The Nigerian Journal of Natural Sciences and Environmental Studies
Godfrey Okoye University, Ugwuomu Nike, Enugu State, Nigeria

PROXIMATE ANALYSIS, ANTIOXIDANT PROPERTIES AND ASCORBIC ACID CONTENT OF FICUS CAPENSIS FRUITS

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Abstract

The application of different parts of *ficus capensis* tree in ethno-medical and nutritional purposes have gathered tremendous interests among scholars currently. However, there is almost absent of such scholarly report on the fruits of this tree. Hence this work is aimed at stimulating the bioprospection of the fruits in order to establish its medicinal and nutritional qualities. The proximate analysis, antioxidant properties and ascorbic acid content of *ficus capensis* fruits collected from Maryland, Enugu South Local Government Area of Enugu State Nigeria is reported. The parameters investigated were determined using standard biochemical methods. The proximate analysis of the fruits give the following distribution: Ashcontent (9.0%), crude fiber (4.53%), crude protein (8.28%), moisture content (6.0%), crude lipid (3.5%), and carbohydrate (68.69%). The high percentage of carbohydrate shows that this fruit is a good source of energy. The antioxidant activity of the methanol extract of the fruits was tested using DPPH- Scaving assay. The DPPH- free radical scarvenging activity of the methanol extract of the fruits show good antioxidant activity.Ascorbic acid was determined by redox titration using iodine solution according to AOAC 1990.This showed that the fruits are quite rich in ascorbic acid which adds to the medicinal and nutritional values of the fruits.

Keywords: Ficus capensis fruits, moraceae, Proximate composition, Antioxidant Property, Metabolic extract, Ascorbic acid.

INTRODUCTION:

Ficus is a genus of family moraceae and consists of about 850 species. About 200 different varieties of *ficus* are present as woody trees, shrubs and vines in the forests of tropical and subtropical regions.Since ancient times, *ficus* species has been used as a source of food to improve the health of mankind. Most of the species of *ficus* are used in industrial products as nourishing foods. These are composed mainly of water, lipids, essential amino acids, minerals and vitamins. *Ficus* genus worked as food additives that are used frequently as health – promoting Mediterranean diet. It has great importance as nutraceutical and in biopharmaceutical industries. They are known as rich sources of amino acids that are totally free from cholesterol and fat contents. *Ficus carica* is

an excellent source of minerals containing copper, manganese, magnesium, potassium and calcium according to human needs.

Ficus species have been used as traditional medicines to cure diseases, such as, astringents carminatives, stomachic, vermicides, hypotensive, anthelmintic and anti-dysentery drugs.

Ficus species, such as, *Ficusracemosa, F, glomerata, F, glumosa, F. carica, F. religiosa and F. benghalensis* are known from ancient times as herbal medicines to treat diabetic disorders as regulating enzymatic activities, carbohydrates absorption rate, increasing insulin sensitivity, insulin secretion, hepatic glycogen synthesis, peripheral glucose uptake and antioxidant status of body.

Ficus Capensis is a fast growing, deciduous or ever green tree. It usually grows to about 5-12 meters (16-39ft) in height but may attain a height of 35-40 meters (115-131ft). The large alternate and spirally-arranged leaves are ovate to elliptic with irregular serrated margins. Fresh foliage is conspicuous red color. The bark of young tress is smooth and pale greyish-white in color in contrast to the flaky, yellow bark of *F.sycomorus*, with increasing age, the bark becomes darker and rough.

The figs are carried on long drooping spurs or fascicles which may emerge from surface roots, the trunk or especially from lower main branches. The figs are 2 – 4cm in diameter and acquire a rosy speckled exterior when ripe (Palgrave, 1984).

Fig.1: *FICUS CAPENSIS* TREE

MATERIALS AND METHODS

Collection of plant material

The fresh fruits of *Ficus capensis* used for the study were collected from the fig tree (F. capensis) from Maryland, Enugu South Local Government Area of Enugu State. They were authenticated by

a Botanist at University of Nigeria Nsukka, in the Department of Bioresources and Conservation Research Centre Nsukka.

Preparation of plant material

The fruits of *Ficus capensis* were first plucked, washed and drained under air. The fruits were cut into pieces after draining under air and were spread under the sun to dry. After drying of the fruits sample, it was then pulverized to powder using an electric grinding machine (Panasonik MX-337N). The powdered material was stored in an air-tight container.

Preparation of the extracts

Four hundred grams (400g) of the powdered fruit sample was extracted with 1500ml of methanol using cold maceration for 24 hours with continuous stirring. The mixture was filtered with whatman No.1 filter paper. The filtrate was concentrated using oven under a reduced pressure at 40°C to obtain the crude extract of *ficus capensis* fruits. The crude extract was stored in a refrigerator until it is ready for use.

PROXIMATE ANALYSIS

Determination of Percentage Moisture

The hot oven method of Pearson (1976) was used. One (1g) of the sample was measured into a thoroughly washed and oven dried crucible. The sample in the crucible was put in the oven at 105°C for 1 hour to dry and the weight was recorded. The sample was dried for another 30 minutes and cooled in desiccators. The weight was also taken. This was repeated till a constant weight was attained. Moisture content was then calculated thus:

$$\% \text{ Moisture} = \frac{W_2 - W_3}{W_2 - W_1} \times 100$$

where Weight of crucible = W_1, Weight of crucible + sample before drying = W_2, Weight of crucible + sample after drying = W_3

Determination of Percentage Ash Content.

An empty crucible was washed, dried and the weight was noted. Two grams of the ground sample was weighed accurately into a platinum crucible and was ignited in a universal hot-air oven for 24 hours at 600°C. The platinum crucible and its content were then cooled to room temperature in desciccator. The ash content was then obtained by calculation.

$$\% \text{ Ash content} = \frac{W_2 - W_1}{2g} \times \frac{100}{1}$$

Where weight of empty platinum crucible = W_1, weight of platinum crucible + sample after burning = W_2.

Determination of Percentage Crude Fibre

In the determination of crude fibre, we used the method of Joshyn (1970)

Two (2g) of ground sample was measured and put in 250 ml conical flask, soaked in 100 ml of 1.25 %v/v H_2SO_4 for 10 minutes, and heated for 30 minutes on a hot plate. The resulted mixture was filtered and the residue washed with hot distilled water three times to ensure that it is no more acidic. The residue was re-soaked in 200 ml of 1.25%w/v NaOH and heated again for another 30

minutes. The solution was filtered in a known weight of filter paper, dried in oven at 100°C for 2 hours, cooled and reweighed.

$$\% \text{ Crude Fibre} = \frac{\text{weight of Fibre}}{\text{weight of sample}} \times 100$$

Weight of ash = weight of Platinum Crucible + Ash - Weight of Platinum Crucible,

Weight of Fibre = Weight of Residue - Weight of Ash

Determination of Percentage Fat and Oil

Soxhlet extraction method of AOAC (2000) was used. Five gram (5g) of the sample was wrapped in a filter paper and put in a Soxhlet extractor. A heating mantle was applied below a conical flask with n-hexane inside, which aided in oil extraction. The system was recycled 8 – 9 times to achieve maximum yield of oil. At the end of the recycling, the extractor was disconnected and distillation apparatus set up to separate the solvent (n-hexane) from the oil, as a way of solvent recovery. An empty beaker was weighed and the mixture containing oil and traces of the solvent after distillation was transferred into the weighed beaker and heated to remove the remaining n-hexane leaving only the oil. This was cooled in desiccators and the weight of the beaker determined again.

$$\% \text{ (Oil and Fat)} = \frac{W_2 - W_1}{\text{Weight of } sample} \times 100$$

W_1 = Weight of empty beaker, W_2 = Weight of beaker + Oil

$W_2 - W_1$ = Weight of Oil

Determination of the Percentage Crude Protein Content:

The Kjeldahl method of AOAC (2000), was used.

This method comprises of three major stage. These are digestion, distillation and titration stages.

Digestion: 0.5 g of the sample was measured into a Kjeldahl flask, 10g of sodium tetraoxosulphate (V1) (Na_2SO_4), was added to increase the boiling point, and 1g of copper (II) tetraoxosulphate (VI) ($CuSO_4$) was added as catalyst. Then 20 ml of concentrated tetraoxosulphate (IV) acid was added.

This was digested by heating with bunsenburner in a fume cupboard until the solution turned bluish green, indicating complete digestion. Heating was stopped and the solution was allowed to cool for 24 hours.

On cooling, the solution solidifies and the colour changed from bluish green to white. The essence of the digestion is to convert all the nitrogen to ammonium ions (NH^+_4).

Distillation stage:

200ml of distilled water was added to the solidified sample in the kjeldahl flask to dissolve it, giving an exothermic reaction. The solution was placed in a refrigerator to cool. After cooling, 60ml of 40% NaOH was added to it.

Also, 3 pieces of zinc metal, acting as catalyst was added and then transferred to a round bottom flask connected to distillation apparatus and heat. The distillate was collected in a 250ml conical

flask containing 4% boric acid (100ml) and 2 drops of screened methyl red indicator. The collected solution in the conical flask was pink in colour but when the distillation was completed, the colour changed to light blue.

Titration stage

The collected solution (distillate) of about 200ml was titrated with 0.1N H_2SO_4. The end point was taken when the colour of the solution changed from blue to pink.

$$\text{Percentage Crude Protein} = \frac{100 \times TV \times 0.0014}{\text{Weight of sample}}$$

Where, 100 = conversion of %, TV = titer value,
0.0014 = constant, which implies that 0.0014 is librated by 1ml of 0.1N H_2SO_4

Determination of Percentage Carbohydrate

The method of Pearson (1976) was used Thus, the carbohydrate content of the sample was determined by taking the sum of ash, protein, moisture, crude fibre, fat and oil from 100. That is % Carbohydrate = 100 – (%Ash + %Protein + %Moisture + %Crude Fibre + % Fat and Oil).

ANTIOXIDANT

DPPH Scavenging Assay

DPPH- free radical scavenging capacity of the extract was evaluated according to the method of Brand Williams (1995).

A number of 0.5mls of the different concentration of the extract and standard were mixed with 3mls of methanol and 0.3mls of DPPH, the mixture were vortex for 1min and left to stand at room temperature in the dark for 30mins and the absorbance was read at 517nm, against a sample blank containing 0.5ml of the sample and 3.3ml of methanol, with a control containing 3.5mls of methanol and 0.3mls of DPPH solution.

ASCORBIC ACID (VITAMIN C)

Vitamin C was determined by redox titration using iodine solution as stated in AOAC (1990).

A number of 5g of sample was weighed into a conical flask and 50mls of water was added and allowed to stand for 24hours after which it was filtered. 20ml of the filtrate was measured into a conical flask. 150ml of distilled water was added. 5mls of potassium iodide solution (0.6M) and 1M hydrochloric acid was added each. 1ml of 5% starch indicator was added. The solution was titrated with 0.6M potassium iodate solution to end point (blue black coloration).

RESULTS AND DISCUSSION

PROXIMATE COMPOSITION

TABLE 1: Percentage proximate compositions of the *ficus capensis* fruit extract

Proximate Parameters	(%) Composition
Ash content	9%
Crude fiber	4.53%
Crude protein	8.28%
Moisture content	6.0%
Crude lipid	3.5%
Carbohydrate	68.69%

From table 1 above it could be seen that the high ash content (9.0%) in the fruits is indicative of the high mineral contents. Mineral helps in water balance, bone and body metabolism. Minerals are essential components of many enzymes, vitamins, hormones and respiratory pigments. They are cofactors in metabolism processes.

Crude fiber (4.53%). Fiber is an essential body nutrient. It helps in lowering constipation, high blood pressure, diabetes, cardiovascular diseases and cancer (Ishu, 2013). Thus its appreciable amount in the proximate composition of the fruit raises the nutritional qualities of this fruit. Moisture content (6.0) of the fruit shows that the fruit is a good source of water for the cells of the body (Okeke et al, 2008). The amount of moisture in the food is an indication of the water activity, hence it is used to determine food susceptibility and stability of spoilage microorganisms. Fat content (3.5%). Fat gives palatability to foods, serves as storage and transport forms of metabolic fuel, serves as thermal/ electrical insulators for subcutaneous tissues, emulsifier for drugs preparation and forms structural components of bio membranes (Antia et al, 2006). Essentially fat-soluble vitamins are processed by dietary lipids and consumption of much fats are known to cause cardiovascular diseases like atherosclerosis, cancer and aging (Antia et al, 2006) hence the moderate quantity of fat in the fruits of Ficus capensis demonstrates its importance for medicinal and nutritional uses,

The percentage composition of protein in the fruit under study is 8.28%. Protiens is essential for healthy growths in children, repair and maintenance in adult, production of immunoglobulins for body defense, production of enzymes and hormones (Emebu and Anyika, 2011).

The percentage carbohydrate in this study (68.69%) is high. Carbohydrates provides energy to body cells, mostly the brain cells which solely depend on glucose component of carbohydrates for its function (Effiong and Udofia, 2009). The high content of carbohydrate in the proximate composition of the fruits shows that it is a good source of energy.

IN VITRO ANTIOXIDANT STUDIES

DPPH Scavenging Assay

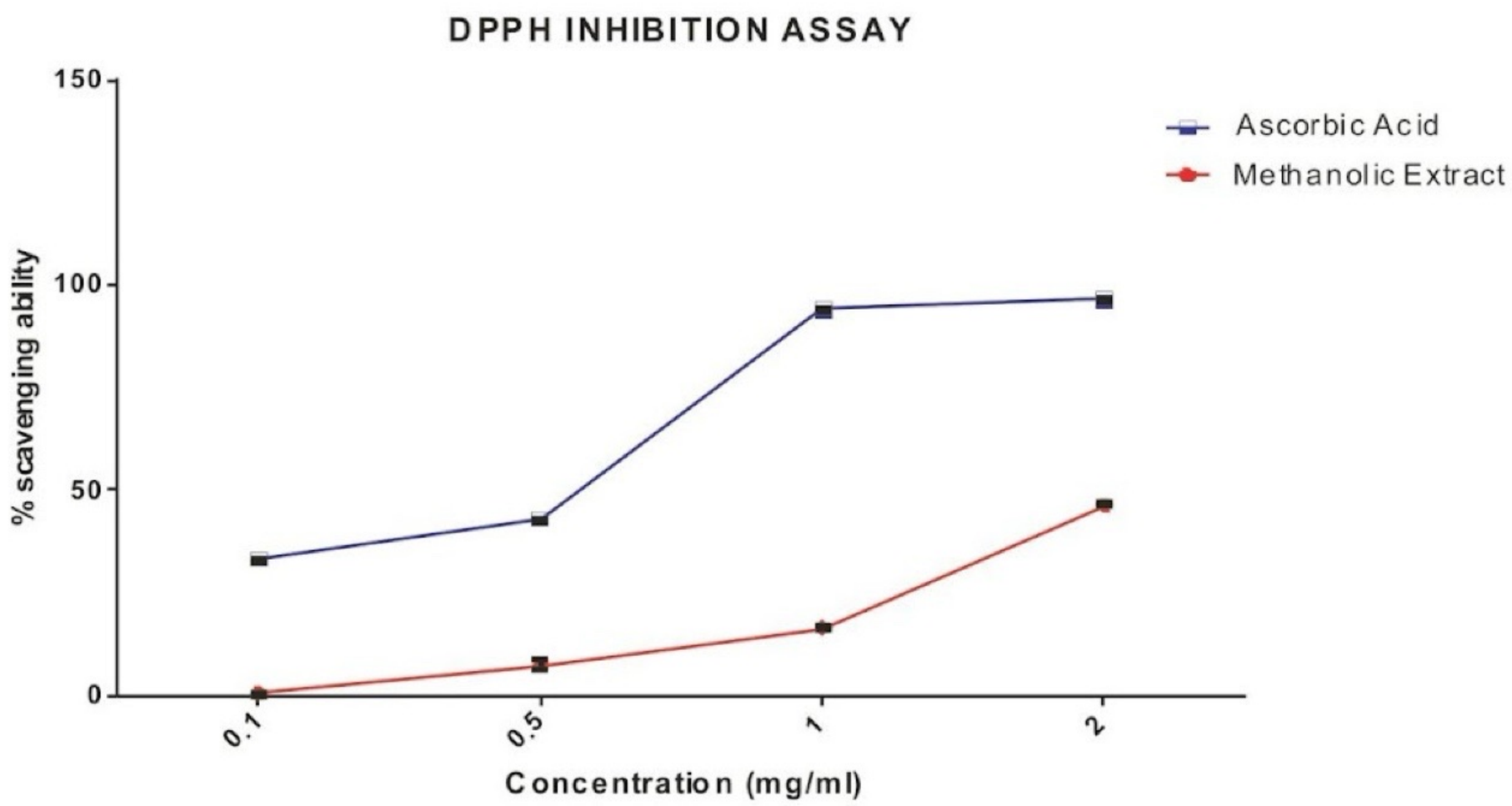

FIG 2: In *vitro* 1-1-DIPHENYL 2-PICRYL HYDRAZYL activities of Methanolic Extract of *Ficus capensis fruits.*

Fig 2 shows *in vitro* DPPH activities of Methanol extract of *ficus capensis fruits*. Different concentrations of extract were compared with ascorbic acid standard (0.1- 2.0 mg/ml). From the results obtained, methanol extract of ficus capensis fruits showed result of antioxidant activities at four concentration used (0.1, 0.5, 1.0, and 2.0). It is observed that the extract showed low antioxidant activities when compared with ascorbic acid standard.

Antioxidants protect cells against the damaging effects of reactive oxygen species otherwise called, free radicals such as singlet oxygen, super oxide, peroxyl radicals, hydroxyl radicals and peroxynite which results in oxidative stress leading to cellular damage (Mattson & Cheng, 2006). Natural antioxidants play a key role in health maintenance and prevention of the chronic and degenerative diseases, such as atherosclerosis, cardiac and cerebral ischema, carcinogenesis, neurodegenerative disorders, diabetic pregnancy, rheumatic disorder, DNA damage and ageing (Uddin *et al.,* 2008; Jayasri *et al.,* 2009). Antioxidants exert their activity by scavenging the 'free-oxygen radicals' thereby giving rise to a fairly 'stable radical'. The free radicals are metastable chemical species, which tend to trap electrons from the molecules in the immediate surroundings. These radicals if not scavenged effectively in time, they may damage crucial bio molecules like lipids, proteins including those present in all membranes, mitochondria and, the DNA resulting in abnormalities leading to disease conditions (Uddin *et al.* 2008). Thus, free radicals are involved in a number of diseases including: tumour inflammation hemorrhagic shock, atherosclerosis, diabetes, infertility, gastrointestinal ulcerogenesis, asthma, rheumatoid arthritis, cardiovascular disorders, cystic

fibrosis, neurodegenerative diseases (e.g. parkinsonism, Alzheimer's diseases), AIDS and even early senescence (Uddin *et al.,* 2008;Chen *et. al.,* 2006).

Antioxidant composition

Antioxidants are the substances which can scavenge free radicals and reduce the oxidative stress in the living and non-living systems. The antioxidants possess electron donating ability and inhibit the free radical-mediated oxidative reactions by various mechanisms, such as, hydrogen donation, metal chelation, metal and lipid reduction, inhibition of lipid peroxidation and free radical inhibition. Free radicals are the reactive oxygen and nitrogen species which are produced during various biochemical reactions particularly redox reactions. If not controlled properly, these free radicals may initiate the chain reactions in the biomolecules particularly the lipids and protein, cause the oxidative stress, and ϵnally lead to the oxidative damage to the cell organelles, cells and tissues. The oxidative damage to the cells and tissues may further lead to various health problems including cardiovascular, neurological, hepatic, and musculoskeletal abnormalities and aging. In non-living system, the free radicals cause oxidative stress and rancidity in the food stuff for human. The naturally occurring antioxidant compounds have been proved to be effective in preventing the oxidative damage to the living and non-living systems. These substances are either synthesized endogenously or taken from exogenous natural sources such as plants. The naturally occurring antioxidants include some enzymes such as glutathione peroxidase, catalase, superoxide dismutase and some non-enzymatic phytochemicals compounds including phenolic acids, polyphenols, ϵavonoids, anthocyanins, ascorbic acid, tocopherols, and B-carotenes. Some synthetic antioxidant compounds have been also reported to be effective against free radical-induced oxidative damage.

ASCORBIC ACID CONTENT

Table 2: The result of the ascorbic acid content of *ficus capensis* fruit at different concentration per gram

Concentration	Concentration per gram of Ascorbic acid
5g	0.000216
15g	0.000648
100g	0.000432

Ascorbic acid is one of the most important water soluble vitamins. It is essential for collagen carnitine and neurotransmitter biosynthesis.

Ascorbic acid (vitamin c) is food substance needed by human to prevent scurvy, a disease of the gums, bones and blood vessels, and to increase the body's resistance to infection. Ascorbic acid acts as an antioxidant, a nutrient that chemically binds and neutralizes the tissue-damaging effects of substances in the environment known as free radicals (Redmond, 2008).

As a result, ascorbic acid is vital for the growth and maintenance of healthy bones, teeth, gums, ligaments and blood vessels. Also because of its role in formation of collagen, the body's major

building protein, ascorbic acid is a central component of all the body organs.

Vitamin C is a cofactor in at least eight enzymatic reaction including severe collagen synthesis reaction that when dysfunctional, causes the most severe symptoms of scurvy (Food Standard Agency, 2007).

CONCLUSION

The study has shown proximate composition, antioxidant properties and ascorbic acid content of *ficus capensis fruits*, in a detailed form that enabled us to show the medicinal and nutritional qualities of the fruits. *Ficus Capensis Fruits* possess antioxidant potential due to higher concentration of phytochemical compounds. The fruits have a valuable role in human nutrition and have a great medicinal importance due to the presence of a variety of bioactive phytochemical compounds. These phytochemicals and water-soluble vitamins make *ficus capensis fruits* a medicinal plant which show various bioactive activities, particularly the antioxidant activity. On the account of its high antioxidant potential, *ficus capensis fruits* can be used for the management of oxidative stress and the treatment of various diseases. Oxidative stress is an important cause of many human diseases. The role of antioxidants in pharmacology is widely studied mostly in the treatment of different types of neurodegenerative diseases and stroke. Antioxidants are mostly used as food supplements so as to maintain health and prevent diseases. *Ficus capensis fruits* is a good source of antioxidants.

REFERENCES

1. Achi, N.K., Chimaraoke, O., Ekeleme – Egedigwe, C.A. Onyeanula J.C. (2017). Phytochemical, Proximate Analysis, Vitamine and Mineral Composition of Aqueous Extract of Ficus Capensis Leaves in South Eastern Nigeria.
2. Ahmed F, Urooj A. (2010). Traditional uses, medicinal properties, and phytopharmacology of *Ficus racemosa:* A review. Pharmaceutical Biology. 48(6):672-681.
3. Al-Snafi A E. (2017). Pharmacology of *Ficus religiosa* – a review. IOSR journal of Pharmacy. 7(3):49-60.
4. Antia, B.S; Akpan, E.J., Okon, P.A. and Umpren, I.U. (2006). Nutritive and anti-nutritive evaluation of sweet potatoes (Ipomea Batatas) leaves. Pakistan Journal of Nutrition 5:166 168.
5. AOAC (1990) Association of Official Analytical Chemists. Method of Analysis; 15th edition, Washington DC. 222-236.

6. AOAC (2000). Official Methods of Analysis International. SeventeenthEdition. Associaition of Official Analytical Chemist. Washington DC, USA.
7. Ayinde BA, Omogbai E, Amaechina FC. (2007). Pharmacognosy and hypotensive evaluation of *Ficus exasperate* Vahl (*Moraceae)* leaf. Acta Poloniae Pharmaceutica. 64(6):543-546.
8. Borokini, T.I., Ighere, D.A., Clement M., Ajiboye, T.O., Alowonle, A.A. (2013). Ethnobiological survey of traditional medicine practice for women's health in Oyo State.
9. Brand-Williams, W., Currelier, M.E. and Berset, C. (1995). Use of free radical methods to evaluate antioxidant activity. Lebensm Wiss Technol. 28:25-30.
10. Chen, F.N., Shieh, P. Kuo, D. and Hsieh, C. (2006) Evaluation of the antioxidant activities of Ruellia tuberosa. Food Chemistry. 94: 14 – 18.
11. Deepa, P. et al (2018). A role of Ficus species in the management of diabetes mellitus: A review Journal of Ethnopharmacology. 215: 210 – 232.
12. Diplock, A.T., Charleux, J.L., Crozier-Willi, G., Kok, F.J., Rice-Evans., Robertroid, M., Stahl, W. and Vina-Ribes, J. (1998). Functional food science and defence against reactive oxidative species. Brazilian Journal of Nutrition 80: S77 – S112.
13. Effiong, G.S., Ibia, I.o and Udofia, U.S. (2009) Nutritive and Energy value of some wild fruits in South Eastern Nigeria. Electronic Journal of Environment, Agriculture and Food Chemistry. 8(10): 917 – 923.
14. El-Fishawy A, Zayed R, Afifi S. (2011). Phytochemical and pharmacological studies of *Ficus auriculata* Lour. Journal of Natural Products. 4:184-195.
15. Emebu P.K., Anyika, J.U (2011). Proximate and Mineral composition of Kale (Brassica Oleracea) grown in Delta State, Nigeria. Pakistan Journal of Nutrition, 10(2):190-194.
16. Ephraim P.L., Helen M.P., Alison D.P. and Robert A.N. (2008). Ethnobotany and potentialas anticancer and anti-inflammatory agents, Journal of Ethnophamacology. 119 (2): 195 – 213.