. Achinewhu S.C. (1982), Composition and food potential of African oil bean (Pentaclethra macrophylla benth) and velvet bean (Mucuna urines). J. Nutri. Sci. p 23-31.

[3]. Elias I G, De Fernadex D G, Bressani R J (1979). Possible effect of seed coat polyphenolics on the nutritional quality of bean protein. J Food Sci 44, 524-527.

[4]. Craig, W.J. (1999), Health-promoting properties of common herbs. Am J Clin Nutr. 70:491S 499S.

[5]. Bressani R., Elias L G., Braham J E (1982). Reduction of digestibility of Legume protein by tannins. J Plant foods 4, 125-126.

[6]. Oakenful, D. and Sidhu, G.S. (1989) Saponins In toxicants of plant origin. Vol 11(Cheelcep Red). Acad. Press, New York, pp 178.

[7]. Achinewhu S.C. (1986), Effect of fermentation on thiamine, riboflavin and niacin of oil bean seed. J. Food sci / 49:1736-1737.

[8]. Oke, O.L. (1968). Cassava as food in Nigeria. World Rev. Nutri Dietetics, 9, 227- 237.

[9]. Jensen G. R. (1970). Amino acid supplementation and the world food problem. In evaluation of novel protein products, London, press p 201.

[10]. Kelly, J. F. (1975). Increasing protein quality. In: Nutritional improvement of food legume breeding, milliner, M.(ed). Proceedings of a symposium sponsored by the protein Adversary group, United Nations Systems, held at the FAO, Rome, Italy in 1972. John Wiley and sons, New York, pp. 184.

[11]. Parpia H. Sro (1965). Protein Food for less developed countries. In pro 2nd edition Inst. Cong. Fd Sci and Tech, Warsaw, Poland, pp 23.

[12]. Haslam E. (1983). The biochemistry of plants. Vol. 17, Academic Press Inc. pp 527-530.