Comparative Phytochemical and Nutritional Profiles of *Ficus capensis* and *Cnidoscolus aconitifolius* Leaves

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***Abstract*: - This study investigated the phytochemical, proximate, mineral, vitamin contents of *Ficus capensis* and *Cnidoscolus aconitifolius* leaves. Phytochemical and Proximate analysis were done according to the AOAC methods. Atomic Absorption Spectroscopy (AAS) was used to determine the mineral content while vitamins were determined spectrophotometrically using the standard method of AOAC. The phytochemical analysis revealed the presence of Flavonoids, alkaloids, Tannin, Saponin, Phytate, Haemaglutinnin, Oxalate, Cardiac glycosides and Phenol in the leaf extract of *F. capensis* and *C. aconitifolius*. The proximate composition of the dried leaf of *F.capensis* was; moisture (11.35± 1.45 %), crude protein (10.85 ± 0.31%), crude fibre (12.38 ± 0.71%), crude fat (3.48±0.01%), ash (6.37 ± 0.30%) and carbohydrate (55.57 ± 3.02%). On the other hand, that of *C. aconitifolius* was; moisture (11.35 ± 0.30%), crude protein (10.85±0.52%), crude fibre (12.38 ± 0.02%), crude fat (3.48 ± 0.02%) ash (6.37 ± 0.09%) and carbohydrate (55.57 ± 1.08%). Elemental analyses showed that *C. aconitifolius* had significantly higher ($p<0.05$) levels of the elements (Cadmium, Arsenic, Fe, Pb, Cu, Na) when compared to *F. capensis*. The leaf of *C. aconitifolius* was significantly higher in vitamins B_1, B_2, B_3, B_6, C, E and K ($p<0.05$) when compared to that of *F. capensis*. However, *F. capensis* leaf had higher vitamins B_{12} and D contents than *C. aconitifolius*. This study suggests that these two plants can serve as a good source of nutraceutical.**

Keywords: **Phytochemical, proximate, mineral, vitamin, *Ficus capensis, Cnidoscolus aconitifolius***

I. INTRODUCTION

The therapeutic use of natural products from indigenous plants for ethnomedicinal and nutritional purposes has grown tremendous interest among scientists to search for bioactive components (Oktay *et al.*, 2003; Wangensteen *et al.*, 2004) that are beneficial to man. Recently, the interest in natural products from plants and their use has increased tremendously even in areas where conventional medicines are very much available. Medicinal plants are sources of raw materials for pharmaceutical drug formulation (WHO, 2014). A significant percentage of medicinal plants used by the rural populace in Africa are affordable when compared to the high cost of conventional drugs.

Presently, in Nigeria, vegetables are the cheapest and readily available sources of proteins, vitamins and minerals (Thompson and Kelly, 1990) and therefore could also benefit the populace with their medicinal properties. *Ficus capensis* commonly called "bush fig tree" belongs to the family *Moraceae*. In Nigeria, it is locally referred to as Akokoro (Igbo) Opoto (Yoruba) and Uwaraya (Hausa) (Otitoju *et al.*, 2014). Its leaves are broad, greenish and produce fruits all year round (Arnold and Dewett, 1993) and have been regarded as an underutilized plant. The leaves of *Ficus capensis* are used as vegetable both in soup and yam pottage in various parts of Nigeria (South East) (Otitoju *et al.*, 2014).

Traditionally, *Ficus capensis* has been used for the treatment of dysentery and wound dressing (Igoli *et al.*, 2005). It is also used to treat circumcision wounds, leprosy and epilepsy, rickets, infertility, gonorrhea, edema and respiratory disorders (Olowokudejo *et al.*, 2008) and abortion (Owolabi *et al.*, 2009). Apart from its traditional uses, scientific investigations have reported its; blood-boosting effect (Njoku-oji *et al.*, 2016), anti-sickling (Umeokoli *et al*.,2013; Mpiana *et al.*, 2008) antibacterial (Oyeleke *et al.*,2008), anti-abortifacient (Owolabi *et al.*, 2009), immune-stimulatory (Daikwo *et al.*, 2012), antidiarrhoea (Owolabi, 2013), antioxidant (Ramde-Tiendrebeogo *et al.*, 2012) and pro-fertility in treating azoospermia (Gelfand *et al.*,1985; Akomolafe *et al.* ,2016).

Cnidoscolus aconitifolius (CA), locally known in Niger Delta as 'hospital is too far' or 'ogwu obala', belongs to the family of *Euphorbiaceae* (McVaugh, 1944). It has succulent stems which exude a milky sap when cut. It is an evergreen, drought deciduous shrubs up to 6m in height with alternate palmate lobed leaves, milky sap and small flowers on dichotomously branched cymes (Awoyinka *et al.*, 2007; Iwuji *et al.*, 2013). It is commonly found in the tropic and sub tropical regions worldwide, including Africa, South of Sahara, North and South America, India, etc. *C. aconitifolius* is commonly known as Chaya or Tree Spinach. It is popular in Mexico and Central America and has been introduced into the United States (mainly South Texas and Florida) for potential uses as a leafy vegetable and/or as a medicinal plant (Breckon, 1979). It

is a large, fast growing leafy perennial shrub that is believed to have originated in the Yucatan Peninsula of Mexico (McVaugh, 1944). It is commonly eaten as vegetable in soup. In fact, levels of leaf nutrients are two to threefold greater than any other land-based leafy green vegetable (Ganiyu, 2005). *C. aconitifolius* leaves have a possible antidiabetic effect (Yang, 1979); antibacterial activities (Ganiyu, 2005; Kuti and Konuru, 2004); and it also ameliorates anaemia and osmotic fragility induced by protein energy malnutrition (Oladeinde *et al*., 2007). Traditionally, leaves of plants have been identified for their nutritional and medicinal values (Oladeinde et al., 2007; Oyagbemi et al., 2008; Sofowora, 1993). The aim of this work is to investigate and compare the phytochemical, mineral content, proximate and vitamin constituents of *F. capensis* and *C. aconitifolius.*

II. MATERIALS AND METHODS

Sample Collection and Identification

The leaves of *Ficus capensis* were collected at Ibeagwa Nike, Enugu East Local Government Area, Enugu State. The leaves of *Cnidoscolus aconitifolius* were collected at Umueze town, Nkanu West Local Government Area, Enugu State. The samples were identified by a botanist in the Department of Botany, Nnamdi Azikiwe University, Awka. The voucher number of *F. capensis* and *C. aconitifolius* is 164 and 168 as deposited at the herbarium of the Department of Botany, Nnamdi Azikiwe University, Awka.

Preparation of F.capensis and C. aconitifolius for Phytochemical and Nutritional Analysis

The leaves were hand-picked, thoroughly washed and air dried at room temperature for four weeks. The dried leaves were ground into powder using Corona manual grinding machine. The sample was then used for the phytochemical, proximate, mineral and vitamin analysis.

Phytochemical Analysis

Cardiac Glycosides were determined according to the method of Osagie (1998). Flavonoids was determined by the method of Boham and Kocipai (1994). Alkaloids were determined by the method of Harborne (1993), Tannin was determined by titration (Pearson, 1976). Saponins were determined according to the method of Obadoni and Ochuko (2001). Phytate was determined according to the method of Young and Greaves (1940). Heamaglutinin was determined by AOAC (1984) method. Oxalate was determined by Titration (Harborne, 1993). Phenols was determined according to the method of Harborne (1995).

Mineral analysis

The minerals cadmium, arsenic, calcium, nickel, iron, manganese, aluminium, selenium, lead, cobalt, manganese, copper, potassium, silver, mercury and sodium were analysed using Varian AA240 Atomic Absorption Spectrophotometer according to the method of APHA 1995 (American Public Health Association).

Proximate analysis

Moisture, ash and fibre content of the samples were determined by the methods of the Association of Official and Analytical Chemists (AOAC), 1984. Crude fat content was by Soxhlet method. Crude protein was determined by Macro-Kjeldahl method. The total carbohydrate was determined by difference. The sum of the percentage moisture, ash, crude fat, crude protein and crude fibre was subtracted from 100 (Usunobun et al., 2015).

Vitamin analysis

Vitamin A was determined by the calorimetric method of Kirk and Sawyer (1991). Vitamin B_1, B_2, B_3, B_6 and B_{12} were determined spectrophotometrically using the standard method of AOAC. Vitamin C was determined by the titrimetric method reported by Kirk and Sawyer (1991). Vitamin E was determined by the futter-mayer colorimetric method with association of vitamin chemist's (Kirk and Sawyer, 1991). Vitamin D and K were determined by the method described by Zakara *et al*, (1979).

Statistical Analysis

Data obtained from the experiments were analyzed using the Statistical Package for Social Sciences (SPSS) software for windows version 25 (SPSS Inc., Chicago, Illinois, USA). All the data were expressed as Mean ± SEM. Statistical analysis of the results obtained were performed by using ANOVA and POST-HOC Tests to determine if significant difference exists between the mean of the test and control groups. The limit of significance was set at $p<0.05$.

III. RESULTS

Phytochemical Analysis

The result of the phytochemical analysis of *F. capensis* and *C. aconitifolius* revealed that *F. capensis* has high content of flavonoids, phenol, tannin, saponin, alkaloids and haemaglutinin while the phytochemical content of *C. aconitifolius* reveal high content of phenols, haemaglutinin, tannin and alkaloids (Table 1).

Table 1: Phytochemical Analysis of *F. Capensis and C. aconitofolius*

Phytochemicals	***F. Capensis***	***C. aconitofolius***
Cardiac glycosides (%)	2.72 ± 0.02	2.94 ± 0.00
Flavonoids (%)	14.22 ± 0.03	2.562 ± 0.00
Alkaloids (%)	7.26 ± 0.02	4.10 ± 0.01
Tannin (%)	11.98 ± 0.03	5.70 ± 0.00
Saponin (%)	9.40 ± 0.01	5.88 ± 0.00
Phytate (%)	0.452 ± 0.04	0.5653 ± 0.00
Haemaglutinin (mg/kg)	8.588 ± 0.02	34.96 ± 0.03
Oxalate (mg/kg)	0.1056 ± 0.00	0.792 ± 0.01
Phenol (mg/kg)	22.911 ± 0.04	57.303 ± 0.05

Mineral Content

The result of the mineral analysis of *F. capensis* and *C. aconitifolius* revealed that *F. capensis* has high content of magnesium, calcium, manganese, potassium, selenium and iron. The mineral analysis of *C. aconitifolius* reveal high content of sodium, manganese, potassium, calcium, iron and selenium (Table 2).

Table 2: Mineral Content of *F. Capensis* and *C. aconitifolius*

MINERALS (PPM)	*F. capensis*	*C. aconitofolius*
Cadmium	0.087 ± 0.00	0.225 ± 0.00
Arsenic	0.00 ± 0.00	0.698 ± 0.02
Calcium	3.124 ± 0.03	3.512 ± 0.04
Nickel	0.086 ± 0.02	0.000 ± 0.00
Iron	1.028 ± 0.05	1.345 ± 0.06
Magnesium	21.36 ± 0.52	22.324 ± 0.53
Aluminium	0.331 ± 0.00	0.301 ± 0.01
Selenium	1.786 ± 0.01	1.991 ± 0.03
Lead	0.008 ± 0.00	0.029 ± 0.00
Cobalt	0.00 ± 0.00	0.013 ± 0.00
Manganese	2.000 ± 0.01	3.427 ± 0.30
Copper	0.180 ± 0.03	0.352 ± 0.02
Potassium	2.555 ± 0.02	2.564 ± 0.50
Silver	0.221 ± 0.05	0.025 ± 0.05
Mercury	0.521 ± 0.03	0.163 ± 0.02
Sodium	2.00 ± 0.40	5.213 ± 0.03

Proximate Analysis

The result of the proximate analysis of *F. capensis* and *C. aconitifolius* revealed that both plants contain virtually the same quantity of macronutrients (Table 3). The macronutrients contained in the leaves of both plant samples include carbohydrate (55.57%), fibre (12%), moisture (11.35%), protein (10.85%), ash (6.37%) and fat (3.48).

Table 3: Proximate Analysis of *F. Capensis and C. aconitifolius*

MACRONUTRIENTS (%)	*F. capensis*	*C. aconitofolius*
Ash content	6.37 ± 0.30	6.37 ± 0.09
Moisture content	11.35 ± 1.05	11.35 ± 0.30
Fibre content	12.38 ± 0.71	12.38 ± 0.02
Fat content	3.48 ± 0.01	3.48 ± 0.02
Protein content	10.85 ± 0.31	10.85 ± 0.52
Carbohydrate Content	55.57 ± 3.02	55.57 ± 1.08

Vitamin Analysis

Comparing the vitamin analysis of *F. capensis* and *C. aconitifolius* reveals that the vitamin C and vitamin B_6 content of *C. aconitifolius* was significantly (p<0.05) compared to that of *F. capensis* leaves. The vitamin B_1, and vitamin B_2 content of *F. capensis* and *C. aconitifolius* leaves are almost the same. The vitamin A, vitamin B_3, vitamin B_{12}, vitamin D and vitamin K content of both plants vary (Table 4).

Table 4: Vitamin Content of *F. Capensis and C. aconitofolius*

Vitamins (mg/kg)	*F. capensis*	*C. aconitofolius*
Vitamin A	14.66 ± 0.20	13.58 ± 0.10
Vitamin B_1	2.053 ± 0.10	2.143 ± 0.00
Vitamin B_2	2.011 ± 0.08	2.128 ± 0.00
Vitamin B_3	1.708 ± 0.00	3.66 ± 0.00
Vitamin B_6	145.0 ± 0.30	565.0 ± 1.33
Vitamin B_{12}	5.55 ± 0.01	4.60 ± 0.00
Vitamin C	567.7 ± 0.03	814.0 ± 0.62
Vitamin D	2.29 ± 0.01	1.625 ± 0.00
Vitamin E	6.25 ± 0.00	6.66 ± 0.03
Vitamin K	1.389 ± 0.00	3.47 ± 0.01

IV. DISCUSSION

Ficus capensis and *Cnidoscolus aconitifolius* are medicinal plants with numerous nutritional importance. From the results, there was high percentage of flavonoids, alkaloids, Tannin and saponin in the ethanol leaf extracts of *F. capensis* when compared to that of *C. aconitifolius*. The high composition of Tannin (11.98±0.03%) in the leaves of *Ficus capensis* confers the leaves to be a good source for the treatment of wounds emanating from varicose ulcers and hemorrhoids (Njoku and Akumufula, 2007). Plants that contain tannins are used as astringents, against diarrhea, as diuretics, against stomach and duodenal tumours (Saxena *et al.*, 2013). Flavonoids in plants possess medicinal benefits which includes antioxidant and anti-inflammatory activities (Saxena *et al.*, 2012). They have the ability to scavenge hydroxyl radicals, super oxide anions and lipid peroxy radicals (Okwu and Josiah, 2006), therefore supports its antioxidant activity. The flavonoid content of the leaves of *Ficus capensis* and *C. aconitifolius* therefore supports its use for protection against diseases such as cancer, inflammation and atherosclerosis (Onyeka and Nwambekwe, 2007).

The alkaloid composition (7.26±0.02%) in the leaves of *F. capensis* was higher (p>0.05) when compared to the alkaloid composition (4.10±0.01%) in the leaves of *C. aconitifolius*. This supports the findings by Oyeleke *et al.*, (2008), that the antibacterial activity of these plants may be attributed to the presence of alkaloids. Alkaloids have been reported to possess various pharmacological activities including antihypertensive effects, antiarrhythmic effect, antimalarial and anticancer activity (Saxena *et al.*, 2013). Pure isolated alkaloids and their synthetic compounds have been used in medicine as an analgesic, antispasmodic and bactericidal agents (Okwu, 2004). Saponins from fruits and vegetables are important

dietary supplements and are known to exhibit antimicrobial activities and protect plants from microbial pathogens (Sczkowski *et al.,* 1988). They could be beneficial in modulating blood lipids, lower cancer risks and improve blood glucose response as well as possess antioxidant activity (Igidi and Edene, 2014). Leafy vegetables such as *F. capensis* and *C. aconitifolius* leaves are thus said to possess antimicrobial property attributed to saponins and other phytochemicals present. This is in agreement with reports on the antimicrobial potentials of *F.capensis* obtained from other localities in Nigeria (Ogundare and Akinyemi, 2013; Igwe *et al.,* 2016).

Results of the elemental analysis of the plant leaves of *F. capensis* and *C. aconitifolius* revealed that the leaves contain considerable amount of Zinc (2.84 ± 0.005), Iron (1.89 ± 0.004), Calcium (1.86 ± 0.003), Magnesium (1.92 ± 0.004) and Potassium (0.72 ± 0.006) (Table 2). Pathak and Kapil, (2004) reported that zinc is vital in protein synthesis, cellular differentiation and replication, immunity and sexual functions. Calcium is reported to be essential for blood clotting, bone and teeth formation and as a co-factor in some enzyme catalysis (Robert *et al*., 2003). In humans, magnesium is required in the plasma and extracellular fluid, where it helps maintain osmotic equilibrium (Thomas and Krishnakumari, 2015). It can also prevent some heart disorders and lower blood pressure in humans. Iron facilitates the oxidation of biomolecules to control obesity, which predisposes an individual to various diseases. It is also essential for hemoglobin formation (Thomas and Krishnakumari, 2015) and plays a role in energy transfer within the plant and also an essential constituent of certain enzymes and proteins. This justifies the use of *F. capensis and C.aconitifolius* in folklore medicine as a blood tonic because of its blood boosting effect (Njoku-oji *et al.*, 2016). Moderate quantities of sodium and potassium were present in the leaves of *Ficus capensis and C. aconitifolius, and* these are principal cations of extracellular and intra-cellular fluids and aid in maintaining electrolyte balance in the body (Robert *et al.,* 2003). Potassium is essential and is required in large amounts for proper growth and plant reproduction. Minerals found to be present in trace quantities are cadmium, nickel and lead. Cadmium and lead in high amounts are not ideal and not desirable for the functioning of the body. The research forms a basis for further isolation and characterization on the bioactive constituents present in the leaves of this plant due to its therapeutic properties.

The result of the proximate analysis showed that *C. aconitifolius* has high carbohydrate and fibre content (Table 3). Like most leaves, they are low in fat and protein contents as compared to carbohydrate content. The result of the low-fat content may imply they are without any risk of obesity (AOAC, 1990). So daily consumption of *F. capensis* and *C. aconitifolius* may not predispose one to obese-associated diseases like diabetes and hypertension. The low moisture content of *C. aconitifolius* probably may not encourage microbial growth and enzyme activities (Nworah *et al.,* 2012). However, the fresh leaves are succulent green and often preserved by drying.

The estimated carbohydrate content in both leaves was high and carbohydrates are known to produce energy required for the body because they are essential nutrient required for adequate diet (Emebu and Anyika, 2011) and supplies energy to cells such as brain, muscle and blood (Ejelonu *et al.,* 2011). The low content of fat (3.48±0.01%) is below the range (8.3%-27.0%) reported for some leafy vegetables consumed in Nigeria (Sena *et al.,* 1998). Leafy vegetables are poor sources of lipids (Ejoh *et al.,* 1996), therefore the increase in the consumption of vegetables would naturally lower fat intake. The protein content of the leaves was found to be moderately available (6.31%). Protein is vital for various body functions such as body development, maintenance of fluid balance, formation of hormones, enzymes and sustaining strong immune function (Emebu and Anyika, 2011). Fresh green leafy vegetables with low protein content have been reported (Ifon and Bashir, 1989; Oboh and Masodje, 2009) and the protein in these leaves are in the form of enzymes, instead of being a storage pool as found in grains and nuts (Wills *et al*., 1998).

Crude fibre content of these plants could aid in the absorption of trace elements in the gut and therefore increases intestinal bowel movement (Abolaji *et al.,* 2007). Consuming vegetables in our diet could aid in managing constipation problems (Olowokudejo *et al.,* 2008). Dietary fibers also lower cholesterol, triglycerides and protect against cancer and digestive disorders (Selvendran, 1984). The moderate amount of ash content in both leaves of *F. capensis* and *C. aconitifolius* provides a measure of total amount of mineral matter in a plant. Measuring ash content is important because mineral matter may be the cause of a pharmacological effect (Okeke, 1998).

The result in Table 4 shows the presence of Vitamin A while the Vitamins B_1,B_2, B_3, B_{12}, Vitamin D, Vitamin E and Vitamin K are in trace amounts, Vitamin B_6, and Vitamin C are in moderate amounts, they have very essential roles to play in the human health. Vitamin C and E are very important antioxidants which protect the cell membranes from oxidative stress/damage caused by free radicals (Guyton and Hall, 2006). *F. capensis* and *C.aconitifolius* leaves contain ascorbic acid and flavonoids, both of which are effective antioxidants. Vitamin C possesses an antioxidant property and required for maintenance of normal connective tissues, wound healing and also facilitates the absorption of dietary iron from the intestine (Button, 2004). Deficiencies of these vitamins predispose the red cell membranes to damage leading to haemolysis (Adesina, 2006). Riboflavin and niacin are necessary for oxidative phosphorylation and for coenzyme formation respectively (Adesina, 2006). The leaves of *F. capensis* and *C. aconitifolius* contains moderate amount of vitamin A and therefore essential for clear vision.

V. CONCLUSION

This study revealed that *F. capensis* and *C. aconitifolius* are important sources of macro and micronutrients. The result of the phytochemical, mineral content, proximate and vitamin analysis shows that the leaves of *F. capensis* and *C. aconitifolius* have great nutritional value. In line with the global demands for food, these plants can therefore be incorporated as potential sources of supplements in the formulation of functional foods. Nevertheless, extensive toxicity study on both plants needs to be done to ascertain their safety levels.

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CONFLICT OF INTERESTS

The authors hereby declare no conflict of interests.

REFERENCES

[1] Abolaji OA, Adebayo AH, Odesanmi OS (2007). Nutritional qualities of three medicinal plant parts (Xylopia aethiopica, Blighia sapida and Parinari polyandra) commonly used by pregnant women in the Western Part of Nigeria. Pakistan Journal of Nutrition 6(6): 665-668.

[2] Adesina SK (2006). Studies of some plants used as anticonvulsants in American and African traditional medicine. London 42 (8): 48-59.

[3] Akomolafe SF, Oboh G, Oyeleye SI, Boligon AA (2016). Aqueous extract from Ficus capensis leaves inhibits key enzymes linked to erectile dysfunction and prevent oxidative stress in rats' penile tissue. NFS Journal 4: 15–21.

[4] APHA (1995). Standard Methods for the Examination of Water and Wastewater. 19th Edition, American Public Health Association Inc., New York.

[5] AOAC (1984). Official Methods of Analysis. 14th Edition, Association of Analytical Chemists, Washington DC, 249-252.

[6] AOAC (1990). Official methods of analysis 15th Edition. Association of Official Analytical Chemists Washington D.C.

[7] Arnold TH, Dewett BC (1993). Plants of southern Africa: names and distribution. Mem. Bot. Surv. S. Africa 62: 23 – 27.

[8] Awoyinka AO, Balogun IO, Ogunnowo AA (2007). Phytochemical screening and in vitro bioactivity of Cnidoscolus aconitifolius (Euphorbiaceae) Journal of Medicinal Plant Research 3: 63-65.

[9] Boham BA, Kocipai-Abyazan R (1994). Flavonoids and Condensed Tannins from Leaves of Hawaiian vaccinium vaticulatum and V. calycynium. Pacific Science 48: 458-463.

[10] Breckon G.J (1979). Studies in Cnidoscolus (Euphorbiaceae). Brittonia 31:125-148.

[11] Button KC (2004). Prescription for nutritional healing. Penguin Putnam 4(5): 478- 479.

[12] Daikwo OA, Tende JA, Okey SM, Eze ED, Isa AS (2012). The effect of aqueous extract of leaf of Ficus capensis Thunb (Moraceae) on invivo leukocyte mobilization in Wistar rats. British Journal of Pharmacology and Toxicology **3**(3):110-114.

[13] Ejoh RA, Tchouanguep MF, Fokou E (1996). Nutrient compostion of the leaves and flower of Colocassia esculenta and the fruits of Solanum melongena. Plant Food Human Nutrition 49: 107-112.

[14] Emebu PK, Anyika JU (2011). Proximate and mineral composition of Kale (Brassica oleracea) grown in Delta State, Nigeria. Pakistan Journal of Nutrition 10(2): 190-194.

[15] Ganiyu OBOH (2005). Effect of some post-harvest treatments on the nutritional properties of Cnidoscolus acontifolus leaf. Pakistan Journal of Nutrition 4: 226-230.

[16] Gelfand M, Mavi S, Drummond RB, Ndemera B (1985). The traditional medicinal practitioner in Zimbabwe. Mambo Press, Gweru, Zimbabwe. 411.

[17] Guyton C, Hall JE (2006). Textbook of medical physiology. Elseveir publisher, Philadelphia, India 11: 113-115.

[18] Harborne JB, Baxter H (1993). Pyrrolizidine Alkaloids. In: Taylor, F., Ed., Phytochemical Dictionary. Bristol 255-266.

[19] Harborne JB (1995). Phytochemical Methods. A Guide to Modern Techniques of Plant Analysis. Third Edition, Champman and Hall, New York.

[20] Ifon ET, Bassir O (1989). The nutritive value of some Nigeria leafy green vegetable Part 1: vitamin and mineral contents. Food Chemistry 4: 263-267.

[21] Igidi OJ, Edene CE (2014). Proximate and phytochemical compositions of Napoleona vogelii hook fruit. The International Journal of Engineering and Science 3(6): 46-51

[22] Igoli JO, Ogaji OG, Tor-Aryiin A, Igoli NP (2005). Traditional Medicinal Practices amongst the Igede people of Nigeria. Part 11. African Journal of Tradition. Complement 2(2):134-152.

[23] Igwe KK, Udeh NE, Madubuike AJ, Amuneke CC (2016). Characterization and antimicrobial studies of Ficus capensis methanolic leaf extract. International Journal of Advanced Research in Science, Engineering and Technology 3(4):1931-1941.

[24] Iwuji SC, Nwafor A, Egwurugwu J, Ejeta K, Akpan U (2013). Comparative Characterization of the Phytomedicinal Constituents of Cnidoscolus aconitifolius Leaf Extracts. American Journal of Pharmaceutical Technology 3(1):779-784.

[25] Kirk RS, Sawyer R (1991). Pearson's Composition and Analysis of Foods, 9th ed. (student edition), England: Addision Wesley Longman Ltd 33-36.

[26] Kuti JO, Konuru HB (2004). Antioxidant Capacity and Phenolic Content in Leaf Extracts of Tree Spinach (Cnidoscolus spp.). Journal of Agriculture and Food Chemistry 52 (1): 117

[27] McVaugh R (1944). The genus Cnidoscolus: generic limits and intrageneric groups. Bul. Torrey Bot. Club 71:457-474.

[28] Mpiana PT, Mudogo V, Tshibangu DST, Kitwa EK, Kanangila AB, Lumbu JBS, Ngbolua KN, Atibu EK, Kakule MK (2008). Antisickling activity of anthocyanins from Bombax pentadrum, Ficus capensis, Zizyphus mucronata: Photo degradation effect. Journal of Ethnopharmacology 120: 413-418.

[29] Njoku PC, Akumufula MI (2007). Phytochemical and nutrient evaluation of Spondias mombin leaves. Pakistani Journal of Nutrition 6(6):613-615.

[30] Njoku-Oji NN, Nwike CV, Dimkpa U, Ifegwu NO, Anike LC, Maduka SO, Sobanke OA, Uchefuna RC (2016). Hematological changes following oral administration of aqueous leaf extract of Ficus capensis in albino rats. International Blood Research and Reviews 5(1): 1-7.

[31] Nworah DC, Nwafor A, Danladi NB (2012). A Comparative Study of Nutritional and Electrolyte Qualities of Xylopia Aethiopica in Novel Hydro-Alcoholic Formulations. American Journal of Pharmacy and Technical Research 2(5): 342-353.

[32] Obdoni BO, Ochuko PO (2001). Phytochemical Studies and Comparative Efficacy of the Crude Extract of some Homostatic Plants Plants in Edo and Delta States of Nigeria. Global Journal of Pure andApplied Science 8b: 203-208.

[33] Oboh FOJ, Masodje HI (2009). Nutritional and antimicrobial properties of Vernonia amygdalina leaves. International Journal of Biomedical and Health Sciences 5 (2):51-56.

[34] Ogundare AO, Akinyemi AI (2013). Synergetic effect of the leaf extracts of Ficus capensis (Linn) and Sorghum bicolor (Linn) Moench against some human bacterial pathogens. FUTA Journal of Research in Sciences (1): 94-100.

[35] Okeke EC. (1998) The use and Chemical content of some indigenous Nigerian spices. Journal of Herbs, Spices and Medicinal plants 5: 51–63.
[36] Oktay M, Gülçin I, Küfrevioglu OI (2003). Determination of invitro antioxidant activity of fennel (Foeniculum vulgare) seed extracts. Journal of Advanced Scientific Research 36: 263 - 271.
[37] Okwu DE, Josiah C (2006). Evaluation of the chemical composition of two Nigerian medicinal plants. African Journal of Biotechnology 4: 357-361.
[38] Oladeinde FO, Kinyua AM, Laditan AA (2007). Effect of Cnidoscolus aconitifolius leaf extract on blood glucose and insulin levels of inbred type 2 diabetic mice. Cell and Molecular Biology 53: 34-41.
[39] Olowokudejo JD, Kadiri AB, Travih VA (2008). An ethnobotanical survey of herbal markets and medicinal Plants in Lagos State of Nigeria. Ethnobotanical Leaflets 12: 851-865.
[40] Onyeka EU, Nwambekwe IO (2007). Phytochemical profile of some green leafy vegetables in South East, Nigeria. Nigerian Food Journal 25(1), 67-72
[41] Oyeleke SB, Dauda BEN, Boye OA (2008). Antibacterial activity of Ficus capensis. African Journal of Biotechnology 7(10):1414-1417.
[42] Osagie AU, Eka OU (1998). Nutritional quality of plant foods. 1st ed. The Post-Harvest Reseach Unit, UNIBEN Nigeria. pp 62.
[43] Otitoju GTO, Nwamarah JU, Otitoju O, Iyeghe LU (2014). Nutrient composition of some lesser known green leafy vegetables in Nsukka L.G.A of Enugu State. Journal of Biodiversity and Environmental Sciences 4(4):233-239.
[44] Owolabi OJ, Nworgu ZA, Falodun A, Ayinde BA, Nwako CN (2009). Evaluation of tocolytic activity of ethanol extract of the Stem bark of Ficus capensis Thunb. (Moraceae). Acta Poloniae Pharmaceutica ñ Drug Research 66(3):293–296.
[45] Owolabi OJ (2013). Active ileum relaxant fractions from the leaves of Ficus capensis Thunb (Moraceae). Nigerian Journal of Pharmaceutical Science 12(1):1-7.
[46] Oyagbemi AA, Odetola AA, Azeez OI (2008). Ameliorative effects of Cnidoscolus aconitifolius on anaemia and osmotic fragility induced by protein energy malnutrition. African Journal of Biotechnology 11: 1721-1726.
[47] Pathak P, Kapil U (2004). Role of trace elements zinc, copper and magnesium during pregnancy and its outcome. Indian Journal of Paediatric 71: 1003-1005
[48] Pearson D (1976). The Chemical Analysis of Foods. 7th ed., Churchill Livingstone, Edingburg.
[49] Ramde-Tiendrebeogo A, Tibiri A, Hilou A, Lomp OM, Millogo-Kone H, Nacoulma OG, Guissou IP (2012) Antioxidative and antibacterial activities of phenolic compounds from Ficus sur Forssk. and Ficus sycomorus L. (Moraceae): Potential for sickle cell disease treatment in Burkina Faso. International Journal of Biology and Chemical Science **6**(1):328-336.
[50] Robert KM, Daryl KG, Peter AM, Victor WR (2003). Harper's Illustrated Biochemistry. In Benders and Mayes Vitamins and Minerals, Lange Medical Books/McGraw-Hill, Medical Publishing Division, New York 496.
[51] Saxena M, Saxena J, Nema R, Singh D, Gupta A (2013). Phytochemistry of Medicinal Plants. Journal of Pharmacognosy and Phytochemistry Center for Microbiology and Bio-Technology Research and Training, Bhopal, India. 8192 (1): 168-182.
[52] Saxena M, Saxena J, Pradhan A (2012). Flavonoids and Phenolic acids as antioxidants in plants and human health. International Journal of Pharmaceutical Science Review and Research 16(2): 130-134.
[53] Selvendran RR (1984). The plant cell wall as a source of dietary fiber: chemistry and structure. American Journal of Clinical Nutrition 39: 320–337.
[54] Sczkowski CP, Kalinowska M, Wojciechowski Z (1998). The 3-O-glucosylation of steroidal saponins and alkaloids in eggplant (Solanum melongena); evidence for two separate glycosyl transferences. Phytochemistry 48: 1151-1159.
[55] Sena LP, Vanderjadt JJ, Rivera C, Tsin ATC, Muhammadu I, Mahamadu O, Milson M, Pastosyn A, Glew RH (1998). Analysis of nutritional component of eight famine foods of Republic of Niger. Plant Food Human Nutrition 52: 17-30.
[56] Sofowora A (1993). Screening Plants for Bioactive Agents. In: Medicinal Plants and Traditional Medicines in Africa. 2nd ed. Spectrum Books Ltd., Sunshine House, Ibadan 81 -93, 134-156.
[57] Thomas RA, Krishnakumari S (2015). Proximate analysis and mineral composition of Myristica fragrans seeds. Journal of Pharmacognosy and Phytochemistry 3(6): 39-42.
[58] Thompson HC, Kelly WC (1990). Vegetable Crops. 5th Ed. New Delhi: Mac Graw Hill Publishing Company Ltd. 120-125.
[59] Umeokoli BO, Onyegbule FA, Gugu TH, Igboeme SO (2013). Evaluation of the erythropoietic and anti-sickling properties of Ficus capensis leaf extract in the treatment of anaemia. Planta Medica 79 -PE29.
[60] Usunobun U, Okolie NP, Anyanwu OG, Adegbegi AJ, Egharevba ME (2015). Phytochemical screening and proximate composition of Annona muricataleaves. European Journal of Botany and Plaint Science Phytology 2(1): 018-028.
[61] Wangensteen H, Samuelsen AB, Malterud KE (2004). Antioxidant activity in extracts from coriander. Food Chemistry 88: 293-297.
[62] Wills R, McGlasson B, Graham D, Joyce D (1998). Postharvest: An Introduction to the physiology and handling of fruit, vegetables and ornamentals. Wallingford: CAB International. 262.
[63] World Health Organisation (WHO) (2014). Traditional Medicine Strategy. Geneva. 10(6): 15-20.
[64] Yang Y.H. (1979) Tropical Home Gardens as a Nutritional Intervention. In: Inglett GE, Charalambous G, eds. Tropical Food Chemistry. Academic Press, New York. 417-436.
[65] Young SM, Greaves JS (1940). Influence of varieties and treatment of phytin contents of wheat. Food Research 5:103-105.
[66] Zakara H, Simpson K, Brown RR, Krotwarie A (1979). Use of reversed phase HPLC analysis for the determination of provitamin A, carotene in tomatoes. Journal of Chromatography, 176: 109-117.