

Macro and Micro Nutrient Composition of Some Indigenous Green Leafy Vegetables in South-East Zone Nigeria

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Abstract

There are several green leafy vegetables already implicated in possessing high nutritional values. There is still the need to add to the growing list of these beneficial plants in order to create more varieties in the food menu of the Nigeria populace. This study examined the proximate, vitamins and mineral composition of some indigenous green leafy vegetables (*Psychotria* sp, *Cnidoscopus aconitifolius* and *Telfairia occidentalis*). Ten (10) kg each of the Green Leafy Vegetables (GLV) was plucked, sorted, cleaned by rinsing with deionized water and solar dried. The dried samples were pulverized and package in an air-tight-polythene bags. The result showed that proximate composition of the GLVs showed moisture content of raw and dried samples (*Psychotria* sp had 62.30 and 12.87%, *C.aconitifolius* 82.16 and 12.87% and *T. occidentalis* 86.28 and 9.82%). Crude protein was high in raw and dried samples. It ranges from 11.75-27.32% in *Psychotria* sp, 4.83-24.13% in *C. aconitifolius* and 5.26-35.06% for *T.occidentalis*. *T. occidentalis* had the highest ash and crude fibre (10.07 and 5.20%), followed by *C.aconitifolius* (8.10 and 4.73%). These GLVs are good sources of pro-vitamin A, B₂, C and E. *Psychotria* sp had the highest pro-vitamin A and E (5.31-6.64 mg and 3.65-4.35 mg/100 g) while *C.aconitifolius* (437.7 and 291.17 mg) and *T.occidentalis* (420.86 and 277.80 mg/100 g) had the highest vitamins C content. These GLVs also had appreciable quantity of minerals (K, 46.43-423 mg; Na, 1.02-19.96 mg; P, 58.34-566.75 mg; Ca, 1.76-8.76 mg; Mg, 1.20-6.02 mg and Fe 1.77-11.80 mg/100 g). This study therefore showed that *Psychotria* sp and *Cnidoscopus aconitifolius* are good sources of macro and micro nutrients.

Keywords: Macro-nutrients; Vegetables; Vitamines; *Psychotria* sp; Nutrition

Introduction

Micronutrients and macronutrients are comprised of vitamins and minerals which are required in small quantities to ensure normal metabolism, growth and physical well-being.

Nutrient deficiency a leading cause of anemia is a major cause of morbidity and mortality among pregnant women and children in most developing nations. The problem of anemia in most rural communities in Nigeria is enormous especially among children and pregnant women. Therefore, communities tend to explore alternative and cheaper means in treating anaemic disease condition when they occur. During the documentation of indigenous food of the Igbo cultural area, Okeke et al. [1] identified *Psychotria* sp as a vegetable used in soup preparation and believed to have several health benefits, including the treatment of anaemia. Also *Cnidoscopus aconitifolius* has also been reported as a vegetable that is used in the treatment of anaemia and is popularly referred to as "hospital too far", meaning that it prevents one from visiting the hospital regularly [2].

There are many plants including green leafy vegetables that have been implicated for several health benefits and nutritional values to mankind, especially in Africa where the traditional use of many of these plants are not documented. Vegetables are those herbaceous plants whose part or parts are eaten as supporting food or main dishes and they may be aromatic, bitter or tasteless [3]. The consumption of leafy vegetable is part of africans' cultural heritage and they play important roles in the tradition and food culture of African household. Nigeria as a country is endowed with a variety of indigenous green leafy vegetables (GLVs) and different types are consumed by the various groups for different reason. According to Mensah et al. [3], vegetables are the cheapest and most available sources of important proteins, vitamins, minerals and essential amino acids. Although, leafy vegetables are known to posses lots of minerals beneficial to human

health, there is still the need to add to the growing list of these beneficial plants in order to create more varieties in the food flare of the rural populace in Nigeria. Therefore, the objective of this study is to evaluate the macro and micro nutrient potentials of some indigenous green leafy vegetables such as *Cnidoscopus aconitifolius*, *Psychotria* sp and *Telfairia occidentalis* as possible sources for the treatment of nutrient deficiency diseases.

Material and Methods

Materials

Sample collection and processing: Samples of *Psychotria* sp "Aya-azu" was collected from Ubulu-Uku, Delta State Nigeria, while *Cnidoscopus aconitifolius* "iyanapaja" and *Telfairia occidentalis* "ugu" were harvested from the vegetable gardens at Sir Louis Mbanefo Street, University of Nigeria, Nsukka (UNN). Ten (10) kg each of *Psychotria* sp, *Cnidoscopus aconitifolius* and *Telfairia occidentalis* leaves were plucked and sorted out by removing extraneous materials and cleaned by rinsing with deionized water. The samples were dried using solar drier (32-37°C) facility at Energy Research Center, UNN. The dried samples were pulverized and packaged in air-tight-polyethene bags while the fresh samples were also freshly blended and stored in the

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refrigerator (4-8°C for chemical analysis in the laboratory).

Proximate analysis

Nutrient analysis: The proximate composition of the GLVs (*Psychotria* sp, *C. aconitifolius* and *T. occidentalis*) was determined using AOAC [4] procedures for the determination of moisture, ash, crude lipid, crude fibre and nitrogen content.

Determination of moisture content: For moisture content determination, ten fresh leaves of the sample in triplicate were weighed in Petri dishes and dried in an oven (Gallenkamp, UK) at 105°C for 24 hours. The dried leaves were cooled in a dessicator and weighed. The percentage loss in weight was expressed as percentage moisture content. Similar determination was carried out on two grams dry sample so as to evaluate the residual moisture content, which was used latter to convert other parameters on 100% dry weight (DW) basis.

Determination of ash content: Ash content was determined by the incineration of two grams samples in a muffle furnace (Lenton Furnaces, England) at 600°C for 2 hours. The percentage residue weighed was expressed as ash content.

Determination of nitrogen content: Micro-Kjeldahl method was used to determine the nitrogen content of the sample. Two grams dried powdered sample was placed into a 100 cm Kjeldahl digestion flask. A Kjeldahl digestion tablet and 10 cm of concentrated tetraoxosulphate (VI) acid were added and the sample digested gently until frothing stopped. The mixture was boiled until the digest become clear. The content was filtered into a 100 cm volumetric flask and made up to 100 cm with distilled water. 10 cm of the aliquot solution and 20 cm of 45% sodium hydroxide solution were put into a distillation flask and steam distilled. The ammonia liberated was collected over 50 cm 20% boric acid mixed indicator solution, cooled and titrated with standard 0.01M HCl solution. Blank determination was carried in similar manner.

Estimation of crude protein and available carbohydrate: Crude protein was estimated by multiplying the sample percentage nitrogen content by a factor 6.25. Available carbohydrate was calculated by difference by subtracting total sum of crude protein, crude lipid, crude fibre and ash from 100% DW sample [5].

Determination of crude lipid content: 2 g of dried samples were weighed into porous thimble and its mouth plugged with cotton. The thimble was placed in an extraction chamber, which was suspended above weighed into receiving flask containing petroleum ether (B.P 40-60°C) and below a condenser. The flask was heated on heating mantle for eight hours to extract the crude lipid. After the extraction, the thimble was removed from the Soxhlet and the apparatus reassembled and heated over water bath for the solvent recovery. The flask containing the crude lipid was disconnected, cleaned with dry cloth, oven dried at 100°C for 30 minutes, cooled in a dessicator and weighed. The difference in weight is expressed as percentage crude lipid content.

Determination of Crude Fibre Content: Crude fibre was estimated by acid-base digestion with 1.25% H₂SO₄ (w/v) and 1.25% NaOH (w/v) solutions residue after crude lipid extraction was put into a 60 cm³ beaker and 200 cm³ of boiling 1.25% H₂SO₄ added. The content was boiled for 30 minutes, cooled, filtered through a filter paper and residue washed with three 50 cm³ portions of boiling water. The drained residue was returned to the original beaker and 200 cm³ of boiling 1.25% NaOH added. The content was boiled for 30 minutes, filtered, washed as above, residue drained

Statistical analysis

The data are expressed as mean ± SEM. Statistical analysis was

carried out by one-way analysis of variance (ANOVA). Difference were considered to be statistically significant when p<0.05.

Results

Table 1 shows the proximate composition result of the green leafy vegetables. The moisture content of raw samples showed that *Psychotria* sp had 62.30%, *C. aconitifolius* 82.16% and *T. occidentalis* had 86.28%. Crude protein result showed that raw *Psychotria* sp, *C. aconitifolius* and *T. occidentalis* had 11.75%, 4.83% and 5.26% respectively. Fat content in *Psychotria* sp was 3.68%, *C. aconitifolius* 1.61% and *T. occidentalis* 1.25%. Carbohydrate results in the three raw samples were 17.54%, 8.52% and 4.72% respectively. Crude fiber content of raw samples showed that *Psychotria* sp had 1.46%, *C. aconitifolius* had 0.95% and *T. occidentalis* had 0.78%. Ash content in *Psychotria* sp was 3.04% while *C. aconitifolius* and *T. occidentalis* had 1.62% and 1.51% respectively. The result of solar-dried samples showed that *Psychotria* sp, *C. aconitifolius* and *T. occidentalis* had 12.87%, 12.73% and 9.82% moisture content respectively. Protein value for *Psychotria* sp was 27.32%, while that of *C. aconitifolius* and *T. occidentalis* were 24.13% and 35.06% respectively. Fat result showed that *Psychotria* sp had 8.55%, *C. aconitifolius* 8.05% and *T. occidentalis* had 8.36%. Carbohydrate content of raw *Psychotria* sp, *C. aconitifolius* and *T. occidentalis* were 40.80%, 42.69% and 31.49% respectively, while the ash contents were 7.06%, 8.10% and 10.07% respectively.

Vitamin composition of fresh and dried samples of *Psychotria* sp, *C. aconitifolius* and *T. occidentalis* is presented in Table 2. In the fresh samples, pro-vitamin A concentrations for *Psychotria* sp, *C. aconitifolius* and *T. occidentalis* were 5.31, 0.66 and 1.23 mg/100g respectively. Vitamin B₂ content in *Psychotria* sp was 0.04 mg/100 g, *C. aconitifolius* had 0.06 mg/100 g and *T. occidentalis* 0.08 mg/100 g. However, vitamin C and E concentrations in raw *Psychotria* sp were 30.50 and 3.65 mg/100 g respectively, while in *Cnidioscolus* they were 437.7 and 0.38 mg/100g respectively. In fresh *Telfaria* samples, vitamin C and E concentrations were 420.86 and 0.56 mg/100 g respectively. However, the result of the solar-dried samples showed that *Psychotria* had 6.64 and 0.14 mg/100 g pro-vitamin A and vitamin B₂ respectively. Also, vitamin C and E content of dried *Psychotria* 20.00 and 4.35 mg/100 g respectively. The vitamin content of *Cnidioscolus* was as follow: 0.18 provitamin A, 0.60 B₂, 291.17 vitamin C and 0.47 mg/100 g vitamin E. Solar-dried *Telfaria* samples had 0.85 provitamin A, 0.80 vitamin B₂, 277.80 Vitamin C and 0.74 mg/100 g Vitamin E. Generally, vitamins A, B₂, and E contents of *Psychotria* sp and *C. aconitifolius* were higher than the *T. occidentalis*. Similarly, the solar dried samples had the highest vitamin content when compared with the raw samples. In addition, the *Psychotria* sp tends to show some vitamin advantage (pro-vitamin A and vitamin E) over the other two samples.

Mineral composition of *Psychotria* sp, *C. aconitifolius* and *T. occidentalis* is presented in Table 3. Fresh samples results showed that potassium (K) concentration for *Psychotria* sp, *C. aconitifolius* and *T. occidentalis* were 129.44, 85.06 and 46.43 mg/100 g respectively. Sodium (Na) content of *Psychotria* sp was 4.79 mg/100 g, 3.99 mg/100 g for *C. aconitifolius* and 1.53 mg/100 g for *T. occidentalis*. Phosphorus (P) and Zinc (Zn) concentrations in fresh *Psychotria* sp were 243.70 and 3.69 mg/100 g, respectively while in *C. aconitifolius* the concentrations were 80.59 and 1.83 mg/100 g. Fresh samples of *T. occidentalis* had 58.34 and 1.02 mg/100 g of P and Zn, respectively. The results of the solar-dried samples showed that *Psychotria* sp had 301.01 mg/100 g potassium, while *C. aconitifolius* had 425.03 mg/100 g and *T. occidentalis* had 309.50 mg/100 g potassium. Na and P concentrations in *Psychotria* sp were 11.03 and 566.75 mg/100 g, while *C. aconitifolius* had 19.96

Vegetables		Moisture	Protein	Fat	Carbohydrate	Crude Fiber	Ash
<i>Psychotria sp</i>	Fresh	62.30 ± 2.53	11.75 ± 2.00	3.68 ± 0.23	17.54 ± 1.54	1.46 ± 0.04	3.04 ± 0.52
	Dry	12.87 ± 1.24	27.32 ± 0.24	8.55 ± 0.26	40.80 ± 0.07	3.40 ± 0.22	7.06 ± 0.13
<i>C. aconitifolius</i>	Fresh	82.16 ± 1.87	4.83 ± 1.56	1.61 ± 0.06	8.52 ± 1.33	0.95 ± 0.04	1.62 ± 0.23
	Dry	12.73 ± 0.76	24.13 ± 0.26	8.05 ± 0.04	42.69 ± 0.30	4.73 ± 0.09	8.10 ± 0.08
<i>T. occidentalis</i>	Fresh	86.28 ± 3.22	5.26 ± 0.45	1.25 ± 0.06	4.72 ± 0.53	0.78 ± 0.11	1.51 ± 0.09
	Dry	9.82 ± 0.27	35.06 ± 0.09	8.36 ± 0.09	31.49 ± 0.05	5.20 ± 0.04	10.07 ± 0.07

Mean ± SD (n=3)

Table 1: Proximate compositions (%) of *Psychotria sp*, *C. aconitifolius* and *T. occidentalis* samples

Green leafy Vegetables	Pro-Vitamin.A (mg/100 g)	Vitamin B ₂ (mg/100 g)	Vitamin C (mg/100 g)	Vitamin E (mg/100 g)
<i>Psychotria sp</i> (Fresh)	5.31 ± 0.52	0.04 ± 0.01	30.5 ± 2.56	3.65 ± 0.32
<i>Psychotria sp</i> (dried)	6.64 ± 1.78	0.14 ± 0.02	20.00 ± 3.26	4.35 ± 0.53
<i>C. aconitifolius</i> (Fresh)	0.66 ± 0.07	0.063 ± 0.02	437.7 ± 21.56	0.38 ± 0.01
<i>C. aconitifolius</i> (dried)	0.18 ± 0.02	0.60 ± 0.02	291.17 ± 5.79	0.47 ± 0.02
* <i>T. occidentalis</i> (Fresh)	1.23 ± 0.07	0.082 ± 0.01	420.86 ± 32.77	0.56 ± 0.03
* <i>T. occidentalis</i> (dried)	0.85 ± 0.02	0.80 ± 0.04	277.80 ± 22.98	0.74 ± 0.06

*Indicates the control Mean ± SD (n=2)

Table 2: Vitamins content of *Psychotria sp*, *C. aconitifolius* and *T. occidentalis* samples

Vegetables	K	Na	P	Zn	Ca	Mg	Cu	Fe	Mn	
	(mg/100g)									
<i>Psychotria sp</i>	Fresh	129.44 ± 11.03	4.79 ± 0.67	243.70 ± 31.53	3.69 ± 0.23	3.090.67	2.39 ± 0.04	0.29 ± 0.04	4.34 ± 0.35	1.430.03
	Dried	301.01 ± 21.69	11.03 ± 2.11	566.75 ± 22.39	8.59 ± 1.22	7.19 ± 1.44	5.56 ± 0.33	0.67 ± 0.02	10.08 ± 1.60	3.34 ± 0.56
<i>C. aconitifolius</i>	Fresh	85.06 ± 5.39	3.99 ± 0.55	80.59 ± 2.73	1.83 ± 0.09	1.76 ± 0.23	1.20 ± 0.05	0.10 ± 0.00	1.72 ± 0.03	0.78 ± 0.03
	Dried	425.03 ± 17.55	19.96 ± 2.79	402.96 ± 5.96	9.16 ± 1.24	8.79 ± 1.32	6.02 ± 0.62	0.51 ± 0.02	8.62 ± 0.55	3.91 ± 0.06
<i>T. occidentalis</i>	Fresh	46.43 ± 3.85	1.53 ± 0.32	58.34 ± 1.65	1.02 ± 0.01	0.96 ± 0.04	0.74 ± 0.15	0.14 ± 0.01	1.77 ± 0.23	0.56 ± 0.01
	Dried	309.50 ± 27.90	10.29 ± 1.54	389.06 ± 1.26	6.81 ± 0.54	6.40 ± 1.12	4.91 ± 0.44	0.96 ± 0.02	11.80 ± 1.15	3.71 ± 0.32

*Indicates the control Mean ± SD (n=2)

Mean ± SD (n=3)

Table 3: Mineral contents of *Psychotria sp*, *C. aconitifolius* and *T. occidentalis* samples

and 402.96 mg/100 g respectively. In *T. occidentalis*, Na and P were 10.29 and 389.06 mg/100 g, respectively. Zn and Ca concentration in *Psychotria sp* were 8.59 and 7.19 mg/100 g, *C. aconitifolius* had 9.16 and 8.79 mg/100g while *T. occidentalis* had 6.81 and 6.40 mg/100 g respectively. Mg and Cu concentrations in *Psychotria sp* were 5.56 and 0.67 mg/100g, *C. aconitifolius* 6.02 and 0.51 mg/100 g and *T. occidentalis* had 4.91 and 0.96 mg/100 g. Iron (Fe) and Mn concentrations in *Psychotria sp* were 10.08 and 3.34 mg/100 g, *C. aconitifolius* had 8.62 and 3.91 mg/100 g. *T. occidentalis* had 11.80 and 3.71 mg/100 g Fe and Mn respectively.

Discussion

Psychotria sp and *C. aconitifolius* leaves are among the vegetables sparingly consumed in the south-eastern Nigeria. The young leaves are cooked as green vegetables while the shrubs are used as boundary divider. The proximate composition of *Psychotria sp*, *C. aconitifolius* and *T. occidentalis* shows that they have high moisture (water) contents like most other vegetables. Moisture content is a widely used parameter in the processing and testing of food. It is an index of water activity of many foods. The observed high values implies that these vegetables may have short shelf life because microorganisms that cause spoilage thrive in foods having high moisture content and also is an indicative of low total solids [6,7]. The high moisture content is consistent with the report of Ekumankama [8] who also observed a high moisture value for vegetables like *Pterocarpus soyauxii* (Oha) (83.75%), *Pterocarpus*

santalinoides (Nturukpa) (80.75%) and *Gnetum africanum* (Okazi). Similarly, the high moisture content provides for greater activity of water soluble enzymes and co-enzymes needed for metabolic activities of these leafy vegetables [9]. Fruits and vegetables contain large quantities of water in proportion to their weight. When these foods are eaten, the water can be absorbed by the body [10].

The carbohydrate content of *Psychotria sp* and *C. aconitifolius* were about 73% and 44.6% (fresh weight) respectively higher than *T. occidentalis*. According to Emebu and Anyika [11], carbohydrates are pivotal nutrients required for adequate diet. *Psychotria sp* and *C. aconitifolius* like most vegetables contains high level carbohydrate but lower than that of other vegetables such as *Amaranthus hybridus* (52.18%) [12]. The fat content of *Psychotria sp* was higher than *Cnidocolius* and *Telfaria*. This may suggest that these latter vegetable may not be a high fat content vegetable. It could therefore be used by individuals on weight reduction. However, *Psychotria sp* may not fattened because of its high level of crude fiber.

Psychotria sp is also a good source of vegetable protein having a protein content of 11.75%. This value was higher than that (3.3%) recorded by the USDA Nutrient Database for Standard Reference [13]. Its protein content makes it suitable for consumption, as a necessity for body development. The protein value of *Psychotria sp* as observed in this study confers on it the advantage as a rich source of vegetable protein over some vegetables such as raw cocoyam leaf (3.4%), cooked cocoyam

leaf (2.1%), *Amaranthus* (6.1%) and *Moringa oleifera* (4.2%) as reported by Adepoju, Chima and Igyor [14] also recorded lower protein values for "Oha" (2.0%) and 'Okazi' (1.5%). Incorporating *Psychotria sp* in the diet can furnish it with sizeable amounts of protein which provides enormous benefits such as maintenance of fluid balance, formation of hormones and enzymes, contribution to immune function, to mention but a few. The fiber content of *Psychotria sp* (1.46%) was found to be lower than that of some other Nigerian vegetables such as "Oha" (*Pterocarpus soyauxii*) 13.1%, "Nturuksa" (*Pterocarpus santalinoides*) 10.55%, "Okazi" (*Gnetum africanum*) 24.6% (Ekumankama, 2008) and pigweed (*Amaranthus hybridus*) 8.61% but higher than that of *Telferia occidentalis* (0.78%) and *Piper guineense* (2.9%). Fibre cleanses the digestive tract, by removing potential carcinogens from the body and prevents the absorption of excess cholesterol. Fibre also adds bulk to the food and prevents the intake of excess starchy food and may therefore guard against metabolic conditions such as hypercholesterolemia and diabetes mellitus. Fiber binds to cancer-causing chemicals, keeping them away from the cells lining the colon, providing yet another line of protection from colon cancer [15]. *Psychotria sp* may also be recognized as an excellent source of fiber, which is an important consideration for people who suffer from elevated cholesterol levels and in helping to cleanse the colon [16]. According to Gates [17], a number of studies have indicated that components of plants such as dietary fiber have beneficial effects in lowering blood cholesterol levels aside from the decreased intake of saturated fat and cholesterol that occurs with high intakes of plant foods. Leafy vegetables serve as supplements for food and also have the potential to improve the health status of its users as a result of the presence of various compounds vital for good health. Their fiber content provides bulk in the diet and this helps to reduce the intake of starchy foods, enhances gastrointestinal function, prevents constipation and may thus reduce the incidence of metabolic diseases like maturity onset diabetes mellitus and hypercholesterolemia. Fibre cleanses the digestive tract, by removing potential carcinogens from the body and prevents the absorption of excess cholesterol. High fiber content and antibacterial activities of this plant have been reported [18]. Fibre also adds bulk to the food and prevents the intake of excess starchy food and may therefore guard against metabolic conditions such as hypercholesterolemia and diabetes mellitus [19]. Current information on the nutritive and medicinal value of many lesser known vegetables is scanty. In most cases, this knowledge is not well documented and disseminated. Ash content which is an index of mineral contents in biota was also high (3.04%) in *Psychotria* leaf as compared to the values in the leaves of *Telfaria* (1.51%). The values of Ash content obtained in this work was generally low compared with earlier work reported for other vegetables like *Talinum triangulare* (20.05% DW) [20], *Ipomea batatas* (11.10%), *Vernonia colorate* (15.86%) and *Moringa oleifera* (15.09% DW) [21], *Ocimum gratissium* (18.00% DW) and *Hibiscus esculentus* (8.00% DW) [22]. Ukam [23] stated that the lower the ash content, the higher the nutrient quality. *Psychotria sp* therefore could be recommended for the preparation of different Nigerian dishes due to its nutritional potentials.

Psychotria sp and *C. aconitifolius* were high in potassium, Iron, Mg, Na, P, Zn and Ca. Ekumankama and Mensah et al. reported lower calcium levels for other vegetables such as Oha, Nturuksa, Okazi, *A. cruentus*, *Celosia sp.* and *V. amygdalina*. Furthermore, based on the findings on the mineral contents from this study, a significant percent of the daily calcium requirement for the average Nigerian can be met through judicious use of *Psychotria sp* and *C. aconitifolius* for meal preparation. Calcium is a major factor sustaining strong bones and plays a part in muscle contraction and relaxation, blood clotting,

synaptic transmission and absorption of vitamin B12. The relatively high content of calcium (3.09 mg/100g) in *Psychotria sp* suggests that it may be of therapeutic value in hypocalcaemic state like osteoporosis. Iron level of *Psychotria sp* was also high (4.34 mg/100 g) than the FAO/WHO [24] recommended dietary allowance for males (1.37 mg/day) and females (2.94 mg/day). Iron has been reported as an essential trace metal and plays numerous biochemical roles in the body, including oxygen binding in haemoglobin and acting as an important catalytic center in many enzymes, for example, the cytochrome system [25]. It is estimated that 2 billion of the world's population (largely in developing countries) have marked iron deficiency anaemia [26]. This in turn limits work performance and leads to impaired performance in mental and motor tests in children [27]. In infants, children and adolescents, iron is also required for growth of the tissues and organs and for the expanding red blood cell mass.

The use of *Psychotria sp* in the diet can furnish the diet with iron sufficient enough to meet the daily requirement for the nutrient. Green leafy vegetables also contain iron needed in haemoglobin formation and hence recommended for anaemic convalescence. *Psychotria sp* has relatively high iron (Fe) contents and may be recommended for iron deficiency anaemia. Various minerals such as Zn, Mg and Mn are also co-enzymes in certain biochemical reactions in the body which underscores the importance of leafy vegetables in metabolic reactions. The zinc content of *Psychotria sp* was also found to be lower than that of other vegetables like "Afang" (5.20mg/100 g), "Editan" (7.40 mg/100 g) and "Atama" (12.00 mg/100 g). FAO/WHO [28] reported that zinc is an essential component of a large number (>300) of enzymes participating in the synthesis and degradation of carbohydrates, lipids, proteins, and nucleic acids as well as in the metabolism of other micronutrients. Zinc stabilizes the molecular structure of cellular components and membranes and contributes in this way to the maintenance of cell and organ integrity. Furthermore, zinc has an essential role in polynucleotide transcription and thus in the process of genetic expression. Its involvement in such fundamental activities probably accounts for the essentiality of zinc for all life forms. Zinc plays a central role in the immune system, affecting a number of aspects of cellular and humoral immunity [29]. Magnesium is widely distributed in vegetables, most green vegetables, legume seeds, peas, beans and nuts are rich in magnesium [30]. From the results of this study, it is clear that *Psychotria sp* and *Cnidocolius*, though lesser known vegetables, have enormous nutritional potentials and thus can favourably be used as alternative good sources of vegetable.

Generally, vegetables are rich in vitamins, minerals, trace elements, dietary fibre and proteins [31-34]. The result of this study showed that *Psychotria* and *Cnidocolius* are rich sources of pro-vitamin A, vitamin C and vitamin E. This finding is in agreement with the result of Rose-Ibarra and Molina-Cruz who reported that *Cnidocolius* (Chaya) is a rich source of vitamin C, β -carotene and the B-vitamins. *Psychotria sp* had the highest level of pro-vitamin A, a vitamin that protect the body cells from the damaging effects of free radicals, they act as good source of vitamin A and Enhance the functioning of the immune system. Similarly, pro-vitamin A also Help the reproductive system to function properly [35,36]. The high level of pro-vitamin A in *Psychotria sp* is a good quality of the Lesser Known Vegetable (LKV) that could be promoted to consumers for its health benefits. Previous studies have reported that leafy vegetables have great potential for the alleviation of nutritional deficiencies in the populations of developing countries, as it is rich in essential amino acids and vitamin [37-39]. *Psychotria sp* possessed the lowest concentrations of vitamin B₂ and vitamin C while the highest values of both vitamins were present in *C. aconitifolius* and

T. occidentalis respectively. Ascorbic acid (vitamin C) is an antioxidant which helps to protect the body against cancer and other degenerative diseases such as arthritis and type II diabetes mellitus [40,41]. It also strengthens the immune system. In fact, green vegetables with high ascorbic acid content, such as *Cnidoscopus* may enhance the absorption of non-heme iron. The antioxidant activity of *Cnidoscopus* may be due to its chemical constituents, such as tannins, phenolics, flavonoids, saponins, and vitamins A and C [42,43]. Additionally, ascorbic acid may potentially act as an anticancer agent [44]. Vitamin E contents of the samples revealed that *Psychotria sp* has the highest while the lowest was *C. aconitifolius*. Vitamin E is an integral part of cellular membranes whose main role is to defend the cell against oxidation. Within cells and organelles (e.g. mitochondria), it is the first line of defense against lipid peroxidation. This vitamin also plays a very important function in lending Red Blood Cells (RBC) flexibility as they make their way through the arterial network [45,46]. Emeka and Onyechi [47] reported that lipid peroxidation significantly reduced in the animals fed with *Telfaria* diet because of the presence of high concentration of vitamins present in this vegetable. This result confirms the antioxidant effects of *Telfairia* extracts reported by Nwanna and Oboh [48]. Anti oxidant effects of vegetables such as *Telfairia* have been attributed to the presence of phenolic compounds such as flavonoids, polyphenols as well as vitamins [49].

In conclusion, the findings of this research work showed that the Lesser Known Vegetables (LKV) *Psychotria sp* and *Cnidoscopus aconitifolius* are good sources of macro and micro nutrients in respect to high protein content, vitamin C, vitamin B, vitamin A, vitamin E, Potassium, Zinc, Calcium, and Iron. They could be useful as possible sources for combating mineral or macronutrient deficiencies.

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