PROXIMATE AND PHYTOCHEMICAL COMPOSITION OF AFRICAN WALNUT *Plukenetia conophora* SEED AND LEAF: IMPLICATIONS FOR THEIR USE IN ANIMAL PRODUCTION

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Abstract
The study was conducted to assess the proximate and phytochemical composition of African walnut (*Plukenetia conophora*) seeds and leaves. The proximate analysis of the seeds and leaves revealed that the leaf has a higher values ($p< 0.05$) than the seeds in moisture content (26.20%), ash content (9.66%), and crude fiber (13.63%) while the seed recorded a higher yield in crude protein (22.09%) dry matter (50.48%) and Nitrogen free extract (45.27%). The phytochemical analysis of seed and leaf revealed that seed has a higher yield in tannins (0.80mg/g), saponins (1.08mg/g), flavonoids (0.02mg/g), glycosides (0.05mg/g) and reducing sugars (2.86mg/g) while the leaf recorded higher value in alkaloids (2.48mg/g), anthraquinones (0.14mg/g) and soluble carbohydrates (1.07mg/g).
The result of the study showed that *Plukenetia conophora* seed and leaf contained nutrients that are important for animal's body health. Thus, they could be recommended as non-conventional feed ingredient after due evaluation have been done.

Introduction
Plukenetia conophora(formerly *Tetracarpidium conophorum*) belongs to the Euphorbiaceae family and is found in southeastern Nigeria and southwestern Cameroon. *P. conophora* is a shrub that rises10-20 feet long, known in southern Nigeria as Ukpa (Igbo) and in western Nigeria as Awusa or Asala(Yoruba). It is known in northern Cameroon and western Cameroon as Kaso or Ngak (Onawumi *et al*., 2013). This plant is mainly grown for nuts, which are cooked and eaten as snacks. A bitter taste is usually observed in drinking water immediately after eating nuts. This could be attributed to the presence of chemicals such as alkaloids (Edem *et al*.,2009).Plants are powerful biochemists and have been components of plant medicines in ancient times; man is able to obtain from the man extraordinary selection of industrial chemicals. Natural components based on plants can be derived from any part of the plant, such as bark, leaves, flowers, roots, fruits, seeds, bulbs that any part of the plant can produce active components. In most reported works, underground parts of plants (roots, roots, bulbs, etc.) are widely used in comparison with other ground parts in the search for bioactive compounds with antimicrobial properties.
Nuts are rich in protein, carbohydrates, fat, oils, vitamins, minerals (Themeje *et al*., 2010). The seed is fat-rich, accounting for almost 80% of the polyunsaturated fatty acid that have proven cholesterol-lowering properties. Chauhan *et al.* (2004) reported that walnut extracts rich in omega-3 fatty acids in the diet are helpful in preventing certain diseases such as depression and dementia. Its bark and leaves are used in traditional medicine to reduce diarrhea and other diseases. In Nigeria, its seeds are reported to be used to treat male fertility (Ouya, 2013). The leaves extracts of *P. conophora* have shown good antibacterial activity, particularly against Gram-positive organisms (Ajaiyeoba and Fadare, 2006).
Several studies have been conducted on walnut seeds such as the determination of oxalate, phylates and tannin (Enujiugha and Ayodele, 2003). Walnuts plants helps prevent and control high blood pressure Despite its health and medicinal values (Wikipedia, 2008). P. *conophora* seeds and leaves are still included in the list of lesser known unconventional feed ingredients hence, this study was undertaken to discuss the nutritional, health and medicinal benefits of the African walnut (*Plukenetia conophora*). Though the leaves are generally available in Nigeria, there is paucity of information on the proximate and phytochemical compositions of the leaves in comparison with the seed within the locality covered in this report. Therefore, the objective of this work is to evaluate the proximate and secondary metabolites compositions of *P. conophora* seeds and leaf in order to ascertain its possible usefulness as feed additives and in feed formulation.

Experimental site

The experiment was carried out at the microbiology laboratory of the institute of Agricultural Research and Training (IAR&T) Moor plantation, Ibadan Oyo State

Collection of materials and processing

The leaves and the leaves of African Walnut used for this study were collected within the environments of Omi Ado town, Ibadan. The leaves were air dried for seven days and were blended into powdery form. The shell of the seeds were removed seeds were sundried for fourteen days after which it was ground into powdery form.

Chemical analysis

The samples were divided into two replicate each with 0.5g in each replicate. Samples were analyzed chemically according to the official method of analysis described by the Association of The Official Analytical Chemist (AOAC, 2005). All analysis were carried out in triplicate.

Proximate analysis

Moisture content was determined by drying to constant weight at 100-105°C in an oven, ash content by ignition at 550 °C in a muffle furnace for 4hr, oil content by sox let extraction with hexane as a solvent, protein by the Kjeldahl method, and crude fiber by the acid and alkaline digestive methods all described by AOAC (2005).

Phytochemical properties determination

Anti-nutritional properties determined were tannin, saponin, alkaloid, flavonoid, anthraquinones, and glycosides according to Harborne (1978).

The sample was mixed with 5ml of distilled water in a test tube and it was thoroughly mixed. The formation of stable foam was taken as an indication of the presence of saponin. The sample was mixed with 2ml of 1% of HCl and heated gently. Mayer and wagers reagents were added to the mixture. The turbidity of the resulting precipitate was taken as evidence of alkaloids.

Crude extracts were mixed with a fragment of magnesium ribbon and concentrated HCL was added dropwise. The pink scarlet colour appeared after a few minutes which indicated the presence of flavonoids.The crude extract was mixed with each 2ml of chloroform and 2ml of acetic acid. The mixture was cooled in iced. Carefully concentrated H_2SO_4 was added. Colour changes from violet to blue-green indicate the presence of glycosides.The crude extract was mixed with 2ml of 2% of the solution of $FeCl_3$. A blue-green or black coloration indicated the presence of tannins.

Results and discussion

The proximate composition of African Walnut (*P.conophora*) Seed and Leaf is shown in Table 1. The leaf recorded Higher ($P < 0.05$) percentage for Ash content (9.66). Crude fiber (13.63) and Crude fat (5.15) compare to that of the seed that had percentages of ash (5.3), crude fiber (3.08) and crude fat (4.18).

The moisture content of the leaf (19.96%) was not as much as the seed value (26.20%).This is contrary to the findings of Onawumi *et al*. (2013) who reported the moisture content of the leaf to be (29.00 %) while Edem *et al.* (2009) reported the moisture content of the seed to be (48.70%) which could be due difference in the processing method used .This implies that leaves could have more shelf life compared to the seeds. Seed recorded higher ($P < 0.05$) values for crude protein (22.09%) and nitrogen free extract (45.28%) than leaf with the value of 15.71% and 29.58% respectively. The crude fat value of leaf is higher that the seeds (5.15%) is slightly lower than that reported (6.21%) by Edem *et al.* (2009).This is in line with the report of Udedi *et al*. (2013) that African walnut seed is an energy rich food substance, because it is an excellent source of polyunsaturated fatty acids such as alpha linoleic acid and contains omega- 3- essential fatty acids. The result of this study showed that the seed of this plant is a rich source of protein, carbohydrate and fat. The leaf may also serve as non conventional feed ingredient because of the amount of protein, crude fat and fibre contents present, which are comparable to that of the seed. Hence, this findings shows that the *Plukenetia conophora* leaf may serve as non- conventional feed ingredient for animal production.

Table 1: Proximate Composition Analysis of African Walnut *(Plukenetiaconophora)*

Proximate Composition %	SEED	LEAF
Moisture content	$49.96^{a}\pm0.04$	$26.20^{b}\pm0.27$
Ash content	$5.38^{b}\pm0.07$	$9.66^{a}\pm0.02$
Crude Protein	$22.09^{a}\pm0.05$	$15.71^{b}\pm0.04$
Crude Fiber	$3.08^{b}\pm0.04$	$13.63^{a}\pm0.02$
Crude Fat	$4.18^{b}\pm0.01$	$5.15^{a}\pm0.01$
Dry matter	$50.48^{b}\pm 0.65$	$73.80^{a}\pm0.01$
NFE	$45.28^{a}\pm 0.02$	$29.58^{b}\pm0.01$

[ab] means along the same row with different superscripts are significantly different

The phytochemical analysis of African Walnut Seed and Leaf is shown in Table 2. The Leaf recorded highest value (mg/100g) in Alkaloids (1.03), Anthraquinones (0.14) and Soluble carbohydrates (1.07) compared to that of seed while Tannins (0.80), Saponins(1.08), Flavonoids (0.02). Glycosides (0.05) and Reducing sugars (2.86) are significantly higher in seed than that of leaf.

Table 2: Phytochemical properties of African Walnut (*Plukenetia conophora*)

Quantitative phytochemical Screening (mg/100g)	Seed	Leaf
Tannin	$0.80^{a}\pm0.01$	$0.56^{b}\pm 0.01$
Saponins	$1.08^{a}\pm0.01$	$1.03^{b}\pm 0.01$
Alkaloids	$0.90^{b}\pm 0.01$	$2.48^{a}\pm 0.01$
Flavonoids	$0.02^{a}\pm 0.01$	$0.01^{b}\pm 0.01$
Anthraquinones	$0.00^{b}\pm 0.01$	$0.14^{a}\pm 0.01$
Terpenoids	N.D	N.D
Glycosides	$0.05^{a}\pm 0.01$	$0.01^{b}\pm 0.01$
Hydrogen cyanides	ND	ND
Soluble carbohydrates	$1.04^{b}\pm 0.01$	$1.07^{a}\pm 0.01$
Reducing sugars	$2.86^{a}\pm0.01$	$1.74^{b}\pm 0.01$

[ab] means along the same row with different superscripts are significantly different (P<0,05)

Discussion

The result indicated that the seeds have the highest composition value(mg/100mg) in Saponin, Flavonoids, soluble Carbohydrates and Reducing sugars which are 1.08, 0.02, 0.05, 1.04 and 2.86 respectively. While leaf has high value in Tannins (0.56), Alkaloids (2.45), Anthraquinous (0.14) and Terpenoids and Hydrogen cyanides were not detected. The phytochemical analysis of *P.conophora* of seeds and leafs such as oxalates, phytates, tannins, saponins and alkaloids which partly shows the use of seed and leafs in herbal medicines. P.*conophora* can also be used as antibiotics, drugs and foods

The phytonutrients present in the seed and leaves as shown in Table 2 shows that leaves were rich in alkaloids, anthraquinones and soluble carbohydrates while seeds contain the highest composition value (mg/100mg) in Saponins, Flavonoids, soluble carbohydrates and Reducing sugars which are 1.08, 0.02, 0.05, 1.04 and 2.86 respectively while Terpenoids and Hydrogen cyanides were not detected. Alkaloids are the most efficient plant substances used therapeutically. Pure isolated alkaloids and the synthetic derivatives are used as the basic medicinal agent because of their analgesic, antispasmodic and bacterial properties. The presence of tannins in both seed and leaf support their strong use for healing of haemorrhoids, frost bite and varicose ulcers in herbal medicine.

Conclusion

Based on the study it can be concluded that African walnut seed is very rich in crude protein and crude fat and can be a potential source of useful for food. Also, the leaf may be used in herbal medicine for curative purposes due to the presence of alkaloids,

Recommendation

Further researches should be carried out to utilize the potentials of African walnut seed and leaf to livestock production

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