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Assessment of the Nutritional and Antinutritional Components of Tiger nut Residues

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Abstract: ***Cyperus esculentus is a monocotyledonous plant and belongs to the family cyperaceae which is made up of over 4000 species. Its common names include; tiger nut, Aya, chufa sedge, yellow nut sedge and earth almond. The tubers are edible and are consumed fresh, dried or in roasted form in some countries which include Burkina Faso and Nigeria. In Valencia and Nigeria, the tubers are usually processed into milk. Residues obtained from processing the tubers into milk are often considered wastes and discarded. An investigation into the nutritional and antinutritional components of these residues was carried out. Results of this investigation show that these residues contain high amounts of carbohydrates (43.0 %), fibre (18.4 %), lipids (24.8 %) iron (70.179 ppm), sodium (13.611 ppm), magnesium (10.820 ppm), calcium (10.641 ppm), vitamins C (286.00 mg/L), B 1 (131.50 mg/L), and B 2 (22.49 mg/L). Furthermore, antinutrients which include, cyanogenic glycosides, oxalates, phytates, saponins, alkaloids, and flavonoids are low in these residues. This research has established that tiger nut residues, often regarded as waste materials, contain highly valuable nutrients in substantial quantities that can be harnessed for various applications. These findings pave the way for research on the potential use of tiger nut residues for feed formulation and other applications and consequently, provide a means of converting waste into wealth and cleaning up the environment of this solid waste especially considering the current increase in environmental pollution.***

Keywords:Tiger nut; Mineral content; Phytochemicals; Vitamins, Proximate composition

1. Introduction

Cyperus esculentus is a monocotyledonous plant and belongs to the family cyperaceae which is made up of over 4000 species **[1]**. Its common names include; tiger nut, Aya, chufa sedge, yellow nut sedge and earth almond. Tiger nut is a perennial grass that grows in wet areas and often occurs as a weed especially on farmlands used for cultivation of vegetables **[2]**. The plant grows to a height of 1-3ft and pollination occurs by the wind. It grows mainly in the tropical and warm temperate regions of the world. Main areas of cultivation include; Spain, Nigeria, Senegal, Guinea, and Cameroun **[3]**. The tubers are edible and are consumed fresh, dried or in roasted form in some countries which include Burkina Faso and Nigeria. Tiger nut tubers are also processed into milk called Horcata (in Valencia) and KunuAya (in Nigeria) **[4].** Residues that result from processing tiger nut tubers into milk are often considered waste materials and discarded. Thereby contributing to environmental pollution. The aim of this research was to ascertain the nutritional and antinutritional components of tiger nut residues.

2. Materials and Methods

2.1 Proximate analysis

The recommended methods of the association of official analytical chemists (AOAC**) [5]** were used for the determination of moisture, ash crude lipid, crude fibre and nitrogen content. Percentage of carbohydrates was determined by difference.

2.2 Phytochemical Screening

Flavonoids were determined by the method of Okwu **[6].** A gravimetric method of AOAC **[7]** was used to determine saponins. Alkaloids determination was conducted using the method of Harborne **[8]** while phytates were analysed using the method of Reddy *et al*. **[9].**

2.3 Determination of vitamins and mineral elements

Vitamins were analyzed using UV spectroscopy while analysis of mineral elements was done using atomic absorption spectroscopy.

3. Results

Results of chemical analysis of tiger nut residues as shown in table 1 revealed that it is rich in carbohydrates (43.0 %) and lipids (24.8 %). It is also a good fibre source as revealed by the high mean value of 18.4 % (Table 1). Substantial amounts of protein (1.5 %) and ash (0.5 %) were also obtained (Table 1).

Table 1: Proximate Composition of Tiger nut Residues

Parameter	Percentage Composition (%)
Moisture	11.8 ± 0.76
Ash	0.5 ± 0.06
Crude Lipid	24.8 ± 0.06
Crude Protein	1.5 ± 0.18
Crude Fibre	18.4 ± 0.77
Carbohydrates	43.0 ± 0.42

Values are means of triplicate measurements ± SD

Results of elemental analysis of tiger nut residues revealed that it is a good source of iron (70.179 ppm), sodium (13.611 ppm), magnesium (10.820 ppm), and calcium (10.641 ppm) as shown in Table 2. The heavy metals, cadmium, chromium and copper had the lowest mean values of 0.014 ppm, 0.053 ppm, and 0.060 ppm respectively (Table 2).

Table 2: Mineral content of Tiger nut Residues

Element	Concentration (ppm)
Cr	0.053 ± 0.010
Cd	0.014 ± 0.0003

Mn	4.223 ± 1.0000
K	2.149 ± 0.0300
Ni	0.118 ± 0.0020
Na	13.611 ± 3.0000
Ca	10.641 ± 3.0000
Fe	70.179 ± 5.0000
Mg	10.820 ± 3.0000
Zn	0.234 ± 0.1000
Cu	0.060 ± 0.5112
Co	0.523 ± 0.3000

Values are means of triplicate measurements ± SD

Tannins were found in high amount in these residues having a mean value of 15.00 % while the phytochemicals found in the lowest amount were phytates with mean value of 0.1 % (Table 3). It is pertinent to mention that these residues also contain a high amount of alkaloids (7.3 %) (Table 3).

Table 3: Results of Phytochemicals analysis of Tiger nut Residues

Phytochemical	**Amount**
Tannins (%)	15.0 ± 0.38
Cyanogenic glycosides	0.2 ± 0.01
Saponins (%)	3.8 ± 0.04
Alkaloids (%)	7.3 ± 0.14
Flavonoids (%)	3.5 ± 0.42
Oxalates (mg/g)	2.8 ± 0.17
Phytates (%)	0.1 ± 0.01

Values are means of triplicate measurements ± SD

Results show that tiger nut residues are rich sources of vitamins. These residues are particularly very rich in Vitamin C (286.00 mg/L) and contain high amounts of vitamins B 1 and B 2 with mean values of 31.50 mg/L and 22.49 mg/L respectively (Table 4).

Table 4: Results of Phytochemicals analysis of Tiger nut Residues

Vitamin	Concentration
C (mg/L)	286.00 ± 4.133
A (mg/L)	0.51 ± 0.001
B1(mg/L)	31.50 ± 0.237
B2 (mg/L)	22.49 ± 0.144
E (mg/L)	5.39 ± 0.152
B9 (mg/mL)	6.00 ± 2.000

Values are means of triplicate measurements ± SD

4. Discussion

Tiger nut residues are good a good source of carbohydrates as reveled by the high level of carbohydrates contained. Considering the current state of global food security crises tiger nut residues could be used in feed formulation as a carbohydrate source in order to increase animal production and consequently increase global food production. More so, the high crude fibre content will help in food digestion by animals thereby enhancing optimal growth **[10].** It is quite obvious from the results presented that tiger nut residues which are often regarded as waste materials are a rich in iron (for blood formation), calcium(for healthy bone and teeth formation), magnesium and sodium which can improve the wellbeing of animals. Arafat *et al*., **[11]** also reported that tiger nut tubers contain small amounts of copper, manganese, zinc and magnesium in addition to high concentration of sodium, calcium and phosphorus. Thus, may be useful in the making infant formulas for the development of strong and healthy bones and teeth. They added that it contains substantial amount of Iron which can help in blood formation **[12].**

The importance of vitamins in maintaining good health cannot be over emphasized and these residues can represent another source for vital vitamins such as vitamin C, vitamin B1 and vitamin B 2. The low level of antinutrients in these residues not only represents an advantage with regards its use in feed production but also shows it potential health applications. Adejuyitan*et al*., **[13]** also reported that tiger nut tubers can help in reducing risk of colon cancer due to its high glucose composition. In addition, it is suitable for people with diabetes and those that have gluten allergy **[14].**

5. Conclusion

This research has established that tiger nut residues, often regarded as waste materials, contain highly valuable nutrients in substantial quantities that can be harnessed for various applications. These findings pave the way for research on the potential use of tiger nut residues for feed formulation and other applications. This will provide means of converting waste into wealth and cleaning up the environment of this solid waste especially considering the current increase in environmental pollution.

6. Future Studies

Future research will focus on the effect of processing on antinutrients. Also, the effect of addition of tiger nut residues to animal feed will be investigated.

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