The Pharmaceutical and Chemical Journal, 2022, 9(6):1-7

Available online www.tpcj.org

Research Article

ISSN: 2349-7092
CODEN(USA): PCJHBA

Nutrient and anti-nutrient components of Pterygota macrocarpa seed (k. schum.)

***Oguntokun Michael Ogunmola[1], Nwaokobia Kingsley[2], Ohwofadjeke Ogheneochuko Paul[3], Oguntokun Esther Adeola[4], Samuel Theresa Aina[5]**

[1]Department of Animal Production and Health (Nutrition Laboratory), Federal University of Technology, Akure, Ondo state, Nigeria
[2]Department of Agricultural Engineering, Delta State University of Science and Technology, Ozoro, Delta State (DSUST), Nigeria
[3]Department of Agricultural Engineering, Delta State University of Science and Technology, Ozoro, Delta State (DSUST), Nigeria
[4]Department of Biochemistry. Federal University of Technology, Akure, Ondo state, Nigeria
[5]Department of Food Technology, Federal Polytechnic, Auchi, Edo state, Nigeria
Email Address: mooguntokun@gmail.com (O. Michael Ogunmola)

Abstract Proximate analysis, mineral composition and some toxic substance of (Pterygota macrocarpa) seed flour were determined using standard methods. The dried samples contained, on average 10.81g/100g Crude Protein (CP), 74.73g/100g ether extract (EE), 7.58g/100g Crude Fibre (CF), 1.57g/100g Ash and 96.33g/100g Dry Matter (DM). Potassium, sodium, calcium and phosphorus were the most abundant minerals in the dry sample with mean value of 13.03, 25.88, 6.50, 26.06 and 475.96g/100g respectively, and very low in iron and manganese (1.22 and 1.61mg/100g respectively). Three toxic substances were determined: phytic acid was 156.8mg/100g, tannin 73.3mg/100g and Oxalate 5.45mg/100g. Conclusively; the Pterygota macrocarpa seed flour can therefore be useful in chemical industries for synthesis(production) of other chemicals and can also be a good ingredient for animal feed production.

Keywords: Kernel, proximate, raw, cooked

Introduction

Pterygota macrocarpa and Cola gigantea are African medicinal plants used in traditional medicine for the treatment of sores, skin infections, and other inflammatory conditions including pains (Christian et al, 2012). It is grey, smooth both in and out, Flowering branchlets ± 5 mm diameter, glabrous, lacking conspicuous lenticels. This plant appears to be widespread and common, and its habitat not significantly threatened as far as is known.

Pterygota macrocarpa belong to the family of mimosaceae. The plant grows along the lowland rain forest zone of tropical Africa. Keay, et al (1989) gave the common name of the plant as "oporoporo", (Yoruba). The plant grows to a large size, of about 40m in height and 4m in width and the seeds in pod ranging from 8-13cm in length and 3-5.5cm wide. The trunk diameter attains 70 to 130 cm. When matured and dry, the pod delusces by explosion mechanism with the values curling outwards to expose the seed. The seed is brown in color. Smooth in texture and

flat shaped. The soaked leaves are used to treat stomachache, pains, and disorders of digestion. Leaf decoctions are used for the treatment of gonorrhea and other urinary tract infections [12–14]. Traditionally, the bark is used in the management of haemorrhoids, dropsy, swellings, edema, gout, leprosy, and pain (keay, 1995). The tree also has local medicinal uses. It is sometimes retained as a shade tree in cacao plantations and has been grown as a timber crop in plantations.

Pterygota Macrocarpa is used for the treatment, control, prevention, & improvement of the following diseases, conditions and symptoms: (Tabletwise, 2022)

- Stomachache
- Pain
- Disorders of digestion
- Gonorrhea
- Urinary tract infections
- Dropsy
- Swellings
- Edema
- Gout

There are a lot of promising species of legumes ready to be used for research, but there is so much dependency on very few species because less than 2% out of these thousands are used very well (Adeparusi, 1998). In many developing countries of the world, development and sustainable growth are serious problems associated with high population growth rates, limited and rapidly diminishing land for food and forage production, etc. These create the need for higher agricultural production and research into full potential of several species of local agricultural crops that abound in such countries but are underutilized.

This work gives information on the proximate composition, mineral content and toxic substances determination of Pterygota macrocarpa seed (nutrient and anti-nutrient components) with the hope that it will further enhance the knowledge of the nutritional value of the seed.

Materials and Methods

Seeds of Pterygota macrocarpa were collected from the Akure forest, located in Akure South local government area of Ondo state, Nigeria. They were thoroughly washed with distilled water and oven dried at 50°C for 72 hours. After which, the seeds were de-shelled manually, dried and ground into fine powder, using a Kenwood food grinder, model KW10, packaged in polythene bags and stored at 4°C until used.

Determination of the proximate constituents: crude protein and dry matter was carried out using standard procedures adopted from AOAC (1995) method and total carbohydrate was determined by difference. The trace and major minerals were determined after dry-ashing by using atomic absorption Spectrometer (Buck 210) model 200 (AOAC, 1995). Sodium and potassium were determined by flame photometric method (AOAC, 1985) using flame photometer (corning EEL model 100).

Moisture and Ash Content Determinations

Moisture content of the samples was determined by oven drying at 105ºC. The samples were ashed by depositing 5g of the grounded samples in a muffle furnace at 550ºC until a constant weight was gotten without any presence of black particles according to the standard of Association of Official Analytical Chemists (AOAC, 1990).

Crude Fat and Crude Fibre Determination

The sample used was grounded and the fat contents were obtained by taking 3g of the samples and extracted using a continuous extractor of the soxhlet with Petroleum spirit at 60ºC for about 4 hours. Crude fibers content was determined by taking a weight of 3g of the dry powered samples extracted with light petroleum. The extracted samples were dried using air, then treated under a standard condition using ether, boiling dilute NaOH, boiling dilute

H_2SO_4, dilute HCl, water and alcohol. Crude fiber was determined by heating the treated sample to ash using dull-red heat according to Pearson, 1976.

Determination of Some Mineral Components of the Seed

The mineral composition of the seed was determined by dry heating the sample to ash in a muffle furnace at 550ºC. The dry ash was dissolved in HCl (10%) and the resulted solutions were used to determine some minerals content of the sample using AAS (atomic absorption spectrophotometer - PYE Unicam sp 9). Sodium (Na) and Potassium (K) was determined using Flame photometer while phosphorous was determined using colorimetric method.

Saponific value was determined by adding alcoholic KOH solution to the sample and heated on a boiling water bath. Excess KOH was then titrated with HCl (0.5M) using phenolphthalein as indicator to assess the quantity of KOH used up in the process (AOAC, 1990).

Iodine value was estimated by using ion chromatography-inductively coupled plasma mass spectrometry (Li Lin et al, 2011).

The sample was evaluated in the dark by dissolving the samples in a mixture of diethyl ether and acetic acid, boiled and poured into a titration flask containing 5% KI, the content was then titrated with 0.002M sodium thiosulphate using starch indicator (Josyln, 1970). This was done to determine the Peroxide value of the sample.

The phytic acid content was determined by the method of Wheater and Ferrel (1971) while any tannin level was determined by Makkar and Goodchild (1996), Day and Underwood (1986) for oxalate.

Figure 1: Pterygota macrocarpa seed

Determined proximate constituents are presented in tables 1, 2 & 3 below

Table 1: Proximate composition of Pterygota macrocarpa g/100g DM

Component	Mean ±SD (g/100g)
Dry matter	96.33 ± 0.04
Protein	10.81 ± 0.28
Ether extract	74.73 ± 0.57
Crude fibre	7.58 ± 0.02
Ash	1.56 ± 0.02
Carbohydrate	1.64 ± 0.42

Table 2: Major and trace mineral components of Pterygota macrocarpa

Mineral's elements	Mean ±SD (g/100g)
Sodium	25.88 ± 0.06
Potassium	13.03± 0.16
Calcium	6.50 ± 0.05
Magnesium	24.06 ± 0.03
Phosphorus	475.96 ± 0.45
Iron	1.22 ± 0.02
Manganese	1.61 ± 0.06
Zinc	28.06 ± 0.03
Capper	ND
Lead	ND

ND = Not detected

Table 3: Toxic substances in Pterygota macrocarpa

Toxicant	Mean ±SD (g/100g)
Phytic acid	156.80 ± 0.47
Tannins	73.30 ± 0.02
Oxalate	5.57 ± 0.02

Statistical Analysis

All the experiments were carried out in triplicates and the mean ± standard deviation are reported.

Data were subjected to analysis of variance [ANOVA]. Significance of means differences were determined (Duncan). Significance was accepted at $P< 0.05$.

Result and Discussion

The proximate composition of pterygota, macrocarpa presented in table one shows that the protein content (10.81g/100g) is lower than the value reported in literature for African locust bean seed (24.10g/100g) (Adeyeye etc Al, 2002). However, 10.81g/100g protein content is high enough to contribute to the protein intake of those who might use this seed as alternative feed protein supplement.

The fat content (74.73g/100g) is also higher than the value reported for groundnut (40g/100g) by Salunkhe et al (1985). The higher fat content is an indication of its potential usefulness as a source of vegetable oil. Fats are essential in value in diet and increases the palatability of foods by absorbing and retaining flavours. They are also vital to the structural and biological functions of cells and transport nutritionally essential fat-soluble vitamins (Martin et al, 1981). The value of 7.58g/100g for crude fibre is quite high and has a far-reaching implication in human nutrition, as the consumption of dietary fiber lowers gastric cholesterol. Leed et al, (1978)

The dry matter recorded for the seed was higher 96.33g/100g than those reported for cowpea varieties (89.0-92.0g/100g) by Alwtor and Aladetimi (1989). The high dry matter is advantageous in that it helps in the enhancement of keeping the quality for a long time and thereby preventing microbial spoilage and pest attack during storage. The ash content of the seed 1.57g/100g is a reflection of the amount of minerals contained in the sample. Pterygota macrocarpa is this rich in minerals and could be particularly useful to pregnant and lactating women.

Analysis for the major and minor nutritionally valuable mineral constituents (Table 2) indicate that of the major minerals, CA, Mg, Na and K were the most abundant in pterygota macrocarpa seed while Pb and Cu were not detected among the trace minerals in *experimental samples (Pterygota macrocarpa seeds)*. The Values obtained for the minerals are lower when compared with other Nigerian food plants as reported by Achinewhu (1983).

Table 3 shows the levels of toxic substances in pterygota macrocarpa seeds. Phytic acid recorded their highest concentration of 156.8mg/100g, followed by Tannin 73.3g/100g, while oxidate was least 5.54mg/100g. The presence of toxic substances otherwise known as anti-nutritional factors are generally low when compared with the

values of some Nigerian food plants (Alwtor, 1990). The phytic acid content of 156.8mg/100g is lower than that reported for Dioclea reflexa seed 318.4mg/100g by Aiyesanmi and Oguntokun (1996), and other beans such as moth bean cultivars (852 to 899mg/100g) Santish and Chauhan (1986). This suggest that nutritive value of Pterygota macrocarpa seeds would be impaired to a comparative lesser extent.

Phytate that represents about 80% of the total phosphorus concentration is widely distributed in food grains, De Beland et al, (1975). It lowers the bio-availability of minerals and inhibits several proteolytic enzymes and amylase (Erdman, 1979, Desplaud, 1984).

The level of 73.3mg/100g tannin is low when compared with the level of tannin containing plants such as Fababeans (Marguardt and Ward, 1979) and sorghum (Price et al, 1979) which contains from 2 to 6% tannin.

Tannins are known to affect the digestibility of proteins, carbohydrates and fats and bio-availability of minerals (Santish and Chauhan, 1986).

The total oxalate of 5.54mg/100g fails within the range (1.7-6.5mg/100g) reported for some oil seeds (Victor and Olubunmi, 2003), and therefore safe for human consumption. However, the role of oxalate in reducing the availability of calcium and magnesium and the subsequent development of ricket when certain legumes and cereals are fed may be important (Alwtor and Adeogun, 1995)

In general, the investigation indicated that, compared with other common legume grains, Pterygota macrocarpa seeds contained considerably lesser concentration of the anti-nutritional factors measured. The seed when de-fatted could be used as an alternative source in livestock feed formulation and industrial purposes. The higher oil content of Pterygota macrocarpa seed suggests that oil can be extracted and put into various uses.

Conclusion

The following findings from this research on "Proximate analysis of Pterygota macrocarpa seeds" were made:

i. That the dried samples of Pterygota macrocarpa seeds contained average of 10.81g/100g Crude Protein (CP).
ii. The dried samples of Pterygota macrocarpa seeds contained 74.73g/100g ether extract (EE).
iii. The dried samples of Pterygota macrocarpa seeds contained 7.58g/100g Crude Fibre (CF).
iv. The dried samples of Pterygota macrocarpa seeds contained 1.57g/100g Ash and 96.33g/100g Dry Matter (DM).
v. In addition; the dried samples of Pterygota macrocarpa seeds contained abundant quantities of Potassium, sodium, calcium and phosphorus minerals in the dry sample with mean value of 13.03, 25.88, 6.50, 26.06 and 475.96g/100g respectively,
vi. The experimental samples of Pterygota macrocarpa seeds had very low iron and manganese (1.22 and 1.61mg/100g respectively).
vii. Lead and Cupper (Pb & Cu) were not detected among the trace minerals in the experimental samples (Pterygota macrocarpa seeds).
viii. Three toxic substances that were found in experimental samples (Pterygota macrocarpa seeds) are: phytic acid was 156.8mg/100g, tanin 73.3mg/100g and Oxalate 5.45mg/100g.

Conclusively; the Pterygota macrocarpa seed flour can therefore be useful in chemical industries for synthesis(production) of other chemicals and can also be a good ingredient for animal feed production.

Conflict of Interests

The authors have no conflict of interest to declare.

Acknowledgement

The authors wish to acknowledge the contributions of M.O. Oguntokun, Department of Animal Production and Health (Nutrition Laboratory) Federal University of Technology, Akure, Nigeria.

Reference

[1]. Achinewhu S.C, The saponific content of some Nigerian oil seeds plant foods Human nutrition. (1983) 33.3-9

[2]. Adeparusi, E.O, "African Yam Bean: Sphenostylis stenocarpa (Hochst ex. A. rich) Harms as a Dietary Source for Clarias gariepinus (BURCHELL, 1822)". Ph. D. Thesis, Department of Fisheries and Widelife, Federal University of Technology, Akure, Ondo State, Nigeria. (1998) 14.

[3]. Adeyeye E.I. Ipinmoroti, K.O and Oguntokun M.O, Chemical Combination and Functional Properties of the African Locust Bean (Parkia Biglobosa) seeds. Pak Journal of Science Industrial Research (1), (2002) 29-33

[4]. Aiyesanmi A.F and Oguntokun M.O, Nutrient composition of Dioclea reflexa seed – An underutilized edible legume. La nv' Ital Delle Sostanze Grasse- Vol. LXXIII, (1996) 521-523

[5]. Aletor, V.A and Adeogun, O.A, Nutrient and anti-nutrient component of some tropical leafy vegetables. Food chemistry 53: (1995). 375-379

[6]. Aletor V.A, Analytical report on anti-nutritional factors in some Nigerian feed stuffs, herbage by products, crops residues and browse plants. A monograph prepared for the presidential Task Force on Alternative Formulation of Livestock Feeds products Development. Quality Evaluation and Health Implications. Cabinet Office, Lagos, Nigeria (1990).

[7]. Aletor V.A and Aladetimi, O.O, Proximate composition of some underutilized Nigerian Legumes. Die Nahrung 33. 10, (1989) 999-1009

[8]. Association of Official Analytical Chemists (AOAC). Official Method of Analysis, 13th ed. Washington, D.C. (1990) 684.

[9]. Association of Official Analytical Chemists (AOAC), Official Method of Analysis. 15th Edition, Association of Official Analytical Chemistry, Washington DC (1995)

[10]. Christian Agyare, George Asumeng Koffuor, Vivian Etsiapa Boamah, Francis Adu, Kwesi Boadu Mensah, and Louis Adu-Amoah (2009): Antimicrobial and Anti-Inflammatory Activities of Pterygotamacrocarpa and Colagigantea (Sterculiaceae). Hindawi Publishing Corporation. Evidence-Based Complementary and Alternative Medicine. Volume 2012, Article ID 902394, 9 pages Doi:10.1155/2012/902394

[11]. De Beland, A.R, Farmer, G.B and O'Del, B.I, "Phytate in grains and oil seeds "Journal of Agric. Food Chemist 23, (1975): 1186.

[12]. Day, R.A (Jnr) and Underwood A.L, Qualitative Analysis, 5th Edition, pp. 701, Prentice-Hall Publication.

[13]. Desplaud S.S and Chevyan, M (1984): "Effects of phytic acid divalent cations and their interactions on amylase activity" Journal of Food Science. (1986): 49, 526

[14]. Erdman (Jnr), J.W, "Oil seed phytates Nutritional implications "Journal of American Oil Chemist. See (1979) 56, 736

[15]. Josyln, A.M. Methods in Food Analysis. Physical, Chemical and Instrumental Methods of Analysis, 2nd edn. Academic Press, New York, NY. (1970) 1-3.

[16]. Keay, R.W.J, Onochie, C.F.A and Stanfield D.P, A revised version of Nigerian Tress. Clavendon Press, Oxford (1989).

[17]. Ken Fern, Useful Tropical Plants Database 2022.

[18]. Leeds, A.R, Bolster, N.R, Andreea, R and Trust well, A.R, Meal Viscosity, gastric emptying the glucose absorption in rat Proceeding of the nutrition society of Nigeria. (1979) P 44.

[19]. Li Lin 1, Guang Chen, Yuhong Chen, Determination of iodine and its species in plant samples using ion chromatography-inductively coupled plasma mass spectrometry. Affiliation with 1China Food Quality Safety Supervision and Inspection Center, Beijing 100094, China. Linli77422@yahoo.com.cn (2011).

[20]. Markkar, R R and Ward, R.T, "Chick performance as affected by autoclave treatment of tannin-containing and tanning-free cultivars of faba beans" Can J. Anim Sci. (1979) 59, 871

[21]. Martin, D.W., Mayes, P.A and Roswell, V.W, "Harper's review of biochemistry" 18th edition Ls Altos, CA Large Medical Publications, (1981) 565-572

[22]. Salunkhe, D.K, Kadem, S.S and Chaven, J.K, CRC Post harvest Biotechnology of Food legume. CFC press Incorporation Boca Raton, FL. USA (1985)

[23]. Price, M.L, Stromberg, A.M and Bubbler, L.G, Tannin content as a function of grain maturity and drying condition in several varieties of sorghum bicolor L. Moench, Journal of Agric. Food Chemists (1979) 27, 1270

[24]. Santish, K and Chauhan, B.M, Anti-nutritional factors in Mothbean (Vigna aconitifolia): Varietal differences and effects of method of domestic processing and cooking" Journal of Food Science (1986) 51, 591-594

[25]. Victor, N Enujugha and Olubunmi, Ayodele-Oni, Evaluation of Nutrients and some anti-nutrients in lesser-known, underutilized oil seeds. International Journal of Food Science and Technology, (2003) 38, 1-4.