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NUTRITIONAL COMPOSITION OF *CORCHORUS OLITORIUS* LEAVES

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ABSTRACT

The proximate and mineral composition of *Corchorus olitorius* leaves collected from a farm site at Barkin-Saleh in Minna town, Niger State, Nigeria, were carried out using standard methods of food analysis. The results of proximate composition showed that the leaves contained 18.38±0.32% ash, 12.54±0.10% crude protein, 11.99±0.50% crude lipid and 19.56±0.18% available carbohydrate. The leaves also had high energy value of 200.78±3.54 kcal/100g respectively. Mineral analysis revealed that potassium (2814.15±8.08 mg/100g) and magnesium (76.69± 0.13 mg/100g) were the dominant elements. The leaves also contained appreciable concentrations of Na (54.56±0.42 mg/100g), Ca (30.55±0.05 mg/100g), P (6.68±0.02 mg/100g), Cu (2.52±0.02 mg/100g), Fe (19.53±0.09 mg/100g), Mn (5.95±0.04 mg/100g) and Zn (4.71±0.01 mg/100g). The present result confirmed that *Corchorus Olitorius* leaves are rich sources of potassium, iron, copper, manganese and zinc as well as high energy values essential in human and animal nutrition.

Keywords: *Corchorus olitorius*, nutritional composition, minerals, human and animal nutrition

INTRODUCTION

Corchorus olitorius ihas various English names, which may include Mallow leaves, Jute Mallow, Jew's mallow, Bush Okra, Tossa Jute. The vernacular names include Tunguruwa (Hausa), Ayoyo (Nupe) and Oogo, eego, ewedu (Yoruba) (Abdullahi *et al.*, 2003). The plant is tall, usually an annual herb, reaching a height of 2-4 meters, unbranched or with only a few side branches. The leaves are alternate, simple, lanceolate, 5-15 cm long, with an acuminate tip and a finely serrated or lobed margin. The flowers are small (2-3 cm diameter) and yellow, with five petals, while the fruit is a many-seeded capsule. It thrives almost anywhere and can be grown year-round. Young leaves of *Corchorus olitorius* and shoot tips can be eaten raw or cooked and are believed to contain high levels of protein and vitamin C.

Corchorus olitorius leaves have a mucilaginous (somewhat slimy) texture, similar to okra, when cooked. The leaves are reported to be rich in betacarotene, iron, calcium, and vitamin C (Abdullahi *et al.*, 2003). The plant has an antioxidant activity with a significant tocopherol equivalent vitamin E. Leaves are shredded and made into a paste. The leaves of *Corchorus olitorius* can also be dried, ground into powder and stored for use during the dry season.

In Nigeria, it is grown as an annual, though it may act as a perennial in some locations. It can be planted at the beginning of the raining season and will withstand the hot, humid months. It can also withstand some drought conditions and extremes in soil (Corchorus, 2008). There is always the need to investigate the biochemical content of different parts of valuable plants such as *Corchorus olitorius*, which could form part of the food of local people and animal browse in any parts of the tropics where the plant is abundant.

The objective of this study was to determine the proximate and mineral composition of *Corchorus olitorius* leaves collected from a farm site at Barkin-Saleh in Minna town, Niger State, Nigeria.

MATERIALS AND METHOD

Sample collection and sample treatment: The sample of *Corchorus olitorius* used in this study was collected from a farm site at Barkin-Saleh in Minna town, Niger state, Nigeria. The chemicals used were sourced from M&B and BDH Chemicals, England.

Prior to analysis, the leaves were separated from their stalks and washed with distilled water. The residual moisture was evaporated at room temperature. Thereafter the leaves were wrapped in large paper envelopes and oven dried at 60^{0}C until constant weight was obtained (Fasakin, 2004). The dried leaves were then ground in porcelain mortar, sieved through 2 mm mesh sieve and stored in plastic container. The powdered sample was used for both proximate and mineral analysis. Moisture content was however, evaluated using fresh leaves.

Proximate analysis: The moisture content of the leaves were determined by drying 5 g of the leaves (in triplicate) in a Gallenkamp oven at 105^{0}C until constant weight was attained (AOAC, 1990). Ash content was determined according to the method described by Ceirwyn (1998) and among others involved dry ashing in Lenton muffle furnace at 600^{0}C until grayish white ash was obtained. Crude protein content was calculated by multiplying the value obtained from kjeldahl's nitrogen by a protein factor of 5.3, a factor recommended for vegetable analysis (Bernice and Merril, 1975). Crude lipid was quantified by the method describe by AOAC (1990) using the soxhlet apparatus and n-hexane as a solvent. Available carbohydrate was determined by Clegg Anthrone method using Jenway 6100 spectrophotometer at 625 nm with glucose and maltose as the standard. The sample calorific value was estimated (in Kcal) according to the formula: Energy = (g crude protein x 2.44) + (g crude lipid x 8.37) + (g available carbohydrate x 3.57) (Asibey–Berko and Taiye, 1999).

Samples preparation for mineral quantification: Six (6) gram of the powdered sample was weighed into a 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 600^{0}C and content ashed until grayish white ash was obtained. It was cooled first at room temperature and then in a desiccator. 5 cm^3 of concentrated HCl was added and heated for 5 minutes on a hot plate in a fume cupboard. The mixture was then transfer into a beaker and the crucible washed several times with distilled water. The mixture was made up to 40 cm^3 and boiled for 10 minutes over a bunsen burner. This mixture was then cooled, filtered into a 100 cm^3 of volumetric flask and distilled water was used to rinse the beaker into the volumetric flask and solution made up the volume to 100 cm^3 (Ceirwyn, 1998). The solution where prepared in triplicates.

Sodium (Na) and Potassium (K) were analyzed by flame atomic emission spectrophotometer with NaCl and KCl used to prepare the standards. Phosphorus (P) was determined with Jenway 6100 spectrophotometer at 420 nm using vanadium phosphomolybdate (vanadate) colorimetric method with KH_2PO_4 as the standard (Ceirwyn, 1998). The concentrations of calcium (Ca), magnesium (Mg), copper (Cu), Iron (Fe), Manganese (Mn) and Zinc (Zn) in the solutions were determined with a Unicam 969 model atomic absorption spectrophotometer, with standard air–acetylene flame (AOAC, 1990). $CaCl_2$, Mg metal, Cu metal, Fe granules, $MnCl_2.4H_20$ and Zn metal were used to prepare the standards.

Data Analysis: Data were generated in triplicates and the mean standard deviation determined according to steel and Torrie (1980).

RESULTS AND DISCUSSION

Proximate composition: The proximate composition of *Corchorus olitorius* leaves was presented in table 1. As with most fresh leafy vegetables, the leaves have high moisture content (88.33±1.30%). This value agrees with the 58.0–90.64% reported in some Nigerian green leafy vegetables (Ladan *et al.*, 1996; Tomori and Obijole, 2000). The value is high when compared to the 72.83±0.29% recorded for water spinach *(Ipomoea aquatica* Forsk) leaves (Umar *et al.*, 2007) and 83.7 – 87.1% recorded for sweet potato (*Ipomoea batatas)* leaves (Asibey – Berko and Taiye, 1999; Ishida *et al.*, 2000).

The ash content of the leaves (18.38±0.32%) was high and revealed that the leaves contain important mineral elements. This value is within the range of 9.2±1.5 to 28.0±1.1% reported in green leafy vegetables of Nigeria (Ifon and Bassir, 1980; Ladan *et al.*, 1996). It was however when high compared with the 10.83±0.80% reported for water spinach *(Ipomoea aquatica*) leaves (Umar *et al.*, 2007) and the 1.8g/100 g dry weight of *Ipomoea batatas* leaves reported by Asibey-Berko and Taiye (1999).

Table 1: Proximate composition of *Corchorus olitorius* eaves (%)

Parameter	Concentration (% Dry Weight)
Moisture content	88.33 ±1.30
Ash	18.38 ± 0.32
Crude protein	12.54 ± 0.10
Crude lipid	11.99 ± 0.50
Available carbohydrate	19.56 ± 0.18
Calorific value (K cal/100g)	200.78 ± 3.54

The data are mean values ± standard deviation (SD) of three replicates.

The crude protein content of *Corchorus olitorius* leaves (12.54±0.10% dry weight) accorded with the protein content of 11.67–18.00% reported in *Ipomoea batatas* leaves (Ishida *et al.*, 2000). The value

is however higher compared to the 6.30±0.27 recorded in *Ipomoea aquatica* leaves (Umar *et al.*, 2007) and the 4.25% dry weight in *Ipomoea aquatica* leaves grown in Vietnam (Ogle *et al.*, 2001). Furthermore, the protein content of this plant leaves can make significant contribution to dietary intake especially during pre-harvest period, when domesticated food are in short supply.

The sample crude lipid content (11.99±0.50%) is very high when compared with the values of 0.74% (Asibey-Berko and Taiye, 1999) and 2.56-6.82% dry weight (Ishida *et al.*, 2000) reported in Ipomoea *batatas* leaves, but within the range (8.5–27.0%) reported in some wild green leafy vegetables of Nigeria and Niger Republic (Ifon and Bassir, 1980; Sena *et al.*, 1998).

Similar to crude lipid, the available carbohydrate content in *Corchorus olitorius* leaves was 19.56±0.18 % dry weight. This is low compare to the 51.8% reported for *Moringa stenopetala* leaves (Abuye *et al.*, 2003), the 52.85% (dry weight) found in *Bauhenia purpurea* (Raghuvanshi *et al.*, 2001) and 82.8% in *Ipomoea batatas* leaves (Asibay-Berko and Taiye, 1999). Carbohydrates provide the body with a source of fuel and energy that is required to carry out daily activities and exercise. Carbohydrates are also important for the correct functioning of vital physiological systems of the body. The calorific values of most vegetables are low (30-50 Kcal/100g) (Umar *et al.*, 2007). The result obtained for *Corchorus olitorius* leaves was however substantial (200.78±3.54 Kcal/100g on dry weight basis), but was however lower than the 288.3 Kcal/100g recorded in *Ipomoea batatas* leaves (Asibey-Berko and Taiye, 1999).

Mineral content: Table 2 showed that potassium content (2814.15±8.08 mg/100g dry matter) in the *Corchorus olitorius* leaves is higher than 220 mg/100g in the leaves of *Tribulus terrestris* (Hassan *et al.*, 2005) and the values in some green leafy vegetables consumed in Sokoto (Ladan *et al.*, 1996; Faruq *et al.*, 2002). The result indicated that *Corchorus olitorius* leaves are useful potassium sources. According to Yoshimura *et al.* (1991), increase of K/Na ratio in the diet assists in the prevention of hypertension and for normal retention of protein during growth stage. The sodium concentration was 54.56±0.42 mg/100g dry matter, and is high compare to the 45 mg/100g reported for *Senna obtusfolia* (Faruq *et al.*, 2002) but lower than the 195.0 mg/100g in *Hibiscus sabdariffa* (Ladan *et al.*, 1996). Sodium, in combination with potassium in the body is involved in maintaining proper acid–base balance and proper nerve transmissions (Setiawan, 1996).

Table 2: Mineral composition of *Corchorus olitorius* leaves

Mineral elements	Concentration (mg/100g dry matter).
K	2814.15 ± 8.08
Na	54.56 ± 0.42
Ca	30.55 ±0.05
Mg	76.69 ± 0.13
P	6.68 ± 0.02
Cu	2.52 ± 0.02
Fe	19.53 ± 0.09
Mn	5.95 ± 0.04
Zn	4.71 ± 0.01

The data is mean value ± standard deviation (SD) of three replicates.

Calcium content was found to be 30.55±0.05 mg/100g. This is low compare to the 33 and 38 mg/100g reported in lettuce and sikle pod respectively (Faruq *et al.*, 2002). Calcium is important for bone and teeth formation, the transmission of nerve impulses, for muscle contraction and blood clothing. The recommended daily allowance for calcium is 210–1200 mg/day (Murray, 1988) and based on this, the leaves of are *Corchorus olitorius* poor sources of calcium.

Magnesium is an important mineral in connection with circulatory diseases such as ischemic heart diseases and calcium metabolism in bone (Ishida *et al.*, 2000). The magnesium content of *Corchorus olitorius* leaves appeared to be high (76.69±0.13 mg/100g), when compared to the 19 mg/100g in *Senna obtusfolia* leaves (Faruq *et al.*, 2002) and other cultivated green leafy vegetables such as cabbage (4 mg/100g) and lettuce (6 mg/100g) (Turan *et al.*, 2003). Compared to the recommended daily allowance for magnesium (350 mg/100g) set by the USA NRC (1989), magnesium content of *Corchorus olitorius* leaves is low; nonetheless, the amount could supplement other magnesium sources.

The Phosphorus content of *Corchorus olitorius* leaves was 6.68±0.02 mg/100g. This value was low when compared to the 23.83±0.9 mg/100g in *Tribulus terrestris* (Hassan *et al.*, 2005) and the 166.0-640.0 mg/100g reported in some green leafy vegetables consumed in Sokoto (Ladan *et al.*, 1996). Phosphorus is important for healthy bones and teeth. It is important for the utilization of nutrients in the body and in order to release energy inside the cells.

Copper is known for the role its plays in hemoglobin formation and also contribution to iron and energy metabolism (Cabrera *et al.*, 1996; Adeyeye, 2002). The concentration of copper in *Corchorus olitorius* leaves was found to be 2.52±0.02 mg/100g. The value reported was higher than 0.1 g/100g in *Lesianthera africana* leaves (Isong and Idiong, 1997) and *Ipomoea batatas* leaves (Ishida *et al.*, 2000). From the result, *Corchorus olitorius* leaves have good amount of copper relative to its recommended daily allowance of 1.5–3 mg (NRC, 1989). Iron is required for hemoglobin formation and its deficiency leads to anemia (Turan *et al.*, 2003). The assay indicated that *Corchorus olitorius* leaves contain 19.53 ± 0.09 mg/100g of iron. This value is higher compared to 2.8 mg/100g in *Tribulus terrestris* leaves (Hassan *et al.*, 2005), 1.6 mg/100g in spinach, 0.7 mg/100g in lettuce and 0.3 mg/100g in cabbage (Turan *et al.*, 2003). When comparing with the RDA for iron (10-15 mg), it can be concluded that *Corchorus olitorius* leaves is a good source of iron. Manganese is a mineral element that is nutritionally essential. The manganese content of *Corchorus olitorius* leave is 5.95±0.04 mg/100g. This value is high compare to 2.14 ± 0.22 mg/100g reported in *Ipomoea aquatica* Forsk leaves (Umar *et al.*, 2007) but agree with 4.83–10.03 mg/100g in *Ipomoea batatas* leaves (Ishida *et al.*, 2002). The RDA for manganese are 2-5 mg for adult male and female, pregnant and lactating mothers, 2-3 mg for children (7-10 years) (NRC, 1989), based on the RDA, it is clearly indicated that *Corchorus olitorius* leave are good sources of manganese.

Zinc is known to play a role in gene expression, regulation of cellular growth and participates as a co-factor of enzymes responsible for carbohydrates, proteins and nucleic acids metabolism (Camara and Amaro, 2003). The concentration of this element was found to be 4.71 ± 0.01 mg/100g which is high compare to 0.1 mg/100g in *Tribulus terrestris* leaves (Hassan *et al.*, 2005) and 1.75-2.58 mg/100g reported in some famine foods of republic of Niger (Sena *et al.*, 1998). This shows that the leaves of *Corchorus olitorius* are poor source of this mineral element compared to the zinc recommended daily allowance of 12-15 mg (NRC, 1989).

The contribution of *Corchorus olitorius* leaves to the dietary intake of essential elements was evaluated as foOllows; Contribution to RDA (%) = $\frac{\text{Concentration of the element}}{\text{RDA}} \times 100$

RDA = recommended dietary allowance (NRC, 1989)

This was presented in table 3. The leaves were rich sources of Iron, copper, potassium and manganese, moderate source of zinc and magnesium and poor source of phosphorous, sodium and calcium when compared with their respective recommended dietary allowances. This indicated that the leaves supplement other dietary sources of copper, iron manganese, zinc, potassium and magnesium.

Table 3: Contribution to the dietary intake to some mineral element by the *Corchorus olitorius* leaves.

Minerals	RDA (mg)	Contribution to RDA(%)
K	2000	141
Na	500	11
Ca	1200	3
Mg	350	22
P	1200	1
Cu	1.5-3	84-168
Fe	10-15	130-195
Mn	2-5	119 – 298
Zn	12-15	31-39

CONCLUSION

The result of nutritional analysis shows that *Corchorus olitorius* leave are good source of carbohydrate, energy and minerals. The leaves are good sources of iron, potassium, copper, manganese and zinc which meet the recommended daily allowances. The result also revealed that, if the leaves are consumed in sufficient amount, could contribute to the intake of the tested elements. Thus, optimal utilization of the plant will help toward realizing a better nutritional standard of the inhabitants and their animals that eat the leaves.

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