Comparative Study on Phytochemical and Mineral Content of Three Leafy Vegetables Commonly Consumed in Selected Local Government Area of Ogun State, South Western Part of Nigeria *(Launaea taraxacifolia, Conyza sumatrensis and Bidens pilosa)*

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DOI : https://doi.org/10.51584/IJRIAS.2024.906042

Received: 09 June 2024; Revised: 17 June 2024; Accepted: 21 June 2024; Published: 19 July 2024

ABSTRACT

This study comparatively determined phytochemical and mineral content of three leafy vegetables *"Launaea taraxacifolia*, Bidens *pilosa* and Conyza *sumatrensis"*. Nigeria is endowed with numerous varieties of useful vegetables whose fruits, stems, roots and leaves serve various important roles in human nutrition. Unfortunately, many of these vegetables have not been put into maximum use. The neglect of these wild food plants has been attributed to the insufficiency of information on their nutritional profile and potential to serve as food security. Mineral analysis of three leafy vegetables in this study revealed that; sodium, magnesium, calcium, potassium, phosphorus and manganese ranged from 4.76±0.02mg/100g to 5.43±0.03 mg/100g, 16.23mg/100g to 26.98mg/100g, 12.47mg/100g to 17.00mg/100g, 11.99mg/100g to13.35mg/100g, 38.52mg/100g to 70.22mg/100g and 2.22mg/100g to 5.40mg/100g respectively. Also, phytochemical analysis of this study indicate that; flavonoid, saponin, alkaloid, steroid, tannin and phenol ranged from 0.54±0.03mg to1.28±0.02mg, 0.67±0.01mg to 1.63±0.02mg, 0.003±0.00mg to 0.120±0.02mg, 0.006±0.00mg to 0.120±0.02mg, 0.03±0.00mg to 1.97±0.02mg and 0.05±0.00mg to 0.21±0.00mg respectively. Analysis of this study therefore established that Conyza *sumatrensis* contained high amount of minerals; Mg (16.23mg/100g); P (38.52mg/100g); K (13.35mg/100g); Ca (12.47mg/100g) with an appreciable amount of bioactive compounds; flavonoid (1.76mg/100g); Saponin (1.63mg/100g); tannin (1.97mg/100g) and alkaloid (0.69mg/100g) compared to other vegetables samples. However, this study therefore concluded that leafy vegetables samples examined contained an appreciable mineral elements and bioactive compounds responsible for nutritional importance and therapeutical properties necessary to maintain good health, proper functional mechanism in the body and it could be a means to alleviate nutritional deficiencies. It is therefore recommended that these native vegetables is good for consumption.

Keywords*:* Phytochemical, Mineral, Leafy Vegetables, Bioactive Compounds and Nutritional Importance

BACKGROUND TO THE STUDY

Leafy vegetables are important items of diet in many Nigerian homes, vegetables are the edible parts of plant that are consumed wholly or in parts, raw or cooked as part of main dish or salad. They are understood to mean the leafy outgrowth of plant used as foods and including those plants and parts of plants used in making soups or served as integral parts of the main source of meal (Asaolu *et al*., 2012). It includes leaves, stems, roots, flowers seeds, fruits, bulbs, tubers and fungi. They are valuable sources of nutrients especially in rural areas where they contribute substantially to protein, mineral, vitamins, fiber and other nutrients which are usually in short supply in daily diets (Mohammed and Sharif, 2014). Besides, they add flavour, taste, colour and aesthetic appeal to what would otherwise be a monotonous diet. Vegetables play an important role in maintaining general good health, leafy vegetables are low in fat and high in protein and dietary fibre and they are rich sources of minerals and contain bioactive compounds which protect the body from nutritional deficiency diseases and free radicals that cause oxidative damage to cells (Momoh-Aliu, 2007).

ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS |Volume IX Issue VI June 2024

Vegetables are important foods both from economic and nutritional stand points, vegetables are at their best when tender or succulent. Many of them can easily be grown in home gardens thus, provide economic, easy access and handy sources of fresh, unprocessed vegetables with active enzymes and nutrients (Bazzano, 2004). Nigeria is endowed with numerous varieties of useful plants whose fruits, seeds, stems, roots and leaves serve various important roles in medicine and nutrition (Adebowale *et al*., 2013). Unfortunately many of such plants have not been put into maximum use except in times of nutritional stress. The neglect of these wild food plants has been attributed to the insufficiency of information on their nutritional profile and potential to serve as food security (Afolayan and Jimoh, 2009). The United Nation Food and Agriculture Organization (UNFAO) have estimated that the number of undernourished people in developing countries was 824 million in 1990-1992. In 2010, the number had climbed to 925 million people. The target set at the 1996 world Food summit was to halve the number of undernourished people by 2015 from their number in 1990-1992. This problem of malnutrition can be reduced by encouraging the use of wild vegetables, as they remain the cheapest source of proteins, minerals and vitamins in the diet of many people (Lyimo *et al*, 2003). *Launaea taraxacifolia* "*Efo yanrin*" commonly known as Dandelion it is a member of the family *Asteraceae*, is a greenish leafy vegetable that is cultivated mainly in the Western part of Nigeria and it is a plant found mainly in the tropics. *Efo yanrin* is a perennial herb of about 150 cm tall with a creeping root system. The plant has an erect stem with the leaves at the base in a rosette form or alternate position capped by golden yellow flowers (Sakpere and Aremu, 2008). *Launaea taraxacifolia* leaves are, used as common vegetable and eaten as salad or cooked in soups and sauces by Ghanaians. Namrata *et al*., (2011) revealed that wild or semi-wild plants are nutritionally important because of high vitamins, minerals, proteins, essential fatty acids and fibre contents.

Blackjack (*Bidens pilosa*) "*efo Abere Oloko*" is a plant that belongs to the *Asteraceae* family. It was originally found in South America but it has spread throughout the tropics and subtropics where it is widely distributed invading both cultivated and undisturbed lands (Silva *et al*., 2011). *B. pilosa* is an easy-to-grow herb that is widely distributed all over the world. It is considered to be a rich source of food and medicine for humans and animals. Since *B. pilosa* is highly invasive in nature, it is most commonly considered as weed. This plant has been utilized as food and ethno-medicine besides incorporation in tea by different communities globally making it an important subject for research (Pozharitskaya, Shikov and Makarova, 2010).

Conyza sumatrensis "*efo olowonjeja*" commonly called broadleaf fleabane is a dicotyledonous herb of the *asteraceae* family occurring widely in Nigeria especially in the Niger Delta region and also in central Kenya. It is an erect, hairy, annual herb up to 120 cm high with sessile and deeply serrated leaves (Opiyo *et al*., 2010). The most prominent uses of conyza *summatresis* in Nigeria include treatment of stomach disorder and facial pimples. It also serves as a good source of food for the fowls. It is the success recorded in the treatment of facial pimples with extract from the leaves of *Conyza sumatrensis* that has prompted the investigation into the phytochemical constituents as well as the antimicrobial activities of the plant (Dansi *et al*., 2012). Even though L. *taraxacifolia, Conyza sumatrensis* and *Bidens pilosa* leaves are used as food, there is paucity of information about their constituents' that make them nutritious and also exhibit their medicinal properties.

Therefore effort geared towards addressing under exploitation and inadequate scientific knowledge of their nutritional potentials of native leafy vegetables in Nigeria necessitates this study.

Statement of Problem

High cost of food items and food insecurity are still major problems in Nigeria. The increase in human populations, high prices of food items, dwindling economy situation of Nigeria and increased rate of poverty are the major causes of food insecurity in most Nigeria home. Food and Agricultural Organization of the United Nations has suggested a 4% increase in the production of nutritious food yearly, as a means of combating food scarcity for the world's projected population (FAO, 2010). This has necessitated the need to incorporate non convectional food plants into human diets as a means of alleviating nutritional deficiencies especially in rural communities. Inadequate scientific knowledge of nutritional potentials of underutilized native leafy vegetable species (L. *taraxacifolia, Conyza sumatrensis* and *Bidens pilosa*) with which Nigeria is richly endowed is partly responsible for their under exploitation especially in areas beyond the traditional localities where they are found and consumed.

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The Food and Agriculture Organization (FAO) has estimated numbers of undernourished people in developing countries was about 824 million in 1990-1992. In 2010, the number had climbed to 925 million people. The target set at the 1996 world Food summit was to halve the number of undernourished people by 2015 from their number in 1990-1992 (FAO, 2010). This problem of malnutrition can be reduced by encouraging the use of wild vegetables, as they remain the cheapest source of proteins, minerals and vitamins in the diet of many people (Lyimo *et al*, 2003). Underutilized leafy vegetables could be incorporated to diet to meet world food security demands as it could effectively reduce the level of micronutrient deficiency.

Objectives of the Study

This main objective of this study is to comparatively determine phytochemicals and mineral contents of three leafy vegetable (L. *taraxacifolia,* "*Efo* yanrin", *Conyza sumatrensis* "*Efo olowonjeja*" and *Bidens pilosa* "*efo Abere oloko*") with view of providing adequate scientific knowledge and information on nutritional potentials of the underutilized plant. And the specific objectives were to:

i. determine the phytochemicals composition of three leafy vegetable (L. *taraxacifolia, Conyza sumatrensis* and *Bidens pilosa*).
ii. determine the mineral contents of three leafy vegetable samples (L. *taraxacifolia, , Conyza sumatrensis* and *Bidens pilosa*).

MATERIALS AND METHODS

Materials

Three (3) freshly harvested leafy vegetables (*Launaea taraxacifolia,* "*efo* yanrin"; *Conyza sumatrensis* "*efo olowonjeja*" and *Bidens pilosa* "*efo abere oloko*") was examined in this study. *Launaea taraxacifolia,* "*efo* yanrin was obtained from a local farm in Yewa North, Aiyetoro, Ogun State. *Conyza sumatrensis* "*efo olowonjeja*" was obtained from a vegetable gathering in Ilaro. Meanwhile, *Bidens pilosa* "*efo abere oloko* was obtained from a vegetable gathering in Obada Oko, Abeokuta South Local Government, Abeokuta, Ogun State. The leaves of the vegetables were collected early in the morning, rinsed with portable water to remove foreign materials, sand and dirt. It was packed in a sterile polythene bag and then transported to Food Processing Laboratory, Federal University, Oye-Ekiti, Ekiti State for identification, authentication and processing prior to further analysis. All the chemicals used were of analytical grade and gotten from Food Technology Department, Federal University, Oye-Ekiti, Ekiti State, Nigeria.

Sample Preparation

About twenty grams (20g) of fresh leaves of *Launaea taraxacifolia*, *Conyza sumatrensis* and *Bidens pilosa* samples were destalked, sorted, washed with potable water, air dried at 28-30^{0}C for 14 days, milled using pestle and mortar into a powdered form, sieved through 2mm mesh and stored in a sterile plastic container at ambient temperature prior to phytochemical and elemental analysis.

Phytochemicals Analysis

Determination of Tannin Content

About four (4) g of the samples was weighed into forty (40) ml plastic bottle. Four (4) ml of distilled water was shaken for one hour, and was filtered. Then four (4) ml of the filtrate was pipetted out into a tube and mixed with three (3) ml of 0.1m $FeCl_3$ in 0.1N HCL and 0.008M potassium ferrocyanide. The absorbance was measured in a spectrophotometer at 120nm wavelengths within 10 minutes. A blank sample was prepared and the color was developed and read at the same wavelength. A standard was prepared using tannin acid to get 100ppm and measured as described by (Okwu and Emenike, 2006).

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Determination of Flavonoid

Flavonoid was determined in the leafy vegetable samples as described by (Vukovi *et al*., 2007). About four (4) g of the plant sample were extracted repeatedly with forty (40) ml of eighty percent (80%) aqueous methanol at room temperature. The whole solution was filtered. The filtrate was later transferred into a crucible and evaporated to dryness over a water bath and was weighed.

Determination of Saponin Contents

Saponin content was determined using method described by (Obadoni and Ochuko, 2001). Four (4) g of each plant specimen were dispersed into forty (40) ml of twenty percent (20%) ethanol. The suspension was heated over a water bath for 4 hours with continuous stirring at about 80^0C. The mixture was filtered and the residue re-extracted with another forty (40) ml of twenty percent (20%) ethanol. The combined extracts were reduced to two (2) ml over a water bath at 900C. The concentrate was transferred into a two hundred and fifty (250) ml separator funnel and four (4) ml of di-ethyl ether was added and shaken vigorously. The aqueous layer was recovered while the ether layer was discarded. The purification process was repeated; twelve (12) ml of n-butanol was added. The combined n-butanol extracts were washed twice with two (2) ml of five percent (5%) aqueous sodium chloride. The remaining solution was heated in a water bath; after evaporation, the samples were dried and weighed. Saponin content was calculated in percentage.

$$(\%)\ \text{Saponin} = \frac{\text{absorbance of sample x gradient factor x dilution factor}}{\text{Weight of sample x 10,000}}$$

Determination of Phenolic Compounds

Total phenol contents was determined using the procedures described by Khatiwora *et al*., 2010). For the extraction of the phenolic component, the fat free sample was boiled with fifty (50) ml of ether for fifteen (15) minutes five (5) ml of the plant extract was pipette into a fifty (50) ml flask and then ten (10) ml of distilled water was added, two (2) ml of ammonium hydroxide solution and five (5) ml of concentration amyl alcohol where also added. The samples were left to react for thirty (30) minutes for color development. The absorbance of the solution was read using a spectrophotometer of five hundred and five (505) nm wavelengths.

Determination of Alkaloid

Alkaloid was determined using gravimetric method (Harborne, 2008). About four (4) g of the sample were weighted into a two hundred and fifty (250) ml beaker and one hundred and sixty (160) ml of twenty percent (20%) acetic acid in ethanol was added and covered to stand for four (4) hours. This was filtered and the extract was concentrated using a water bath to one-quarter of the original volume. Concentrated ammonium hydroxide was then added drop wise to the extract until the preparation was complete. The whole solution was allowed to settle down and the precipitate was collected by filtration and was weighed.

$$\%\ \text{Alkaloid} = \frac{W_1 - W_2}{W_3 - W_4} \times 100$$

Where

W_1 = Weight of sample

W_2 = Weight of empty filter paper

W_3 = Weight of filter paper + precipitate before drying.

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W_4 = weight of filter paper + precipitate after drying

Determination of Steriod

About two $2cm^3$ of acetic anhydride was added to 0.5g ethanolic extract of the sample with $2cm^3$ of H_2SO_4. The colour does not change from violet to green to indicate the presence of steroids as described by (Ladipo, Doherty and Kanife, 2010).

Mineral Analysis

Procedure for digestion

About one (1g) of each samples was weighed (oven dry at 60^0C) into a 125ml Erlenmeyer flask which have been previously washed with acid and distilled water. 4ml of perchloric acid was added, 25ml conc. HNO_3 and 2ml conc. H_2SO_4 under a fume hood. Mix the contents and heat gently at low to medium heat on a hot plate under Perchloric acid fume hood as described by (AOAC, 2010).

It was continued heating until dense white fumes appear. If any traces of carbon remain, allow the flask to cool and add 1-2ml conc. HNO_3 and digest again to the fuming stage. Finally, heat strongly (medium to high heat) for half a minute. It was Allowed to cooled, then 40-50ml distilled water was added. It was then boiled for half a minute on the same plate at medium heat. Cool and filter the solution completely with a was bottle into a 100ml pyrex volumetric flask. Make up to mark with distilled water (Whatman No.4 filter paper 9cm). Store the solution for P determinations (colorimetry), Ca, and Mg determinations (atomic absorption spectrometry), Na, K, determination (flame photometry).

Mineral Determination

Atomic absorption spectroscopy (AAS) was used for the mineral determination in the leafy vegetable samples. Atomic absorption spectrophotometric (Perkin-elmal model 403, Norwark, CT, USA) was used to determine the levels of calcium, sodium, manganese and magnesium in the samples after digestion with concentrated nitric acid as described by Association of Official Analytical Chemists (AOAC, 2010).

Potassium was determined colorimetrically using spectronic 20 (Gallenkap, UK) with KH_2PO_4 as standard.

Method of Data Analysis

All the analyses was carried out in triplicates and results was recorded as Mean ± standard deviation. Difference between the groups was determined by subjecting the data to analysis of variance and means which was separated using Duncan multiple range test (SPSS Version 27.0)

RESUTLS AND DISCUSSION

Results

Table 1: Mineral Composition of three Leafy Vegetable (mg/100g dry basis)

Sample	Sodium (mg/100g)	Magnesium (mg/100g)	Calcium (mg/ 100g)	Potassium (mg/ 100g)	Phosphorus (mg/ 100g)	Manganese (mg/ 100g)
A	5.16^{a}±0.03	25.13^{ab}±0.02	15.52^{ab}±0.02	11.99^{ab}±0.02	62.05^{b}±0.03	4.89^{ab}±0.02
B	4.76^{ab}±0.02	16.23^{bc}±0.00	12.47^{b}±0.01	13.35^{a}±0.02	38.52^{c}±0.41	5.40^{a}±0.02
C	5.43^{a}±0.03	26.98^{a}±0.02	17.00^{a}±0.07	12.13^{ab}±0.03	70.22^{a}±0.03	2.22^{b}±0.02

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Value of triplicate mean ± standard deviation determination with the significant different in ($p<0.05$).

Samples with different superscripts within the same column were significantly ($p\leq0.05$) different.

KEY:

Sample A *Launaea taraxacifolia* "*Efo yanrin*"

Sample B *Conyza sumatrensis* "*efo olowonjeja*"

Sample C *Bidens pilosa* "*efo Abere Oloko*"

Table 4.2 Phytochemical Constituents of three Leafy Vegetables (mg/100g)

Sample	Flavonoid	Saponin	Alkaloid	Steroid	Tannin	Phenol
A	$0.54^{c}\pm0.03$	$0.67^{b}\pm0.01$	$0.003^{cd}\pm0.00$	$0.006^{cd}\pm0.00$	$0.03^{bc}\pm0.00$	$0.05^{bc}\pm0.00$
B	$1.76^{a}\pm0.01$	$1.63^{a}\pm0.02$	$0.690^{b}\pm0.01$	$0.690^{b}\pm0.01$	$1.97^{a}\pm0.02$	$0.84^{b}\pm0.01$
C	$1.28^{b}\pm0.02$	ND	$0.120^{a}\pm0.02$	$0.120^{a}\pm0.02$	ND	$0.21^{a}\pm0.00$

Value of triplicate mean ± standard deviation determination with the significant different in ($p<0.05$).

Samples with different superscripts within the same column were significantly ($p\leq0.05$) different.

KEY:

Sample A *Launaea taraxacifolia* "*Efo yanrin*"

Sample B *Conyza sumatrensis* "*efo olowonjeja*"

Sample C *Bidens pilosa* "*efo Abere Oloko*"

Discussion

This study comparatively determined mineral and phytochemical composition of the three leafy vegetables *Launaea taraxacifolia* "*efo yanrin*", *Conyza sumatrensis* "*efo olowonjeja*" *Bidens pilosa* "*efo Abere Oloko*". Sodium, magnesium, calcium, potassium, phosphorus and manganese were determined in three leafy vegetables, analysis of this study revealed that, significance differences was observed in magnesium, calcium phosphorus among the three leafy vegetables. Minerals play important roles for proper tissue functioning and also serve as cofactor for many physiological and metabolic functions (Balogun and Olatidoye, 2012).

From table 1 above, sodium composition of the leafy vegetable ranged from 4.76mg/100g to 5.43mg/100g. *Bidens pilosa* leave has the highest sodium followed by *L. taraxacifolia* with the value of 5.43mg/100g and 5.16mg/100g. While, Sodium has an important role in maintaining the water balance within cells and in the function of both nerve impulse and muscles. The sodium also helps in maintenance of normal acid-base balance. An adult need about 3g per day of sodium but modern dietary habits take in 5-20 per day (Milbury *et al.,* 2008). The sodium content of the plant is within the recommended level by WHO, 2012 (70.048 - 0.56mg/kg). Result of sodium composition obtained in this study is lower compared to 25.40mg/kg sodium composition of *Ocimum gratissiumum* leaves reported by Ajayi (2015).

Magnesium composition of the three leafy vegetables ranged from 16.23mg/100g to 26.98mg/100g. *Bidens pilosa* leave has the highest magnesium composition followed by *L. taraxacifolia* with the value of 26.98mg/100g to 25.13mg/100g respectively.

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However, *Conyza sumatrensis* has the least magnesium composition with the value of 16.23mg/100g. Magnesium composition of three leafy vegetable obtained from this was in agreement with the magnesium composition of *Ficus thonningii Annona senegalesis, Hibiscus sabdariffa* Ubwa *et al*., (2014). Magnesium recorded the highest levels in all the samples ranging from 13.10 to 64.11 mg/100g and 186.89 to 257.22 mg/100g for fresh and dried samples respectively. These levels of Mg are however below the National Agency for and Drug Administration and Control (NAFDAC, 2010) recommended daily intake (RDI) of 375 mg/100g. The magnesium content of the leaf meal was found to be 0.23 mg/100g.Magnesium plays fundamental roles in most reactions involving phosphate transfer. Magnesium is essential in skeletal tissue metabolism and neuromuscular transmission. Magnesium is necessary as an activator of many enzyme systems, particularly those concerned with carbohydrate metabolis (Anhwange, Ajibola and Oniye, 2004). It is believed to be essential in the structural stability of nucleic acids. It plays a significant role in the intestinal absorption of electrolyte in the body.

Also, calcium composition of the leafy vegetables ranged from 12.47mg/100g to 17.00mg/100g.

Bidens pilosa "*efo Abere Oloko*" has the highest calcium content followed by *L. taraxacifolia* "*efo yanrin*" will the value of 17.00mg/100g to 15.52mg/100g while, *Conyza sumatrensis* "*efo olowonjeja*" has the least calcium content with the value of 12.47±0.01mg/100g respectively. Calcium composition of three leafy vegetables obtained in this was greater than calcium composition of *Senecio biafrae* with the Ca (2.67 mg/100 g) content and calcium content of *Ocimum gratissimum* (1.23 mg/100 g) as reported by Ajiboye *et al*., (2014). Calcium helps in the regulation of muscle contraction required by young animals and foetuses for bones and teeth development. Calcium is useful in sustaining strong bones, muscular contraction and relaxation, blood clotting (Oluyemi *et al*., 2006).

In addition, table 1 above revealed the potassium content of the leafy vegetables, potassium content of the vegetables ranged from 11.99mg/100g to 13.35mg/100g. *Conyza sumatrensis* "*efo olowonjeja*" has the highest potassium content, while *L. taraxacifolia* "*Efo yanrin*" has the least potassium content with the value of 13.35mg/100g to 11.99mg/100g respectively. Result obtained in this study was lower than 42.74 reported by Ihediaho and Okoye (2011) for *mucunaflagellipes*. Potassium is crucial to heart and smooth muscle contraction, making it important for normal digestive and muscular function. Potassium is the most abundant mineral in Nigerian agricultural products. Potassium helps to maintain body weight and regulate water and electrolyte balance in the blood and tissues (Melaku, Clive and Habtamon, 2005). Keeping the right potassium balance in the body depends on the amount of sodium and magnesium in the blood (Oshodi, 2003). Calcium, magnesium, sodium and potassium are essential minerals for life, they are important in the formation of bones and teeth as a cofactor for enzymes and a component of ATP, DNA, RNA and cell membranes.

However, phosphorus content of the leafy vegetable ranged from 38.52mg/100g to 70.22mg/100g. *Bidens pilosa* "*efo Abere Oloko*" has the highest phosphorus content followed by *L. taraxacifolia* "*Efo yanrin*" with the value of 70.22mg/100g to 62.05mg/100g respectively. While, least phosphorus content was found in *Conyza sumatrensis* "*efo olowonjeja*" with the value of 38.52mg/100g. Phosphorus content of this study was greater than phosphorus content of the *biden pilota* 0.31 mg/100g reported by Alikwe, Ohimain and

Omotosho (2014). Phosphorus plays a vital role in normal kidney functioning and transfer of nerve impulse More so, manganese content of the leafy vegetables ranged from 2.22mg/100g to 5.40mg/100g. *Conyza sumatrensis* has the highest manganese composition while *Bidens pilosa* has the least manganese content.

Manganese is a co-factor for antioxidant enzymes like mitochondrial superoxide dismutase, oxygen-handling enzymes, and also helps in brain functioning, bone structure, and regulation of blood sugar. It acts as a cofactor for numerous vital enzymes e.g. Manganese peroxide dismutase is an antioxidant enzyme that prevents or reduces the oxidative stress, controls the chronic diseases such as diabetes mellitus (Murray *et al*., 2000).

In addition, table 2 indicates the phytochemical constituents of the leafy vegetable samples. Flavonoid of the leafy vegetable samples ranged from 0.54 to 1.76mg/100g. *Conyza sumatrensis* "*efo olowonjeja*" has the highest constituent of flavonoid, followed by *Bidens pilosa* "*efo Abere Oloko*", while Sample A (*Launaea taraxacifolia* "*Efo yanrin*") has the least composition of flavonoid with the value of 1.76mg/100g,

ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS |Volume IX Issue VI June 2024

1.76mg/100g and 1.28mg/100g respectively. Flavonoids in plants possess medicinal benefits which includes antioxidant and anti-inflammatory activities (Saxena *et al*., 2012). They have the ability to scavenge hydroxyl radicals, super oxide anions and lipid peroxy radicals (Okwu and Josiah, 2006), therefore supports its antioxidant activity. The flavonoid content of the leaves of the leafy vegetables therefore supports its use for protection against diseases such as cancer, inflammation and atherosclerosis (Onyeka and Nwambekwe, 2007). The result obtain in this study was in tandem with the flavonoid composition of *Ficus capensis* leaves with 1.37mg/100g reported by (Ngozi *et al*., 2017).

Saponin composition of the vegetables ranged from 0.67mg/100g to 1.63mg/100g. *Conyza sumatrensis* has the highest saponin value followed by *Launaea taraxacifolia* with the value of 1.63mg/100g and 0.67mg/100g respectively. While, no traces of saponin was not detected in *Bidens pilosa*. Result obtained from this study was greater than saponin content reported by Ngozi *et al*., (2017) in aqueous extract of *Ficus capensis* leaves with the value of 0.27mg/100g. Saponins from fruits and vegetables are important dietary supplements and are known to exhibit antimicrobial activities and protect plants from microbial pathogens (Sczkowski *et al*., 1988). They could be beneficial in modulating blood lipids, lower cancer risks and improve blood glucose response as well as possess antioxidant activity (Igidi and Edene, 2014).

Leafy vegetables such as *Launaea taraxacifolia*, *Conyza sumatrensis* and *Bidens pilosa* leaves are thus said to possess antimicrobial property attributed to saponins and other phytochemicals present. However, alkaloid composition of the leafy vegetables ranged 0.003mg/100g to 0.690 mg/100g. *Bidens pilosa* has the highest alkaloid composition, followed by *Conyza sumatrensis* while *Launaea taraxacifolia* with the value of 0.120mg/100g, 0.690mg/100g and 0.003mg/100g. The presence of alkaloids in these leafy vegetables supports the findings by Oyeleke *et al.*, (2008), that the antibacterial activity of this plant may be attributed to the presence of alkaloids. Alkaloids have been reported to possess various pharmacological activities including antihypertensive effects, antiarrhythmic effect, antimalarial and anticancer activity **(**Saxena *et al.*, 2013). Pure isolated alkaloids and their synthetic compounds have been used in medicine as an analgesic, antispasmodic and bactericidal agents (Okwu, 2004).

Furthermore, steroid composition of the vegetables ranged from 0.006mg/100g to 0.120mg/100g. *Bidens pilosa* has the highest steroid composition followed by *Conyza sumatrensis* while *Launaea taraxacifolia* has the least steroid content with the value of 0.120mg/100g, 0.690mg/100g and 0.006mg/100g respectively. Steroid content of the leafy vegetables used in this study corroborates steroid composition of *Ficus capensis* leaves reported by Madziga *et al*., (2010) with the value of 0.48mg/100g. Plant steroids are phytoconstituents that have found therapeutic applications as arrow poisons or cardiac drugs (Firn, 2010). Trace steroid in the leaves could be useful in promoting nitrogen retention in osteoporosis and in animals with wasting illness (Maurya *et al*., 2008).

Also, Tannin content of the leafy vegetables ranged from 0.03mg/100g to 1.97mg/100g. *Conyza sumatrensis* has the highest content of tannin followed by *Launaea taraxacifolia*, while no traces of tannins was observed in *Bidens pilosa* "*efo Abere Oloko*". The presence of tannins in the leafy vegetables confers the leaves to be a good source for the treatment of wounds emanating from varicose ulcers and hemorrhoids (Njoku and Akumufula, 2007). Plants that contain tannins are used as astringents, against diarrhea, as diuretics, against stomach and duodenal tumours (Saxena *et al.,* 2013).

Lastly, phenol content of the leafy vegetables ranged from 0.05mg/100g to 0.21mg/100g. *Bidens pilosa* has the highest phenol content, followed by *Conyza sumatrensis* while *Launaea taraxacifolia* has the least phenol content with the value of 0.21mg/100g, 0.84mg/100g and 0.05mg/100g respectively. The presence of these phytochemicals in the vegetables is an indication that the plant can be a potential source of precursors in the development of synthetic drugs.

CONCLUSION

This study comparatively determined mineral and phytochemical composition of the three leafy vegetables *Launaea taraxacifolia* "*Efo yanrin*", *Conyza sumatrensis* "*efo olowonjeja*" *Bidens pilosa* "*efo Abere Oloko*". Mineral analysis of this study revealed that leafy vegetable samples contained an appreciable amount of

sodium, magnesium, calcium, potassium, phosphorus and manganese. Leafy vegetables samples have good nutritive value and suitable mineral elements necessary to maintain good health, proper functional mechanism in the body and it could be a means to alleviate nutritional deficiencies. However, *Bidens pilosa* "*efo Abere Oloko* has the highest mineral composition among the samples.

Conclusively, phytochemical analysis of this study revealed low level of bioactive compounds such as flavonoid, alkaloid steroid, phenol which justify its therapeutical benefits to human health. Thereby, these leafy native vegetables is good for consumption.

RECOMMENDATIONS

Firstly, this study therefore recommend consumption of native leafy vegetables in full or when incorporated into diets which could help to fulfil the growing demands of plants-based food for human nutrition.

Also, further studies could be intensify on phytochemical and mineral contents examined as well as vitamins and proximate composition of the native leafy vegetables to ascertain its nutritional potentials for human consumption in different season.

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ISSN No. 2454-6194 | DOI: 10.51584/IJRIAS |Volume IX Issue VI June 2024

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