International Journal of Innovative Agriculture & Biology Research 4(1):18-25, Jan.-Mar. 2016

© SEAHI PUBLICATIONS, 2016 www.seahipaj.org ISSN:2354-2934

Nutritional Evaluation of the Leaves of some Selected Plant Species in Maiduguri Borno State, Nigeria

***Bitrus Apagu[1], Binta Aliyu Kyari[2], Mohammed Sadisu Waziri[3], Bitrus Yunana Duhu[4], Musa Ibrahim[5], Hyelanada Mari[6], Musa Adamu[7].**

Department of Biological Sciences
University of Maiduguri
P.M.B 1069 Maiduguri Borno State Nigeria
Corresponding author's email: waibra88@yahoo.com

ABSTRACT
The nutritional values of leaves of some selected plant species in Maiduguri Borno State Nigeria was evaluated, the methods used for food analysis was adopted for the proximate and mineral analysis of *Telfairia occidentalis HOOK .F. Manihot esculenta Cranzs, Brassica oleraceae,Ipomae batatas* , *Amaranthus caudatum* leaves. The experiment on proximate and mineral analysis and screening of leaves of the selected plant species was conducted in Soil Science Laboratory, Faculty of Agriculture University of Maiduguri. The experiment was completely randomized design. Results indicated that the moisture content in the leaves of the selected plant species was low but the dry matter content was high. The ash content was significantly $P<0.05$ high in *A. caudatum* and *I.batatas* (9.6% and 8.7% respectively) than in *T. occidentalis* (5.0%). Carbohydrate was the main food reserves in all the leaves of the selected plants, followed by protein, fibre, ether extract and then ash. Carbohydrate was highest in *A.caudatum* (49.4%) while *T. occidentalis* leaves had the least (37.5%). In contrast *T.occidentalis* leaves had the highest protein content (28.21%) while *A. caudatum (*21.8%) has the lowest. Significance differences were observed in ether extract among the leaves studied with *T. occidentalis* having the highest (11.0%). Fibre content was significantly higher in leaves of *A. caudatum* (7.92%) while *B. oleraceae* has the least (7.2%). The Mineral composition in the samples were also found to differs significantly ($P<0.05$), with *T.occidentalis* having the highest (1.3mg/100g) nitrogen content while Phosphorous content was higher in *T.occidentalis* (0.6mg/100g), *I.batatas* leaves had the highest calcium content (4.2mg/100g), while *A.caudatum* had highest copper content (0.1mg/100g). The iron content in *A.caudatum* was highest (5.8mg/100g), Magnesium content was higher in *A. caudatum* (3.6mg/100g), and manganese content in *M.esculenta* was highest (4.8mg/100g). There are significances differences among the selected plants species ($P<0.05$), with *I.batatas* having the highest content (1.9mg/100g) potassium. No significance difference was observed in the Sodium content of the selected plant leaves ($P<0.05$) significance, While *A. caudatum* had the highest zinc content (0.8mg/100g).
Keywords: Nutritional, Evaluation, Leaves, Plant species

INTRODUCTION
Malnutrition affects a large number of children worldwide (Fernanda *et al.*,2006). Eating is not an optional event in the maintenance of life, rather, it is an essential action that must be taken by humans to stay alive (Fernanda *et al.*,2006). Eating a balanced diet is equally essential in supporting life. An unbalanced diet is described as one deficient in at least a class of essential nutrient. Continuous ingestion of such unbalanced diet may lead to malnutrition (Keusch and Farthing, 1986).
The knowledge of nutrient composition of food is quite essential in dietary treatment of disease or in quantitative study of human nutrition. There are different food composition tables that are used in nutritional studies in developing countries, although there are gaps in terms of food and other nutrients. Data on the consumption of food are essential for diversity of purposes in many field of human activity, they are important to spectrum of users ranging from international organization to private individuals (Rand*et al*., 1991). Hence, there is no food composition data in north eastern region

of Nigeria. Although, there are various food composition tables available for use in developing countries, many of these tables however do not contain sufficient information on food values and several nutrients. Besides, most of these tables contain data that are not recent and have information mostly on raw foods. The gaps may be as a result of minerals content of the soil, fertilizer used, method of processing, the length and method of storage, the moisture content of the sample and the method of analysis (Sanusi and Adebiyi, 2009). The data is significant in dietary formulations for infants and children which are essential for optimal growth and development and for good health also in the dietary formulation and management of diseases such as scurvy, kwashiorkor or other health threatening conditions like obesity, diabetes and osteoporosis etc., (Osho, 1988; Mariam, 2005). In every society, every individual and any other living organism needs knowledge about the nutritional content of both raw and processed foods; this is because food contains substances called nutrients. Food is made up of different nutrients which include proteins, carbohydrates, fats, water, minerals and vitamins. All nutrients are needed by the body and are available through food. Combination of many kinds of food can form a well balance diet. Each nutrient has specific uses in the body. It is the relationship of food to the health of the body that determines nutritional status. Proper nutrition means that all the nutrients are supplied and utilize in adequate amount to maintain optimal health and well-being (Thomas, 2006).

The study is significant to spectrum of users ranging from international organizations to private individuals. The knowledge of nutritional composition of food is quite essential in dietary treatment in chronic diseases such as cardiovascular (heart) disease, stroke hypertension, diabetes and some form of cancer which account for two thirds of all death and also disease that are associated with deficiency of nutrients in younger children such as osteoporoses and iron deficiency Anemia. Nigeria is witnessing an increase in population growth; National Population Commission (2006) estimated it to be 140,003,542. The high population without corresponding increase in food production and availability to the citizenry can lead to household food insecurity. This is an issue posing serious nutritional problem in Nigeria, particularly among children and lactating mothers. The resultant effect can lead to malnutrition, retarding growth in children and low productivity level among the mothers (Ward-Law and Kessel, 2002). In view of this, there is the need to carryout nutritional analysis of indigenous food produced in Borno state with the view of formulating food composition table for the state. Therefore this work aim at determine the nutritional composition of these mostly eaten vegetables in Borno state in other to educate the public on the benefits of these leaves.

MATERIALS AND METHODS

Fresh leaves of *Telfairia occidentalis* were collected in the Agricultural farm of University of Maiduguri, while *Amaranthus caudatum , Brassica oleracea, Manihot esculenta and Ipomoae batatas leaves* used in the study were purchased from sales men selling fresh vegetables at tashan bama park along Bama road, Maiduguri, Borno state. The identification and authentication of the plant material was done in the Department of Biological sciences, University of Maiduguri. Prior to the analysis, the leaves were washed with tap water and then rinsed with distilled water. The residual moisture was evaporated at room temperature and thereafter the leaves were oven dried at 60^{o}c until properly dried. The dried leaves were then ground in porcelain mortar, sieved through 2mm mesh sieve and stored in polythene bags. The powdered samples were used for both proximate and mineral analysis. Moisture content was determined using fresh leaves.

For the proximate analysis, shredded fresh vegetables were dried in a thermostatically controlled ventilated oven at 105^{o}c until constant weight was obtained. The loss in weight was recorded as moisture content (AOAC, 1984).

Moisture (%) = $\frac{wt\ of\ sample\ after\ drying}{wt\ of\ sample\ before\ drying}$ X 100.

The Crude protein was determined by the Kjeldahl method. Dried and pulverized leaf sample (2g) was digested 20ml con H_2SO_4 in the presence of selenium catalyst until a clear digest was obtained (AOAC, 1984), the nitrogen content of dilute digest was determined calorimetrically at 680nm according to (charlot, 1964). The protein content of leaves was calculated as nitrogen content X 6.25. While, the ash content was obtained by drying the pulverized vegetable and ashed at 550^{o}c in a muffle furnace (AOAC, 1984). for the crude fiber, about 3.5 – 5g sample ware transferred into a 500ml conical flask with 200ml of boiling 1.25% H_2SO_4. This was again subjected to boiling for one minute.

This was filtered through poplin cloth rinsed well with hot distilled water and separate material back into flask with spatula. 200ml of boiling 1.25% NaOH and few drops of anti flaming agent. Savage the residue into a test tube after drain, dry in the oven at 105°c, cool in desiccator and weight w_2. The desiccator was removed and allowed to cool at room temperature, it was weight again w_3. For the Ether extract Lipid was determined on 2.0g of the sample in the by soxhlent apparatus, extracted with 50ml petroleum ether and distilled at 30°C to 60°C until all the ether in the flask has completely dried. The sample was then oven dried to a constant weight at a temperature of 105°C and transferred to the desiccator for cooling and weighed immediately for the determination of fat content using the formulae below;

$$EE\ (\%) = \frac{wt\ of\ fat(wt\ of\ flask\ after\ extraction - wt\ of\ empty\ flask}{wt\ of\ sample} \times 100$$

Dry matter was determined by putting 1.0g of the sample in a weighed Petri dish, oven dried at 105°C for 2hours. The sample was removed and cooled in a desiccator and weighed and reweighed several times until a constant weight was obtained. Dry matter was computed as follows:

$$Moisture\ (\%) = \frac{wt\ of\ sample\ after\ drying}{wt\ of\ sample\ before\ drying} \times 100.\ DM = 100 - moisture$$

Carbohydrate content was determined by differences as follows:

CHO = 100- (%p +%F+%L+%A+%M); Where, P = protein, F= Fiber L=Lipid, A=Ash, M=Moisture

Mineral analysis

From the mineral analysis, 24 gram of each powdered samples was weighed into a separated, crucible and gently heated over a Bunsen burner until it charred. The charred sample with the crucible was transferred into a lento muffle furnace at about 500°C and content ashed until grayish white ash was obtained. It was cooled first at room temperature then in a desiccator; 5cm3 of con HCl was added and heated for 5minutes on a hot plate in a fume cupboard. The mixture was then transferred into a beaker and the crucible washed several times with distilled water. The mixture was made up to the volume $1000cm^3$(Ceirwyn, 1995). The solution prepared in triplicate. Sodium (Na) and potassium (K) were analyzed by flame atomic emission spectrophotometer. Phosphorus (P) was determined with Jenway 6100 spectrometer at 420nm using vanadium phosphomolybdate (vanadate) colorimetric method with $KHPO_4$ as the standard Ceirwyn, 1995. The concentrations of calcium (Ca) magnesium (Mg) and zinc (Zn) in the solution using atomic absorption spectrophotometer AAS969 (AOAC, 1990). Nitrogen (N) was determined by Kjeldahl digestion. The data obtained from proximate and mineral analysis were subjected to Analysis of Variance (ANOVA).

RESULT

Table 1: profile of the plant used in the study

Plant	Family	Local name (Hausa)	Habit	Parts used	Colour of the leaves
T.occidentalis	Curcubitaceae	Kabewa	Herb	Leaves	Green
A.caudatum	Amaranthaceae	Aleyahu	Herb	leaves	Green
M.esculenta	Convulvulaceae	Rogo	Herb	leaves	Green
I.batatas	Solanaceae	Dankali	Herb	leaves	Green
B.oleraceae	Brassicaceae	Kabeji	Herb	leaves	Green

Table 2. Proximate composition of leaves of five plant species

	Parameters composition						
Plant	Moisture	Ash	Protein	Dry matter	Ether	Fibre	Carbohydrate
T.occidentalis	9.00^{a}	5.00^{c}	28.21^{a}	90.60ab	11.04^{a}	7.84^{c}	37.53^{d}
M.esculenta	8.50^{b}	5.91^{d}	24.37^{c}	90.70^{ab}	7.60^{b}	8.20^{a}	44.63^{c}
B.oleraceae	7.50^{c}	6.80^{c}	21.81^{d}	90.80^{a}	7.61^{b}	7.203^{e}	47.39^{b}
A.caudatum	7.00^{d}	9.60^{a}	19.65^{e}	90.80^{a}	4.20^{d}	7.92^{b}	49.43^{a}
I.batatas	9.00^{a}	8.75^{b}	24.82^{b}	90.50^{ab}	5.20^{c}	7.30^{d}	44.43^{c}
SEM±	5.57	0.02	4.94	0.14	0.14	5.37	0.09

The data are mean values of three replicates.Values within a column marked with different superscript are significantly different P< (0.05)

Table 3: Mineral composition of leaves of five plant species (mg/100g)

Plant	Nitrogen	Phosphorus	calcium	Magnesium	Potassium	Sodium	Copper	Iron	Manganese	Zinc
T.occidentalis	1.35^{b}	0.60^{a}	1.21^{c}	1.20^{d}	1.53^{b}	0.21^{a}	0.00^{c}	4.39^{c}	2.38^{c}	0.23^{d}
B.oleraceae	0.27^{e}	0.08^{b}	3.90^{b}	1.12^{e}	1.50^{c}	0.03^{a}	0.00^{c}	3.94^{d}	2.08^{d}	0.01^{e}
A.caudatum	0.70^{c}	0.05^{c}	0.50^{d}	3.69^{a}	1.45^{d}	0.04^{a}	0.17^{a}	5.86^{a}	1.82^{e}	0.80^{a}
M.esculenta	0.35^{d}	0.02^{d}	0.42^{d}	3.05^{b}	0.40^{e}	0.28^{a}	0.03^{b}	4.95^{b}	4.89^{a}	0.55^{b}
I.batatas	1.95^{a}	0.02^{d}	4.25^{a}	1.40^{c}	1.93^{a}	0.14^{a}	0.00^{c}	2.42^{e}	3.21^{b}	0.28^{c}
SE±	0.01	0.01	0.08	0.01	0.01	0.09	0.001	0.02	0.02	0.01

The data are mean values of three replicates. Values within a column marked with different superscript are significantly different (P<0.05)

DISCUSSIONS

Proximate Composition of the leaves of selected plant extract

The results for the proximate analysis showed that all the five plant leaves *T. occidentalis*, *B.oleracea*, *I.batatas*, *M. esculenta* and *A.caudatum* have low moisture content. The moisture content of the leaves of five plant species were *T.occidentalis* 9.0%, *M.esculenta* 8.50%, *B.oleraceae* 7.50%, *A.caudatum* 7.0% and *I.batatas* 9.05 showed that they have a low moisture content. These moisture contents values agrees with most values obtained for some leafy vegetables studied in Nigeria, this indicated that these plants leaves can store well for future use as high moisture content is associated with increase of microbial activities during storage which reduces the nutritional value of feed material (Idris, 2011).

The inherent ash content of the five plant leaves *T. occidentalis* 5.00%, *M.esculenta* 5.91%, *B.oleraceae* 6.80%, *A.caudatum* 9.60% and *I.batatas* 8.75% leaves showed a high ash content. These shows that the plant leaves contain important mineral elements since the ash content of any sample is an index of mineral content. The ash content of *I.batatas* 8.7% and *T. occidentalis* 5.0% does not agree with the levels of ash in the same plant reported as 11.10% and 17.2% respectively. This however, might be due to methods of processing and strength of reagents.

The inherent protein content in the leaves of some selected plants species, *T.occidentalis, 28.21*%, *M.esculenta* 24.37%, *B.oleraceae* 21.81%, *A.caudatum* 19.63% and *I.batatas* 24.82% showed that the plant leaves are good sources of protein. Protein is responsible for the formation of bones, teeth, hair and outer layer of the skin (Protein, 2010). The high protein content in leaves of plants such as *T. occidentalis* could have supplementary effect for the daily protein requirement of the body. The symptoms of protein energy malnutrition such as Kwashiorkor and marasmus were rarely observed among dwellers in region where adequate amount of protein is obtained from fruits seeds and leaves by plant rich in proteins such as *T. ccidentalis* (Dike, 2010). The crude protein content of *T.occidentalis* leaves was high 28.2% as shown in table 1 compared to the protein content of the *T.occidentalis* reported by (Idris, 2011) which was 8.72% . The crude protein content of *I. batatas* was found to be 24.82% which is similar to the findings of (Idris, 2011) who also reported the content as 24.85% in Kwara state. The crude protein value for *A.caudatum* was close to the value of 20.1% reported by Aletor (1999), but the value for *T.occidentalis* was lower than 54.9% reported by Aletor (1999). These differences could be due to the method of calculation by Aletor who based her results on dry matter (DM) basis. The protein content of *M.esculenta*, *B.oleraceae* and *I.batatas* leaves extract obtained was higher than the published value for the same plants 6.0%,1.4% and4.6% respectively as reported by Will *et al*.,(1998), however, the protein content in *M.esculenta* 24.37% and *I.batatas* 24.82% agrees with the findings of Antie *et al*.,(2006) who also reported the contents as 24.85%.

The inherent dry matter content of the five plant species leaves ,*T.occidentalis* 90.60%,*M.esculenta* 90.70%,*B.oleraceae* 90.27% ,*A.caudatum* 90.80% and *I.batatas* 90.50% showed that the plant leaves have high dry matter content. The high dry matter content in the leaves of these plant species indicates that the plants leaves have low moisture content which makes them useful for storage.

The inherent ether extract of the five plant leavesin table 1 were, *T.occidentalis* 11.04%, *M.esculenta* 7.60%, *B.oleraceae* 7.61% ,*A.caudatum* 4.20% and *I.batatas* 5.20% showed that they are good source of lipids. The high ether extracts in *T. occidentalis* indicates that the leaves might possibly be used as a source of oil in food, pharmaceuticals, cosmetics or used as biofuel. The ether extract in *T. occidentalis* 11.0% is comparable to the one reported for the same plant in Minna by (Idris 2011) who obtain the result as 11.27%.The ether extract for *I.batatas* was 5.20%, this value is similar to the one reported for the same plant by Antie *et al.*, (2006), who obtained the value as 4.90%. A child consuming 100g of *T.occidentalis* would be ingesting approximately (11.0g) of fatty acid which translates into 84.5Kcal of energy or about 6% of their daily total energy.

The inherent crude fibre content in the leaves of five plant species are *T.occidentalis* 7.84%, *M.esculenta* 8.20%, *B.oleraceae* 7.20%, *A.caudatum* 7.92% and *I.batatas* 7.30% showed high fibre content in all the five plant species leaves.The crude fibre content of *T.occidentalis* leaves as shown in the table 1 was found to be 7.8% which is similar to the value reported by (Idris, 2011) on the same plant leaf. The crude fibre in *I.batatas* was found to be 7.3% which is not in agreement with the value obtain for the same plant leaves (Idris,2011), however, the value is in agreement with the value reported by Antie *et al*., (2006) who also obtained 7.20%. Fibre is the portion of the plant that provides it with structural strength and form; it is useful in providing roughages that aid digestion, fibre consumption also lower plasma cholesterol level in the body (Eva, 1983). The fibre content of *M.esculenta* 8.20% leaves was high compared to the fibre content of legumes and leafy legumes. Dietary fibre is considered part of a healthy diet and can reduce problems of constipation. Although recent evidence is mixed, fibre may help prevent colon cancer (Rock, 2007).The rich fibre of *M.esculenta* leaf may assist intestinal peristalsis and bolus progression but if fibre content from any source is too high, it will have negative effects in the body (Baer *et al*., 1996). Excess fibre will increase feacal nitrogen, cause intestinal irritation and reduce nutrient digestibility (Favier, 1977).

The inherent Carbohydrate content in the leaves of five plant species , *T.occidentalis* 37.53%,*M.esculenta* 44.63%, *B.oleraceae* 47.39%, *A.caudatum* 49.43% and *I.batatas* 44.43% showed that the plant leaves have high carbohydrate content. Carbohydrate content in *A.caudatum* was found to be 49.43% as shown in table 1, the obtained value was seen to be higher than the value reported for *Amaranthus cruentus* 29.40%. *M.esculenta* carbohydrate content was 44.63% this is higher than the value reported for the same plant 7.0% by (Chavez *et al*., 2000).Carbohydrate provides the body with a source of fuel and energy that is required to carry out daily activities. The carbohydrate content in *T.occidentalis* was high 37.5% which closely agrees with the findings of (Idris, 2011) who obtain the carbohydrate content as 38.0%.Carbohydrate content in *I.batatas* leaves extract was 44.43% which is lower than 51.95% reported by Antie *et al*., (2006).

Mineral Composition of the selected plant leaves extract

The results for the mineral analysis reveal that nitrogen, calcium, magnesium and iron in the samples were significantly within the levels that are optimal for consumption. Minerals are important in the diet because they serve as cofactors for many physiological and metabolic functions; they are of interest due to their pro-oxidant activities and health benefits (Alpha *et al*., 1996).

Inherent nitrogen content of the leaves of five plants leaves in table 2 were, *Occidentalis* 1.35mg/100g,*B.oleraceae*0.27mg/100g, *A.caudatum* 0.70mg/100g, *M.esculenta* 0.35mg/100g and *I.batatas* 1.95mg/100g showed that they have a high content of nitrogen which also indicate that they have a high protein content since crude protein were calculated using nitrogen content (Adaramoye *et al.*,2007).Nitrogen is an important element which forms the backbone of proteins, its contents in *I.batatas* was (1.9mg/100g), this value falls within the recommended values for consumption (NRC,1989).

The inherent potassium content in the leaves of five plants species, 1.53mg/100g, 1.50mg/100g, 1.45mg/100g,0.40mg/100g and 1.93mg/100g showed that the have met the requirement for recommended dietary allowances. The results indicated that the plant leaves samples are useful which are advantageous health wise since any diet rich in this mineral element is important in preventing hypertension as potassium depresses blood pressure. The result obtained for *T.occidentalis* is higher than the one reported by (Idris, 2011) mg/1which was 0.02mg/100g.

Phosphorous value table 3, is of significant importance as calcium is closely related to phosphorus metabolism in the formation of bones with the tolerable limits of Ca: P ratio being in the range of 1:1 to 7:1 (Guil- Guerrren *et al*., 1998).

The inherent calcium content for the leaves of five plants species studied were, *T.occidentalis*1.21mg/100g,*B.oleraceae* 3.90mg/100g, *A.caudatum* 0.50mg/100g,*M.esculenta* 0.42mg/100g and *I.batatas* 4.25mg/100g when compared to *I.batatas* (4.25mg/100g). In fact the level of calcium in *B.oleraceae* (3.9mg/100g) in this study compares favourably with that reported by (Moyo *et al.*,2011,) as (3.65mg/100g).preventing calcium deficiency related diseases

Manessium is a constituents of chloroplast in green plants , it is one of the element that impart green pigment to the green plants that the plant used in photosynthesis.The level of magnesium content in *A.caudatu*m was 3.6mg/100g this is similar to the one reported by (Antie, *et al.*,2006) which was 3.40mg/100g

The inherent potassium content in the leaves of selected plant species*, T.occidentalis* 1.53mg/100g, *B.oleraceae* 1.50mg/100g, *A.caudatum* 1.45mg/100g, *M.esculenta* 0.40mg/100g and *I.batatas* leaves 1.93mg/100g in table 3 showed a moderate contents and falls within the range recommended for daily intake and compares favourably with other leafy vegetables 1.1 to 1.9mg/100g. *I.batatas* contents in the extracts were 1.93mg/100g; this was lower than the value reported by (Antie *et al*., 2006).The result indicated that *Telfairia occidentalis* leaves *B.oleraceae, A.caudatum* and *I.batatas* are useful potassium sources which are advantageous health wise since any diet rich in this mineral element is important in preventing hypertension as potassium depresses blood pressure. Sodium, in combination with potassium in the body is involved in maintaining proper acid – base balance and proper nerve transmissions (Mensah *et al*., 2008).The plant leaves could therefore be recommended to patient with soft bone problem.

Sodium content in *T.occidentalis* 0.21mg/100g ,*B.oleracea* 0.03mg/100g *A.caudatum* 0.04mg/100g, *M.esculenta* 0.280mg/100g and *I.batatas* 0.14mg/100g leaves in table 2 was found to be within the range of 0.1-0.28mg/100g this agrees with values recommended for sodium (NRC, 1989).Sodium in combination with potassium in the body is involved in maintaining proper-acid base balance and proper nerve transmission.

The concentration of trace element Copper, iron, manganese and Zinc.

Copper was not detected in *T. occidentalis* and *B.oleracea* but present in *A.caudatum* and *M.esculenta* in trace amount, 0.17mg/100g and 0.003mg/100g respectively. This element is an essential component of many enzymes; superoxide dismutase which protects the body against the harmful effects from free radicals (Agbaire and Emoyan, 2012). It has been reported that Copper consumption in excess of 3mg/L of drinking water results in nausea and other adverse effects on the gastrointestinal tract (Pizzaro *et al*., 1999).

The inherent Iron content in the selected plant species *T.occidentalis* 4.39mg/100g, *B.oleraceae* 3.94mg/100g ,*A.caudatum* 5.86mg/100g, *M.esculenta* 4.9mg/100g and *I.batatas* 2.42mg/100g showed that the plants have appreciable amount of iron. Human body needs iron for the formation of the oxygen carrying protein haemoglobin and myoglobin.

The concentrations of microelements (iron, copper, and zinc) are high compared to recommended values for leafy vegetables, thus indicating that all the five plant leaves samples are good sources of these essential microelements. The inherent Manganese content of the leaves some selected plant extract in table 2,*T.occidentalis* 2.38mg/100g, *B.oleraceae* 2.08mg/100g, *A.caudatum* 1.82mg/100g, *M.esculenta* 4.89mg/100g and *I.batatas* 3.21mg/100g showed that they are moderate sources of this element with regard to recommended daily allowances..Manganese activates various enzymes which are important for proper digestion and utilization of foods. Manganese functions as an essential constituent of bone structure, for reproduction and for normal functioning of the nervous system; it also a part of the enzymes system. Meat and poultry products contribute a little of this micro- mineral (Fleck, 1976), in snails, they also contribute low values for example, Mn (mg/wet weight) in *Archatina maginata* 0.41mg/100g, *Archatina archatina* 0.38mg/100g and *limocolaria sp* 0.59mg/100 (Adeyeye, 1996).This means manganese may be a persistently low content of both plants and animals.The leaves of *T.occidentalis* was found to contain (2.3mg/100g), *M.esculenta* leaves (4.8mg/100g) and *I.batatas* leaves (3.2mg/100g). Manganese content in these leaves falls within the recommended dietary allowance (RDA) which are 2-5 mg/day for adult, pregnant and lactating mothers 2-3 mg/day for children (7-10 years) (NRC 1989), based on recommended daily allowances, it is clearly indicated these plant leaves are good sources of manganese .

Zinc help to speed up the healing process after an injury. The concentration of zinc in *A. caudatum* was (0.8mg/100g), this value was lower than the recommended (RDA) of zinc which is 10-19mg/day. The value obtained for *I.batatas* leaves 3.20mg/100g is closely similar to the value reported by (Antie *et al.,* 2006) as 4.64mg/100g.

CONCLUSION

The result of the present study indicated that the leaves of *Telfairia occidentalis*, *Amaranthus caudatum*, *Brassica oleracea*, *Manihot esculenta* leaves and *Ipoma batatas* are a good source of plant protein and minerals, which might be an indication that they could be used as vegetables in our soups and other dietary dishes.

The results also revealed that extracts from these samples have antimicrobial properties due to the presence of phytochemicals in the leaves such as tannin, flavonoids, glycosides, tapenoids and saponin. The confirmatory result for the test organisms is added evidence to the study that the extract was used against the actual target organisms.

ACKNOWLEDGEMENT

We acknowledged all the citations made and we appreciate the efforts of staff of Faculty of Science and Agriculture of University of Maiduguri.

REFERENCES

Adaramoye, O.A., Chem, J.A., Akintayo, O.O. and Fafunso, M.A. (2007) Hypolipidemic Effect of *Telfiaria occidentalis* (Fluted Pumpkin) in Rat Fed a Cholesterol-rich diet. *J.Med. Food.***10**:330-336.

Adeyeye,E.I., (1996). Waste yield, proximate and mineral composition of three different types of land snails found in Nigeria, *Int.J.Food Sci. Nutr*. **47**: 111-116

Aletor,O.,(1999).Chemical composition of common leaf vegetables functional properties of their leaf protein concentrates. M.Tech.(Ind. Chem) Thesis, Federal University of technology, Akure.

Alpha, E., Bala, M., Ackurt,F and Yilmaz,T.(1996). Nutritional composition of hazelnuts and its effects on glucose and lipid metabolism. Actta horticulture 445:305-310.

Antie,B.S.Akpan,E.J.Okon,P.A.and Umoren I.U.(2006).*Pakistan Journal of nutrition* 5(**2**): 166-168.

AOAC, Association of official Analytical Chemist (1984). Official methodsof Analysis (14^{th} edn). *Association of official Analytical ChemistWashington DC*

Ceirwyn, S.J., (1995). Analytical Chemistry of food. Chapman and Hall Publisher, London,76 – 77

Charlot, G. (1964)Colorimetric Determination of Elements. Principles and Methods, Elsevier publishing company, pp 320-3.

Deo,M.G.,(1978).The cell Biology of protein-calorie malnutrition world pev. *Nutri. Diet*.,**32**:499-95.

Dike, M.C, (2010). Proximate phytochemical and nutrient compositions of some plant species at Umodike, Nigeria, *ARPN Journal of Agriculture and Biological Sciences*, **5**:7-16.

Favier, J.C., (1977). Value alimentaire de deux aliment de base Africarines: is Manioc et le surgho. Paris, Frannce:ORSTOM (editions de l'office dela Rechorche Scientifique et Technique Outre-mer). Travaux et documents nr 67.

FAO, (1986).Development of traditional food crops in developing countries.Report of a joint consultation committee. FAO,Geneva.

Fernanda,B.,M polydoro, M.E. Andrades, M. Luiz and F .Dial-Pizzol *et al.,(*2006).Effect of maternal protein malnutrition on oxidative markers in the young rat cortex and cerebellum. *Neurosci. Lett*.**,406**: 281-284.

Fleck, H., (1976).Intoduction to nutrition, 3rd edition. MacMillan, New York.

Guil-Guerrero,J.L., Gimenez-Gimenez,A., Rodriguez Garcia, I. and Torija-isasa,M.E.,(1998). Nutritional composition of Sonhcus species (*S.asper L,S. Oleraceus L*. and *S.,tenerrimus* L.) .*J. of the Sci. of food and Agric*., *76*:628-632.

Idris,S.(2011).Compositional studies of *Telfairia occidentalis* leaves. *American Journal of Chemistry*, **1**(2) 56-59.

Lupien,J.R,(1994). The FAO food composition initiation food,nutrition and Agriculture 12-food composition data. *Food nutri. Agric*., **2** (1994): V600/T.

Mariam, S., (2005). Nutritional evaluation of cereals and legumes-based complementary diets used in Jos, Plateau State, Ph. D. Thesis, Faculty of medical Sciences, University of Jos, pp:1-5.

Maziya-Dixan,B.F.,E.B. Onyezili, S.E. Oguntona, R.A. Harris,S. Sanusi, V. Noke,D.Manyongi,Almustafa and I.O.Akinyele, (2003). National consumption and nutrition survey. IITA. Ibadan.

Mensah, J.K., Okoli, R.I.,Ohaju-Obodo,J.O. and Eifediyo, K. (2008).Phytochemical, nutritional and medicinal properties of some leafy vegetables consumed by Edo people of Nigeria. *African journal of Biotechnology*. 7(14): 2304-2309.

Mohammed, A.I and Rangappa, M.A. and Lamont (2011). Screening Soybean genotype for nutrients and antinutrients factors plant food for human nutrition **42:** 87-96.

Moyo, B. Masika, P.J., Hugo,A. and muchanje, V. (2011). Nutritional characteristics of *Moringa* leaves. *African journal of Biotechnology* **10**(60): 12925-129.

National population commission, (2006).

NRC (National Research Council) (1989): Lost Crops of the Incas: Little-Known Plants of the Andes with Promise for Worldwide Cultivation, Washington. D.C.

National population census Kwara State office Branch retrieved from: http://www. Population. Gov.ng/index.php?option=com content and review=article and id=193 and itemid=99.

Osho, S.M., (1988). Soybean processing for household use. Proceeding of the course held at the University of Nigeria. J. Nutr. Sci., **30** (2): 54-63.

Pizzaro,F., A. Olivares, M.,Uauy, R.contreras, P.Rebelo,A. and Gidi, V. (1999) Acute Gastrointestinal effect of graded levels of copper in drinking water.Environmental health perspective **107** (2) 117-121.

Rand, W.M.,J.A.T. Pennington, S.P.Murphy and J.C.Klensin, (1991). Compiling Data for food composition Data bases. United Nation University Press. Tokyo, Japan, WHTR-15/UNUP-772 ISBDN:92-808-07702-2.

Rock, C.L.,(2007).Primary dietary prevention: is the fibre story over? Recent result cancer Res. **174**:171-177.

Sanusi,R.A. and A.E. Adebiyi, (2009). Proximate and mineral elament composition of commonly consumed foods in Nigeria .J. Nutr. Sci.,**30** (2): 54-63.

Thomas, M.D., (2006). Textbook of Biochemistry . 6th Edn., Wiley- Liss,USA, PP:1080-1084.

Ward-Law,G.M. and M.W. Kessel, (2002).Perspective in nutrition. 5th Edn., MC Graw-Hill, New York.

Wills, R. McGlasson, B., Graham, D., and Joyce, D. (1998) Postharvest An Introduction to the physiology and Handling of Fruit vegetables and ornamentals CAB international. PP. 15-32.