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Phytochemical, Proximate and Total Antioxidant Analysis of Ogbu (*Ficus exasperata*) and Uvuru (*Anthocleista djalonensis*) Healthygreen Leaves

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Abstract: The demand for more nutritional leafy vegetables among wild unconsumed trees and vegetables known in Africa for nutritive, therapeutic and ethnomedicine purpose spur this research. The phytochemical, proximate and total antioxidant analysis of Ogbu (*Ficus exasperata*) and Uvuru (*Anthocleista djalonensis*) leaves were carried out. The young and healthy leaves of the samples under studywere plucked from their respective trees; shade dried for seven days and grinded into powdery form using a grinder and stored in an airtight container before been used for analysis. The result of the study, shows that in Ogbu *(Ficus exasperate)*; the flavonoids, phenols, saponins, steroids, tannins and glycosides were present in the following quantities 23.42%, 1.94%, 1.74%, 0.50%, 0.39% and 0.17% respectively. In Uvuru *(Anthocleista djalonensis)*, the flavonoids, saponins, phenols, tannins and glycosides are present in the 26.62%, 4.62%, 1.80%, 0.53% and 0.01% respectively. From the results of the proximate analysis ofOgbu *(Ficus exasperate)*; carbohydrates, fiber, ash content, protein, moisture content and lipids content of the sample were observed to be present in the following percentage of: 43.81%, 21.55%, 14.15%, 12.25%, 5.05% and 3.49% respectively. In Uvuru *(Anthocleista djalonensis)*, carbohydrates, fiber, protein, ash content, moisture and lipids content of the sample were observed to be present in the following percentage of: 48.88%, 16.35%, 15.75%, 10.10%, 6.70% and 2.22% respectively. Also, in the results of the antioxidant analysis of Ogbu *(Ficus exasperate)*; it was observed that vitamin E, vitamin A and vitamin C were present in the following concentrations of: 12.23 mg/g, 6.99 mg/g and 0.189 mg/l respectively. In Uvuru *(Anthocleista djalonensis)*; vitamin E, vitamin A and Vitamin C were observed to be present in the following concentrations of: 15.20 mg/g, 6.72 mg/g and 0.086 mg/l respectively. Hence, we thereby recommend the use of both Ogbu and Uvuru leaves as vegetables in our diets since they contain important phytochemicals and their nutrient level falls within other popular edible vegetables. We also suggest that it be used as a source of raw material for drug synthesis; to make vaccines and supplements that can control and prevent diseases.

Key words: Proximate · Total Antioxidant · Phytochemical and vegetables

INTRODUCTION

The African continent is one of the continents endowed with the richest biodiversity in the world. It has an avalanche of many food plants used as herbs; health foods and for therapeutic purposes. Over 5000 different species of plants substances have been recognized to occur in these areas and many of them have been found to be useful in traditional medicine for prophylaxis and cure of diseases [1]. Amongst the numerous plant species are *Anthocleista djalonensis* and *Ficus exasperate* etc.

The valuable medicinal properties inherent in plants have long been acknowledged, as biologically active molecules and lead structures for the development of modified derivatives with enhanced activity have been obtained through various natural product researches [2]. The use of medicinal plants all over the world predates the introduction of antibiotics and other modern drugs into Africa. Medicinal plants constitute an effective source of antimicrobial natural products [3]. Historically, plants have provided a source of inspiration for novel drug compounds, as plant-derived medicines have made large contributions to human health and well-being. Their role

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is two-fold in the development of new drugs: (a) they may become the base for the development of a medicine, a natural blueprint for the development of new drugs and (b) a phytomedicine to be used for the treatment of diseases [4].

Phytochemicals also known as phytonutrients are naturally occurring substances found in plant [5]. These substances have been found to be beneficial to human health as well as possessing antioxidant activity [6]. Many common plants based foods and herbs contain powerful phytochemical substances that can improve the quality of our health. Phytochemical can also protect us against many diet related disease.

Phytochemicals can act as an antioxidant and anti-inflammatory. It plays vital role in detoxification of harmful and deleterious chemicals of the body. Vegetables are mostly annual crops belonging to the group of plant called horticultural crops that are diverse in nature. Vegetable can be grouped into leafy and fruity vegetables on the nature of their consumable products or parts. Typical examples of fruits vegetable are those that produce fruit like okro, tomatoes, garden egg. While that of leafy vegetables are lettuce, spinach, fluted pumpkin and pumpkin. Iwu, [7] point out that fluted pumpkin (*Telfairia occidentals* seeds are consumed for their nutritional and medicinal benefit.

Ficus exasperata belongs to the family *Moraceae* and is commonly called sand paper or fig tree/plant, widely spread in all eco-regions of Nigeria. The plant has been ethnobotanically reported to have diverse medicinal uses. The leaf extract is reported to have diverse medicinal uses such as treating hypertensive patients [8], haemostative, ophthalmia, coughs and haemorrhoids (Odunbaku*et al*., 2008). The root bark is reported to be used in the treatment of high blood pressure [9]. The leaf is used to scratch skin parts affected by ringworm while the grounded leaves applied topically are used to treat boils [10]. Furthermore, the young leaves are prescribed as a common anti-ulcer remedy. Various pharmacological actions such as anti-diabetic, lipid lowering and anti-fungal activities have been reported for *Ficus exasperata*. Other industrial uses of sand paper leaves are for polishing woods [11], stabilization of vegetable oils, suppression of foaming, supplement as food stock and antimicrobials [12]. The activities of the leaf extract of *Ficus exasperata* against some pathogenic organisms have been extensively investigated [13]. Furthermore, it was reported that the viscid non-milky sap is used for treating sores eye trouble and stomach pains in Ivory Coast [14].

The sap is used to arrest bleeding in Ghana [15]. The liquid in which the bark is boiled is given to cows to hasten the expulsion of the after birth [16]. It is also used by traditional birth attendants (TBAS) in Congo to ease childbirth [17]. In Southern Africa scrapings of the bark is used in an embrocating of the body and also as a stimulant [18]. In Upper Ivory Coast it is applied to leprous sores (Bouquet 1969). In Zaire a leaf poultice is used in medication for ring worm [19]. Chest complications are treated in the Gambia by steam inhalation of the leaves boiled in water.

Anthocleista djalonensis is a species of the genus *Anthocleista*, their types, the English common name "Cabbage Tree" or "Candelabrum Tree" bear, within the family of gentian (*Gentianaceae*). It is located in West Africa widespread. *Anthocleistadjalonensis* grows as a small tree and reaches stature heights of up to 15 meters. Its slender trunk has a diameter of 40 cm. On the branches sometimes located at the leaf axils two upright spikes or upholstery. *Anthocleista djalonensis* has soft white wood [20-25, 28].

The opposite constantly arranged leaves are divided into petiole and leaf blade. The geöhrte petiole is 1 to 9 cm long. Great, simple leaf blade is elongated elliptical to obovate-elliptic with a length of 9 to 35 cm in young plants of up to 115 cm and a width of 5 to 17 cm, with young plants up to 50 cm a heart-shaped, rounded or wedge-shaped base, wedge-shaped upper end and a smooth edge [21]. The hermaphrodite flowers are radial symmetry. The four free sepals are circular with a length of 6 to 10 mm. The 11 to 14 white to creamy white petals are fused into a 20 to 32 mm long cylindrical tube of the corolla. The 11 to 14 spread corolla are oblong-lanceolate with a length of 10 to 18 mm. It is only the outer circle with 11 to 14 stamens present; this project from the corolla tube. The stamens are fused to form a ring. The anthers are cream or pale yellow. The Upper constant, four-chambered ovary is has a length of 6 to 7 mm and a diameter of 3 to 4 mm.

MATERIALS AND METHODS

Ogbu (*Ficus exasperata*) and Uvuru (*Anthocleista djalonensis*) green healthy leaves were used for the study.

Preparations and Method: Freshly harvested leaves of Ogbu (*Ficus exasperata*) and Uvuru (*Anthocleista djalonensis*) were collected and identified by a taxonomist and registered in the herbarium of Environmental biology

of Institute of management and technology (IMT) Enugu. The samples were washed with distilled water to remove dirty particles and shade dried for 7 days before grinding. After grinding, 5 grams of the Ogbu leaf (sample A) was weighed into in a washed dried bottle labeled A another 5 grams of grinded Uvuru leaf (sample B) was weighed and poured inside a washed dried bottle labeled B. The phytochemical, proximate and total antioxidant analysis were carried out in the laboratory of Project Development Agency (PRODA) Emene, Enugu.

The phytochemical which involve the determination of phenol, alkaloid, terpenoids was done using the method described by Harborne [17], steroid was determine using Okeke and Elekwa [18] method, tannin and flavonoids was done using Boham and Kocipai [19] method. For saponin, [20] and for Cynogenic glycoside, [23]; for proximate analysis, AOAC [22] and total oxidant determination was done using the method described by AOAC [23].

RESULTS

Phytochemicals:

Table 1: The comparison of the qualitative analysis of sample A [ogbu (*Ficus exasperata*)]and sample B [Uvuru (*Anthocleista djalonensis*)] green healthy leaves using different solvents

	Water		Methanol		N-hexane		Acetone		Diethyl ether		Ethanol	
Parameters												
Sample	A	B	A	B	A	B	A	B	A	B	A	B
Alkaloids	+	+	+	+	+	+	+	+	+	+	+	+
Tannins	+	-	+	+	+	+	+	+	+	+	+	+
Phenols	-	+	-	-	+	-	-	-	-		-	-
Steroids	+	-	-	-	-	-	-	-	-	-	-	-
Terpenoid	+	+	+	+	+	+	+	+	+	+	+	+
Glycosides	+	+	+	+	+	-	+	+	+	+	-	+
Saponin	+	+	+	+	+	+	+	+	-	+	+	+
Flavonoids	-	+	-	-	+	-	+	-	-	-	-	+

Table 2: The comparison of the quantitative analysis of sample A [ogbu (*Ficusexasperata*)]and sample B [Uvuru (*Anthocleista djalonensis*)] green healthy leaves

	Parameters (%)						
Samples							
Sample A	Tannin	Phenol	Steroids	Saponin	Glycosides	Flavonoids	Terpenoids
	0.50	1.94	0.17	1.74	0.39	23.42	1.05
Sample B	0.53	1.80	N.D	4.62	0.01	26.62	N.D

A = Ogbu leaves.
B = Uvuru leaves.
N.D = Not detected.

Proximate Analysis:

Table 3: The comparison of the result of the proximate analysis of sample A [ogbu (*Ficusexasperata*)] and sample B [Uvuru (*Anthocleistadjalonensis*)] green healthy leaves

Sample	Moisture	Ash	Lipids	Protein	Fiber	Carbohydrate
A	5.05	14.15	3.49	12.25	21.55	43.81
B	6.70	10.10	2.22	15.75	16.35	48.88

sampleA = Ogbu leaves.
Sample B = Uvuru leaves.

Vitamins:

Table 4: The comparison of the result of the total antioxidants analysis of sample A [ogbu (*Ficus exasperata*)]and sample B [Uvuru (*Anthocleista djalonensis*)] green healthy leaves

Sample	Vitamin A (mg/g)	Vitamin C (mg/l)	Vitamin E (mg/g)
A	6.99	0.189	12.23
B	6.72	0.086	15.20

A = Ogbu leaves
B = Uvuru leaves

DISCUSSION

The result of the phytochemical qualitative analysis of Ogbu (*Ficus exasperate*)and Uvuru (*Anthocleista djalonensis*) green healthy leaves using different solvent as shown in Table1 shows that alkaloid, tannin, terpenoid, glycoside, saponin was present in *Ficus exasperate* and *Anthocleista djalonensis* while flavonoid was sparingly present but steroids and phenol were absent in both. Alkaloids have been implicated in the inhibition of activities of some bacterial species (Tor-Anyiin, 2009). But boiling the vegetables in hot water reduces the anti-nutrients in the plant products [25], saponin in excess causes hypocholestrolaemia because it binds to cholesterol making it unavailable for absorption and also reduces protein digestibility. (Soetan, 2009). Flavonoids provides protection against diseases such as cancer, ageing, inflammation ischaemic injury and neuro-degenerative diseases [27].

Phytochemicals have varying amount in leafy vegetable. Levels of plant chemicals may vary depending on species and varieties of green leafy vegetables [27]. The quantitative analysis of the samples under study, shows that in *Ficus exasperate*; flavonoids, phenols, saponins, steroids, tannins, terpenoidsand glycosides were present in the following concentrations of 23.42%, 1.94%, 1.74%, 0.17%, 0.5%, 1.04% and 0.39% respectively. In *Anthocleista djalonensis*, flavonoids, saponins, phenols, tannins and glycosides are present in the following concentrations of 26.62%, 4.62%, 1.80%, 0.53% and 0.01% respectively. This shows that the plants are rich in phytochemicals and may be utilized as conventional vegetables.

The proximate analysis of *Ficus exasperate,*further shows that carbohydrates, fiber, ash content, protein, moisture content and lipids content of the sample were in the following concentrations: 43.51%, 21.55%, 14.15%, 12.25%, 5.05% and 3.49% respectively which is in line with trends of other researchers (www.academia,edu/nutrient). In *Anthocleista djalonensis*, carbohydrates, fiber, protein, ash content, moisture and lipids content of the sample were observed to be present in the following concentrations of: 48.88%, 16.35%, 15.75%, 10.10%, 6.70% and 2.22% respectively. *Ficus exasperate* is called *Ogbu* in Igbo, is used to treat colds, sore throats, diarrhea and wound and to stimulate lactation [28]. Some local palm oil producer use the leaves of the plant during squeezing of the plant fruit for oil as it catalyse the process of separation of the mesocarp from the kernel and enhancesthe liberation of the oil from the mesocarp.

From the results of the vitamin analysis of *Ficus exasperata*, it was observed that vitamin E, vitamin A and vitamin C were present in the following concentrations of: 12.23 mg/g, 6.99 mg/g and 0.189 mg/l respectively. In *Anthocleista djalonensis*, vitamin E, vitamin A and Vitamin C were observed to be present in the following concentrations of: 15.20 mg/g, 6.72 mg/g and 0.086 mg/l respectively.

The comparative result of the qualitative analysis of the samples under study it was observed that in *Ficus exasperate*, tannins was observed to be slightly present in all extract while in *Anthocleista djalonensis*, tannins was observed to be moderately present in methanol, diethyl ether and ethanol solvents, slightly present in n-hexane and acetone solvents and absent in water solvent. In *Ficus exasperata*, phenols was observed to be moderately present using n-hexane solvent while absent in all other solvents while in *Anthocleista djalonensis*, phenols was observed to be moderately present in water solvent, slightly present in diethyl ether solvent and absent in all other solvents. In *Ficus exasperata*, steroids were observed to be abundantly present in water solvent, slightly present in n-hexane solvent and absent in other solvents. In *Ficus exasperata*, terpenoids was observed to be abundantly present in acetone solvent, slightly present in n-hexane solvent and absent in other solvents. In *Ficus exasperata*, glycosides was observed to be moderately present in methanol solvent, slightly present in water, n-hexane and acetone extracts and absent in other solvents while in *Anthocleista djalonensis*, glycosides was observed to be moderately present in acetone solvent, slightly present in water, methanol and ethanol solvent and absent in other solvents. In *Ficus exasperata*, saponins was observed to be abundantly present in acetone solvent, moderately present in ethanol solvent and absent in all other solvents while in *Anthocleista djalonensis*, saponins was observed moderately present in water solvent, slightly present in n-hexane, acetone, diethyl ether and ethanol solvents and absent in methanol solvent. In *Ficus exasperata*, flavonoids was observed to be abundantly present in n-hexane solvent, moderately present in acetone extract and absent in all other solvents while in *Anthocleista djalonensis*, flavonoids was observed to be abundantly present in water solvent, slightly present in methanol and ethanol solvent and absent in all other solvent.

From the comparative analysis of the result of the quantitative analysis of both samples it was observed that for the tannin content of the samples under study, *Anthocleista djalonensis* leaves contains a little bit more

tannins (0.53%) than *Ficus exasperate* leaves (0.50%); for phenol content of both samples, *Ficus exasperate* leaves contains more phenols (1.90%) than *Anthocleista djalonensis* leaves (1.80%); for steroids content of both sample, *Ficus exasperate* leaves contains more steroids (0.17%) than *Anthocleista djalonensis* leaves which has non (N.D); for saponin content of both samples, *Anthocleista djalonensis* leaves contains more saponin (4.62%) than *Ficus exasperate* leaves (1.74%); for glycosides content of both samples, *Ficus exasperate* leaves contains more glycosides (0.39%) than *Anthocleista djalonensis* leaves (0.01%), while for flavonoids content of both samples, *Anthocleista djalonensis* leaves contains more flavonoids (26.62) than *Ficus exasperate* leaves (23.42).

From the comparative analysis of the result of the proximate analysis of both samples it was observed that for the moisture content of *Anthocleista djalonensis* leaves contain more moisture (6.70%) than *Ficus exasperate* leaves (5.05%), for ash content of both sample, *Ficus exasperate* leaves contains more ash (14.15%) than *Anthocleista djalonensis* leaves (10.10%), for lipids content, *Ficus exasperate* leaves contains more lipids (3.49%), than *Anthocleista djalonensis* leaves (2.22%), for protein content, *Anthocleistadjalonensis* leaves contain more protein (15.75%) than *Ficus exasperate* leaves (12.25%), for fiber content, *Ficus exasperate* leaves contains more fiber (21.55%) than *Anthocleista djalonensis* leaves (16.35%), while for carbohydrate content, *Anthocleista djalonensis* leaves contain more carbohydrate (48.88%) than *Ficus exasperate* leaves (43.81%).

From the comparative analysis of vitamins, it was observed that for the vitamin A content, *Ficus exasperate* leaves contains more vitamin A (6.99 mg/g) than *Anthocleista djalonensis* leaves (6.72 mg/g), for vitamin C content, *Ficus exasperate* leaves contains more vitamin C (0.189 mg/l) than *Anthocleista djalonensis* leaves (0.086 mg/l), while for vitamin E content, *Anthocleista djalonensis* leaves contain more vitamin E (15.20 mg/g) than *Ficus exasperate* leaves (12.23 mg/g).

CONCLUSION

The evaluation of the nutrient composition of *Ficus exasperate* leaves (Ogbu) and *Anthocleista djalonensis (Uvuru)* leaves has confirmed that varying number of phytochemicals are present in both samples and in different proportions. In other words, the leaves are highly rich in nutrients and good for human consumption for good and healthy living. They may be utilized for various therapeutic purposes since these nutrients are available during the dry season.

Recommendations: It is therefore recommended that the young leaves *Ficus exasperate* leaves (Ogbu) and *Anthocleista djalonensis (Uvuru)* should be taken as a source vitamin in our diets. This study supports the idea that both Ogbu and Uvuru leaves can be useful in the Pharmaceutical and Medical science to make vaccine and supplements that can prevent diseases. It can be useful also in various manufacturing industries as raw material.

REFERENCES

1. Iwu, M.M., 1993. Handbook of Africa Medicinal Plant.CRC press, Inc. Florida.
2. Sundaram, R., I.S. Jacob and P. Suganthi, 2012. *In vitro* antiplasmodial activity of ethanolic extracts of South Indian medicinal plants against *Plasmodium falciparum*. Asian Pacific Journal of Tropical Diseases, 2: 180-183.
3. Haslam, E., T.H. Lilley, R.M. YaCai and Magnolato, 1989. Traditional herbal medicine: The role of polyphenols. Planta Medica, 55: 1-8.
4. Rafat, H.S., B.S. Cilland and N.T. Cilland, 2008. Hydroxyl Radical Scavenging activity of flavonoids. Journal of Phytochemistry, 26(9): 2489-2491.
5. Ugwu Okechukwu, P.C., O.F.C. Nwodo, P.E. Joshua, A. Bawa, E.C. Ossai and C.E. Odo, 2013 Phytochemical and Acute Toxicity studies of *Moringa oleifera* Ethanol leaf extract. International Journal of Life Science Biotechnology and Pharmaceutical Research, 2(2): 66-71.
6. Adonu Cyril, C., P.C. Ugwu Okechukwu, C.O. Esimone, C. Ossai Emmanuel, Bawa Abubakar and U. Okorie Chris, 2013. Phytochemical Analyses of the Menthanol, Hot water and n-hexane extracts of the Aerial Parts of *Cassytha filiformis (linn)* and Leaves of *Cleistopholis patens (benth)*. Research Journal of Pharmaceutical, Biological and Chemical Sciences, 4(2): 1143-1149.
7. Iwu, M.M., A.R. Duncan and C.O. Okunji, 1999. New antimicrobials of plant origin In: Perspectives in new crops and new uses, [Ed. Janick J.]. ASHS Press, Alexandria, VA.
8. Buniyamin, A.A., K.I.Q. Eric and C.A. Fabian, 2007. Pharmacognosy and hypotensive evaluation of Ficus *exasperata* VVahl. (Moraceae) leaves. Acta Poloniae Pharmaceutical-Drug Research, 64(6): 543-546.

9. Odunbaku, O.A., O.A. Ilusanya and K.S. Akasoro, 2008. Antibacterial activity of ethanolic leaf extract of *Ficus exasperata* on *Escherichiacoli* and Staphylococcusalbus. Science Research Essays, 3(11): 562-564.
10. Okoli, A.S. and C.U. Iroegbu, 2004. Evaluation of extracts of *Anthocleista djalonensis*, *Nauclealatifolia* and *Uvariaafzalii* for activity against bacterial isolates from cases of non-gonococcal urethritis, Journal of Ethnopharmacology, 92: 135-144.
11. Lawal, I.O., N.E. Uzokwe, D.O. Ladipo, I.O. Asinwa and A.B.I. Igboanugo, 2009. Ethnophytotherapeutic information for the treatment of high blood pressure among the people of Ilugun, Ilugun area of Ogun State, Southwest, Nigeria. Afrcan Journal of Pharmaceutical Pharmacology, 3(4): 222-226.
12. Burkill, H.M., 1997. The useful plants of tropical West Africa. 4 3rd Ed. Royal Botanic Gardens Kew, pp: 166-179.
13. Abbiw, T., 1990. Study of Tropical shrubs and plant. J. Biogeorge, 23: 591-602.
14. Hallan, P., 1979. Population dynamics of Fig wasps from *Ficus exasperata* Vah,. Proc. Kon, Ned. Akad - We Ser. C, 87: 365-375.
15. Bouquet, A.J., 1969. Natural products as an alternative remedy. 4th Ed. Royal Botanic Gardens. Kew, pp: 166-179.
16. Mubo, A., M.O. Sonibare and S.Y. Ekine-Ogunlana, 2007. A chemotaxonomic approach to the alkane content of three species of *AnthocleistaAfzel*. (Loganiaceae), In: African Journal of Biotechnology, 6(13): 1516-1520.
17. Harborne, J.B., 1973. Phytochemical methods: A guide to Modern techniques of plant Analysis. Chapman A and Hall, London, pp: 49-98; 113-185; 279.
18. Okeke, C.U. and I.Z. Elekwa, 2003. Phytochemical study of the extracts of *Gongronemalatifolium*(Asclepiacleaseae). Journal of Health and Visual Studies, 5: 47-55.
19. Boham, A.B. and A.A. Kocipai, 1994. Flavonoids and condensed tannins from leaves of Hawaiian *Vacciniumvaticulation*and *V. calycinium*, Pacific Science, 48: 458-463.
20. Obadoni, B.O. and P.O. Ochuko, 2001. Phytochemical Analysis; Phytochemical Studies and Comparative Efficacy of the Crude Extracts of Some Homeostatic Plants in Edo State and Delta State of Nigeria, Global Journal of Pure Applied Science, 8(2): 203-208.
21. Van-Burden, T.P. and W.C. Robbinson, 1981. Formation of Complex Proteins and Tannin Acids. Journal of Agriculture and Food Chemistry, 1: 77.
22. Association of Official Analytical Chemists, (AOAC). 1994. Official Method of Analysis, 16th Ed. Association of Official Analytical Chemists, Washington, D.C.
23. Association of Official Analytical Chemists, (AOAC). 2005. Association of Official Analytical Chemists.Official Methods of Analysis, 18th Edition, AOAC Press, Washington DC.
24. Tor-Anyiin T.A., 2009. Chemical characterisation of stem bark of Sterculiasetigera. PH.D Thesis, NnamdiAzikiwe University, Awka, Nigeria.
25. Enechi, O.C. and I. Odonwodu, 2003. An assessment of the phytochemical and nutrient composition of the pulverised root of Cissusquadrangulais, Bioresearch, (1): 63-68.
26. Soetan, K.O. and O.E. Oyewole, 2009. The need for adequate processing to reduce the anti-nutritional factors in animal feeds, A review. African Journal of food Science, 3(9): 223-232.
27. Onyeka, E.U. and I.O. Nwambekwe, 2007. Phytochemicalm profile of some green leafy vegetables in South East Nigeria. Nigeria Food Journal, 25(1): 67-76.
28. Ochulayi, P.O. and G.E. Anekwe, 2013. Lipid composition of medical plants: portulacaOleracea and FicusThonningi. Africa Journal of Food Science, 7(5): 76-79.