

# CHEMICAL COMPOSITIONS, ANTIOXIDANT CAPACITY OF TIGERNUT (*Cyperus esculentus*) AND POTENTIAL HEALTH BENEFITS

*Ogunlade, I., PhD*  
*Adeyemi Bilikis, A., B.Sc*  
*Aluko Olanrewaju, G., B.Sc.*

Department of Chemistry, Department of Science Laboratory Technology  
Ekiti State University, Ado-Ekiti, Ekiti State, Nigeria

---

## Abstract

Tiger nut (*Cyperus esculentus L.*) considered as an intrusive weed in most countries but taken as snack in Nigeria was analyzed for proximate and mineral compositions using standard analytical techniques. Antioxidant activity of the methanolic extract was measured using 2, 2-diphenyl-1-picrylhydrazyl (DPPH), while the total phenolic content was determined according to Folin-Ciocalteu method. The results revealed that the three forms of the tuber (dry, raw and roasted) as consumed had % moisture ranging from (12.57-43.84); protein (1.32-2.24); fat (1.44-1.54); ash (3.34-6.69); crude fibre (16.14-17.14); and carbohydrate (30.58-62.79). The samples were significantly high in Na, K and Ca. Na-K ratio was also found to be less than 1 suggesting its suitability in formulating diets for hypertensive patients. Antioxidant activity of the samples ranged from 3.72-5.90; 5.22-9.72; 11.63-16.10; and 15.95-23.00 % inhibitions at different levels of concentrations while total phenolic content ranged from (806.7-1150.7) micromole GAE/g. The results indicate that the edible tubers which are used for non-alcoholic local beverage formulation, in medicine and cosmetic industry can be utilized to ‘mop up’ and scavenge free-radicals generated by essential metabolic body reactions and environmental pollutants. It is hoped that addition of tiger nut as side dish and adjunct in traditional diets will probably alleviate the symptoms associated with neurodegenerative and cardiovascular diseases.

---

**Keywords:** Tiger nuts, Antioxidant capacity, Free radicals and Diseases

## **Introduction**

The existence of large population and biodiversity of food plant species has continued to play a prominent role in ensuring healthy lives and promoting well-being for all at all ages. This becomes imperative with increase in population, growing environmental population and its resultant health hazards.

One of such plant is Tigernut (*Cyperus esculentus L.*) an annual or perennial plant called chufa sedge, nut grass, a mildly poisonous crop of the sedge family. It is found wild as a weed (Sánchez-Zapata, *et al*, 2012) or as a crop often cultivated for its edible tubers in many countries including Nigeria.

Tigernut, a tuber with sweet and nutty taste can be consumed raw, roasted, dried or as tigernut milk or oil (Rita, 2009). It can be stored and rehydrated by soaking without losing the crop texture which ensures acceptable sensory quality (Tucson & Arizona, 2003)

Tigernut is sometimes added to biscuits and other baking products, as well as in making oil, soap and starch extracts (Cantalejo, 1997). It is reported to be in use in medicine and cosmetic industry ( Defelice, 2002) as an animal feed and eaten raw as a side dish (Omode *et al*, 1995;).

It is also used for the production of nougat, jam, beer and as a flavouring agent in ice cream (Cantalejo, 1997) and in the preparation of Kunnu Aya (a non-alcoholic local beverage in Nigeria. (Belewu & Abodunrin, 2008).

Literature values revealed that tigernut helps to prevent heart problems, thrombosis and activate blood circulation; it is also responsible for preventing and treating urinary tract and bacterial infection and assist in reducing the risk of colon cancer when eaten. (Adejuyitan *et al*. 2009).

The local non-alcoholic drink has it's advantage of no containing sodium, lactose sugar, casein protein, gluten, cholesterol and therefore suitable as beverage for diabetics or do not tolerate gluten or lactose and its derivatives present in cow milk (Belewu & Abodunrin, 2006).It is at the backdrop of the information on the potentials of this edible tuber in chemical, pharmaceutical and food industries that this present work, analytical evaluation and antioxidant capacity of the various forms (raw, dry & roasted) of tigernut often consumed as snack, side dish and drink formulation in Nigeria is undertaken.

## **Materials and methods**

### ***Collection of the samples***

Tigernut tubers were bought from a local market Ado-Ekiti, Ekiti State, Nigeria.

### ***Preparation of the Sample***

The tigernut tubers were properly screened to remove the defective ones. Raw tigernut tubers were divided into three parts. One part was air dried; the second part was roasted for 20 minutes while the third sample was left as raw. The three samples were blended with an electric blender separately.

### ***Extraction of the samples***

10g of each of the sample were weighed and dissolved in methanol for extraction.

### ***Proximate analyses***

The proximate analyses were carried out according to the method of AOAC, 1990. The result of the proximate analyses was determined in %.

### ***Mineral analyses***

Atomic absorption spectrophotometer (Perkin-Elmer Model, Norwalk CT) was used to determine Ca, Fe, Cu, and Mn. Na and K was evaluated using Flame photometer (FP. Model 140).

### ***Antioxidant activity (AA)***

The antioxidant activity of the samples were analyzed using DPPH method (2, 2-diphenyl-1-picrylhydrazyl) free radical by Huang *et al*, 2005. 3ml of the filtrates of each of the samples dissolved in methanol was mixed with 0.5ml of DPPH reagent. The absorbances of the samples at different concentrations were read at 517nm and the percentage inhibitions were calculated against the control.

### ***Total phenolic content (TPC)***

The total phenolic content of the samples were determined using Folin-Ciocalteu method (Singleton *et al*, 2006). The absorbances of the extracts were determined at 750nm after 30minutes. The results were expressed as micromole GAE/100g.

### **Results and discussion**

The results of the proximate and mineral compositions of the various forms of tigernut tubers were presented in table 1.

Table 1: Proximate and Mineral Compositions of Tigernut tubers

Components	Sample A	Sample B	Sample C
<b>Proximate composition (%)</b>			
Moisture content	12.27 (0.02)	43.84 (0.02)	24.96 (0.06)
Crude protein	1.56 (0.02)	1.32 (0.01)	2.24 (0.01)
Fat	1.49 (0.01)	1.44 (0.01)	1.54 (0.01)
Ash	5.64 (0.02)	6.69 (0.01)	3.34 (0.04)
Crude fibre	16.26 (0.01)	16.14 (0.01)	17.14 (0.01)
Carbohydrate	62.79 (0.03)	30.58 (0.02)	50.82 (0.01)
Metabolisable energy (KJ/100g)	1149.08	595.88	959.00
<b>Mineral compositions (mg/100)</b>			
Na	101.17	101.30	111.10
K	122.90	122.40	123.60
Ca	91.60	83.00	93.40
Fe	3.80	3.60	4.20
Mn	0.40	0.20	0.50
Cu	0.30	0.20	0.60
Na/K	0.82	0.83	0.90

## LEGEND

(±) SD = Standard deviation in parenthesis

SAMPLE A = Dry Tigernut tubers

SAMPLE B = Raw Tigernut tubers

SAMPLE C = Roasted Tigernut tubers

Higher results were observed in moisture content; ash; and crude fibre when compared with the literature (Aremu *et al*, 2015; Oladele and Aina, 2007). The higher significance observed in this present result occurred because the samples were oven dry at 20<sup>0</sup>C when compared with those samples in the literature. In addition, the values observed in crude protein, fat, and metabolisable energy were found to be lower when compared with those reported on tigernut by Gambo and Da'u, 2014 which would probably be due to difference in variety.

Essential minerals such as Na, Ca, K are found to be comparable with the results in the literature. (Olade and Aina, 2007) Na-K ratio was found to be less than 1 in all the samples suggesting that tigernut tubers will probably be suitable for food formulation of diets for hypertensive patients (Ogunlade, 2005).

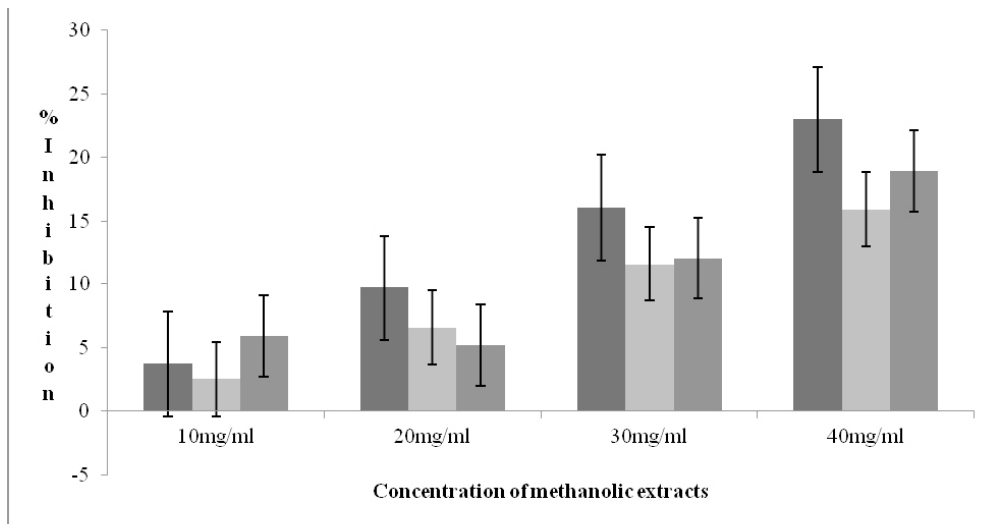


Figure 1: % Inhibition of the Antioxidant Activity of Tigernut tubers

The results of the % inhibitions of the antioxidant activity of the samples at different concentrations were presented in Figure 1 with roasted tigernut significantly higher in antioxidant activity.

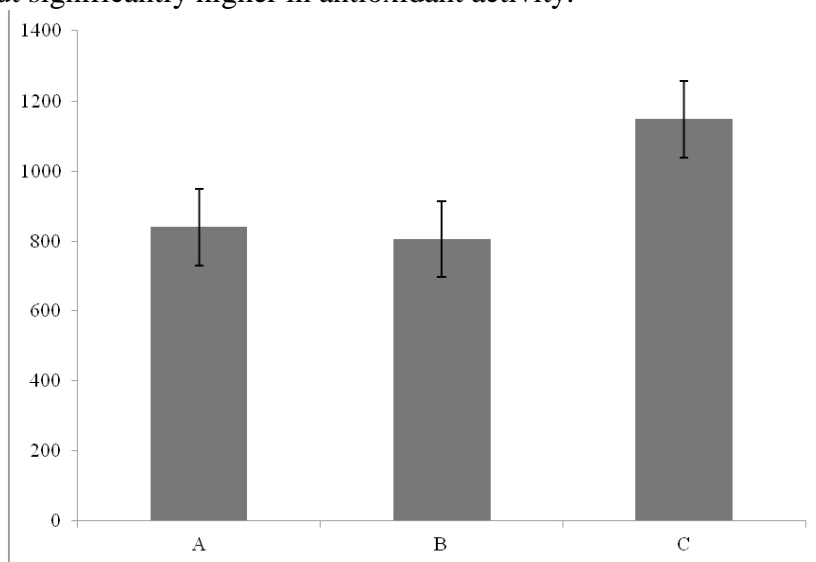


Figure 2: Total Phenolic Content of Tigernut (micromoleGAE/g)

**LEGEND**

- (±) SD = Standard deviation in parenthesis
- SAMPLE A = Dry Tigernut tubers
- SAMPLE B = Raw Tigernut tubers
- SAMPLE C = Roasted Tigernut tubers

Figure 2 showed the result of the total phenolic content of the sample. Roasted tigernut was found to be significantly higher. The result obtained in this work are favourably compared with those reported for other commonly consumed nuts and fruits (Ogunlade *et al*; 2011 and Ogunlade *et al*, 2012.).

Figure 1 and 2 indicate that all the forms of tigernut contain phytochemical substances which are responsible for high antioxidant capacity.

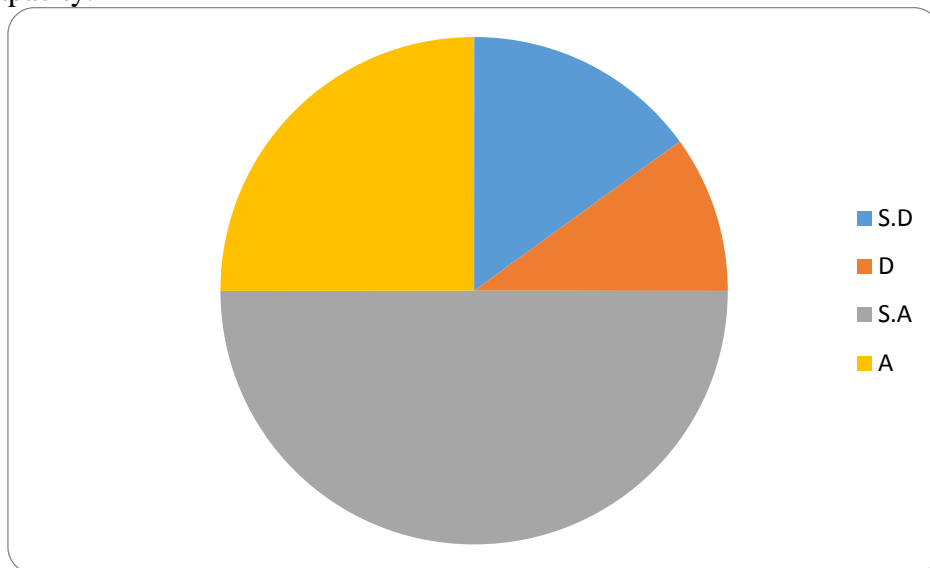


Figure 3: Pie chart representation for the result of the consumption pattern observed from the questionnaire administered.

A survey conducted on the consumption pattern of the various forms of consumed in southwest of Nigeria as shown in fig. 3, revealed that 50% of the correspondents eat the raw tigernut tubers as snack food, while 25% prefer the dry form. 15% only took it based on the fibre content which is said to aid digestion (Abaejoh *et al*, 2006) while 10% preferred roasted form which is scarcely found in market.

## Conclusion

Tigernut has been grossly underutilized and unexploited despite its potentials, which is due to paucity of information and lack of awareness of the composition. The results showed that tiger nut can be a valuable source of nutrients and phytochemicals as it favorably compared with the proximate and mineral composition of some other edible nuts and tubers. It is hoped that utilization of tigernut in diets will probably help to ‘mop-up’ the free radicals and lower the incidence of cardiovascular and other age-related disorder diseases.

## References:

- Abaejoh, R., Djomdi, I. and Ndojouenkeu, R. (2006). Characteristics of tigernut (*Cyperus esculentus*) tubers and their performance in the production of a milky drink. *J. Food Process Preservatives*, 30: 145-163
- Adejuyitan, J.A., Otunola E.T., Akande. E.A., Bolarinwa. I.F. and Oladokun, F.M. (2009). Some Physicochemical properties of Flour obtained from fermentation of tiger nut (*Cyperus esculentus*) sourced from a market in Ogbomoso, Nigeria. *African Journal of Food Science*, 3: 51-55.
- AOAC, (1990) Official methods of analysis 15<sup>th</sup> ed. Washington: Association of Official Analytical Chemist.
- Aremu, M. O; Bamidele, T. O. Agere H., Ibrahim H. and Aremu, S. O. (2015). Proximate Composition and Amino Acid Profile of Raw and Cooked Black Variety of Tiger nut (*Cyperus esculentus* L.) Grown in Northeast Nigeria. *Journal of Biology, Agriculture and Healthcare*. ISSN 2224-3208 (Paper) ISSN 2225-093X (Online) Vol.5, No.7.
- Belewu, M.A; Abodunrin, O.A (2008). "Preparation of Kunnu from Unexploited Rich Food Source: Tiger Nut (*Cyperus esculentus*)". *Pakistan Journal of Nutrition* 7: 109-111. doi:10.3923/pjn.2008.109.111.
- Belewu M. A, and Abodunrin A. O.(2006). Preparation of kunnu from unexploited rich food source: Tigernut (*Cyperus esculentus*). *World Journal of Dairy and Food Sciences*. 1: 19-21.
- Cantalejo, M.J. (1997). Analysis of volatile components derived from raw and roasted earth –almond (*Cyperus esculentus* L.). *J. Agric. Food Chem.* 45: 1853 – 1860.
- Defelice, M.S (2002). "Yellow Nutsedge *Cyperus esculentus* L.—Snack Food of the Gods1". *Weed Technology* 16: 901–7. doi:10.1614/0890-037x(2002)016[0901:yncels] 2.0.co;2.
- Gambo, A. and Da’u, A. (2014). Tiger nut (*Cyperus esculentus*): composition, products, uses and health benefits – a review. *Baryero Journal of Pure and Applied Science*. 7(1): 56-61. Ba j o p a s Vo lum e 7 N um b e r 1
- Ogunlade,I; O. Olaofe and T. Fadare (2005). Chemical composition, amino acids and functional properties of some selected seafoods. *J. Fd. Agriculture and Environment*. Vol 3 (2): 130–133.
- Ogunlade, I; A. Oni and A.I. Osasona (2011). Comparative analysis of antioxidant capacity and total phenolic content of some selected fruits in Ekiti State, Nigeria. *NISEB Journal* 11,4,329-334.
- Oladele, A.K., and. Aina, J.O. (2007). Chemical composition and Functional properties of Flour produced from two varieties of tiger nut. *African Journal of Biotechnology*, 6: 2473- 2476.

- Omode A. A, Fatoki O. S, and olaogun K. A (1995). Physicochemical properties of some underexploit and nonconventional oilseeds. *J. Agric Food Chem* **43**: 2850-3. CrossRef, CAS, Web of Science. Times Cited: 23
- Rita E.S (2009). The use of tiger-nut (*Cyperus esculentus*), cow milk and their composite as substrates for yoghurt production. *Pak. J. Nutr.*; **6**: 755758.
- Sánchez-Zapata, Juana Fernández-López and José Angel Pérez-Alvarez (2012). Tiger Nut (*Cyperus esculentus*) Commercialization: Health Aspects, Composition, Properties, and Food Applications. Article first published online: 12 JUN 2012 DOI: 10.1111/j.1541-4337.2012.00190.x © 2012 Institute of Food Technologists®
- Singleton, V., R., Orthefer, R., Lamela-Raventos, R, M., 1999. Analysis of total phenols and opher oxidation substrates and antioxidants by means of Folin-Coicaltea reagent.Method is Ennymology. 299, pp 152-178.
- Temple VJ, Ojebe TO, Kapu MM. 1989. Chemical analysis of tiger nut (*Cyperus esculentis*). *J Sci Food Agric* **49**:261–2.
- Tucson & Arizona (2003). USGS Weeds in the West project: Status of introduced Plants in Southern Arizona Parks, Factsheets for *Cyperus esculentus L.*