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Comparative studies of the phytochemical and proximate analysis; mineral and vitamin compositions of the root and leaf extracts of *Tetracarpidium conophorum*

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ABSTRACT

Samples of *Tetracarpidium conophorum* root and leaf were analyzed for phytochemical and proximate compositions, vitamin and mineral constituents. The phytochemical analysis indicated that tannins, alkaloids and saponins were present in both the root and leaf extracts. Also present were oxalates, phenols, flavonoids and gallic acid. Cardiac glycosides, anthraquinones, ellagic acid and caffeinic acid were absent in both the root and leaf extracts. The proximate analysis revealed the presence (%) of moisture (41.02 leaf, and 43.10 root), protein (18.11 leaf, 20.64 root), carbohydrate (19.41 leaf, 18.92 root), fat (34.13 leaf, 32.22 root), fibre (5.63 leaf, 7.43 root), ash (5.37 leaf, 5.92 root). The mineral analysis revealed, K (6614.00mg/kg root, 5920.42mg/kg leaf), Mg (1621.45mg/kg root, 1553.10mg/kg leaf), Na (4340mg/kg root, 4316.29mg/kg leaf), Ca (4331.20mg/kg root, 4341.22mg/kg leaf), Fe (121.01mg/kg root, 126.04mg/kg leaf), Cu (32.40mg/kg root, 36.22mg/kg leaf), Zn (60.440mg/kg root, 51.55mg/kg leaf), Mn (22.49mg/kg root, 29.50mg/kg leaf), Co (1.03mg/kg root, 0.93mg/kg leaf). The vitamin composition indicated the presence of ascorbic acid (4.33µg/100g root, 4.28µg/100g leaf), thiamine (B₁) – (0.58µg/100g root, 0.63µg/100g leaf), riboflavin (B₂) – (0.03µg/100g root, 0.02µg/100g leaf), niacin (0.06µg/100g root, 0.05 µg/100g leaf), cyanocobalamin (B₁₂) – (0.22µg/100g root, 0.16µg/100g leaf). These results indicate that *Tetracarpidium conophorum* root and leaf contain nutrients and minerals which may be very useful nutritionally. The presence of some phytochemicals including alkaloids, phenols, saponins, flavonoids and gallic acids establish the pharmacological basis of the therapeutic applications of this plant in traditional medicine and as potential source of drug formulation.

Key words: *Tetracarpidium conophorum*, phytochemical, proximate, root, leaf, vitamin and mineral.

INTRODUCTION

Medicinal plants and indeed herbal medicine is the oldest form of health care known to mankind. From antiquity, the primitive man observed and appreciated the great diversity of plants available to him; the plants among other things principally provided food, clothing, shelter, and medicine [1]. A medicinal plant is defined as any plant which in one or more of its organs contains substances that can be used for therapeutic purposes or which are precursors for the synthesis of useful drugs [2]. Herbs contain a variety of chemical substances that are pharmacologically active [3]. Traditional medicine, being the oldest form of healthcare known throughout history of mankind uses herbs [4]. However, due to resistance many of the drugs that were previously effective are now obsolete, and therefore necessitates research and development in alternative and herbal medicine.

Tetracarpidium conophorum is a climbing shrub grown in southern Nigeria and western Cameroon for its leaf, root and nut. Ayodele [5], reported the presence of oxalates, phytates and tannins in the raw *Tetracarpidium conophorum* nuts. Edem [6] reported on the proximate composition, ascorbic acid and heavy metal contents of the nut. Oyenuga [7], reported on the amino acid and fatty acid components of the nuts and the use of its leaf juice for the treatment of prolonged and constant hiccups. The effects of different methods of extraction of the walnut seeds on phytochemical constituents and on antimicrobial activities was reported by Malu *et al* [8]. The root of walnut was reported to be a potential source of useful drug formulation due to the fact that it contains important bioactive components [9]. The present work focuses on the comparative evaluation of the phytochemical composition, proximate analysis, mineral and vitamin contents of the root and leaf extract of *Tetracarpidium conophorum*. This will help in ascertaining the usefulness of this plant in drug formulation and as a useful medicinal plant.

MATERIALS AND METHODS

The leaf and root samples of *Tetracarpidium conophorum* were harvested from Ikot – Nakanda village in Akpabuyo Local government Area of Cross River State, Nigeria and was authenticated by taxonomist from Botany department of the University of Calabar. The fresh leaves and roots of *Tetracarpidium conophorum* were washed free of dirt and debris and shade dried for two weeks. The dried samples of the root and leaf were crushed into powder and extracted using methods described previously by Sofowara and Olaniyi [10] and Udia *et al* [11]. The resulting dried extract was labeled and stored in the refrigerator at 40°C for use throughout the study.

The phytochemical analysis was done using the methods described by Sofowara [2], and AOAC [12]. Alkaloid was extracted using slightly modified method of Maxwell *et al* [13]. The proximate analysis was done using the procedure of Association of Official Analytical chemist AOAC [12]. The mineral composition of sodium, calcium, potassium and magnesium were determined using flame photometric method while iron, manganese, zinc, copper and cobalt were determined using atomic absorption spectrophotometric method. The vitamin composition was determined using method of AOAC [12].

RESULTS AND DISCUSSION

TABLE 1: Proximate analysis in% (percentage)

Constituents	Leaf extract	Root extract
Moisture	41.02	43.10
Protein	18.11	20.64
Carbohydrate	19.41	18.92
Fat	34.13	32.22
Fiber	05.63	07.43
Ash	05.37	05.92

Tetracarpidium conophorum leaf and root contains moisture, protein, carbohydrate, fat, fiber and ash although in variable proportions (Table 1). The results indicates that the root extract contains more moisture, protein, fiber and ash contents but with lower fat content when compared with the leaf extract. The moisture content in the root and leaf of *Tetracarpidium conophorum* were moderate (leaf 41.02% and root 43.1%). Water is the major part of the body cells. It helps to cushion and lubricate the brain and the joints and also helps to transport nutrients and waste as well as regulation of body temperature and blood pressure.

The root and leaf of *Tetracarpidium conophorum* also contain two other macronutrients- protein and fat. The protein content of the root was higher than that of the leaf (Root 20.64%, leaf 18.11%). The presence of protein indicates that the leaf and root of *Tetracarpidium conophorum* may assist in growth, tissue repair and energy production in the body. *Tetracarpidium conophorum* root and leaf also contain fat (root 32.22% and leaf 34.13%). But leaf contains higher percentage of fat than the root. There is also the presence of fiber in both the root and leaf of *Tetracarpidium conophorum*, but higher in the root than the leaf. The fiber content is needed in the production of softer and bulkier stools. There is also a higher ash content in the root than the leaf of *Tetracarpidium conophorum*.

TABLE 2: Phytochemical analysis in mg/Kg

CONSTITUENTS	LEAF CONTENT	ROOT CONTENT	BIOASSAY
Tannins	0.168	0.084	+++
Alkaloids	3.104	2.123	+++
Saponins	5.640	5.020	+++
Phenols	0.032	0.025	+
Oxalates	0.510	0.490	++
Flavonoids	0.120	0.003	+
Gallic acid	0.033	0.029	+
Cardiac glycosides	-	-	-ve
Anthraquinones	-	-	-ve
Ellagic acid	-	-	-ve
Caffeinic acid	-	-	-ve

+++ Means present in high amount

++ Means present moderate amount

+ Means Present in low amount

- Means not present.

Tetracarpidium conophorum leaf and root extracts contain very high amounts of tannins, alkaloids, and saponins, moderate amount of oxalate and low amounts of phenols, flavonoids and Gallic acid (Table 2). The presence of tannins in both the root and leaf support its use in the treatment of hemorrhoids, frost bite and varicose ulcers in herbal treatment [14, 15]. This supports the anti-inflammatory efficacy of the plant as used in traditional medicine. Presence of alkaloids lays credence to the plant's uses in traditional medicine as analgesic, antispasmodic, anti-asthmatic and antibacterial medication. From table 2, the tannins, alkaloids, saponins, phenols, Oxalates, flavonoids and gallic acid contents of the leaf of *Tetracarpidium conophorum* were more when compared to the root. The presence of gallic acid has been found to be associated with astringency, discolouration and inhibition of some enzymes activity. They provide extra defense against bacterial and viral infections [16].

TABLE 3: Mineral composition of the root and leaf extracts on dry weight basis in mg/kg.

CONSTITUENTS	ROOT	LEAF	BOASSAY
Potassium	6614.00	5920.42	+
Magnesium	1621.45	1553.10	+
Sodium	4340.22	4316.29	+
Calcium	4331.20	4341.22	+
Iron	121.01	126.04	+
Copper	32.40	36.22	+
Zinc	60.40	51.55	+
Manganese	22.49	29.50	+
Cobalt	1.03	0.93	+

+ Means present

Table 3 indicates that *Tetracarpidium conophorum* root and leaf contain all the major macroelements. The root extract of *Tetracarpidium conophorum* contains more of potassium, magnesium, sodium, zinc, and cobalt than the leaf. The leaf contains higher amounts calcium, iron, copper and manganese. Presence of sodium is advantageous in hypertension treatment in human [17]. The plant is used in the prevention and control of high blood pressure in man [18]. The presence of copper is responsible for the absorption of iron. Copper is important for cellular defence and protection of the mucous membrane, antianaemic and essential for the formation of haemoglobin from iron [19]. The presence of manganese supports the plant's use in the treatment of bone diseases [19]. Manganese is necessary for the functioning of the pituitary gland, the pineal gland and the brain. The presence of zinc in the root and leaf is an indication that the plant may have some effects on the functioning of the nervous system and in male fertility. *Tetracarpidium conophorum* may thus be essential in sexual development and stimulation of the activity of vitamins and formation of red and white corpuscles [19] It can also be used for healthy functioning of the heart and normal growth [20]. Cobalt found will help in the re-epithelization of the cell and red blood cell production.

Table 4 shows that the root and leaf of *Tetracarpidium conophorum* contain ascorbic acid, thiamine (B₁), riboflavin (B₂), niacin and cyanocobalamin (B₁₂). The root contains higher amounts of these vitamins except thiamine which is higher in the leaf than the root. The presence of ascorbic acid is indicative of the plant's use in herbal medicine for the treatment of skin conditions [16]. Ascorbic acid is also essential in the treatment of common cold and other diseases including prostate cancer [21, 22]. Ascorbic acid, as an antioxidant, helps to minimize the formation of

carcinogenic substances from dietary material and in the absorption of iron[23]. The presence of ascorbic acid, thiamine (Vit.B₁), riboflavin (Vit.B₂), niacin and cyanocobalamine (Vit.B₁₂) indicates that *Tetracarpidium conophorum* is useful for the treatment and/or alleviation of arthritis, anaemia, scurvy, diarrhea and skin rash [23]. Ajaiyeoba *et al* [24] attributed the antimicrobial potential of the leaf extract of *Tetracarpidium conophorum* to the presence of important phytochemical components.

Table 4: Vitamin composition of root and leaf of *Tetracarpidium conophorum* in µg/100g.

CONSTITUENTS	ROOT	LEAF
Ascorbic acid(Vit. C)	4.33	4.28
Thiamine(B ₁)	0.58	0.63
Riboflavin (B ₂)	0.03	0.02
Niacin	0.06	0.05
Cyanocobalamin(B ₁₂)	0.22	0.16
Pantothenic acid	-	-
Biotin	-	-
Folacin	-	-

CONCLUSION

Tetracarpidium conophorum is a nutritious plant that provides efficient amounts of nutrients needed for the body functions and growth and also involve in the correction of altered biological parameters. Our findings provide evidence that the methanolic extract of *Tetracarpidium conophorum* is a potential source of natural anti-oxidant, and this justified its uses in folkloric medicines. Further trials in humans are required to determine the efficacy of the plant or one or more of its constituents and to establish what, if any adverse effects are observed.

In addition, further studies are needed to determine, isolate and characterize the structure of the bioactive compounds from the root and leaf of *Tetracarpidium conophorum*.

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