



# Phytochemical screening, proximate analysis and mineral composition of some leafy vegetables consumed in Nigeria

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## Abstract

Phytochemical screening, proximate analysis and mineral composition of nine leafy vegetables; *Teifaria occidentalis*, *Veronia amygdalina*, *Ocinum gratissimum*, *Corchorus olitorius*, *Piper guineese*, *Amaranthus hybridus* *Talinum triangulare*, *Gnetum africanum* and *Murraya koenigii* was carried out using standard methods. The proximate analysis results showed that the moisture, ash, crude lipid, crude fibre, crude protein and carbohydrate ranged as followed; 10.20 to 15.17%, 6.65 to 28.33%, 1.44 to 11.29%, 0.52 to 2.33% 2.24 to 35.21% and 22.66 to 62.80% respectively. The mineral composition results showed that on the average, highest concentration of calcium was recorded in the range of 838 to 1258mg/100g, while Cr was found to be the least with concentration range of 0.19 to 0.48mg/100g. Cd was absent in all the samples. The phytochemical screening results also showed the presence of tannin, alkaloids and carbohydrate in all the leafy vegetables. The result of this study indicates that the leafy vegetables could be a good supplement for some the nutrients and elements analyzed.

**Keywords:** Leafy Vegetables, Mineral Composition, Phytochemicals, Proximate Analysis.

## 1. Introduction

Leafy vegetables are important items of diet in many Nigerian homes. 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 our daily diets (Mepba et al. 2007). The need for leafy vegetables in man's diet throughout the year cannot be overemphasized because aside providing nutrients to the body it also supplies some biologically active non-nutritive compounds which exhibit medicinal and physiological potentials. Consumption of fresh vegetable enables full assimilation of vitamins on the human body (Gender 1994). The basic elements in leafy vegetables provide alkalizing effects, neutralizing the acidity caused by other foods of animal origin (Gender 1994). Leafy vegetables contain both essential and toxic metals over a wide range of concentrations (Radwan & Salama 2006). Some metals are essential and their deficiency results to biological malfunctions in the body but when present in excess, they become toxic (Soylak et al. 2003). The aim of this work is to ascertain the nutritive and the non-nutritive value as well as the metal composition of nine leafy vegetables consumed in Nigeria.

## 2. Materials and methods

### 2.1. Sample collection and preparation

The nine leafy vegetables used in this study were purchased from a local market in Gwagwalada Area Council of the Federal Capital Territory Abuja, Nigeria. The leaves were identified by the Chemistry Advanced Laboratory of Sheda Science and Technology

Complex, Abuja. The leaves were shade dried for 7 days ground into powder using pestle and mortar. The grounded portion was then stored in plastic containers prior to analysis.

### 2.2. Proximate analysis

Moisture, ash, crude fibre, crude fat, were determined using standard methods (AOAC 1999), protein was determined by the Kjeldahl method (Pearson 1976). Carbohydrate was determined by the difference.

### 2.3. Phytochemical screening

Chemical test were carried out on the aqueous extracts of the leafy vegetables to ascertain the presence of tannin, steroids, triterpenoids, glycosides, saponins, phenols, alkaloids, terpenoids, carbohydrate, flavonoids, cardiac glycosides, phlobatanins, resins, and balsams using method described by (Sofowora 1993).

### 2.4. Mineral composition analysis

Some portion of the dried powder samples was digested as reported by (Soylak et al. 2003). 1 g of each samples was weigh into separate beakers and treated with 12ml of 10M  $\text{HNO}_3/\text{H}_2\text{O}_2$  (2:1). The mixture was heated to 130°C for 4 hrs. After cooling, it was filtered into 100ml volumetric flask and the was made up with deionized water. The digests were analyzed for the minerals and trace metals content using ThermoScientific ICE 3000 Atomic Absorption Spectrophotometer.

### 3. Results and Discussions

The proximate analysis of the leafy vegetables is shown in (Table 1). The moisture content ranges from 10.20% in *Gnetum africanum* to 15.17% in *Talinum triangulare* the moisture contents observed in the leaves provides for greater activity of water soluble enzymes and co-enzymes needed for metabolic activities of the vegetables (Iheanacho & Ubebani 2009). The ash content varies from 6.65% in *Gnetum africanum* to 28.33% in *Talinum triangulare*. These results showed that there are more minerals in *Talinum triangulare* compared to the rest of the leaves investigated. The ash content of *Teifaria occidentalis* and *Piper guineese* shown is higher than the values reported by (Taiga et al. 2008). The crude lipid ranges from 1.44% in *Teifaria occidentalis* to 12.43% in *Gnetum africanum*. Crude lipids are the principal sources of energy but must be consumed with caution to avoid obesity and other related diseases. A diet providing 1-2% of its caloric energy as fat is sufficient in human beings as excessive consumption have been implicated in certain cardiovascular disorders such as atherosclerosis cancer and aging (Antia et al. 2006). The crude lipid content in *Veronia amygdalina* (11.29%) and *Ocinum gratissimum* (7.84%) is higher than the values reported by (Asaolu et al. 2012). The crude fibre results ranges from 0.52% in *Amaranthus hybridus* to 2.33% in *Murraya koenigii*. The fibre content in *Veronia amygdalina* (2.33%), *Ocinum gratissimum* (0.73%) and *Teifaria occidentalis* (1.17%) are lower compared to the values reported by (Taiga et al. 2008). Adequate intake of dietary fibre can lower cholesterol level, risk of coronary heart disease, hypertension, constipation, diabetes, colon and breast cancer (Rao & Newmark 1998). The protein content as reported in this work varies from 1.82% in *Talinum triangulare* to 35.12% in *Teifaria occidentalis*. The protein content of *Teifaria occidentalis*, *Amaranthus hybridus* and *Veronia amygdalina* is within the range of 20.48 to 41.66% reported by (Roger et al. 2005). Crude protein content greater than 30% of leafy vegetables indicates that it is a good source of protein supplement to meet the recommended daily requirement (RDA) for humans (FND 2002). The carbohydrate content is in the range of 22.6 to 62.80% which is relatively high compared to similar work reported by (Iniaghe et al. 2009, Asaolu et al. 2012 & Oko AO 2012). The results of the phytochemical screening (Table 2) shows the presence of tannins, carbohydrate and alkaloids and the absence of resins, phlobatannins and flavonoids in all the samples studied. Tannin found in all is of high importance in the treatment of hereditary hemochromatosis (Sofowora 1993). The presence of phenol, saponins in some of the leaves and alkaloids in all the leaves are known to exhibit medicinal and physiological activity (Rao & Newmark 1998). Steroids present in *Amaranthus hybridus*; *Murraya koenigii* and *piper guineese* are of importance and interest in pharmacy due to their relationship with some compounds as sex hormones (Okwu 2001). Cardiac glycosides found in *Ocinum gratissimum*, *Murraya koenigii* and *Corchorus olitorius* can be used to treat heart diseases like congestive heart failures and cardiac arrhythmia (Okwu 2001). Balsams are oily or gummy oleoresins found in various pleasantly scented plant products (Iniaghe et al. 2009). This is confirmed as it is detected only in *Ocinum gratissimum* and *Murraya koenigii*. The results of mineral composition were shown in (Table 3). The Fe content range from 3.80mg/100g in *Ocinum gratissimum* to 28.50mg/100g in *Teifaria occidentalis*. The concentration of Fe in *Veronia amygdalina* and *Corchorus olitorius* in the work is lower compared to the 27.7mg/100g and 84mg/100g reported by (Anyoola et al. 2010), 28mg/100g and 38mg/100g reported by (Mohammed & Sharif 2011), respectively. Fe is important in the diet especially for pregnant and nursing mothers as well as infants (Dioxon & Haris 2003). Deficiency in Fe will lead to reduced work capacity, impairment in behavior and intellectual performance and decrease resistance to infection (Dioxon & Haris 2003). The 28.50mg/100g, 26.20mg/100g and 22.30mg/100g of *Teifaria occidentalis*, *Veronia amygdalina* and *Talinum triangulare* respectively could contribute greatly to the recom-

mended daily allowance of Fe (10-15mg/day). Zn content range between 1.44mg/100g in *Piper guineese* to 9.61mg/100g in *Murraya koenigii*. Zn is essential for nerve function and male fertility. It is important for normal sexual development of testes and ovaries (Anyoola et al. 2010). Regular consumption of these leafy vegetables most especially *Murraya koenigii* may assist in the preventing the effect of Zn deficiency such as retarded growth and delayed sexual maturation (Barminas et al. 1998). Ca content of the leafy vegetables range from 838mg/100g in *Gnetum africanum* to 1258mg/100g in *Amaranthus hybridus*. The Ca content recorded in this work is very high and could help to prevent osteoporosis, arthritis, pyorrhea, rickets and tooth decay when consumed daily. The Mg content of the leafy vegetables is relatively high ranging between 56.38 to 60.50mg/100g. *Talinum triangulare* had the highest Mg content. The Mg content of *Corchorus olitorius*, *Ocinum gratissimum*, *Amaranthus hybridus* and *Teifaria occidentalis* are lower compared to a similar work reported by (Asaolu et al. 2012). Mg helps in energy metabolism, protein synthesis, RNA and DNA synthesis and maintenance of electrical potential of nerves tissues (FAO/WHO 2003). The Mn content range from 1.94mg/100g in *Piper guineese* to 80.30mg/100g in *Gnetum africanum*. This work reported 8.25mg/100g in *Veronia amygdalina* and 10mg/100g in *Corchorus olitorius* which is lower compared to the work reported by (Mohammed & Sharif 2011). The concentration of some heavy metals recorded in this work Cr (0.19 – 0.48mg/100g) and Pb(nd – 2.34mg/100g) is low and Cd is absent in all the leafy vegetables while Ni is found in *Talinum triangulare* and *Gnetum Africanum* to be 0.20mg/100g and 0.22mg/100g respectively.

**Table 1:** Proximate Analysis Results of the Leafy Vegetable

S/ N	Leafy Vegetables	Parameter (%) Of Dried Leaves					
		Ash	Moisture	Lipid	Fibre	Protein	Carbohydrate
1	Teifaria occidentalis	12.73	13.85	1.44	1.17	35.21	35.60
2	Amaranthus hybridus	22.42	14.65	7.46	0.52	31.02	22.66
3	Ocinum gratissimum	12.12	13.99	7.84	0.73	2.62	62.70
4	Murraya koenigii	11.53	14.36	10.09	2.33	2.86	58.83
5	Veronia amygdalina	15.77	15.11	11.29	1.40	20.70	35.73
6	Gnetum africanum	6.65	10.20	12.43	1.13	12.94	56.65
7	Corchorus olitorius	13.72	14.24	5.19	0.55	3.50	62.80
8	Piper guineese	20.92	10.67	7.25	1.18	2.24	57.74
9	Talinum triangulare	28.33	15.17	8.07	1.34	1.82	45.27

**Table 2:** Phytochemical Constituents of Aqueous Extract of the Leafy Vegetables

S/ N	CONSTITUENTS	LEAFY VEGETABLES									
		T O	A h	O C	M k	V a	G a	C o	P g	T t	
1	Tannin	+	+	+	+	+	+	+	+	+	
2	Steroids	-	+	-	+	-	-	-	+	-	
3	Triterpenoids	-	+	-	-	+	-	+	+	+	
4	Glycosides	-	-	-	+	-	-	-	-	-	
5	Saponius	+	+	+	+	+	-	-	+	+	
6	Phenols	+	+	-	-	-	+	-	-	-	
7	Alkaloids	+	+	+	+	+	+	+	+	+	
8	Terpenoids	+	+	+	+	-	-	-	-	-	
9	Carbohydrate	+	+	+	+	+	+	+	+	+	
10	Flavonoids	-	-	-	-	-	-	-	-	-	
11	Cardia Glycosides	-	-	+	+	-	-	+	-	-	
12	Phlobatannius	-	-	-	-	-	-	-	-	-	
13	Resins	-	-	-	-	-	-	-	-	-	
14	Balsams	-	-	+	+	-	-	-	-	-	

NOTE: To = Teifaria occidentalis; Ah = Amaranthus hybridus; Og = Ocinum gratissimum; Mk = Murraya koenigii; Va = Veronia amygdalina; Ga = Gnetum africanum; Co = Corchorus olitorius; Pg = Piper guineese; Tt = Talinum triangulare  
+ Defected  
- Not defected

**Table 3:** Mineral Composition of the Leafy Vegetables

S/ N	SAM- PLES	Mineral Composition (Mg/100g)								
		Fe	Zn	Cr	Ca	Ni	C d	Mg	Pb	Mn
1	Teifaria occident alis	28.	6.3	0.3	922.9	-	-	60.	1.8	19.
		50	7	2	0	-	-	21	3	37
2	Amarant hus hybridus	12.	5.4	0.2	1258.	-	-	60.	2.0	18.
		90	0	9	00	-	-	30	4	60
3	Ocinum gratissim um	3.8	1.8	0.1	1219.	-	-	56.	-	5.0
		0	2	9	00	-	-	38	-	0
4	Murraya koenigii	9.6	9.6	0.4	1228.	-	-	59.	2.3	2.9
		0	1	0	00	-	-	36	3	6
5	Veronica amygdali na	26.	6.1	0.4	871.2	-	-	59.	2.0	8.2
		20	0	1	0	-	-	79	5	5
6	Gnetum africanu m	17.	2.6	0.4	838.0	0.2	-	58.	2.3	80.
		00	0	2	0	2	-	24	4	30
7	Corchoru s olitorius	7.6	4.5	0.4	949.0	-	-	59.	1.0	10.
		0	4	4	0	-	-	70	0	00
8	Piper guineese	18.	1.4	0.2	1254.	-	-	59.	0.4	1.9
		30	4	7	00	-	-	14	0	4
9	Talinum triangula re	22.	5.9	0.4	839.5	0.2	-	60.	0.7	25.
		30	8	8	0	0	-	50	6	97

Table 4 shows the botanical, common and vernacular names of the nine leafy vegetables used in this study.

**Table 4:** The Botanical, Common English and Local Vernacular Names of Leafy Vegetables

S/N	BOTANICAL NAMES	COMMON ENGLISH NAMES	LOCAL VERNACULAR NAMES
1	Teifaria occidentalis	Fluted pumpkin	Ugu
2	Amaranthus hybridus	African spinach	Alefo, Efofete
3	Ocinum gratissimum	Scent leaf	Efirin, Nahianwu, Daidoya
4	Murraya koenigii	Curry	
5	Veronica amygdalina	Bitter leaf	Efo ewuro,
6	Gnetum africanum	-	Okazi, Ukazi, Afang
7	Corchorus olitorius	Jute leaf, Mallow leaves	Ewedu, Rama
8	Piper guineese	-	Oziza, Uziza
9	Talinum triangulare	Water leaf	Gbure

## 4. Conclusion

The proximate analysis indicates that the nine leafy vegetables investigated are very rich in carbohydrate and a good source of energy. This work also showed that *Teifaria occidentalis*, *Amaranthus hybridus* and *Veronica amygdalina* are good source of protein. The presence of some biologically active non-nutritional components can serve as a potential source of useful drugs. The mineral composition indicates that the leafy vegetables is a good source of minerals and make significant contribution to the recommended dietary allowance for the minerals most especially Ca, Mg, Mn and Fe.

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