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Preliminary Phytochemical Screening, Elemental and Proximate Composition of Two Varieties of *Cyperus esculentus* (Tiger Nut)

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ABSTRACT: The study aimed at phytochemical screening, elemental and proximate composition of two varieties of *Cyperus esculentus* (tiger nut) big yellow and small brown nuts using standard methods. The phytochemicals tested for were alkaloid, saponin, tannin, glycoside, flavonoid, steroid and resin. All the aforementioned phytochemicals with the exception of resin were present in the two varieties. The elements tested for were Na, Ca, Mg, Mn, Zn, K and Fe. The result shows big yellow variety had higher Na, K, and Ca with mean values 70.8 mg/Kg, 3694.43 mg/Kg and 372.2 mg/Kg respectively. Both samples had equal Fe, Zn and Mn contents of 21.0 mg/Kg, 8.3 mg/Kg and 1.67 mg/Kg respectively. Small brown variety had higher Mg content (308.3 mg/Kg). The proximate analysis show brown yellow variety had higher ash, crude protein and crude fiber contents with values of 1.85%, 2.75% and 9.25% respectively. While small brown variety had higher moisture and fatty acid contents of 4.25 % and 15.2% respectively. Considering the potential nutritive and health benefits of the underutilized tiger nuts, it is suggested that utilization of tiger nut products (such as biscuits, flour and milk etc.) should be encouraged so as to ameliorate the problem of protein-calorie malnutrition in children, since it is rich in nutritional contents.
Keywords: *Cyperus esculentus*, elemental, phytochemical, proximate, tiger nut

INTRODUCTION

Tiger nut is a grass-like plant of the Family *Cyperaceae* (sedge family), Order Cyperales or Graminales (Takhatajah, 1992). Like other sedges, the plant is most frequently found inhabiting wet marshes and edges of streams and ponds where it grows in coarse turfs (Saxena, 2001).
In Nigeria, the Hausas call it "Aya", Yorubas "Imumu" the Igbos "Ofio", or "aki Hausa" in southern Nigeria (Oladele *et al*., 2009). Tiger nut has many other common names which include, Zulu nut, yellow nut grass, ground almond, Chufa, edible rush, rush nut, duck potato etc (Oladele *et al*., 2009).

In Nigeria, tiger nut is well grown in the middle belt and northern region (Oladele *et al*., 2009), where it is sold locally and consumed uncooked. In Spain, the tubers are consumed mainly as a drink called "horchata de chufa" (Chufa Milk). It has been cultivated as a livestock food and for human consumption (Umerie *et al*., 1997). According to Belewu and Abodunrin (2006), three varieties are cultivated i.e. yellow, brown and black. Among these only two varieties; yellow and brown are readily available in Nigeria market (Omode *et al.,* 1995).

The medicinal benefits of tiger nuts are ascribed to a large number of nutritional components or constituents it contains. Sugar free tiger nut milk is suitable for diabetic patients (Anon, 1992). They are thought to be beneficial to those seeking to reduce cholesterol or lose weight (Beniwal, 2004). It is good for arteriosclerosis (Mohammad *et al*., 2005).

According to Stern *et al*., (2003) Paiute Indians pound tiger nut tubers with tobacco leaves applied en masse on wet dressing for treatment of athlete's foot. Tiger nut milk is used in making soap and bath milk due to its high content of vitamin E, (Tiger Nut and Health, 2013). Chufa tubers can be used for the production of alcohol by fermentation (Des-Vries, 1991). Roasted tubers are used as a coffee substitute (Oderinde and Tahir, 1988). The oil of tiger nut (*C. esculentus*) is used for the production of biodiesel (Nag, 2008).

The research for lesser known and underutilized crops, which include tiger nuts, many of which are potentially valuable as human and animal food has been intensified to maintain a balance between population growth and agricultural productivity particularly in tropical and sub-tropical areas of the world (FAO, 1985).
This study is aimed at preliminary phytochemical screening, elemental and proximate analysis of two varieties of *Cyperus esculentus* (tiger nut).

MATERIALS AND METHOD

Collection and Identification of Sample

The two varieties of *Cyperus esculentus* (yellow and brown) were collected from markets in Katsina, Kaduna, Bauchi and Kano states in Nigeria. The Samples were identified according to the identification protocols of Dutta (2011). Samples were coded BY (big yellow) and SB (small brown) after sorting them based on their colour and relative size.

Preparation of Sample

The tubers were thoroughly screened to remove the bad ones and stones. The tubers were later washed, drained and air- dried. The samples were ground using wooden mortar and pestle until a fine powder was obtained to ensure homogeneity. The powdered sample was passed through a fine (2mm mesh) sieve to remove any remaining residue. The fine powdered sample was then stored into labeled plastic containers.

Preparation of Plant Extract

Aqueous extract of each sample was prepared by soaking 100g of dried powdered sample in 200ml of distilled water for 24 hours. The extracts were filtered using whatman filter paper No.42 (125mm) (Edeoga *et al.,*2005*).*

Preliminary Qualitative and Quantitative Phytochemical Screening

The aqueous extracts were analyzed for alkaloids, glycosides, flavonoids and resins as described by El-Mahmood and Dhoughari, (2008); test for reducing sugar was carried out as described by Trease and Evans (1989); while tests for saponins, tannins and steroids were conducted as described by Hassan *et al.* (2005).

Proximate Composition Analysis

The samples were subjected to proximate analysis to determine the moisture, ash, crude fiber, crude protein and nitrogen using the standard method of the Association of Official Analytical Chemists, AOAC (2003).

Drying, Ashing, Digestion and Determination of Elemental Concentrations

The samples after drying and grounding, 1g of the powdered sample was spread in porcelain dish and placed in muffle furnace. The ash sample was digested using 6N HCl. Analysis of Na, K and Ca was carried out using atomic absorption spectrophotometer (AAS) (APHA, 2005).

Statistical Analysis

SPSS version 15.0 statistical software was used to compute data for statistical significance. The data obtained were analyzed for descriptive (i.e. mean, sum, standard deviation), Chi-squared test in order to test for the significance at $P \leq 0.05$ between varieties.

RESULTS AND DISCUSSION

The physical properties of the aqueous extract of the phytochemical screening of the two varieties of *Cyperus esculentus* are presented in Table 1. *C. esculentus,* as shown in Table 2 show that the small brown variety has higher alkaloid, saponin, flavonoid, glycoside, than the big yellow variety. While the big yellow variety has higher tannin, steroid and reducing sugar. Resin is absent in both samples (Table 3). The absence of resin in *C. esculentus* in the present study is in contrast with the opinion of Gills (1992). The absence may be due to differences in soil composition, amount of rainfall, leaching effect, climate and type of manure used. Saponins have been reported to be useful in reducing inflammation of the upper respiratory passage (Frantisek, 1991). Alkaloids are known for their toxicity but not all Alkaloids are toxic. They inhibit certain mammalian enzymes and are also known to affect glucagon and thyroid stimulating hormones (Okaka *et al.,* 1991). Steroids are of importance and interest in pharmacy due to their relationship with such compounds as sex hormones (Okwu, 2001). Tannins have astringent properties that hasten the healing of wounds and prevention of decay. Glycosides help modify biologically activity by helping to strengthen contraction of the heart muscle (Frantisek, 1991). The phytochemicals obtained from the tuber posses some biological active compounds which could serve as potential source of vegetable drugs in herbal medicine.

The current study show that the big yellow nut has higher calcium, potassium, and sodium contents with values 372.2mg/kg, 36940.43mg/kg and 70.8mg/kg respectively, but with lower manganese content (1.67mg/kg) (Table 4). The presence of potassium and calcium in tiger nut are adequate for bone and teeth development in infants (Chevalier, 1996). The small brown nut has higher concentration of magnesium than the big brown variety. The presence of other minerals such as iron is highly important because of its requirement in blood formation, almost two-third of Fe

in the body is found in haemoglobin which helps in carrying oxygen to tissues (National Institute of Health, 2013). The World Health Organization considers Fe deficiency as number one nutritional disorder in the world (CDC, 1998). The proximate composition of food is a major index of nutritious potentials of crops. The analysis show higher carbohydrate and crude fibre contents in the big yellow nut than in the small brown variety (Table 5). But, moisture and fatty acid contents are higher in the small brown nut than in the big yellow variety although not significant (P>0.05).

Table 1: Physical Properties of Aqueous Extract of Two Varieties of *C. esculentus*

Sample ID	Color	Taste	Texture	Odour
BY1	light brown	Sugary	clear with suspension	nutty
BY2	light brown	Sugary	clear with suspension	nutty
BY3	light brown	Sugary	clear withsuspension	nutty
SB1	dark brown	slightly sugary	slightly clearwith suspension	nutty
SB2	dark brown	slightly sugary	slightly clear with suspension	nutty
SB3	dark brown	slightly sugary	slightly clearwith suspension	nutty

BY1 = big yellow from Kaduna BY2 = big yellow from Katsina BY3 = big yellow from Kano
SB1 = small brown from Kaduna SB2 = small brown from Katsina SB3 = small brown from Kano

Table 2: Preliminary Qualitative Phytochemical Screening of Aqueous Extract of *C. esculentus Varieties*

Sample ID	Alk	Tan	Sap	Gly	Flav	Ste	R/S	Res
BY1	++	+++	++	++	++	+++	+++	-
BY2	++	+++	++	++	++	+++	+++	-
BY3	++	+++	++	++	++	+++	+++	-
SB1	+++	++	+++	+++	+++	++	++	-
SB2	+++	++	+++	+++	+++	++	++	-
SB3	+++	++	+++	+++	+++	++	++	-

Alk=Alkaloid; Tan=Tannin; Sap=Saponin; Gly=Glycoside; Flav=Flavonoid Ste=Steroid; R/S=Reducing sugar; Res=Resin
- = not present; + = present at trace amount; ++ = present at low amount; +++ = present at moderate amount; ++++ = present at high amount

Table 3: Preliminary Quantitative in mg/g Phytochemical Screening of Aqueous Extract of Two *C. esculentus Varieties*

Sample ID	Alkaloid	Glycoside	Tannin	Flavonoid
BY	0.34±0.20	0.47±0.002	0.45±0.07	0.23±0.001
SB	0.45±0.01	0.48±0.002	0.27±0.07	0.27±0.001

The values in the table are Mean± SD from duplicate determinations, there was no significant difference at p≤0.05.

Table 4: Elemental Composition in mg/kg dry weight of *Cyperus esculentus*

Sample ID	Na	K	Mg	Mn	Ca	Fe	Zn
BY	70.8±3.19	3694.43±127.29	283.3±38.17	1.67±1.45	372.2±78.77	21.0±2.85	8.3±2.62
SB	65.07±8.79	2750.0±166.7	308.3±14.43	1.67±1.45	273.9±57.38	21.0±2.85	8.3±2.62

The values in the table are Mean± SD from triplicate determinations. There was significant difference at p≤0.05 using X^2 test.

Table 5: Proximate Analysis (%) of *Cyperus esculentus*

Sample ID	Ash	Moisture	DM	CP	CF	CHO	F/acid
BY	1.85±0.15	3.75±0.25	96.25±0.25	2.75±0.25	9.25±0.25	68.15±0.85	7.40.55
SB	1.25±0.25	4.25±0.25	95.75±0.35	2.50±0.02	8.95±0.25	67.85±0.75	7.6±0.62

The values in the table are Mean± SD from duplicate determinations. There was no significant difference at p≤0.05 using X^2 test.
KEY: ASH=Ashing; DM =dry matter; CP=crude protein; CF=crude fibre, CHO =carbohydrate; f/acid =fatty acid

The moisture content of the two varieties decreased appreciably due to their dry state or climatic condition. The ash content value of C. *esculentus* of 1.85% and 1.25% for both big yellow and small brown varieties respectively was within the range of 1.5-2.5% reported by Sofowora (1993). The fat content is within the range reported by Borges *et al.,* (2008), which promotes fat soluble vitamin absorption. Tiger nut has high fibre content, the consumption of significant quantities of *C. esculentus* would therefore not constitute a risk factor to some pathologic stages i.e diabetic mellitus, obesity and coronary heart disease. Past researches have linked low fibre content in the diet with health problems such as heart disorders, bowel cancer and appendicitis (Pyke, 1979).

CONCLUSION

It is noteworthy that both the two tiger nuts varieties (small brown and big yellow nuts) contain all the phytochemicals tested with the exception of resin. Essential elements such Na, K, Mg, Mn, Ca, Fe and Zn were found in appreciable levels in both two varieties. Also other classes of food such as carbohydrate, protein, fatty acid, and fibre were present. Considering the nutritive and health benefits of the underutilized tiger nuts, there is the need for increased utilization and awareness of its health benefits.

RECOMMENDATIONS

i. Government should encourage farmers towards large scale cultivation of tiger nut.
ii. Bakers should be introduced to the usage of tiger nut flour so as to reduce over-dependence on wheat flour.
iii. Cattle rearers or livestock farmers should be sensitized on feeding livestock with tiger nut seed meal base diet so as to improve feed efficiency and weight gain.
iv. Establishment of small scale industries to enhance the production of tiger nut oil, cosmetics, papermaking and mat production from tiger nut so as to boost economic development and reduce unemployment in the society.
v. Further research should be carried-out on the medicinal properties of the tuber.

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