



ABSTRACT

Vegetables are the fresh and edible portion of herbaceous plants which can be eaten raw or cooked. They are valued mainly for their high carbohydrate, vitamin and mineral contents. Vegetables play a vital role in the culture of people in Nigeria and Africa as a whole. This research is aimed at identifying the phytochemicals and determining the elemental composition

P

HYTOCHEMICAL AND ELEMENTAL ANALYSIS OF SOME SELECTED VEGETABLES SOLD IN DAMATURU METROPOLIS YOBE STATE, FLUTED PUMPKIN (*Telfairia occidentalis*) and SPINACH (*Amaranthus hybridus*)

KATUZU. M. I¹, HODI. A. I², LAWAN. L³ AND AMINA. G. M⁴.

¹Department of Science of Basic Science, Federal Polytechnic Damaturu, Yobe State. ^{2&3}Department of Science Laboratory Technology, Federal Polytechnic Damaturu, Yobe State. ⁴Department of Midwifery Aminu Sule College of Nursing and Midwifery, Damaturu. Yobe State.

Introduction

Vegetables are the fresh and edible portion of herbaceous plants which can be eaten raw or cooked. They are valued mainly for their high carbohydrate, vitamin and mineral contents. Vegetables may be edible root, stem, leaves, fruit or seed. Each group contributes to diet in its own way. Vegetables are valuable sources of nutrients especially in rural areas where they contribute substantially to protein, minerals, vitamins, fibers and other nutrients which are usually in short supply in daily diets (Mohammed and Sharif, 2011).

Green vegetables have long been recognized as the cheapest and most abundant potential source of protein because of their ability to synthesize amino acid from a wide range of virtually unlimited



and readily available primary materials such as water, CO_2 and atmospheric nitrogen in sunlight (Uusiku, et al., 2010). In most developed nations of the world, most of the green vegetables are either canned or refrigerated to increase their shelf life and nutritional potentials. In more advanced nations some are fractionated to leaf protein concentrates and are used as condiments in the foods of aged, pre-school children and some protein vulnerable groups (Aletor et al., 2002).

Vegetables are one of the food sources which are numerous and diverse. They are classified into several groups such as algae, mushrooms, root, tubers, bulbs and stalk, leafy, inflorescence and seed. The classification are important as dietary guidance materials to facilitate people in selecting appropriate types of these vegetables to meet the required nutrients and health (Pennington and Fisher,

pumpkin and spinach. Using solvent extraction method; the result showed that alkaloids, tannins, flavonoids, cardiac glycosides, steroids and carbohydrate were present in both vegetables. Saponin and quinones were present only in spinach (Amaranthus hybridus) and Phenol is present only in fluted pumpkin (Telfairia occidentalis), while terpenoids were absent in both vegetables. The result for mineral composition of fluted pumpkin shows that it contained K (80.20), Fe (15.64) Mg (76.46) Zn (5.52) Na (47.81), Ca (27.48) and P (13.02). Elemental analysis in mg/100g indicated that leaves of spinach contained Na (7.43), K (54.20), Ca (44.15), Mg (231.22) Fe (13.58), Zn (3.80) and P (34.91). The result indicated that the fluted pumpkin and spinach leaves are good sources of minerals. Therefore based on the result obtained, fluted pumpkin (Telfairia occidentalis) and (Amaranthus hybridus) could be used to improve the health status and essential in reducing a number of diseases in human. Further research should be carried out on both plants to determine their potency in the prevention and treatment of chronic diseases like diabetes, and high blood pressure.

Keywords: Vegetables, phytochemicals, diseases, flavonoids, extraction.



2009). Leafy vegetables are belong to the groups which the leafy part including leaves, petioles, succulent stems and shoots are consumed whereas other parts are inedible and discarded However, in some countries such as South Africa the vegetables contribute significantly in household food security It plays an important role in alleviating hunger and malnutrition especially during famine and disasters (Kidane *et al.*, 2015)

NUTRITIONAL AND HEALTH BENEFIT OF VEGETABLES

The wide range of biologically active substances that are found in vegetables contributes to the fact that vegetable-rich diets are associated with a number of health benefits. In addition to a high nutrient density, most vegetables also contain a high volume of water and are therefore relatively low in calories. There is convincing evidence that diets that include a large proportion of fruit and vegetables can help protect against coronary heart disease, hypertension and stroke; in addition, they can also improve the condition of patients suffering from these illnesses (Boeing *et al.*, 2012).

The benefits of consumption of vegetable such as the Cruciferous vegetables (Cabbage and Mustard) on prevention of prostate cancer. The reported high antioxidant activities of vegetables also help in protecting cell membrane integrity and reducing rate of aging. Vegetables offer protection against cardiovascular diseases since they are free of saturated fat, trans fat, and cholesterol and rich in bioactive compounds such as dietary fibers, flavonoids, carotenoids, phytoestrogens, monoterpenes, and sterols. Unbalanced diets with low vegetable intake have been estimated to cause about 31% of ischemic heart disease and 11% of stroke worldwide. A healthy diet with high vegetable consumption has been associated with lower risk of cardiovascular dis-ease in humans. In spite of modern development of sophisticated pharmaceutical chemicals to treat illnesses, medicinal plants remain an important tool for treating illness (Genoveva and Rajendra, 2001).

MEDICINAL USES OF FLUTED PUMPKIN (*telfairia occidentalis*)

Plants have been used medicinally in all civilizations. Despite the effectiveness of chemically synthesized medicines, screening for plant drugs will continue for the development of new pharmaceuticals to r



esolve both old and new health problems. Aqueous extract of fluted pumpkin (*Telfairia occidentalis*) reduces blood sugar and increases haematological indices and reproductive indices in male rats. It also reduces blood glucose levels and therefore could be a hypoglycaemic agent. The roots and leaves of fluted pumpkin (*Telfairia occidentalis*), have been shown to contain highly toxic alkaloids and saponins, glycosides and triterpenes. The Leaves are also rich in essential and non-essential amino acids, vitamins and minerals. Studies have also shown that fluted pumpkin (*Telfairia occidentalis*) leaf is rich in antioxidant phytochemicals such as vitamin C and phenols (Salman *et al.*, 2008).

Amongst the different foods, production and consumption of fluted pumpkin is very important because of their contribution to good health by providing inexpensive sources of minerals and vitamins needed to supplement people's diet which are mainly carbohydrates. Fluted pumpkin is the most important and extensively cultivated food and income generating crops in many parts of Africa (Adebisi *et al.*, 2011).

The study of the therapeutic effect of fluted pumpkin (*Telfairia occidentalis*) on Protein Energy Malnutrition-Induced Liver Damage shows that it has a restorative ability in the treatment of oxidative stress. Fluted pumpkin (*Telfairia occidentalis*) is used for the treatment of convulsion in ethno medicine, where the young leaves of are sliced and stored in a bottle to which coconut water and salt are added. It is also an indigenous plant used in ethno medicinal treatment of anemia in Nigeria (Kayode *et al.*, 2009).

NUTRITIONAL AND HEALTH BENEFIT OF SPINACH (*AMARANTHUS HYBRIDUS*)

Spinach (*Amaranthus hybridus*) (popularly called Amaranth or “pig weed”) is a herbaceous plants that have found large applications in food and medicinal industries. In Nigeria and other parts of Africa, the leaves combined with condiments are used to prepare soup In Congo, their leaves are eaten as spinach or green vegetables These leaves boiled and mixed with a groundnut sauce are eaten as salad in Mozambique and in West Africa (Dhellit *et al.*, 2006)

Spinach (*Amaranthus hybridus*) is a herbal plant that is grown to be consumed leaves. This vegetable is known as an important source of



iron. This plant originated in America, but it has spread all over the world. *Spinach* (*Amaranthus hybridus*) can be consumed in various ways, namely made vegetables, directly consumed when raw, or made into chips. The nutrients contained in 100 grams of Health Benefits of *Spinach* (*Amaranthus hybridus*)s include: 3 grams of protein, 2 grams of carbohydrates, 3 grams of iron, 81 gr of calcium, Vitamin A, C, Niacin, Thiamin, Phosphor, Riboflavin, Sodium, Potassium, Magnesium. Abundant content in *Spinach* (*Amaranthus Hybridus*) makes it as a vegetable that is beneficial to the body; For diet, Fight cancer, maintain eye health, maintain the health of the digestive system, prevent constipation, boost immunity, smooth blood circulation, maintain the health of the nervous system, solve the problem of bleeding gums, maintaining the health of pregnant women. (Lim et al., 2004).

COLLECTION OF SAMPLES (VEGETABLES)

The fresh leaves of the two different vegetables which are Fluted pumpkin (*Tefairia occidentalis*) and Spinach (*Amaranth hybridus*), were purchased from bayan tasha in Damaturu, Yobe State. Samples were then washed thoroughly and were immediately taken to the laboratory in other to avoid contamination of the leaves. It was then arranged differently according to their types and was labeled for identification.

DRYING OF SAMPLE

The samples fluted pumpkin (*Tefairia occidentalis*) and Spinach (*amaranthus hybridus*) were air-dried at room temperature (24°C) for two weeks and pulverized by a mechanical grinder and was passed through a 40mesh sieve. When the samples have been sieved, then it was packed into a tightened container and was labeled appropriately and separately.

QUALITATIVE PHYTOCHEMICAL ANALYSIS

The ethanolic extract were tested for the presence of alkaloids, flavonoids, saponins, cardiac glycosides, quonones, terpenoids, tannins, sterols, phenols, and carbohydrate.



TEST FOR ALKALOIDS

The ethanolic extract (0.2g) was dissolved in 5 ml of m of HCL and filtered. A few drops of mayer's reagent was added, the presence of white (turbid) precipitate indicates the presence of alkaloids.

TEST FOR TANNINS (BRAYMER'S TEST)

About 0.2g of the ethanolic extract dissolved in 2ml of methanol and 1ml of water was added, the mixture was treated with 10% alcoholic ferric chloride solution. (2-3 drops). Formation of blue/greenish color indicates tannins.

TEST FOR FLAVONOIDS

The ethanolic extract (0.2g) was dissolved in 2ml of methanol, concentrated sulphuric acid (1 ml) was followed by 0.5g of magnesium metal. A pink coloration indicates the presence of flavonoids.

TEST FOR CARDIAC GLYCOSIDES (KELLER KELLIANI'S TEST)

About 0.2g of methanol was treated with 2ml of glacial acetic acid in a test and a drop of ferric chloride solution was added to it. This was carefully under laid with 1ml of concentrated sulphuric acid. A reddish brown at the interface indicates the presence of deoxy characteristic of cardenolides. A violet ring may appear below the ring while in the acetic acid layer a greenish layer may form.

TEST FOR TERPENOIDS (SALKOWKI'S TEST)

Aliquot (1 ml) of chloroform was added to 0.2g of the extract in 2ml of methanol followed by a drop of concentrated sulphuric acid. A reddish brown precipitate produce immediately indicates the presence of terpenoids.

TEST FOR STEROLS (LIBERMANN-BURCHARD TEST)

1 ml of extract was treated with few drops of chloroform, acetic anhydride and concentrated sulphuric acid, and the observed for the formation of dark pink or red color.

TEST FOR PHENOLS

A fraction of the extract (0.2g) was treated with few drops of aqueous 5% ferric chloride and observed for the formation of deep blue or black color indicating the presence of phenol.



TEST FOR SAPONONS

Foam Test: 0.5 g of the ethanolic extract was shaken with 2ml of water formation of foams which persisted for over ten minutes indicates the presence of saponins.

ELEMENTAL ANALYSIS

The digested samples were then transferred into separate plastic bottles, labelled and stored waiting for analysis. For background correction, seven blanks were digested as pre-test samples and each of the blanks was analysed for K, Na, Mg, Zn, Ca, Fe and P, by atomic absorption spectrophotometer model 210VGP.

RESULT

TABLE 1: PHYTOCHEMICAL ANALYSIS OF FLUTED PUMPKIN (*Telfairia occidentalis*) AND SPINACH (*Amaranthus hybridus*)

S/N	TEST	<i>T. occidentalis</i>	<i>A. hybridus</i>
1	Alkaloids	+	+
2	Tannins	+	+
3	Flavonoids	+	+
4	Cardiac Glycosides	+	+
5	Terpenoids	-	-
6	Sterols	+	+
7	Phenols	+	-
8	Saponons	-	+
9	Quinones	-	+
10	Carbohydrates	+	+

KEY: + Present

- Absent

TABLE II: ELEMENTAL ANALYSIS OF FLUTED PUMPKIN (*Telfairia occidentalis*) AND SPINACH (*Amaranthus hybridus*)

Mineral element	SPINACH (<i>Amaranthus hybridus</i> L). leaves	FLUTED PUMPKIN (<i>Telfairia occidentalis</i>)
	Composition (mg/100 g)	Composition (mg/100 g)
Sodium (Na)	7.43	47.81
Potassium (K)	54.20	80.20



Calcium (Ca)	44.15	27.48
Magnesium (Mg)	231.22	76.46
Iron (Fe)	13.58	15.64
Zinc (Zn)	3.80	5.52
Phosphorus (P)	34.91	13.02

DISCUSSION

The phytochemical analysis conducted on fluted pumpkin (*Tefairia occidentalis*) and Spinach (*amaranthus hybridus*) using ethanolic leaf extract revealed the presence of alkaloids, tannins, flavonoids, cardiac glycosides, steroids and carbohydrate in both the extracts. These phytochemical compounds are known to support bioactive activities in medicinal plants and are thus responsible for the antioxidant activities of these plants.

Alkaloids are beneficial chemicals to plants serving as repellent to predators and parasites. This probably endows these group of agents its antimicrobial activity. Alkaloids have been found to have microbiocidal effect and the major anti-diarrheal effect and antihypertensive effect. Some alkaloids are useful against HIV infection as well as intestinal infection associated with AIDS. Tannins are known to be useful in the treatment of inflamed or ulcerated tissues and have remarkable activity in cancer prevention. Thus fluted pumpkin (*Tefairia occidentalis*) and Spinach (*amaranthus hybridus*) containing tannins may serve as a potential source of bioactive compound in cancer prevention and treatment (Okwu, 2004).

Flavonoids are anti-inflammatory, anti-tumor, anti-viral, and antiplatelet. Flavonoids also are potent water soluble antioxidants and free radical scavengers, which prevent oxidative cell damage and have strong anticancer activity. Flavonoids and cardiac glycosides, are responsible for the radical scavenging effects of most plants. They show antioxidant activity and their effects on human nutrition and health is considerable (Pourmorad *et al.*, 2006 and Tomoyuki *et al.*, 2005).

The presence of steroids, in both the extracts may be contributory to its anti-inflammatory activity (Pourmorad *et al.*). The presence of these phenolic compounds in these plants contributes to their antioxidative properties and thus the usefulness of these plants in herbal medicament. Phenols have been found to be useful in the preparation of some antimicrobial compounds such as dettol and cresol (Francis *et al.*, 2002).

fluted pumpkin (*Tefairia occidentalis*) happens to be the vegetable with the least number of phytochemical compounds which was absence to



terpenoids, saponins and quinones. Phenols being present only in fluted pumpkin (*Tefairia occidentalis*) has been reported to have natural protective effects against many illnesses. Phenols also have a potential of combating oxidative stress syndrome, causative of some neurodegenerative diseases and cardiovascular diseases (Francis *et al.*, 2002).

The phytochemical analysis revealed that fluted pumpkin Spinach (*amaranthus hybridus*) has the highest number of phytochemical compounds which was absence to terpenoids and phenols. Terpenoids happens to be absent in both the plant extracts.

Spinach (*amaranthus hybridus*) Showed positive test for saponins which are known bioactive substances that can reduce the uptake of cholesterol and glucose in the gut through intra-luminal physiochemical interaction. Saponins is also involved in complexation with cholesterol to form pores in cell membrane bilayers as such may be used as anticholesterol agents or cholesterol lowering agent (Francis *et al.*, 2002).

Quinones which is present in Spinach (*amaranthus hybridus*) is rich in antioxidant activity Studies have shown that antioxidant compounds possess anti-inflammatory, antiatherosclerotic, antitumor, antimutagenic, anticarcinogenic, antibacterial, and antiviral activities. The ingestion of natural antioxidants has been associated with reduced risks of cancer, cardiovascular disease, diabetes, and other diseases associated with ageing (Cai *et al.*, 2003).

Plants are reservoir of bioactive constituents which are used for treatment of various disease. The ethanolic extract of the selected vegetables were screened for the presence of phytoconstituents. Elemental analysis was carried out using atomic absorption spectrophotometer (AAS). Preliminary phytochemical screening indicated the presence of Alkaloids, tannins, flavonoids, cardiac glycoside as steroids in both vegetables while terpenoids was absent in both vegetables. The result for mineral composition of fluted pumpkin shows that it contained K (80.20), Fe (15.64) Mg (76.46) Zn (5.52) Na (47.81), ca (27.48) and P (13.02). Elemental analysis in mg/100g indicated that leaves of spinach contained Na (7.43), K (54.20), Ca (44.15), Mg (231.22) Fe (13.58), Zn (3.80) and p (34.91). The result indicated that the fluted pumpkin and spinach leaves are good sources of minerals.

Mineral composition of *A. hybridus* leaves in decreasing order in mg/100 g is 80.2, 54.200, 44.15, 34.91, 13.80, 7.43 and 3.80 for Mg, K, Ca, P, Fe Na and Zn, respectively. Hence, consumption of *A. hybridus* would probably reduce high blood pressure diseases.



Calcium and phosphorus are associated with each other for growth and maintenance of bones, teeth and muscles. The Calcium level in the leaves studied compares favourably with the value reported in some green leafy vegetables consumed in Nigeria and some wild edible leaves grown in Eastern Anatolia, Turkey (Turan et al., 2003). The phosphorus content (34.91 mg/100 g) compares favourably with that of *I. batatas* (37.28 mg/1000 g) but is low compared to 166 – 640 mg/100 g observed in some green leafy vegetables consumed in Nigeria. Magnesium content (231.22 mg /100 g) of the leaves is within the range reported in some green vegetables (Hassan and Umar, 2006). This is a component of chlorophyll. It is an important mineral element in connection with ischemic heart disease and calcium metabolism in bones (Ishida et al., 2000).

Iron content of the leaves (13.58 mg/100 g) compares favourably with the value reported in *I batatas* (16.00 mg/100 g) (Antia et al., 2006), but low compared with values of other green leafy vegetables (DW) (Ibrahim et al., 2001). Iron is an essential trace element for haemoglobin formation, normal functioning of the central nervous system and in the oxidation of carbohydrates, protein and fats. The Zinc content (3.80 mg/100 g) compares favourably to most values reported for green leafy vegetables in literatures. Zinc is involved in normal function of immune system.

CONCLUSION

The phytochemical analysis of both plants has shown the presence of alkaloids, tannins, flavonoids, cardiac glycosides, steroids and carbohydrate. Spinach (*amaranthus hybridus*) with the highest number of phytochemicals and absence of terpenoids in both plants. Fluted pumpkin (*Tefairia occidentalis*) and Spinach (*amaranthus hybridus*) leaves are a very rich source of phytochemicals and the intake of these plants chemicals have a protective potential against some tropical disease in the use of leaves in folk medicine. The plants are important sources of phytochemicals. They are therefore, nutritionally and medicinally relevant. The presence of these phytochemical compounds indicates that these plants can be useful drugs, and may play vital role in preventing various diseases such as inflammation, bacterial infection, lipid peroxidation, fever, constipation, etc.

The leaves of Fluted pumpkin (*Tefairia occidentalis*) and Spinach (*amaranthus hybridus*) contain appreciable amount of minerals element, therefore can contribute significantly to the nutrients requirements of man and should be used as source of nutrients to supplement other major sources. Higher potassium content further confirmed that Fluted



pumpkin (*Tefairia occidentalis*) leaves can serve as a better diet for hypersensitive patients.

RECOMMENDATIONS:

- fluted pumpkin (*Tefairia occidentalis*) and Spinach (*amaranthus hybridus*) should be considered for quantitative phytochemical analysis on the weight of the naturally occurring chemicals present in them which might be helpful in wound healing effect, treatment of diseases and production of drugs in pharmaceutical industries.
- Both fluted pumpkin (*Tefairia occidentalis*) and Spinach (*amaranthus hybridus*) should be consumed regularly as they contain many nutrients and minerals which are helpful in maintaining human health and sources of energy.
- Further research should be carried out on both plants to determine their potency in the prevention and treatment of chronic diseases like diabetes, and high blood pressure

REFERENCE

- Adebisi. A. O., Olajide-Taiwo F.B., Adeoye. I.B. and Olajide-Taiwo. L.O., (2011). Analysis of Production Constraints facing Fadama Vegetable Farmers in Oyo State, Nigeria. *World J. Agric. Sci.*, 7(2):189-192.
- Aletor, O.A., Oshodi. A. and Ipinmoroti. K. (2002). Chemical composition of common leafy vegetables and functional properties of their leaf protein concentrates. *Food Chem.* 78: 63-68.
- Antia, B.S, Akpan, E.J, Okon, P.A, and Umoren, I.U (2006). Nutritive and AntiNutritive Evaluation of sweet potatoes (*Ipomoea batatas*) leaves. *Pak. J. Nutr.* 5(2): 166-168.
- Boeing, H., Bechthold, A. and Bub, A. (2012). Critical review: vegetables and fruit in the prevention of chronic diseases. *Eur J Nutr* 51(6):637-663
- Cai, Y.Z., Sun, M., and Corke, H. (2003). Antioxidant activity of betalains from plants of the Amaranthaceae. *J. Agric. Food Chem.* 51(8):2288-2294.
- Dhellit, J.R., Matouba, E., Maloumbi, M.G. Nzikou, J.M., Dzondo, M.G., Linder, M., Parmentier, M. and Desobry, S. (2006). Extraction and Nutritional properties of *Solanum nigrum* L seed oil. *African Journal of Biotechnology.* 5: 987 - 991.
- Francis, C., George, G., Zohar, K., Harinder, P. S., Makhar, L. M., and Klaus B. (2002). The biological action of saponins in animal system: a review. *British J. Nutrition* 88(6):587-605
- Genoveva M., and Rajendra. G. M. (2001). Cruciferous Vegetables and Cancer Prevention Nutrition and Cancer; 41: 17-28.
- Hassan LG, Umar KJ (2006). Nutritional value of Balsam Apple (*Momordica balsamina* L.) leaves. *Pak. J. Nutr.* 5(6): 522-529.
- Ibrahim NDG, Abdurahhman EM, Ibrahim G (2001). Elemental analysis of the leaves of *Vernonia amygdalina* and its biological evaluation in rats. *Niger. J. Nat. Prod. Med.* 5:13-16.



- Ishida H, Suzuno H, Sugiyama N, Innami S, Todokoro T, Maekawa A (2000). Nutritional evaluation of chemical component of leaves, stalks and stems of sweet potatoes (*Ipomea batatas* poir). *Food Chem.* 68: 359-367.
- Lim, P., Wuenschell, G.E., Holland, V., Lee, D., Pfeifer, G.P., Rodriguez, H., Termini, J. (2004). Peroxyl radical Mediated oxidative DNA base damage: Implications for lipid peroxidation induced mutagenesis. *Biochemistry*; 43:15339-15348
- Mohammed, M.I. and Sharif, N. (2011). Mineral composition of some leafy vegetables consumed in Kano, Nigeria. *Nigerian Journal of Basic and Applied Science* 19(2): 208 - 211.
- Kayode, O.T., Kayode, A.A., and Odetola, A.A., (2009). Therapeutic effect of *Telfairia occidentalis* on protein energy malnutrition-induced liver damage. *Res. J. Med. Plant.*, 3: 80-92.
- Kidane, B., Van der Maesen, L., Asfaw, Z., Sosef, M. and Andel, T., (2015). Wild and semi-wild leafy vegetables used by the Maale and Ari ethnic communities in Southern Ethiopia. *Genet Resour Crop Env*; 62(2): 221- 234. <https://doi.org/10.1007/s10722-014-0147-9>
- Okwu, D.E. (2004). Phytochemicals and Vitamin content of indigenous spices of South eastern Nigeria. *J. Sustain. Agric. Environ.* 6(1): 30-37.
- Penningtonm, J., and Fisher, R.A. (2009). Classification of fruits and vegetables. *J. Food Compos Anal*; 22: 23 - 31.
- Pourmorad, F., Hosseinimehr, S.J. and Shanabi Majd. N. (2006). Antioxidant activity, Phenol and flavonoid contents of some selected Iranian medicinal plants. *Afr. J. Biotechnol.*, 5(11):1142-1145.
- Salman, T.M., Olayaki, L.A., and Oyeyemi, W.A. (2008). Aqueous extract of *Telfairia occidentalis* leaves reduces blood sugar and increases haematological and reproductive indices in male rats. *African Journal of Biotechnology* 7 (14): 2299-2303.
- Tomoyuki, K., Yoko, A., Chika, M., Manami, M., Chiho, I., Shizuka, K., and Toshio, I. (2005). Free radical scavenging and hepatoprotective actions of the medicinal herb, *Crassocephalum crepidioides* from the Okinawa Island. *Biology and Pharmaceutical Bulletin*, 28(1) 19-23.
- Turan M, Kordali S, Zengin H, Dursun A, Sezen Y (2003). Macro and Micro- Mineral content of some wild edible leaves consumed in Eastern Anatolia. *Acta Agric. Scand., Sect. B, Plant Soil Sci.* 53: 129-137
- Uusiku, N.P., Oelofse, A., Duodu, K.G., Bester, M.J., Faber, M. (2010). Nutritional value of leafy vegetables of sub-Saharan Africa and their potential contribution to human health: A review. *J. Food Compos Anal*; 23(6): 499- 509.