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, Veronica amygdalina, Ocimum gratissimum, Corchorus olitorius, Piper guineense, 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 carbohydrates 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 vegetables enables full assimilation of vitamins on the human body (Genderd 1994). The basic elements in leafy vegetables provide alkalinizing effects, neutralizing the acidity caused by other foods of animal origin (Genderd 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 Ggwagwalada 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, phlobatansins, 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 HNO3/HClO3 (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 Tefaria occidentalis and Piper guineense shown is higher than the values reported by (Taiga et al. 2008). The crude lipid reported from 1.44% in Tefaria 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 calorific 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 Veronica amygdalina (11.29%) and Ocimum 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 Veronica amygdalina (2.33%), Ocimum gratissimum (0.73%) and Tefaria 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 Tefaria occidentalis. The protein content of Tefaria occidentalis, Amaranthus hybridus and Veronica amygdalina is within the range of 20.48 to 41.66% reported by (Roger et al. 2005). The crude lipid ranged from 28.30mg/100g to 35.21mg/100g in Gnetum africanum. The mineral composition was shown in (Table 3). The results of mineral composition were shown in (Table 3). The Mn content range from 1.94mg/100g in Piper guineense to 80.30mg/100g in Gnetum africanum. The Mn content range from 1.94mg/100g to 80.30mg/100g in Gnetum africanum. The Mn content range from 1.94mg/100g to 80.30mg/100g in Gnetum africanum. This work reported 8.25mg/100g in Veronica 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 (0.19 – 0.48mg/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 of the Leafy Vegetables

| S/N | Leafy Vegetables | Parameter (%) Of Dried Leaves | Ash (%) | Moisture (%) | Lipid (%) | Fibre (%) | Protein (%) | Carbohydrate (%) |
|-----|------------------|--------------------------------|---------|--------------|-----------|------------|-------------|------------------|
| 1   | Tefaria occidentalis | 12.7                          | 3.38    | 1.44         | 1.17      | 35.21       | 35.60       |
| 2   | Amaranthus hybridus | 22.4                          | 2        | 14.65        | 0.52      | 31.02       | 22.66       |
| 3   | Ocimum gratissimum | 12.1                          | 2        | 13.99        | 0.74      | 2.62        | 62.70       |
| 4   | Murraya koenigii | 11.5                          | 7        | 15.11        | 1.40      | 20.70       | 35.73       |
| 5   | Veronica amygdalina | 15.7                          | 9        | 11.2         | 2.33      | 2.86        | 58.83       |
| 6   | Gnetum africanum | 6.65                          | 10.6    | 12.4         | 1.13      | 12.94       | 56.65       |
| 7   | Corchorus olitorius | 13.7                          | 2        | 14.24        | 0.55      | 3.50        | 62.80       |
| 8   | Piper guineense | 2                          | 9        | 10.67        | 2.75      | 2.24        | 57.74       |
| 9   | Talinum triangulare | 28.3                          | 3        | 15.17        | 1.34      | 1.82        | 45.27       |

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

| S/N | CONSTITUENTS | LEAFY VEGETABLES | T | O | Q | K | A | A | C | M | G | C | G | C | T | P |
|-----|--------------|------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1   | Tannins      |                   | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| 2   | Steroids     |                   | - | - | - | + | - | - | - | - | - | - | - | - | - | - | - |
| 3   | Terpenoids   |                   | - | - | - | - | + | - | + | - | - | - | - | - | - | - | - |
| 4   | Glycosides   |                   | - | - | - | - | - | - | + | + | + | + | + | + | + | + | + |
| 5   | Saponins     |                   | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| 6   | Phenols      |                   | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| 7   | Alkaloids    |                   | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| 8   | Terpenoids   |                   | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| 9   | Carbohydrate |                   | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| 10  | Flavonoids   |                   | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| 11  | Cardia Glyco-sides |               | + | + | + | + | + | + | + | + | + | + | + | + | + | + | + |
| 12  | Phlobatannins |                   | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 13  | Resins       |                   | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |
| 14  | Balsams      |                   | - | - | - | - | - | - | - | - | - | - | - | - | - | - | - |

NOTE: To = Tefaria occidentalis; Ah = Amaranthus hybridus; Og = Ocimum gratissimum; Mk = Murraya koenigii;Vs = Veronica amygdalina; Go = Gnetum africanum; Co = Corchorus olitorius; Pg = Piper guineense; Tt = Talinum triangulare + Defected – Not defected
Table 3: Mineral Composition of the Leafy Vegetables

| S/ N | SAM- PLES | Fe | Zn | Cr | Ca | Ni | C d | Mg | Pb | Mn |
|------|-----------|----|----|----|----|----|-----|----|----|----|
| 1    | Tefiaria occidentalis | 28 | 6.3 | 0.3 | 922.9 | - | - | 60 | 1.8 | 19 |
| 2    | Amaranthus hybridus | 50 | 7 | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| 3    | Ocinum gratissimum | 3.8 | 1.8 | 0.1 | 1219 | - | - | 56 | 5 | 0 |
| 4    | Murraya koenigii | 0.2 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 5    | Veronica amygdalina | 9.6 | 9.6 | 0.4 | 1228 | - | - | 59 | 2.3 | 9 |
| 6    | Gnetum africanum | 26 | 6.1 | 0.4 | 871.2 | - | - | 59 | 2.0 | 8.2 |
| 7    | Corchorus olitorious | 20 | 0 | 1 | 0 | 0 | 0 | 79 | 5 | 5 |
| 8    | Talinum triangula | 17 | 2.6 | 0.4 | 838.0 | 0.2 | 0 | 58 | 2.3 | 8.0 |
| 9    | Piper guineense | 0 | 0 | 0 | 0 | 0 | 0 | 24 | 4 | 3.0 |

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    | Tefiaria occidentalis | Fluted pumpkin | Ugu |
| 2    | Amaranthus hybridus | African spinach | Afele, Efote |
| 3    | Ocinum gratissimum | Scent leaf | Efirim, Naihanw, Daidoyu |
| 4    | Murraya koenigii | Curry | |
| 5    | Veronica amygdalina | Bitter leaf | Efo ewuro |
| 6    | Gnetum africanum | Okaiz, Ukazi, Afang | |
| 7    | Corchorus olitorious | Jute leaf, Mallow leaves | Ewedu, Rama |
| 8    | Piper guineense | - | Oziza, Uziza |
| 9    | Talinum triangula | 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 Tefiaria 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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