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Chemical evaluation and nutritive values of African walnut leaf (*Plukenetia conophora* Mull.arg.)

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ABSTRACT

Sample of *Plukenetia conophora* leaf (African walnut) was analysed for Proximate composition, secondary metabolites, vitamins and mineral constituents. The result of proximate analysis shows that the leaf contained 29±0.71% moisture, 5.63±0.08% fat, 14.92±0.04% fibre, 16.62±0.30% protein, 12.89±0.02% Ash and 20.94±0.01% carbohydrate. The secondary metabolites screening and subsequent quantification revealed the presence of bioactive compounds such as tannin which is 0.560±0.01mg/kg, alkaloids, 2.670±0.02mg/kg, saponin, 1.080±0.01mg/kg and anthraquinones, 0.130±mg/kg. The mineral analysis revealed the presence of K which is 15937±0.02mg/kg, Na, 7980±0.01mg/kg, Ca, 18700±0.02mg/kg, Mg, 1766.25±0.1mg/kg, Fe, 4610±0.10mg/kg, Zn, 61.15±0.08mg/kg, Mn, 79.50±0.03mg/kg and Cu, 8.60±0.10mg/kg. Vitamin composition results showed that the leaf contained Thiamine (B_1) 0.29±0.01µg/100g, Ascorbic acid (C) 16.28mg/100g, Riboflavin (B_2) 0.34±0.01µg/g, Niacin, 0.12±0.3µg/1 00g and Cyanocobalamin (B_{12}), 0.23±0.03µg/100g. The results proved that *Plukenetia conophora* leaf is a food and could be a potential source of useful drug formulation.

Keywords: *Plukenetia conophora, Coula edulis,* Phytochemical, Nutrient, Leaf.

1. Introduction

Plukenetia conophora (*Formerly called Tetracarpidium conophorum*) belong to the family of *Euphorbiaceae* and is found in South east and South west Nigeria and Cameroon.

P. conophora is a climbing shrub 10-20 ft long, it is known in the Southern Nigeria as ukpa (Igbo), Western Nigeria as awusa or asala (Yoruba). It is known in the littoral and the Western Cameroon as *kaso or ngak* [1].

This plant is cultivated principally for the nuts which are cooked and consumed as snacks [2]. It is contained in a pod which may house; one shelled nut (single), two shelled nut (double) and three shelled nut. The walnut shells could be black or brown from the plant. The nut is whitish upon cracking from the shell. The nut has a thin layer in between two halves (when a nut is divided into two equal parts) of nut. 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 alkaloids [2, 3].

Several works had been done on the walnut seed such as the determination of oxalate, phylates and tannin [4]. The proximate composition, ascorbic acid and heavy metal contents of the nuts[5]. Amino acid and fatty acid compositions of the nut and the use of its leaf juice for the treatment of prolonged and constant hiccups and the methods of processing the *P. conophora* nuts has also been reported [6, 7]. Walnuts plants are considered to be herbs in traditional Chinese medicine. They are said to tonify kidneys, strengthen the back and knees, and moisten the intestines. It is believed to stop asthma and is prescribed to be taken between bouts of asthma, but not for acute asthma. It is used for elderly as a constipation cure and the bark is used as tea for laxative and chewed for toothache, it also helps to prevent and control high blood pressure [8]. Though the leaves are generally available in Nigeria, much work has not been reported on the proximate, vitamins and phytochemical compositions of the leaves within the locality and state covered in this report. Therefore, the objective of this work is to evaluate the proximate, mineral, vitamin and secondary metabolites compositions of *Plukenetia conophora leaf in order to ascertain* its possible usefulness as food and in formulation of drug.

2. Materials and Methods:

The leaves used for this study were collected at Oshu village in Oko area, Alagbayen farm, Surulere Local Government Area, Oyo State, Nigeria. The leaves were thoroughly washed and dried under room temperature for fourteen days before blended into powder and stored in an air tight bottle prior to analysis.

2.1 Proximate Analysis:

Moisture content was determined by drying to constant weight at 60-80 ^{o}C in an oven. Ash content was determined by ignition at 550^{o}C in a muffle furnace for 4hr, oil content was determined by using soxhlet extraction with n- hexane as solvent, protein by the kjeldahl method, and crude fibre by the acid and alkaline digestive methods. The carbohydrate content was estimated by difference, by subtracting the sum of moisture, protein, fat, crude fibre and ash percentages from one hundred [9].

2.2 Phytochemical analysis:

The phytochemical screening was done on the sample using methods as described by Ajaiyeoba *et al*., [10]. Alkaloids were extracted using a slightly modified method [11].

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 wisely until a precipitate occurred. The crude alkaloid was dried to constant weight in an oven and the percentage alkaloid calculated.

2.3 Mineral Analysis:

The AOAC 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 (AAS) [9].

2.4 Vitamin Analysis:

The composition of the water-soluble vitamins such as thiamine (B_1), riboflavin (B_2), niacin (B_3), cyanocobalamin (B_{12}) and ascorbic acid (vitamin C) content were determined by the method of AOAC [9].

The Bohmand Kocipai-Abyazan method [12] was used for the determination of tannins, while saponin was analyzed using that of Peng and Kobayasli method [13].

Table 1: Proximate analysis of the *Plukenetia conophora* leaves

Parameter	Composition (%)	Literature
Moisture content	29±0.71	48.70
Crude Fat content	5.63±0.08	6.21
Crude Protein content	16.62±0.30	35.22
Crude Fibre content	14.92± 0.04	3.34
Ash content	12.89±0.02	2.03
Carbohydrate content	20.94±0.01	53.20

Values are means (±SD) of triplicate determinations
*Literature [5]

3. Results and Discussion

Based on the results of the proximate composition of the leaf as shown in Table 1, the moisture content (29%) was not as much as the seed value (48.70) as reported by Edem *et al* [5]. The crude fat content value (5.63%) slightly lower than that reported (6.21%) by Edem *et al* [5]. The leaf may serve as food because of the amount of protein content (16.62%) present, crude fat and fibre contents which are comparable to that of the seed reported (26.3%) by Stevens [14].

Table 2: Mineral composition of the leaves on a dry weight basis

Mineral	Concentration (mg/kg)	Literature*
Potassium	15937.00±0.02	12500.59±0.53
Sodium	7980.00±0.01	1360.03±0.30
Calcium	18700.00±0.02	6669.99±0.10
Magnesium	1766.25±0.1±0.65	20999.65±0.65
Iron	4610.00±0.10	166.06±0.06
Zinc	61.15±0.08	110.84±0.79
Manganese	79.50±0.03	22.66±0.11
Copper	8.60±0.10	45.08±0.10

Values are means (±SD) of three determinations.
Literature [27]

Fig 1: Walnut leaves with the pod which enclosed the nut

Table 3: Phytochemical screening of the leaves

Constituent	Bioassay
Alkaloids	+++
Flavonoids	-ve
Cardiac glycosides	-ve
Saponin	++
Tannins	+
Anthraquinones	++

Key:
-ve = absent
\+ = present in a minute amount
++ = present in a moderate amount
+++ = present in an appreciable amount

Table 4: The amount of secondary metabolites present in the leaf

Constituent	Quantity w/w (mg/kg)	Literature*
Alkaloids	2.670±0.02	0.41±0.01
Flavonoids	ND	-
Cardiac glycosides	ND	-
Saponins	1.080±0.01	5.03±0.01
Tannins	0.560±0.01	0.51±0.2
Anthraquinones	0.130±0.01	-

Values are means (±SD) of three determinations.
ND=Not detected
*Literature [15]

Table 5: Vitamin compositions of the leaf on a dry weight basis

Vitamin	Amount	Literature*
Ascorbic acid (C) mg/100g	16.28±0.04	17.57±0.02
Tocopherol (E) µg/100g	2.67±0.008	0.27±0.02
Thiamine (B1) µg/100g	0.29±0.01	0.12±0.01
Riboflavin (B2) µg/100g	0.34±0.01	0.13±0.01
Niacin (B3) µg/100g	0.12±0.3	2.91±0.10
Pantothenic acid (B5) µg/100g	ND	-
Pyridoxine (B6) µg/100g	ND	-
Folic acid (B9) µg/100g	ND	-
Cyanocobalamin (B12) µg/100g	0.23±0.03	-

Values are means (±SD) of three determinations.
ND=Not detected
*Literature [15]

Table 2**:** Shows the result for the mineral analysis of the leaf of *P. conophora which* indicates that the leaf is a good source of potassium, sodium, magnesium and calcium, these elements are very useful to mankind in bone managements. Manganese is used in the management of diabetes [5]. It can be seen from table 3 that the leaf was rich in alkaloids, while tannins and saponins were present in minute quantity. The most abundant secondary metabolites present in the leaf are the alkaloids while others were in trace amount (Table 4).

From table 5, it can be deduced that the leaf was rich in vitamin C, E, B_1 and B_2 (16.28±0.04, 2.67±0.008, 0.29±0.01, 0.34±0.01) respectively compare with the values of *P. conophora* seed (17.57±0.02, 0.27±0.02, 0.12±0.01,0.13±0.01) reported by Nwaoguikpe *et al* [15]. As a result of the presence of ascorbic acid in the leaf, the plant can be used in herbal medicine for the treatment of skin conditions, including eczema, pruritus, psoriasis and parasitic skin conditions [16]. It can also be used for the treatment of common cold and other diseases like prostrate cancer [17, 18]. 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 [19]. The presence of vitamin E in the leaf supports its use in southern Nigeria ethnomedicine as a male fertility agent [20].

The presence of other vitamins, though in trace amount are also essential for body metabolism. Walnut is used in treatment of indigestion, constipation and diarrhoea [21]. The leaf is a good source of vitamins, especially the B group. 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 [22]. The presence of tannins in the leaf of the *P. conophora plant* can support its strong use for healing of haemorrhoids, frost bite and varicose ulcers in herbal medicine [23, 24]. The result of mineral compositions clearly shows that *P. conophora* leaf contains rich source of mineral elements. The presence of copper may be 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, anti-anaemic and essential for the formation of haemoglobin from iron [25].

The presence of manganese shows that the plant can be used to protect bone disease. The activity of this element is noticed in the metabolism of food incorporated into the bone.

According to Claude and Paule [25], 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 leaf 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 and healthy functioning of the heart and normal growth [25, 26].

4. Conclusion*:*

The present study has shown the proximate, vitamins, minerals and secondary metabolites compositions of *Plukenetia conophora* (African walnut) leaf. The study has shown that the leaf may be used in herbal medicine for curative purposes as being claimed in some traditional quarters because of the presence of alkaloids, coupled with the presence of the essential vitamins and minerals. *P. conophora* can also be seen as a potential source of useful food and drugs.

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