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Phytochemical screening, proximate nutritional analysis and anti-nutrient analysis of tiger nut (*Cyperus esculentus*)

David Christopher Bando[1*], Jummai Adamu Tutuwa[2], Emmanuel Odiba Ogu[3], Imbasire Nuhu[4], Shamaki John Mbaragbog[5]

[1-4] Bioresources Development Centre, National Biotechnology Development Agency, Jalingo, Taraba State, Nigeria

[5] Department of Genetics and Biotechnology, Faculty of Biological sciences, University of Calabar, Nigeria

Abstract
The Phytochemical, Proximate Nutritional Analysis and anti-nutrient analysis of tiger nut (*Cyperus esculentus*) were determined and results were expressed in means ± standard. The phytochemical analysis revealed the presence of alkaloids, Glycoside, Flavonoids, Polyphenol, reducing sugar in ethanolic extracts of three samples, which are as follows, sample A (yellow tiger nut), sample B (Brown tiger nut), and sample C (Black tiger nut). The result revealed that the tiger nut were high in polyphenol (21.20±0.1), Flavonoids (8.20±0.1), and reducing sugar (7.20±0.2). The proximate nutritional analysis revealed moisture, ash, crude protein, fat, carbohydrate. Fat (41.30±0.1) has the highest concentration followed by carbohydrate (30.90±0.02) protein (22.20±0.1), while moisture (6.23±0.02), fibre (3.61±0.01) and Ash (3.30±0.01) had low concentration. Anti-nutrient analysis revealed HCN, soluble oxalate, total oxalate, phytate. Total oxalate (42.80±0.01) had the concentration followed by soluble oxalate (18.48±0.02), while HCN (2.81±0.01) and phytate (0.46±0.02) low concentration. This study justifies the use of *Cyperus esculentus* by individuals to treat various ailments.

Keywords: *Phytochemical; Proximate; HCN; Cyperus esculentus*

1. Introduction

Tiger nut (*Cyperus esculentus L.*) is an edible perennial grass-like C4 plant of the sedge family [1], nut grass, yellow nut sedge, earth almond, edible galingale and ground almond [2, 3]. It is widely used for human and animal's consumption as a nutritious food and feed in Africa, Europe and America [3].

Tiger nut is rich in starch, oil, mineral and vitamin E and C. The starch and oil are major macronutrients in the tiger nut tuber. High starch content of this plant provides unique functional properties [4], cold storage stabilities, and preserves organoleptic properties of foods [5]. The tiger nut oil also has high monounsaturated fatty acids, similar to olive. Avocado and hazelnut oil [6]. This monounsaturated oil has high unsaponifiable matter, phospholipids and other bioactive compounds such as tocopherols, phospholipids and polyphenols [3, 6]. Although tiger nut oil fatty acid profile is similar to olive oil, nut oil has unique gold-yellow colour, neutral taste properties, high in phytosterols and better deep-frying stability [3, 7]. The nutritional profiles and unique functional properties have made tiger nut as unique food [8] like beverage, flour [9, 10] edible oil [7, 11], and a feed source [3].

Tiger nut belong to the kingdom of plantea, phylum tracheophyta, class liliopsida, Order cyperales, family cyperaceace with scientific name *Cyperus esculstus*. It is a perennial herb growing in seasonally flooded area, swaps, but usually found in cultivated lands. The roots are edible, used as drugs and plant used as ceremonialemetic [12]. Roots are used for cold remedy and are chewed for cough and also used for snake bites. It is also veterinary medicine, the chewed roots are placed in horses nostrils as a stimulant. The unspecific tubers are eaten [13] (Daniel and Moerman 1998).

Tiger nut "*Cyperus esculentus lativum*" is an underutilized tuber of family Cyperaceace, which produces rhizomes from the base of the tuber that is somewhat spherical [14]. It is a tuber that grow freely and is consumed widely in Nigeria, other parts of West Africa, East Africa, part of Europe particularly Spain as well as in the Arabian Peninsula. It has been reported that grainy sandy group and mild temperatures are special for the cultivation growth of earth tuber [15]. Tiger nut tubers appear somewhat long or round in shape with dimension of 8mm to 16mm, smaller size however, are not used for human consumption. When hydrated, it is slightly harder (nut texture), but with is April to November [16]. Being cultivated through continuance irrigation, tiger nut has to be properly dried before storage. The drying process completely natural, (i.e sun drying) and the process can take up to one month. The dehydrating process ensures longer shelf life, preventing rot or any other bacterial infection securing their quality and nutrition level. Unfortunately, the dehydration process make the tiger nut skin wrinkled a situation that limits its acceptability to some people [17]. It is known in Nigeria as "Aya" in Hausa, "OFio" in Yoruba and "Akiausa" in Igbo where these varieties (black, brown and yellow) are cultivated [18].

As food, tiger nut can be eaten as snack which can be prepared by soaking in water for few minutes. It can also be eaten roasted, dried baked and can be made into a refreshing beverage called "Horchata De Chufas" of tiger nut milk. It also finds uses as a flavouring agent for ice cream and biscuits [19], as well as in making oil, soap, starch and flour. Tiger nut has a unique sweet that is found to be idea for use

in the baking industry. It can be us in making delicious cakes and biscuits and also as component of fruit favors. Through various analyses, there is a strong belief in the benefits of flour for health reasons as it has been found to be an alternative for dietetics and it is gluten free which in any case, is a positive alternative within the use of any type of flour.

The tiger nut milk compared with any other soft drink is not just a refreshing drink but also very healthy. It contributes to the reduction in the in cholesterol by diminishing the "bad" cholesterol low density Lipoprotein (LDL), and increasing the "good" cholesterol, high density lipoprotein (HDL) [17]. It content of vitamin E also collaborates against the cholesterol because it has an antioxidant effect over fats, which are idea for coronary heart disease [20]. *Cyperus esculentus* was reported to help in preventing heart, thrombosis and activates blood circulation, responsible for preventing and treating urinary tract and bacterial infection assist in reducing the risk of colon cancer. It could also be recommended for those who have problems with digestion, flatulence, and diarrhea because it provides some digestive emzymes like catalase, lipase and amylase [21].

Tiger nut (*Cyperus esculentus*) is a major source of food and income for most Nigerians and Africans as a whole. Despite the extensive use of this nut for both nutritional and medicinal purposes, little information is available on its nutrients and anti-nutrient constituents. Thus, there is a need to make available sufficient information on the nutrient and anti-nutrient constituents of the nut. This will further unravel the basis of its use for nutritional and medicinal purposes. This study was to determine the nutrient and anti-nutrient composition of three known types of tiger nuts (The Black, Brown and Yellow) in Northern Nigeria.

2. Materials and methods

2.1 Collection and identification of plant materials

Three common types of tiger nuts (the black, brown and yellow) which Sample A yellow tiger nut, sample B brown tiger nut and sample C black tiger nut were collected at Jalingo main market, Taraba State. They were kept in a dry polythene bag and transported in this form to Calabar, where they were properly washed and analyzed in biochemistry department university of Calabar, Nigeria.

2.2 Preparation of plants materials

The dried tiger nut samples were milled using a manual grinder to obtain fine powder. They were then stored in three different air- tight containers and labeled appropriately, until required for analysis.

2.3 Preparation of alcoholic plant extract

Twenty grams of the dried leaf powder was soaked in 100ml of ethanol in continuous extraction apparatus.

This extract was then filtered out with cheese cloth.

2.4 Qualitative screening phytochemicals

Twenty grams of the milled tiger nut samples were soaked in 100ml of ethanol in continuous extraction apparatus. These extracts were then filtered out with chess cloth and used for the various qualitative screening for the presence of phytochemicals.

2.4.1 Test for Alkaloids

The test was conducted using the method of 2ml of each extract was stirred with 5ml of 1% aqueous HCL in water Bath. 1ml of the filtrate of each sample was treated with Mayer reagents. The qualitative chemical used for detection of alkaloids are depend on the character of alkaloids to give turbidity and precipitation as salt of organic acid of heavy metal like Hg, Au, etc. alkaloids gives redish-brown precipitate with this reagent [22].

2.4.2 Test for Glycosides

Two ml of each extract were dissolved in 2ml of glacial acetic acid containing 2ml of concentrated H2SO4. A violet ring appearing below the brown ring who (G) acetic acid layer, gradually spread through the layer shows the presence of glycosides [23] (Salkowski test)

2.4.3 Test for Sapinins

Two ml of the alcoholic extracts wee diluted with 10ml of distilled water and heated n a water bath. After heating, this was shaken vigorously; stable foam indicates the presence of Saponins [23]. (Frothing test).

2.4.4 Test for Tannins

Two ml of alcoholic extracts were stirred with 10ml of distilled water and heated in the bath. 1ml of 1% fecl3 added tunicate note; Blue-Black, green or blue-green precipitation or colourauon indicates the presence of tannins [22].

2.4.5 Test for Reducing Compounds

Two mls of the extracts were put in test tubes and 5ml of Fehling's solution added to it and heated in water bath for 5mins. The formation of brick-red precipitation or coloration indicated the presence of reducing compounds [24]. (Fehling's Test)

2.4.6 Test for Flavonoids

Two Mls of the alcoholic extracts were added a few pieces of aluminum metal and concentrated HCL added. The formation of orange, red, crimson or magnetic indicated the presence of flavonoids [24].

2.4.7 Test for Polyphenol

Two Ml of alcoholic plant extract was treated with 5ml of distilled water and heated for 30min in a water bath. 1ml of 1% fecl3 added to the mixture and followed by adding 1ml of 1% potassium ferrocyanide solution. The formation of green-blue colouration indicated the presence of polyphenol [24].

2.5 Quantitative screening for phytochemicals

The milled samples were subjected to quantitative analysis to quantify the various phytochemicals presence in the samples.

2.5.1 Determination of Alkaloids

The alkaline precipitation gravimetric method [25] was used. Five grams of the milled samples were dispersed in 100mls of 10% acetic in ethanol solution. The mixture was shaken well and allowed to stand for 4 hours at room temperature being shaken every 30min. at the end of this period the mixture was filtered through whattman No.42 grade of filler paper.

The filtrates (Extracts) were concentrated by evaporation, to a quarter of its original volume. The extracts were then

treated with drop-wise addition of concentrated NH_3 was solution to precipice the alkaloid. The dilution was done until the NH_3 was in excess.
The alkaloid precipitate was removed by filtration using weighed whattman No.42 fitter paper after wasting with NH4OH solution, the precipitate in the filler paper was dried off 600c and weighed after cooling in desiccators. The alkaloid content was calculated as shown below
% Alkaloid = w2 – w1 X 100
Wt of sample 1
Where W1 = Weighed of empty filter paper
W2 = Weighed of filler paper of alkaloid Ppt.

2.5.2 Determination of Flavonoids
Flavonoid was determined using the method described by [25]. Five grams of the milled samples were boiled in 100mls of 2MHCL solution under reflux for 40 minutes. They were allowed to cool before being filtered. The filtrates were treated with equal volume of ethyl acetate and the moisture transferred to a separation funnel. The flavonoid extracts (contained in the ethyl acetate portion) were recovered by filtration using weighed filter paper. The weighed was obtained after drying in the oven and cooling in desiccators. The weighed was expressed as a percentage of the weighed analyzed. It was calculated as shown below:
% Flavonoid = w2 – w1 X 100
Wt of sample 1
W2 = weighed of filler paper x Flavonoid precipitate.
W1 = Weighed of filter paper alone
Ws = Weighed of sample

2.5.3 Determination of sugar content (Reducing compounds)
The quantitative estimation of sugars was carried out using Bennedict's quantitative test. 10ml of the plant extract was diluted in 90ml of distilled water. This solution was then transferred to a burette and titrated against 20ml of standard Benedict's regent in a 100ml conical flask placed on electric hot plate with anti-bump chips placed inside the conical flask. Titration was continued until the blue colour of the Benedict's regent was completely changed and the end point recorded. The process was repeated three times and the average volume of titre calculated. Result obtained was then computed against that of a glucose standard and using the formular described by [26] as presented below:

$$\frac{\text{18.9 mg standard glucose x average volume of titerr}}{\text{10 ml Benedict's reagent}}$$

2.5.4 Determination of Glycosides
This was carried out following the methods described by [26]. One gram of the milled samples were weighed and dissolved in 200 ml of distilled water contained in a 250ml flask and allowed to stand for 2 hours. Full distillation was then carried out and 150-170 ml of distillate was collected in a 250 ml conical flask containing 20 ml of 2.5% NaOH. An antifoaming agent (tanic acid) was measured into a fresh 200 ml flask and 8.0 ml 6N NH_4OH and 2.0 ml of 5% KL was added, mixed and titrated with 0.02 N silver nitrate ($AgNO_3$) using a micro – burette against a black background. Permanent turbidity indicated end points. The process was repeated and the average titer volume calculated. Glycoside content of the sample was then calculated using the formula below, as described by [26].

$$\text{Glycosides (mg/g)} = \frac{\text{Titre Volume (ml) x 1. 08 (g)}}{\text{Weighed of sample (g)}}$$

2.5.5 Determination of Polyphenol
Polyphenol content of the sample was determined using the spectrophotometric method as described by [27]. One gram of the sample was extracted in 10 ml of pure methanol and filtered with Whattman No. I filter paper and 1.0 ml of the filtrate was then mixed with equal volume of Folin-ciocaltean regent in a test tube, followed by the addition of 1.0 ml of standard solution was also treated in the same way. Thereafter, 1ml of sodium bicarbonate solution was added to both tubes. Absorbance of both mixtures was read at 560mm wavelength and their respective content was calculated using the formula below:
% polyphenols = AE x C x VE x 100
AP X W1 1
Where:
AE = Absorbance of extract
C = Concentration (mg/ml) of standard phenolic acid
VE = Total volume of extract
Ap= Absorbance of standard phenolic acid solution
Ws= Weight of sample analyzed.

2.6. Screening for proximate composition
The milled samples were also analyzed for proximate composition.

2.6.1 Determination of Moisture content
Two grams of the milled samples were weighed in covered crucible dishes previously dried at 98-100^{0}C cooled in a desiccator and weighed taken soon after attaining room temperature.
The crucible and the sample were heated at 100^{0}C for 5 hours to obtain loss in weight or to constant weight.
The dishes and their contents were cooled in a desiccator containing fused calcium chloride as drying agent then weighedted. The loss in weight was expressed as a percentage.

$$\% \text{ Moisture} = \frac{\text{Loss in weight on drying (g) x 100}}{\text{Initial sample weight (g)}}$$

2.6.2 Determination of ash content
Two grams of the well mixed sample were weighed accurately into shallow relatively broad porcelain crucibles which had been ignited, cooled in desiccator and weight soon after reaching temperature.
The porcelain crucibles and their contents were covered and ignited in a muffed furnace at 550^{0}C (dull red) until light gray ash resulted, or to constant weight.
The crucibles and their contents were cooled in desiccator and weighed soon after reaching room temperature.

$$\% \text{ Ash} = \frac{\text{Weight of ash (g)}}{\text{Weight of original sample (g)}} \times 100$$

2.6.3 Determination of total nitrogen and crude protein
Two grams of each sample were accurately weight and put into a 300ml standard Kjeldahl digestion flask containing 8g of the sodium sulphate catalyst, some anti-bumping chips and 30ml of concentrated sulphuric acid. The digestion flask was placed unto the digestion rack and heated gently to

prevent vigorous charring and frothing. The flask and its contents were then subjected to vigorous heating for about 2 hours until a clear digest was obtained. After digestion, the solution was cooled, then transferred quantitatively into a 100ml standard flask and made up to the mark with distilled water.10ml portion of this digest was pipette into a semi-micro Kjeldahl-markham distillation apparatus, 10ml distilled water added and treated with 30ml 40% NaOH solution. The ammonia evolved was steam distilled as described by [28] into a 50ml conical flask containing 10ml solution of 4% boric acid into which 2 drops of the double indicator had been added. The tip of the condenser was immersed into the boric acid double indicator solution and the distillation continued until about 3 times the original volume was obtained and there was a change in colour of the original content of the conical flask. The tip of the condense was rinsed with a few milliliters of distilled water. What remained of the 10ml digest was discarded and the flask rinsed 3 times with distilled water before the next determination. The distillate was then titrated with standard 0. In hydrochloric acid solution until an end-point was reached. Distillation was carried out in triplicates for each digest and the percentage nitrogen content obtained by appropriate calculations.

$$\% \text{ Nitrogen(N)} = \frac{14 \text{ X } 0.1 \text{ X titre value X dilution factor X } 100}{1000 \text{ X wt of sample}}$$

The crude protein was obtained by multiplying the percentage N content by the factor 6.25 i.e.
% Crude protein = % N X 6.25.

2.6.4 Determination of Crude fat
Two grams of ground samples were weighed accurately into a fat extractor thimble. 25ml of petroleum ether were poured into a previously weighed 500ml flask containing anti-bumping chips.
The soxhlet extractor into which the thimble with its content had been introduced was filtered into the round bottom flask and the extraction apparatus sitting on the heating mantles. The content of the flask were heated. As the either evaporated, it condensed and dropped into the thimble where it extracted the ether soluble concentration into the round bottom flask. The extraction process lasted for 8 hours. The thimbles was then removed and dried in an oven at 50^0C.The petroleum ether contained in the round bottom flask was distilled off using the soxhlet. The small amount of the ether left in the flask was evaporated off using water bath at 50^0C.The round bottom flask and the lipid extract were finally dried in an oven at 100^0C, cooled in a desiccator and weighed. The amount of lipid extract was obtained from the difference between the weight of the flask before and after extraction.

$$\text{Petroleum ether extract (\%)} = \frac{\text{Weight of extract (g) X } 100}{\text{Weight of dry sample (g).}}$$

2.6.5 Determination of crude fiber
(a). Acid Digestion
The fat-free material (8-10g) was weighed and quantitatively transferred into a 40ml beaker which had been previously marked at the 200ml level.50ml of 1.25% sulphuric acid were added and the mixture was made up to 200ml mark with distilled water. The contents of the beaker were heater to boiling point for 30minutes.

(b). Filtration
The contents of the beaker were filtered through a Buchner funnel with the aid of a suction pump.
The residue was washed with hot water until it was acid free.

(c). Base Digestion
The residue left after acid digestion was quantitatively transferred into the 500ml beaker. 50ml of 1.25% (W/V) NaOH was added and made up to the 200ml mark with distilled water. The mixture was again heated for 30minutes with constant stirring. The content of the beaker was filtered through the Buchner funnel and washed several times with hot water until it was free from sodium hydroxide. Finally, the residue was washed twice 95% methanol quantitatively transferred into a porcelain crucible and dried at 100^0 C.

(d). Ignition
The weight of then oven-dried residue was noted and was later ignited in a furnace at 550^0C.The weight of the ash left after ignition was also noted. The crude fiber content was determined from the loss in weight of crucible and its contents after ignition i.e:
Weight of sample = a
Weight of crucible + oven dried sample = b
Weight of crucible + ash = c
Fiber = b-c
$\% \text{ crude fiber} = \text{b- c X } \frac{100}{A}$

2.6.6 Determination of total carbohydrate content
The carbonate contents of the samples were determined by difference. The sum of the percentages of protein, fat, ash fiber and moisture was determined and the value deducted from 100% to obtain the value for total carbohydrate.

2.7. Anti-nutrients analysis
2.7.1 Total Oxalate
Two grams dried sample was weight in a beaker. 190ml of distilled water and 10ml of 6N HCL were added. The mixture was digested in a water bath for 4hrs at 50^0C. The digested sample was centrifuged and the filtrate was diluted to 25ml with distilled water using a 250ml volumetric, flask. Three 50ml aliquots were taken and evaporated to about 25ml. The brown precipitate was filtered off and washed with hot distilled water. The combined solution and washing was treated with one. NH_3 until the pink colour of methyl red indicator changed to faint yellow. The solution was heated in a water bath to about 90^0C and the oxalate was precipitated with 10ml of 5% $CaCl_2$ solution. The solution was allowed to stand overweight and then centrifuged. The precipitate was washed into a beaker with hot 25% H_2SO_4, diluted to 125ml, warmed to 900C and finally titrates with persisted for about 15 secs.

2.7.2 Soluble Oxalate
Two grams of the dried sample was digested in water bath with 200ml of distilled water at temperature of 90^0C for 4 hours. The combined solution and washing was treated with one. NH_3 until pink color of methyl red indicator changed to faint yellow. The solution was heated in a water bath to

about 90^0C and the oxalate was precipitated with 10ml of 5% $CaCl_2$ solution. The solution was allowed to stand overweight and then centrifuged. The precipitate was washed into a beaker with hot 25% H_2SO_4, diluted to 125ml, warmed to 90^0C and finally titrates with persisted for about 15secs.

2.7.3 Phytic Acid

Four grams of the milled sample

25ml filtered extract was neutralized to phenolphthalein with NaOH then rendered slightly acid with HCL and made up to 50ml.Duplicate 20ml aliquots were treated 50ml; centrifuge tubes with 4mls of FeC12 solution. The tubes were heated in a boiling water bath for 15 minutes to flocculate the precipitate of ferric phytate, cooled, centrifuged and the supermarket liquid poured off. The precipitate was washed with 5ml of 0.17HCL, centrifuged again and the acid decanted.

The precipitate was then stirred up with 2mls of distilled water and heated in boiling water bath for a few minutes. 2ml of 2% NaOH solution was then added and the heating continued for further 15minutes.The solution containing the phytic acid as sodium phytate was filtered into a Kjedahi digestion flask, the precipitate of ferric hydroxide was well washed with hot distilled water and then washing were added to the filtrate in the flask.1ml conc. H_2SO_4 and 1ml $HCL0_4$ were added and the mixture incinerated very gently until completely digested. It was then heated strongly for 60 minutes to give off many residues $HCL0_4$.When cooled, about 20ml of distilled water was added then the contents of the flask just neutralized to phenolphtalene with 40% NaOH. The solution was then made up to 100ml.An aliquot of 5ml was then taken in a test tube and the volume was made up to 10ml in each case. A blank containing 1ml conc. H_2S0_4 and almost neutralized with 40% Na0H and made up to 100ml was used in the dilution. Standards containing 0.025, 0.5, 1.0, 2.0ml of the standard solution of phosphorus were prepared by diluting 0.25, 0.5, 1.0, 2.0ml of the standard solution of phosphorus (containing 0.1mg p/m) with the blank.5ml of aliquots were pipette into a test tube, 2mls molydate solution, 1ml $NaS0_3$ solution and 1ml hydroquinone solution were added and solution diluted to 10ml with distilled water. A blink for absorbance reading was obtained by pipetting 5ml of distilled water into a test tube, 2ml of molydate solution. 1ml Na0H and 1ml hydroquinone solution were added and the solution diluted to 10ml with distilled water. It was allowed to stand for 30 minutes for the development of a blue colour and the absorbance read at 62nm using corning calorimeter (Model 253). Triplicate-determination was made for each sample. The concentrations of the phytic acid in the sample were determined using the calibration curve.

2.8. Statistical Analysis

All estimation were carried out using completely randomized designs, Date obtained from quantitative analyses were subjected to analysis of variance (ANOVA) test. The least significant difference (LSD) test was used to identify significance among treatment means ($p<0.05$).

3. Results

3.1. Qualitative photochemical screening the result of the qualitative analysis of samples of Cyperus esculentus is presented in table 1. The result reveals the prescence of Alkaloids, Glycosides, flavonoids, Reducing compounds, polyphenol, and absence of saponins, Tannins, Phlobatanins, Anthraquinones, hydroxymethyl and Anthraquinones in different concentration.

Table 1: Results of phytochemical screening of samples A, B and C

S/N	Chemical Constituents	Sample A		Sample B		Sample C	
		Ethanol Extract	Aqueous Extract	Ethanol Extract	Aqueous Extract	Ethanol Extract	Aqueous Extract
1.	ALKALOIES	++	++	++	++	++	++
2.	GLYCOSIDES	++	+	+	+	++	+
3.	SAPONINS	-	-	-	-	-	-
4.	TANNINS	-	-	-	-	-	-
5.	FLAVONOIDS	++	+	++	++	++	++
6.	REPUING OMPANDS	+++	++	+++	++	++	+
7.	POLYPHENOL	+++	+++	++	++	++	+
8.	PHLOBATANINS	-	-	-	-	-	-
9.	ANTHAQUINONES	-	-	-	-	-	-
10.	HYDROXYMETHYL ANTHAQUINOE	-	-	-	-	-	-

Key

+	Present
++	Present in Excess
+++	Present in much excess
-	Absent

3.2. Quantitative analysis.

The result of quantitative analysis of the different samples of *Cyperus esculentus* in table 2 revealed the presence of Alkaloids, Glycosides, flavonoid, polyphenol and reducing compounds in different concentration as calculated using mean and standard deviation. And there is significant difference in the three samples (black, brown and yellow tiger nut).

Table 2: Quantitative estimation of alkaloids, glycosides, flavonoids, polythenol and reducing compounds in sample A, B and C

Names of sample	ALKALOIDS %	GLYCOSIDES %	FLAVONOIDS %	POLYPHENOL %	REDUCING COMPOUDS %
A	2.3 ± 0.1	2.54 ± 0.1	4.50 ± 0.1	21.20 ± 0.1	5.75± 0.01
B	2.30 ± 0.1	1.25 ± 0.01	7.30 ± 0.1	12.40 ± 0.02	7.20± 0.02
C	2.50 ± 0.1	2.40 ± 0.02	8.20 ± 0.1		4.58± 0.01
LSD	P<0.05	NS	NS	P<0.05	P<0.05

3.3. Proximate analysis

The result of proximate analysis of samples A, B and C of *Cyperus esculentus* in table 3 revealed that the samples contained moisture, Ash, Protein, fat, Fibre, and carbonhydrate.

Table 3: Proximate composition of sample A, B and C

Names of Sample	Moisture	ASH	Protein	Fat	Fibre	Carbohydarte
A	5.40± SD	1.52±0.02	21.30± 0.1	41.30± 0.1	3.61±0.01	26.52± 0.02
B	4.50±0.1	2.52 ± 0.0	22.20± 0.1	36.70± 0.1	2.82±0.02	20.90± 0.02
C	6.23±0.02	3.33 ± 0.2	20.82±0.02	37.50± 0.1	3.34±0.01	28.41± 0.02
LSD	P<0.05	P<0.05	P<0.05	P<0.05	NS	

3.4 Anti-nutrients analysis

The result from the proximate analysis of samples A, B, and C of *Cyprus esculentus* in table 4 revealed level of HCN, Total oxalate, soluble oxalate, and phytate.

Table 4: Level of anti-nutrient in sample A, B and C.

Names of Sample	HCN	Total Oxalate	Soluble Oxalte	Phytate
A	2.81 ± 0.01	40.48 ± 0.01	16.48 ± 0.02	0.65 ± 0.02
B	2.40 ± 0.02	42.80 ± 0.01	17.38 ± 0.02	0.46 ±0.02
C	2.66 ± 0.02	42.80 ± 0.01	18.48 ± 0.02	0.58 ± 0.002
LSD	P<0.05	NS	P<0.05	P<0.05

4. Discussion

From Adam, Tiger Nut are widely used for human and animal consumption as a nutritious food and feed in Africa, Europe and America [3]. The phytochemical, proximate nutritional analysis and anti-nutrient analysis of tiger nut (*Cyperus esculentus*) were determined and results were expressed in means ± standard. The phytochemical analysis revealed the prescence of Alakloids, Glycoside, Flavonoid, polyphenol, reducing sugar in ethanol extracts of three samples, which are as follows, sample A (Yellow tiger nut), sample B (Brown tiger nut), and sample C (Black tiger nut). The result revealed that the tiger nut were high in polyphenol (21.20 ± 0.1), Flavonoid (8.20 ± 0.1), and reducing sugar (7.20 ± 0.02) [6, 20]. The proximate nutritional analysis revealed moisture, ash, crude protein, fat, carbohydrate. Fat (41.30±0.1) has the highest concentration followed by carbohydrate (30.90±0.02) protein (22.20±0.1), while moisture (6.23±0.02), fibre (3.61±0.01) and Ash (3.30±0.2) had low concentration. Anti-nutrient analysis revealed HCN, soluble oxalate total oxalate, phytate. Total oxalate (42.80±0.01) had the concentration followed by soluble oxalate (18.48±0.02), while HCN (2.81±0.01), and phytate (0.46±0.02) had low concentration. This study justifies the use of *Cyperus esculentus* by individuals to treat various illments [21].

The research shows that the *Cyperus esculentus* are good source of protein, carbohydrate and fat for animals. The medicinal value of plant lies in some chemical substances that have definite physiological action on the human body. Different phytochemicals perform different functions against disease. This plant screened for phytochemicals have potentials to act as a source of developing new drugs and also can improve health status of users as the result of phytochemicals in them.

5. Conclusion

The tiger Nut (*Cyperus esculentus*) contains phytochemicals (Alakloids, flavonoids, Glycoside, reducing compounds and polyphenol, which are potential sources for useful drugs. This study goes a long way to justify the use of tiger nut (*Cyperus esculentus*). And this might be as a result of knowledge on the composition of tiger nut especially the protein and fibre, the protein helps in body development and repair of tissues, the fibre also helps in reducing cholesterol and body weight.

The awareness created by this study can be used for further development of phytomedicines and remedies that can improve health status of humans.

This research shows that the tiger nut "*Cyperus esculentus*" is a good source of animal feed because of its richness in carbohydrate, fat and protein.

This research shows the level of HCN, Total Oxalate soluble Oxalate, and phytate, and therefore making it clear that the level of oxalate and phytate in tiger nut is moderate and consumable by humans.

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