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Comparative Analysis of the Phytochemical and Nutrient Evaluation of the Seeds and Leaves of *Plukenetia conophora plant*

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ABSTRACT

Samples of Plukenetia conophora fresh seeds and fresh leaves were analysed for Proximate composition, secondary metabolites, Vitamins and Mineral constituents. The result of proximate analysis shows that the fresh seeds and leaves respectively contained 46.03±0.03% and 29±0.71% moisture, 4.28±0.01% and 5.63±0.08% fat, 7.34±0.71% and 14.92±0.04% fibre, 21.65±0.5% and 16.62±0.30% protein, 5.27±1.35% and 12.89±0.02% Ash, 18.10±0.01% and 20.94±0.01% carbohydrate. The phytochemical screening and subsequent quantification of the seed and leaves revealed the presence of tannin, 0.089±0.01mg/kg and 0.560±0.01mg/kg, alkaloid, 2.380±0.2mg/kg and 2.670±0.02, gallic acid, 0.024±0.01mg/kg and 0.180±0.02mg/kg. There was no traces of saponin and anthraquinones in the fresh seed, while flavonoids, cardiac glycosides, anthraquinones, ellagic acid and caffeinic acid were absent in both part of the plant samples. The mineral analysis revealed the constituents to be K, 6250±0.2mg/kg and 15937±0.02, Na, 4830±0.1mg/kg and 7980±0.01mg/kg, Ca, 4337.5±0.08mg/kg and 18700±0.02mg/kg, Mg, 1711.25±0.8mg/kg and 1766.25±0.1mg/kg, Fe, 110±0.04mg/kg and 4610±0.10mg/kg, Zn, 40.10±0.10mg/kg and 61.15±0.08mg/kg, Mn, 22.00±0.01mg/kg and79.50±0.03mg/kg, Cu, 16.45±0.03mg/kg and 8.60±0.10mg/kg for the fresh seed and leaves respectively.

Vitamin composition results showed that the fresh seed and leaves respectively contained Thiamine (B_1) 0.06±0.008µg/100g and 0.29±0.01µg/100g, Riboflavin (B_2) 0.02±0.008µg/100g and 0.34±0.01µg/100g, Niacin, 0.05±0.02µg/100g and 0.12±0.3µg/100g, Cyanocobalamin (B_{12}),0.12±0.1µg/100g and 0.23±0.03µg/100g. Ascorbic acid (C) 4.15±0.02mg/100g and 16.28±0.04mg/100g, tocopherol (E), 122.57±0.20µg/100g and 2.67±0.008µg/100g. The results proved that Plukenetia conophora fresh seeds and leaves can serve as foods and could also be potential sources of useful drugs formulation.

Key words: Plukenetia, conophora, phytochemical, nutrient,

INTRODUCTION

Plukenetia conophora , formerly called *Tetracarpidium conophorum (*family *Euphorbiaceae)* is found in Nigeria and Cameroon. It is a climbing shrub 10-20ft long, it is known in the Southern Nigeria as ukpa (Igbo), Western Nigeria as awusa or asala (Yoruba). It is found in Uyo, Akamkpa, Akpabuyo, Lagos, Kogi , Ajaawa-Ogbomoso and Ibadan. This plant is cultivated principally for the nuts which are cooked and consumed as snacks [20]. A bitter taste is usually observed upon drinking water immediately after eating the nuts. This could be attributed to the presence of chemical substances such as alkaloid. [3] reported the presence of oxalate, phylates and tannin in the raw *Tetracarpidium conophorum* nuts. [9] also reported the proximate composition, ascorbic acid and heavy metal contents of the nut. The work done by [25] revealed the presence of amino acid and fatty acid components of the nut and the use of its leaf juice for the treatment of prolonged and constant hiccups.

The impact of traditional processing on the nutrient and sensory qualities of the nut. the methods of processing the *Tetracarpidium conophorum* nuts [21], and in processing waste in livestock feed formulation have been reported. [10] compared the level of toxicant in the seeds of *Terminalia catappa* (Indian almond) and *Coula edulis* (African walnut). They also determined the lipid content of the fresh seed. [4] reported the phytochemical and nutrient evaluation of the *T.conophorum* root.

Though the nuts are generally eaten in Nigeria as snack not minding is medicinal properties. Some data are available on the phytochemical constituents of the seeds but the leaves are of little or not available. The objective of this work therefore is to compare and evaluate the secondary metabolites, proximate, mineral contents and vitamin compositions of *Plukenetia conophora* seeds and leaves in order to ascertain their possible usefulness as food and in formulation of drugs.

MATERIALS AND METHODS

Fresh seeds and leaves samples of study plant were collected at Oshu village in Oko area, Alagbayen farm, Surulere Local Government Area of Oyo State, Nigeria. The materials were washed, cut into small pieces to facilitate dryness, and air-dried for fourteen days. The dried samples were ground into fine powder and stored in an air tight bottle and stored in the desiccator prior to analysis.

Proximate analysis:

Moisture content was determined by drying to constant weight at 100-105^{o}C in an oven, ash content by ignition at 550^{o}C in a muffle furnace for 4hr, oil content by soxhlet extraction with hexane as solvent, protein by the kjeldahl method, and crude fibre by the acid and alkaline digestive methods all described by [15]. The carbohydrate content was estimated by difference, subtracting the sum of water, protein, fat, crude fibre and ash percentages from one hundred.

Phytochemical analysis:

The phytochemical screening was done on the sample using methods as described by [2, 27] Alkaloids were extracted using a slightly modified method of [17]. Here, the dried sample was homogenized and the alkaloid extracted from 10g of the sample for 4h using 20% v/v acetic acid in ethanol. The extract was filtered to remove cellulose debris and then concentrated to about one quarter of the original volume. One percent NH_4 OH was added drop wise until a precipitate occurred. The crude alkaloid was dried to constant weight in an oven and the percentage alkaloid calculated.

Mineral analysis:

The [2] method was used for the determination of minerals in the test sample. Calcium, sodium, potassium, magnesium were determined by flame photometric method while iron, zinc, manganese, copper and chromium were determined by atomic absorption spectrophotometric method.

Vitamin analysis:

The composition of the water-soluble vitamins such as thiamine (B1), riboflavin (B2), niacin (B3), cyanocobalamin (B12) were determined by the method of scalar analyzer (2000) While ascorbic acid (vitamin c) content was determined by the method of [2]. [5] was used for the determination of tannins, while saponin was analyzed using that of [26].

RESULTS AND DISCUSSION

Based on the results of the proximate composition of the seeds and leaves as shown in Table 1, the moisture content was much in the seed than the leaves which is an indication that the leaves could have longer shelf life than the seeds. The fat content in the leaves was higher (5.63 ±0.08%) than that of the seed and can be compared to the reported value by [9]. The higher ash content of the leaves is an indication of the presence of high inorganic materials than the seed. Leaves contained more nutrients than the seed except the protein content where the seeds have higher value but lower than the reported value [9].

The result for the mineral analysis (Table 2) shows that leaves of *Plukenetia conophora* plant contained higher values of minerals except copper that was higher in the seed. Both parts are good sources of important minerals that are useful to the human body. This result become so important when the usefulness of such minerals like Ca, Mg, Na, K in the body are considered and their usefulness in bone management. The presence of copper is responsible for the absorption of iron, it is therefore often seen with iron naturally. Copper is important for cellular defence and protection of the mucous membrane, antianaemic and essential for the formation of haemoglobin from iron [6]. Manganese is necessary for the functioning of the pituitary gland, the pineal gland and the brain, it promotes hepatorenal function, combat anaemia and also essential for growth.

The presence of zinc is an indication that the seed and leaves may have some effect on the nerve function and male fertility. It is important for normal sexual development, especially for the development of testes and ovaries, it is also essential for reproduction. Zinc stimulates the activity of vitamins, formation of red and white corpuscles [6], healthy functioning of the heart and normal growth [11].

The phytonutrients present in the seed and leaves as shown in Table 3 and 4, shows that leaves were rich in alkaloids, saponin, tannin and anthraquinones while seeds contained less alkaloids and traces of tannins, saponin and anthraquinones were absent in the seed. 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 [13].

PLATE 1.0: *P.CONOPHORA LEAVES AND* A POD OF THE NUT

PLATE 2: WALNUT SEEDS IN THE POD: SINGLE AND DOUBLE PODS

PLATE 2: WALNUT SEEDS RELEASED FROM THE POD

PLATE 3: WALNUT SEED RELEASED FROM THE SHELL

Table 5 shows the vitamin composition of both the seed and leaves. The seed contained higher amount of Vitamin E than the leaf, while the leaf contained higher amount of vitamin C than the seed (Both vitamins are antioxidants). Vitamin B groups are present in the leaf in trace amount yet more than that of the seed. Considering the importance of all these mentioned vitamins, vitamin C can be used for the treatment of common cold and other diseases like prostrate cancer [23, 24]. Higher amount of vitamin E in the seed supports the use of the seed in southern Nigeria ethnomedicine as a male fertility agent [1].

Other vitamins though in trace amount are essential for body metabolism. There is also an interesting ability of ascorbic acid as an antioxidant, to prevent or at least minimize the formation of carcinogenic substances from dietary material. Deficiency of ascorbic acid is associated with pains in the joint and defect in skeletal calcification, anaemia, manifestation of scurvy haemorrhage from mucous membrane of the mouth and gastrointestinal track [12].

CONCLUSION

The present study compared the phytochemicals, proximate, vitamins and minerals composition of *Plukenetia conophora (*African walnut) seeds and leaves. This partly shows that the leaf is also useful and important as the seed and can equally be used as food and drug in herbal medicine or drug formulation.

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RESULTS AND DISCUSSION

Table 1: Proximate composition of the fresh seeds and leaves of *Plukenetia conophora (Tetracarpidium conophorum)* plant

Component	Fresh seeds	Leaves	Literature Edem *et al*, 2009
Moisture content (%)	46.03±0.30	29±0.71	48.70
Crude Fat content (%)	4.28±0.01	5.63±0.08	6.21
Crude Protein content (%)	21.65±0.5	16.62±0.30	35.22
Crude Fibre content (%)	7.34±0.71	14.92±0.04	3.34
Ash content (%)	5.27±1.35	12.89±0.02	2.03
Carbohydrate content (%)	18.10±0.01	20.94±0.01	53.20
Total energy value (J)	197.52±2.13	200.91±1.96	409.57±0.5

Results are means (±SD) of three determinations

Table 2: Mineral compositions of the raw seeds and leaves of the *Plukenetia conophora* plant on a dry weight basis.

Mineral Mg/Kg	Fresh seeds Mg/kg	Leaves Mg/kg	Literature Tidjain *et al*, 2010
Potassium	6250.00±0.2	15937.00±0.02	12500.59±0.53
Sodium	4830.00±0.1	7980.00±0.01	1360.03±0.30
Calcium	4337.5±0.08	18700±0.02	6669.99±0.10
Magnesium	1711.25±0.8	1766.25±0.1	20999.65±0.65
Iron	110.00±0.04	4610.00±0.10	166.06±0.06
Zinc	40.10±0.10	61.15±0.08	110.84±0.79
Manganese	22.00±0.01	79.50±0.03	22.66±0.11
Copper	16.45±0.03	8.60±0.10	45.08±0.10

Results are means (±SD) of three determinations

Table 3: Phytochemical screening of the fresh seeds and leaves of *Plukenetia conophora* plant

Constituent	Fresh seeds	Leaves	Literature (Ajaiyeoba and Fadare,2006)
Alkaloids	+++	+++	++
Flavonoids	-ve	-ve	-ve
Cardiac glycosides	-ve	-ve	-ve
Saponins	-ve	+++	++
Tannins	+++	++	++
Anthraquinones	-ve	+	+
Gallic acid	+	++	-ve
Ellagic acid	-ve	-ve	-ve
Caffeic acid	-ve	-ve	-ve

KEY: -ve= absent

+ = present in a minute amount

++ = present in a moderate amount

+++ = present in an appreciable amount

Table 4: Quantitative estimates of secondary metabolites present in the fresh seeds and leaves of the *Plukenetia conophora* plant

Constituent	Fresh seed	Leaves	Literature Nwaoguikpe *et al*, 2012.
Alkaloids	2.380±0.2	2.670±0.02	0.41±0.01
Flavonoids	0.000	0.000	2.70±0.1
Cardiac glycosides	0.000	0.000	0.000
Saponins	0.000	1.080±0.01	5.03±0.01
Tannins	0.089±0.01	0.560±0.01	0.51±0.2
Anthraquinones	0.000	0.130±0.01	-
Gallic acid	0.024±0.01	0.180±0.02	-
Ellagic acid	0.000	0.000	-
Caffeinic acid	0.000	0.000	-

Results are means (±SD) of three determinations

Table 5: Vitamin compositions of the fresh seeds and leaves of *Plukenetia conophora* plant on a dry weight basis

Vitamin	Fresh seeds	Leaves	Literature Nwaoguikpe *et al*,2012
Ascorbic acid (C) mg/100g	4.15±0.02	16.28±0.04	17.57±0.02
Tocopherol (E) µg/100g	122.57±0.20	2.67±0.008	0.27±0.02
Thiamine (B_1) µg/100g	0.06±0.008	0.29±0.01	0.12±0.01
Riboflavin(B_2) µg/100g	0.02±0.008	0.34±0.01	0.13±0.01
Niacin (B_3) µg/100g	0.05±0.02	0.12±0.3	2.91±0.10
Pantothenic acid (B_5) µg/100g	0.00	0.00	-
Pyridoxine(B_6) µg/100g	0.00	0.00	-
Folic acid (B_9) µg/100g	0.00	0.00	-
Cyanocobalamin (B_{12}) µg/100g	0.12±0.1	0.23±0.03	-

Results are means (±SD) of three determinations