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MINERAL AND PROXIMATE COMPOSITION OF *SENNA OCCIDENTALIS* LEAVES

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ABSTRACT

This study was designed to evaluate the mineral and proximate composition of leaf of Senna occidentalis a common vegetable in the northern Nigeria. Mineral and proximate compositions were carried out using standard procedure outlined by Association of Official Analytical Chemists (A.O.A.C).

The result of the mineral analysis revealed that the leaf of *Senna accidentalis* contained phosphorous (3.65±0.0mg/100g) as the highest mineral. Other minerals detected were iron (2.46±0.01mg/100g), zinc (1.85±0.004mg/100g), sodium (1.85±0.01mg/100g), calcium (0.77±0.01mg/100g), magnesium (0.6565±0.004mg/100g), copper (0.39±0.01mg/100g) andpotassium (0.65±0.01mg/100g) in the sample. The result of the proximate analyses also showed that the plant has a high nutrient concentration in carbohydrate (63.03±0.4%), moisture (21.96±0.3%) and lower contents of fibre (6.89±0.6%), ash (3.77±0.7%), protein (2.75±0.5%) and fats (1.62±1.0%). The presence of these nutrients may be responsible for the nutritional properties of the plant.

Key Words: Mineral, Proximate, *Senna occidentalis,* Leaf and A.O.A.C.

INTRODUCTION

Plants have been found to be good source of energy for human and animal at large. In addition, plants can synthesize large variety of chemical substances that are of physiological importance (Kretovich, 2005). Vegetable is the fresh and edible portions of herbaceous plants. They are important food and highly beneficial for the maintenance of good health and prevention of diseases (Robinson, 1990). They contain valuable food nutrients which when successfully utilized, can help to build up and repair worn out tissues in the body. They are valued mainly for their high vitamin such as riboflavin, folic acid, ascorbic acid; minerals like calcium (Ca), iron (Fe), magnesium (Mg), sulfur (S), zinc (Zn), nitrogen (N), phosphorous (P), cupper (Cu), manganese (Mn) contents and anti-oxidant activities. There are different kinds of vegetables, with each group contributing to diet in its own way (Hanif, 2006; Robinson, 1990).

Senna occidentalis (Septic Weed or Coffee Senna), was introduced to Africa from tropical Asia. It is part of the numerous important wild plant species growing on the savanna region of Nigeria (Umar and Ahmad, 2014). It is a small shrub about 3 feet high, belongs to leguminosae family. Its leaves, especially when young are cooked and eaten as vegetable by majority of the rural communities in Asian countries and in some parts of Africa like Nigeria, boiled and the solution taken. The flowers, fruits and seeds are also parts of human food (Bello *et al.,* 2008). The roots, stems, fruits, flowers and leaves of *Senna occidentalis* have been reported to have antimicrobial, anti-malarial and anti-trypanosomial activities by Samy (2000). The leaf when boiled, its extract is taken as tea for constipation, treatment of eczema, treatment for smallpox, measles and other skin diseases; potent cure for gonorrhea, pile, and treatment of fever (Olaiya, 2006).

Malnutrition, protein deficiency and hunger are on the increase worldwide mainly due to insurgency, militancy, natural disaster like flooding and lack of environmental impact assessment studies before embarking on projects. Boko Haram insurgency in the northeast as well as Fulani herdsmen attack on farmers have driven farmers out of their farmland with resultant negative effect on food production and security. Equally, lack of information on the specific nutrients in a large number of the native vegetables species 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. Among the vegetables and medicinal plants in which their proximate

and mineral analyses have not been extensively studied are leaves of *Senna occidentalis.* The study therefore evaluates the proximate and mineral compositions of leaf of *Senna occidentalis*.

MATERIALS AND METHODS

Materials

The chemicals, reagents and equipment used were of analytical quality.

Collection and Preparation of *Senna occidentalis*

Fresh leaves of *Senna occidentalis* were collected from Sokoto State and were identified by a taxonomist in Applied Biology Department, Ebonyi State University, Abakaliki, Nigeria. It was dried under room temperature for two weeks. A part of the plant was also kept in the herbarium for reference purposes. The dried *Senna occidentalis* leaves were ground into appreciable mass using manual blender and stored in air tight bottle. It was kept in a refrigerator until required.

Figure 1: *Senna occidentalis* growing in the wild.

METHODS

Proximate and Mineral Contents Analyses:

The proximate and mineral analyses were carried out according to the procedure of Association of Official Analytical Chemist (A.O.A.C.,1995; 1997).

Determination of Protein Content

The protein content was determined by the method of AOAC (1995)

Procedure: Exactly 0.5g of the sample was added to 15mls of concentrated sulphuric acid and a pinch of Kjeldahl catalyst (selenium) as the digestion catalyst and mixed. Few drops of water were also added (for exothermic reaction). The mixture was heated cautiously on digestion rack under

fume hood until a greenish clear solution appears. It was allowed to cool and made up to 50mls with distilled water in a graduated cylinder and taken to the kjeldahl stand for distillation. The apparatus was cooled with normal water. 10ml of boric acid indicator was added into the distillation flask containing 10ml of the sample and added to it 10ml of 40% sodium hydroxide (NaOH). The sample was then taken to the kjeldahl unit for distillation to take place. As the process starts, release and check for colour change in the conical flask containing the indicator and also increase in volume to 40-50ml of the distillate. The process was repeated (Kjeldahl process) and using 10ml of the two distillates each; titrates with 0.01molar hydrochloric acid (NHCl) to first pink color.

$$\% \text{ Nitrogen} = \frac{\text{Titre} \times 14.01 \times 0.01\text{m} \times 100 \times 50}{1000\text{mg} \times 0.5\text{g} \times 10}$$

% Crude Protein = N x 6.25

Where:

14.01	=	**Molarity of Nitrogen**
0.01m	=	**Normality of HCl**
50	=	**volume after digestion with H_2SO_4**
0.5	=	**sample weighed**
10	=	**aliquot from 50ml**
l00	=	**percentage.**

Determination of Moisture content (Ovum Method)

The moisture content was determined by the method of AOAC (1995)

Procedure: Exactly 2g of the sample was weighed inside a clean dried crucible. It was dried at 60^0C in a hot stimulating ovum for 24hrs and allowed to cool inside a desicator and weighed again. The crucible was washed, ovum dried and the empty weight of the crucible taken.

$$\% \text{ moisture} = \frac{\text{Difference in weight}}{\text{Weight of sample used}} \times \frac{100}{1}$$

Determination of Ash Content

The Ash content was determined by the method of AOAC (1995)

Procedure: The crucible was heated in an oven at 600^0C, cooled and weighed. 2g of the sample was transferred into a weighed crucible and the weight taken, and the content placed into a muffle furnace and ashed to give a gray color of the sample at 600^0C for 3hrs. It is allowed to cool in a desicator and reweighed.

$$\% \text{ Ash} = \frac{\text{Difference in weight}}{\text{Weight of sample used}} \times \frac{100}{1}$$

Determination of Crude Fibre

The Crude fibre content was determined by the method of AOAC (1995)

Procedure: Exactly 2g of the sample was macerated in petroleum ether by boiling under reflux for 30minutes with 200ml of a solution containing 1.25g of

tetraoxosulphate (IV) acid (H_2SO_4) per 100mls of solution. It was filtered with cheese cloth and washed with boiled water until the acids runs off. The residue was transferred to a beaker and boiled for 30minutes with 200mls of a solution containing 1.25g of carbonate free sodium hydroxide per 100mls. It was then filtered again and transferred into a crucible. The residue was dried in the ovum and weighed. Then the sample was ashed at 600^0C in a muffle furnace and the dried weight taken.

$$\% \text{ Crude fibre} = \frac{\text{Loss in weight}}{\text{Weight of original sample}} \times \frac{100}{1}$$

Determination of Fat (Soxhlet Method)

The fat/oil content was determined by the method of AOAC (1995)

Procedure: 250mls of clean boiling flask was dried in the ovum at 105^0C for 30 minutes. Exactly 2g of the sample was transferred into the flask. 300ml of petroleum ether was added. The gimble was plugged and the extraction thimble covered with cotton wool and the soxhlet apparatus assembled and reflu $\frac{100}{1}$ 6hours. The thimble was removed and the petroleum ether in the top container of the setup run off and drained for another extraction. The petroleum ether layer was collected into a beaker and dried in the ovum and weighed. The beaker was washed and also dried in the ovum to get the empty weight.

$$\% \text{ Fat} = \frac{\text{Difference in weight}}{\text{Weight of sample used}} \times \frac{100}{1}$$

Carbohydrate Content

The carbohydrate content was determined by the method of AOAC (1995)

Carbohydrate = 100 – [% fats + % Ash + moisture + 2 protein + % crude fibre]

Determination of Minerals

The method involves the separation of minerals from the food matrix by destruction of the organic matter of the sample through dry ashing or wet digestion.

Determination of Calcium

The amount of calcium was determined by the method of (AOAC, 1997)

Procedure: Exactly 10ml of the sample filtrate was pipetted into 250ml conical flask and 25ml of 10% potassium hydroxide was added into the same flask and a pinch of calcein indicator was also added. 0.1N EDTA was used to titrate the solution till colour changed from pinkish-green to full pinkish colour.

Determination of Phosphorus

The amount of phosphorous was determined by the method of AOAC (1997)

Procedure: Exactly 5ml of the sample was pipetted into a test tube, 1ml of ascorbic acid solution and 1ml of 2.5% ammonium molybdate reagent was added to the sample and mixed well. The well mixed sample was boiled in a water bath for about 5minute for the blue colour to develop. The absorbance was read at 620nm.

Determination of Magnesium

The amount of Magnesium was determined by the method of AOAC (1997)

Procedure: Exactly 10ml of the sample filtrate was pipetted into 250ml conical flask after which 25ml of ammonia buffer solution was added into the conical flask and was properly mixed. Then a pinch of Erichrome black T indicator was added and titrated with 0.02N of EDTA until the colour of the solution changed from wine-red to blue colour.

Determination of Iron

The amount was determined Iron was determined by the method of AOAC (1997)

Procedure: Exactly 5ml of the sample was pipette into a test tube and 1ml of 2.5% hydroquinol and 1.5ml of acetate buffer was added to the sample, after which 1ml of 0.1% pyridine was also added and stirred properly to mix. The volume of solution was made up with dilute water and was properly mixed. The colour was allowed a maximum of 24hoursfor it to develop and the absorbance was read at 530nm using spectrophotometer.

Determination of Zinc

The amount of Zinc was determined by the method of AOAC (1997)

Procedure: Exactly 5 ml of the sample was pipetted into a test tube and 2 ml of citric acid solution was added and neutralize with ammonia. Exactly 5 ml of dithizone solution was added and the lower layer was discarded. Then, 2 ml of carbon tetrachloride was added and stirred vigorously and the lower layer discarded. The upper layer was allowed for 30 minutes and 5 ml of dilute dithizone was added and stirred. The absorbance of dithizone layer was taken at 532 nm.

Determination of Manganese:

This was carried out by the procedure of AOAC (1997).

Procedure: Exactly 5 ml of the ashed sample was pipetted into a test tube. Then, 0.5 ml of concentrated H_2SO_4 was added and boiled for 1 hour. Exactly 0.1 g of sodium m- periodate was added into the test tube and boiled for 10 minutes and allowed to cool and made up to 10 ml with water. The absorbance was measured at 570nm.

Determination of Sodium and Potassium

These were determined using flame photometric method by AOAC (1997)

Determination of Copper:

This was carried out by the procedure of AOAC (1997).

Procedure: Exactly 5 ml of the ashed sample was pipetted into a test tube and 1 ml of vasanate citrate solution was added. The mixture was made alkaline with ammonia and 0.1 ml of 1% sodium diethyldithiocarbamate was added with 5 ml of carbon tetrachloride and stirred properly. Then, the mixture was allowed to

separate and the absorbance of the lower layer taken at 440 nm.

RESULTS

Results of Mineral Analysis of *S. occidentalis* Leaves

The results of mineral composition of *S. occidentalis* leaves revealed high concentrations of phosphorous (3.65±0.004 mg/100g) followed by iron (2.46±0.01mg/100g) with a reduced copper (0.38±0.01mg/100g) concentration as shown in Figure 2 and 3.

Results of Proximate Composition of *S. occidentalis* Leaf in percentage

The results of proximate composition of *S. occidentalis* leaf revealed high carbohydrate concentration and low concentrations of fat, fibre and ash as shown in Figure 4.

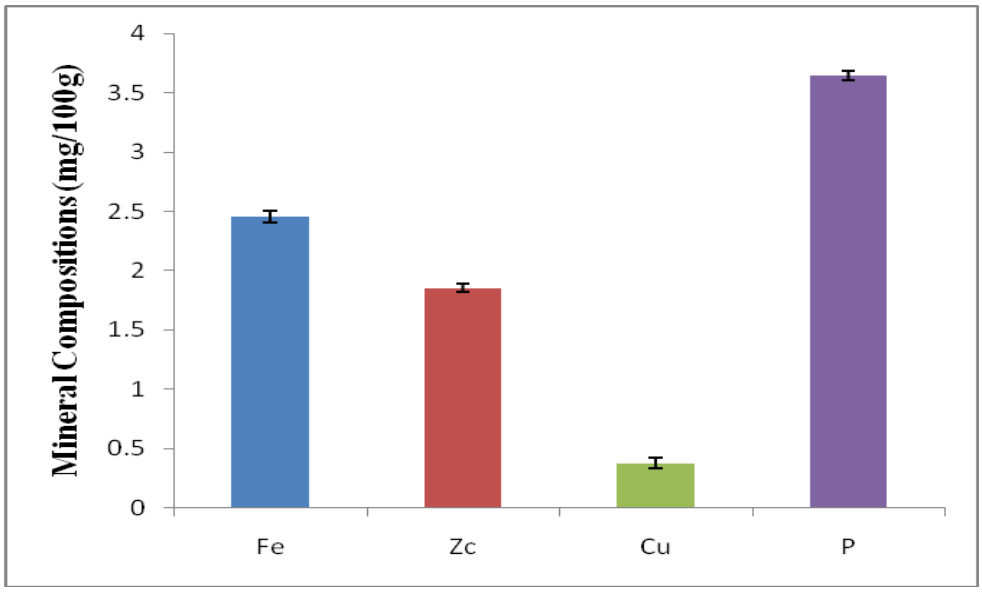

Figure 2: Mineral Compositions of *S. occidentalis* Leaf in mg/100g

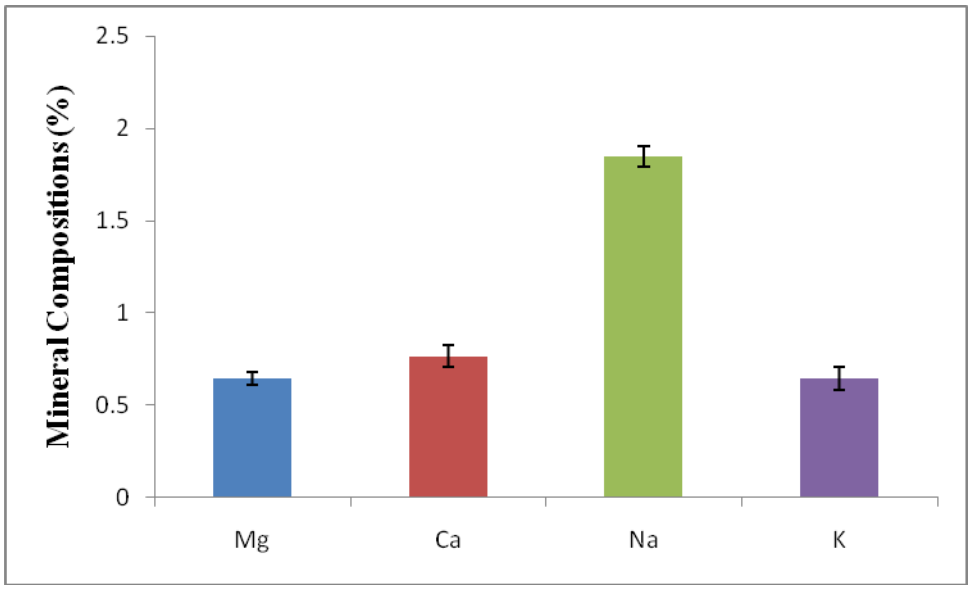

Figure 3: Mineral Compositions of *S. occidentalis* Leaf in percentage

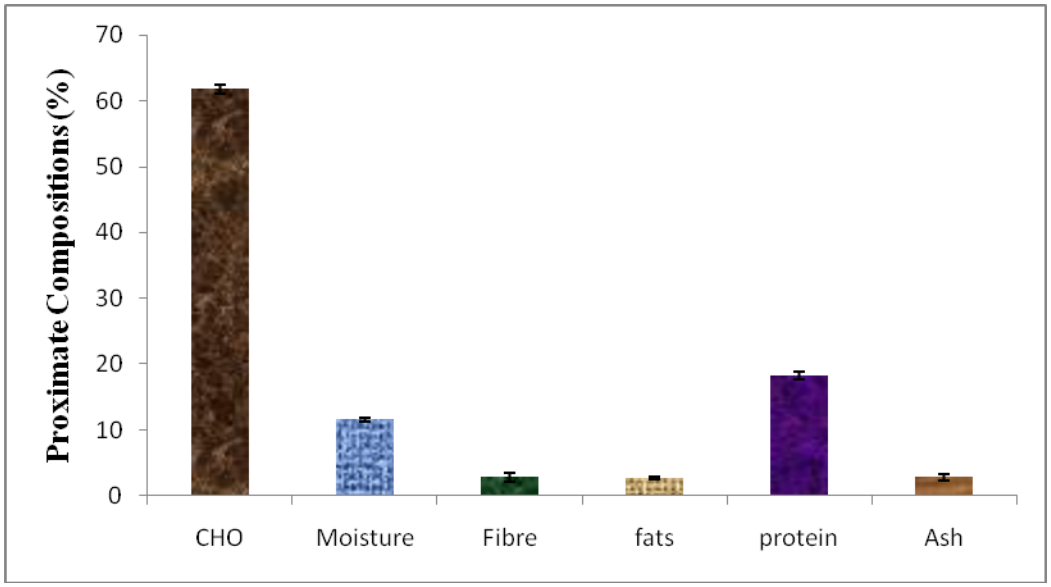

Figure 4: Proximate Compositions of *Senna occidentalis* Leaves.

DISCUSSION

The result of the mineral analysis in Figure 2 and 3 revealed that leaf of *Senna occidentalis* is a good source of phosphorous, iron, zinc and sodium. This result correlates with the findings of Abolaji *et al.* (2007) on *Xylopla aethlopica* and *Parinari polyandra*. The values obtained for zinc were higher than those reported by Hassan *et al.* (2002) in *Cassia occidentalis* leaves. The result of zinc concentration reported by Ngaski (2006) in *C. siamea* leaves was higher (6.85 mg/100 g) when compared to the result of this research. This result does not agree with the report of Nwali *et al.* (2014) that revealed high values of potassium (3.49±0.01and 3.74 ±0.04 %) and calcium (4.99±0.01 and 6.82 ± 0.04 %) in *Bryophyllum pinnatum* leaves in wet and dry samples. Whereas, Igwenyi *et al.* (2011) reported relatively high values of iron, magnesium and calcium in µg/ml and low values of phosphate, manganese, sulphate and nitrates in *Ipomea aquatic* leaves. Aja *et al.* (2013) revealed Calcium concentration of 1.475 x 10^2 + 0.15mg/l, Chlorine concentration of 2.482 x 10^2 + 0.01mg/l and Phosphorus concentration of 3.85 + 0.20mg/100g in seed of *Moringa oleifera* whereas the concentration in the leaves recorded calcium (1.151 x 102 + 0.02mg/l), Chlorine (0.319 + 0.07mg/l) and Phosphorus (3.85 + 0.04mg/100g). Zinc is distributed widely in plant and animal tissues and occurs in all living cells. It functions as a cofactor and is a constituent of many enzymes like lactate dehydrogenase, alcohol dehydrogenase, glutamic dehydrogenase, alkaline phosphatase, carbonic anhydrase, carboxypeptidase, superoxide dismutase, DNA and RNA polymerase. Zn dependent enzymes are involved in macronutrient

metabolism and cell replication (Hays and Swenson, 1985).

Phosphorus formed part of the constituents of bone tissue and they form compounds needed for energy conversion. Potassium plays a vital role in normal cell function including neurotransmission, muscle contraction, and maintaining acid-base balance. Magnesium is essential for healthy bones and proper functioning of muscle and nerve tissue. The iron content, a component of hemoglobin in red blood cells, determines the balance of oxygen in the blood. The primary roles of zinc appear to be in cell replication and gene expression and in nucleic acid and amino acid metabolism. Vitamins A and E metabolism and bioavailability are dependent on zinc status (Szabo *et al*., 1999). The basic functions performed by the minerals includes, structural components of body tissues; are involved in the maintenance of acid-base balance and in the regulation of body fluids, in transport of gases and in muscle contractions (Malhotra, 1998; Murray *et al*., 2000).

The proximate analysis as shown in Figure 4 revealed that *Senna occidentalis* is a good source of carbohydrate (63.03%). Study on proximate of *Senna siamea* reported by Odeja *et al*. (2014) was not in agreement with this study which revealed that carbohydrate (7.67%) concentration is very low. The result is in correlation with Nwali *et al.* (2014) that reported 72.92 ± 1.08% carbohydrates in *Bryophyllum pinnatum* leaves. Igwenyi *et al*. (2011) also reported 42.18% of carbohydrates in *Ipomea aquatic*. The result of Aja *et al.* (2013) also revealed low percentage of carbohydrates (23.60% and 18.00%) in *Moringa oleifera* leaves and seeds. Proximate compositions of *Irvigna gabonesis* and *Citrullus colocynthis* also revealed that they are rich in carbohydrate and oil, but low in protein (Igwenyi *et al.,* 2011). Aja *et al.* (2015) also reported 57.06% of carbohydrates in *Parkia biglobosa* fruits. This confirms *phoenix dactylifera* as a good source of carbohydrates. The results also revealed that protein content is relatively low. The ash content was equally low. It however, serves as a means of assessing the quality of grading plants and also an idea of the proportion of minerals present in the sample. The plant has a very low fat content. Perhaps, the plant can be consumed by individuals on weight reduction diet for management of obesity, cholestasis and various pulmonary disorders. The moisture content of the plant is 21.96%. This is relatively low because the leaves were oven dried before the analysis. It therefore indicates that a freshly harvested leaf of *Senna occidentalis* may contain higher amount of moisture in

variance with the results reported of *Zanthoxylum zanthoxyloides* moisture content (15.20%). This was however higher in fruits of *Xylopla aethlopica* and *Parinari polyandra* with moisture content of 16.04% and 30.65% respectively, as reported by Abolaji *et al.* (2007). The plant is rich in carbohydrate. It has a carbohydrate content of 63.03%. This however, is relative to the value estimated from *Xylopla aethlopica* and *Parinari polyandra* which has a content of 55.80% and 54.27% respectively (Abolaji *et al*., 2007). This result showed that the plant when consumed can generate adequate amount of energy and can be stored for further use in the body system.

CONCLUSION

The analysis on *Senna occidentalis* revealed that the leaf is rich in carbohydrate and can help supply the energy need of the cell when consumed. The mineral content of the leaf suggests that the plant can contribute significantly to the nutrient requirements of man owing to the high concentrations of phosphorous and iron as it may help build strong bones and teeth; and may help to ameliorate anaemia due to significant amount of Fe.

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