PRODUCTION AND UTILIZATION OF TIGER NUTS USING VARIOUS PROCESSING TECHNIQUES

ABSTRACT

The feeding potential of tiger nut tubers (*Cyperus esculentus* L.) was evaluated. The general structure of 100g of raw and treated tiger nuts is that the water content of tiger nuts is 4.1951.93%, crude protein 2.61% 10.12%, waste 0.70% 1.77%, unrefined fiber 7.4813 .97%, unrefined. It was shown to be 10.79% 32.06% fat. And sugar 22.7356.85%. The energy value was taken from 232.31487.15Kcal. For tiger nuts, Mg (95.32–140.96 mg), K (106.44427.92 mg), P (121.78–195.95 mg), Fe (1.60–4.03 mg), Cu (0.08–0.99 mg), Zn (0.32–2.46) Contains the critical mass. mg), lascorbic acid (30.90–84.66 mg), vitamin E (2.22–5.26 mg), moderate Ca (24.42–62.29 mg) and low Na content (15.77–18.27 mg). When dealing with tiger nuts, sugar usually swells, but magnesium and sodium levels decrease. Malting altogether expanded calcium content (85 %) and drying and simmering expanded Zn and Cu by 100 %. Physicosynthetic and useful properties showed that tiger nuts and its items are acidic while consistency of the items per 100 ml was between 88 90 cP, explicit gravity 1.01 1.07, diminishing sugar 0.30 0.44 g , frothing limit 18 %. Frothing steadiness 5.35 %, emulsion limit 21.88 %, and emulsion strength 49.38 %. Liquor content of tiger nut wine was between 3.17 7.13 %. New tiger nuts were used in the improvement of tiger nut items (milk, espresso and wine) utilizing family techniques like drenching, drying, cooking, malting, aging and freezing. An assessment of the sensuality and value of the prepared tiger nut items showed that there was no significant difference between the tiger nut items and their controls at most of the tested limits (P> 0.05). All the articles at that time were very orderly. Evaluation of tiger nut products (milk concentrate and wine) per 100 ml is ascorbic acid (6.18-7.8 mg), thiamine (0.80-1.25 mg), riboflavin (0.35-0.59 mg), vitamin E (0.22- 0.75 mg) And cyanocobalamin (0.03-0.05 µg).) Content The sequelae of bacterial counts of tiger nuts (milk and wine) showed values of 3.0 x 102-8.0 x 102 CFU / ml, with shelf life of 6 hours to 10 months.

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Keywords: Tiger nut, Food potentials, Organoleptic, Natural fermentation, nutritional properties

1. Introduction

Tiger nuts (*Cyperus esculentum*) are perennials with spherical bulbs, pale yellow, and cream-colored parts surrounded by winding pods. Also known as yellow nutsedge, soil or ground almonds, Suchet in French, Elmandern in German, and Chufa in Spanish (TTSL, 2005). Grossman and Thomas (1998) revealed that Chufa came from Africa to Spain. Tiger nuts have been wildly discovered and developed in Africa, South America, Europe and Asia. Tiger nuts are stored wild along the waterways and are cultivated on a limited scale, primarily by local producers in the northern region of Nigeria. In Hausa, it is personally called "Aya". The Igbo word "Akiauusa". "O fio" in Yoruba and "isipaccara" in Efik. Tiger nuts are flavorful, sweet, nutty, improved tubers that contain protein, carbohydrates, sugar, and lots of oil and fiber (FAO, 1988). Grossman and Thomas (1998) found that tiger nuts have long been developed for men's food and drink in Spain and are cultivated for pigs, and a wonderfully smooth blend

is refreshing in wellness spas, pubs and restaurants. Shown that it is offered as (effectively shared with others)). Soda competes). Unfortunately, despite these opportunities for tiger nuts, it was an abandoned crop in Nigeria. This may be due to inadequate information on manufacturing, use, and health benefits. Tiger nuts can be a prerequisite for local African ventures. It is an important edible crop for certain African clans and is often collected raw, eaten, heated, boiled, or dried as a vegetable and ground into flour. Mix ground flour with sorghum to make porridge, frozen yogurt, sorbet, or a smooth drink. It is usually eaten raw as a snack and there are no claims of food or health quality (FAO, 1988). It has also been found to have very useful qualities (Moore, 2004; Zimmerman, 1987; Farre, 2003; Bixquert, 2003; Valls, 2003). Moore (2004) expressed that "the extension of tiger nuts smooth beverages will essentially help the exploration connecting tiger nuts milk to better cholesterol levels and other nondairy producers. This could likewise acquire a lift from an expanded customer interest in wellbeing food sources". Assortment of food items can be gotten from tiger nut tubers however there is little documentation at large. Different food handling methods can be applied to tiger nut handling to adjust its appearance, foster its regular flavor, animate the stomach related juices, change up the menu, and make it effectively absorbable and bioaccessible, obliterate hurtful microorganisms, work on its wholesome quality and forestall disintegration. This task work 14 expects to fundamentally assess, advance creation and use of tiger nuts utilizing different handling methods.

1.2 Statement of Problems

Considering the functional meaning of family food security expressed by ACC/SCN (1991), a family is food secure when it approaches the food required for a sound life for every one of its individuals (satisfactory regarding quality, amount, wellbeing and socially OK), and when it isn`t at excessive gamble of losing such access. Satisfactory sustenance is fundamental for individual turn of events, movement, great wellbeing, satisfaction capacity and progress in social orders and countries (ACC/SCN, 1991). A portion of the elements that might influence food security as well as sustenance are Inadequate creation and information on the food use, Poor handling, conservation and capacity strategies, Poor framework, particularly unfortunate lodging, sterilization and Storage offices, instruction, interchanges, and moving frameworks. , Poverty, Extreme lopsided characteristics in food or populace proportion, War/political or common distress, Rapid exhaustion of regular assets, Cultural mentalities toward specific food varieties, High outer obligation, Seasonal variables or climatic varieties, Food costs Tiger nuts has been for a long time one of the underutilized food crops in Nigeria. Tiger nuts are one of the underutilized tubers with incredible potential for homegrown and business purposes.

1.3 Aim and Objectives of Study

The purpose of this study is to evaluate the nutritional value of tiger nut tubers (tiger nuts) and their constituents. The clear goals are:

1) Determines the general, mineral, nutritional, physical and beneficial properties of tiger nuts.

2) Development of articles made from tiger nuts using traditional processing methods such as regular aging, malting, drying and cooking.
3) Evaluation of the sensory properties and general validity of manufactured tiger nut items (milk, espresso, wine beverages).
4) Identifies some health-promoting properties and a pile of microorganisms in manufactured tiger nut products (milk, espresso, wine drinks).

2. Materials and Methods

Collection of samples

New rough tiger nuts (around 10 kg) and the wide scope of different trimmings except for palm wine were purchased from the Nsukka Urban Main Market, Enugu State, Nigeria.

Test arrangements and examinations

Test planning

New tiger nuts (untreated tiger nuts) were used for the status of tiger nuts smooth juice remove (plain tiger nuts milk), matured tiger nuts smooth juice (tiger nuts wine), treated tiger nuts (dried, malted and cooked tiger nuts) and all the made tiger nuts things (milk, coffee and wine).

New tiger nuts (Unmalted tiger nuts)

Tiger nuts were weighed out in fragments washed totally in two changes of clean water and drained before use for all of the examinations. A piece of tiger nuts (500 g) was packaged in nylon sacks kept in a water/air evidence compartment and set aside in the cooler (new unmalted tiger nuts).

Tiger nuts smooth juice eliminate (plain tiger nuts milk)

New tiger nuts (500 g) were assimilated two changes of clean water for 12 hours. The soaked tiger nuts were washed in two changes of water, drained, blended into stick in electric blender and slurried. 2500 ml of refined water was used all together during the blending and slurring process. The slurry was isolated with the aide of an ideal soaked muslin texture and the filtrate gained was moved into cleaned plastic containers, stopped and set aside in the cooler (for not north of three days) going before examination (tests were taken out from the set aside new tiger nuts smooth juice remove). Tests were discarded following a restriction of three days and new models sorted out for replicate examination.

Matured tiger nuts smooth juice

New tiger nuts (500 g) were retained water (1: 3 w/v) for 12 hours (to cultivate sharpness, incite mixtures and local microbial fermentative natural elements) and washed in water. Tiger nuts are blended into fine paste in with water (2000 ml) using a mammomlex electric blender. The resultant paste was slurried with water (2500 ml) and isolated using a muslin texture (squashing the edges of the material towards the slurry for most outrageous liquid extraction). Around 450 g of granulated sugar (as osmotic experts which will make water unavailable for crumbling changes and causes plasmolysis of pathogenic animals) and 200 ml of juice isolated from new lemon (to obstruct bacterial activity by cutting down the pH of the aliquot under the span persevered for improvement and processing for most pathogenic natural substances anyway could allow the advancement of yeast and lactic destructive microorganisms) was added to the filtrate. The entire mix was homogenized by shaking excitedly for 5 minutes, filled a cleaned maturing gallon and halted. The medium was matured for 24, 36 and 48 hours. Test sections were taken out from in sets of three from the gallon at 24, 36 and 48 hours season of maturing into cleaned plastic containers and set aside in the cooler before assessment. Tests were discarded following multi week in the cooler and new models set up for reproduce examination.

Malted tiger nuts

Around 2 kg of picked new tiger nuts were drenches (caught up) in water (1:3 w/v) at room temperature (27 °C - 30 °C for 24 hours) in for changes of water at 6 hours stretch before re-sprinkling. Around the completion of the drenching time span, the tubers were grown on a disinfected jute material. The jute texture was treated by washing, oven drying at 60 °C and cooling. Tiger nuts tubers were spread out on the jute texture and malted for multi week in a grill compartment (around 30 °C). Tubers were water sprinkled with the aide of showering guide for somewhere near twice every day. Close to the completion of the malting time period, created tubers were determinate or devegetated (ejection of juveniles, shoots and roots), washed to diminish microbial weight and drained. The malted tiger nuts were isolated into three portions. The principal piece was taken care of in the cooler in a fixed shut nylon pack (recently malted tiger nuts), the ensuing part was used for preparing malted dried tiger nuts and third part was used for arranging malted cooked tiger nuts.

Dried tiger nuts

Roasted unmalted tiger nuts: About 600g of new unmalted tiger nuts were air dried at room temperature for 24 hours and cooked at 150 °C in an electric stove plate (40 liter, Gold star broiler) for 3

hours . They were simmered at 150 °C for 3 hours until espresso brown in variety in an electric stove (40 liter, Gold star broiler).

General synthesis examinations of tiger nuts (treated and untreated)

Dampness content

While still in the air, grill to dry at 105 ° C until constant. Weigh 5 grams (5 g) of each example into a pre-weighed tray and store in a broiler replaced at 105 ° C. After 6 hours, the sample was taken out, cooled in a desiccator and checked again. The water content of each example was determined as follows. % Moisture content (M) = W2W3x100. W2W1 W1 = Initial pot load W2 = Kettle weight + Pre-drying test W3 = Pot weight + Post-drying test

Carbohydrate content

Accessibility not set to stone by identification (in the example of 100 tiger nuts, of unrefined protein (%), water (%), fat (%), crude fiber (%), and debris (%) Removal). Sugar = 100 {protein (g%) + fat (g%) + water (g%) + fiber (g%) + debris (g%)}

Energy value

Energy really well worth of tiger nuts instance became decided using Atwater values: four, nine, four as follows (four x protein, nine x fat, and four x starch) and speaking the quantity of objects in (four x protein + nine x fat + four x sugar kilocalories. This became converted absolutely to kilo joule (KJ) using a metamorphosis factor = four. 184 (more or less four. 2) to copy the electricity values given in Kcal (MAFF, 1981)

Mineral and vitamin content analyses of tiger nuts (treated and untreated)

Mineral content

Five grams (5g) of each tiger nuts instance turned into warmed tenderly over a Bunsen burner hearthplace till the huge majority of the herbal rely turned into obliterated. This turned into moreover warmed firmly in a suppress heater for some hours till white-darkish particles turned into gotten. The particles fabric turned into cooled. Around 20 ml of subtle water and 10ml of the weaken hydrochloric corrosive turned into introduced to the ashed fabric. This mixture turned into bubbled, sifted right into a 250 ml volumetric carafe, washed absolutely with heated water, cooled and made as much as volume. Minerals content material of every instance turned into dissected making use of colourimetric or spectrophotometric or titrimetric techniques have been pertinent (AOAC, 1995; Pye Unicam, 1970; Pearson, 1976). Tests have been tested for sodium (Na), potassium (K), calcium (Ca), iron (Fe), magnesium (Mg), zinc (Zn), copper (Cu) and phosphorus (P).

Vitamin C and E content of tiger nuts (treated and untreated)

L-ascorbic acid or Ascorbic Acid now no longer absolutely set in stone through 2, four dinitrophenyl hydrazine approach for Roe and Kuethe portrayed through Ball (1994) making use of colourimetric strategy. Vitamin now no longer absolutely set in stone through spectophotometric techniques (AOAC, 1995).

Ascorbic Acid (Vitamin C)

One gram (1 g) of newly macerated tiger nuts instance changed into liquidized with 50 ml subtle water and sifted. Around 1 ml of the examples filtrate changed into homogenized with 10 % trichloroacetic corrosive and 0.five ml chloroform. The mixture changed into centrifuged and accredited to settle. The affordable supernatant fluid changed into taken out and combined in with 0.four ml newly pre-organized range reagent (five ml 2, four, dinitrophenyl hydrazine, 0.1 ml five % cupric sulfate and 0.1 ml 10 % thiourea) and hatched for 56 ○C in a water bathe for 60 minutes.

Total available reducing sugar of tiger nuts milk and wine

All out handy reducing sugar as nevertheless up withinside the air via way of means of phosphomolybdic technique. The weakened example (tiger nuts milk separate, tiger nuts lemon milk and the elderly easy juice) changed into combined in with cooper reagent, bubbled and cooled on ice, then, at that point, combined in with phosphomolybdic corrosive reagent and examine at 420 nm. All out sugar changed into resolved making use of spectrophotometric strategy. Around 0.1 ml of object exams changed into made up to one ml with water. Around 1 ml of soluble cooper reagent changed into then delivered and the combo bubbled in a water bathe for eight mins and cooled on ice. Around 1 ml of phophomolybdic corrosive reagent and 7ml of water changed into delivered and absolutely shaken. Absorbance changed into perused at 420nm. Computation changed into made making use of: Absorbance of take a look at x Concentration of trendy association x Dilution thing Absorbance of trendy association x Sample volume Development of tiger nuts merchandise Created from new tiger nuts making use of essential meals coping with and safeguarding procedures, for example, drying, simmering, malting, processing, mixing, maturation, refrigeration in addition to freezing. Aged and unfermented tiger nuts refreshments have been produced the use of new crude tiger nuts (unmalted) whilst coffee liquids have been produced the use of dried floor simmered forty seven malted and unmalted tiger nuts.

Tiger nuts milk (unfermented tiger nuts beverages)

New uncooked tiger nuts (500 g) had been soaks or absorbed a bowl of smooth water (approximately t1:three w/v at room temperature; 27°C - 30°C) for round 24 hours to assure finest water assimilation, sugar degree maintenance, mellowing of tuber tissues and squeeze do away with recuperation. Smell expand became abstained from with the aid of using converting the soaking water every 6 hrs (nonetheless, a extra prolonged soaking time of 24 hrs without adjustments of water will affect the flavor and nature of the clean juice do away with). Following 12 hours, tiger nuts became depleted with

the manual of a sifter, washed once more in adjustments of smooth compact water, floor into glue utilising an electric powered blender and slurried with water (2500 ml). A muslin cloth became applied to channel the ensuing glue to accumulate the clean juice separate (undeniable tiger nuts milk). This became applied in getting geared up tiger nuts refreshments. Brands of tiger nuts milk became found out utilising sweetner (sugar) and flavors, for example, lemon squeeze and its strip, floor new ginger and fluid vanilla taste as follows: 1) Unsweetened-unflavoured/undeniable tiger nuts milk/tiger nuts milk do away with Fixings: About 500 g tiger nuts and 2500 ml of water Strategies: Fresh tiger nuts tubers had been washed, doused for 12 hours, depleted, washed once more instances in smooth water and mixed. The glue became slurried with water and sieved with a washed wet smooth muslin cloth. The filtrate were given became saved within side the fridge or cooler (half-hour or extra) to kick back earlier than utilization. 2) Ginger enhanced - progressed tiger nuts milk/ginger tiger nuts milk Fixings: About 500 g tiger nuts, 2500 ml water, one hundred twenty five g sugar and 1 tablespoon new floor ginger. Strategy: Fresh tiger nuts tubers had been washed, splashed for 12 hours, depleted, washed once more instances in smooth water and mixed. Ground new ginger (very a great deal washed and cleaned) became delivered and combining proceeded. The resultant glue became slurried with water and sieved with a washed clammy smooth muslin cloth. Sugar became delivered to the filtrate received and this became saved with inside the fridge or cooler (half-hour or extra) to kick back earlier than utilization. three) Vanilla seasoned - progressed tiger nuts milk/vanilla tiger nuts milk Fixings: About 500 g tiger nuts, 2500 ml water, one hundred twenty five g sugar and 1 tablespoon vanilla taste (Rayners fluid concentrate). Strategy: Fresh tiger nuts tubers had been washed, sopping wet for 12 hours, depleted, washed once more instances in smooth water and mixed.. The resultant glue became slurried with water and sieved with a washed wet smooth muslin cloth. Sugar and vanilla taste had been delivered to the filtrate were given and the combo became packaged and saved within side the fridge or cooler (half-hour or extra) to kick back earlier than utilization.

Microbial count and keeping of quality assessment of tiger nuts products

The microbial load (general microbial rely) with inside the samples from tiger nuts milk and tiger nuts wine liquids had been decided via way of means of the usage of the unfold (viable) plate rely method (Pelczar et al, 1993; Mountney and Gould, 1988; Garbutt, 1997). Dilution series (10-1 – 10-6) had been organized from the liquid pattern homogenate. 0.1 ml turned into taken from every dilution to an agar plate (plate rely agar) and every of the inoculums at the floor unfold with the useful resource of a loop at the agar plate. This turned into incubated at 37°C for 24 – forty eight hours. Plates with colony boom had been counted at 24 hr and forty eight hr. Numbers of colony forming devices had been calculated as follows: cfu g-1 = rely x 1/ dilution inoculums Keeping pleasant of products (milk, espresso and wine) had been decided the usage of a graded stage sensory assessment at 6 hrs, 12 hrs, 18 hrs, 36 hours… 1 week, 2 weeks, three weeks… 1 month, 2 months…1 12 months and above… at room temperature (27 – 30°C), refrigeration temperature (> 17°C) and freezing

3. Statistical analyses

The imply and popular deviation of the end result statistics from the test become calculated and analyzed the use of unmarried issue ANOVA within side the Statistical Package for Social Science (SPSS, 2003) Software (SPSS version12. 0.1 for windows). The Duncan's New Multiple Range Test become used to decide the sizable distinction among imply values.

4. RESULTS

Proximate composition and energy value of tiger nuts

Table 1: gives the overall shape of new, dried, cooked and malted tiger nuts in step with a hundred gram. The dampness content material of tiger nuts went from 4.19 - 51.93%, unrefined protein 2.61 - 10.12%, particles 0.70 - 1.77 %, hard fiber 7.48 - 13.97 %, unrefined fats 10.79 - 32.06 %, carb 22.73 - 56.85 %. The electricity values went from 232.31 - 486.26 kilo energy in step with a hundred gram test (976 - 2042 Kilo joules). The dampness values for dealt with and untreated unmalted tiger nuts went from 4.62 - 51.93 %, and that of dealt with and untreated malted tiger nuts have been from 4.19-44.84 %. Dried tiger nuts went from 4.92 - 5.47 % and broiled tiger nuts have been from 4.19 - 4.62 %. Protein values for dealt with and untreated unmalted tiger nuts went from 2.61 - 10.12 %. The dealt with and untreated malted tubers had protein values going from 3.75 - 7.41 %. Debris values for dealt with and untreated unmalted tiger nuts went from 0.70 - 1.77 % and the features for dealt with and untreated malted tiger nuts have been 0.72 % for new, 1.36 % for dried, and 1.54 % for broiled examples. Rough fiber values for dealt with and untreated unmalted tiger nuts went from 7.48 - 12.66 % and that of malted tiger

Table 1: Energy (Kcal / KJ) and proximate composition (%) of tiger nuts (fresh, dried, roasted and malted)

Sample / 100 g	Moisture	Protein	Ash	Crude fibre	Crude fat	CHO	Energy Unmalted
Fresh (S)	51.93 ±6.44	2.61 ±1.58	0. 70 ± 0.50	7.48± 1.63	14.55± 1.30	22.73± 2.29	232.31 (976 KJ)
Fresh (U)	38.86±1.78	3.94± 1.05	0.91±0.47	9.28±0.39	20.42±1.00	26.59±0.94	305.90(1285KJ)

Dried [a]	5.47±0.50	6.12±0.37	1.53±2.00	11.51±1.68	32.06±1.00	43.31±1.19	486.26(2042KJ)
Roasted [b]	4.62±1.00	10.12±0.66	1.77±2.73	12.66±1.70	20.07±1.22	50.76±1.46	478.15(2008KJ)
Malted							
Fresh (S)**	44.84±6.32	3.75±2.45	0.72±0.53	8.80±1.78	10.79±4.23	31.10±3.06	235.70(990KJ)
Dried [a]	4.92±0.73	5.92±0.54	1.36±1.84	12.70±0.19	19.80±3.43	55.30±1.35	423.08 (1777 KJ)
Roasted [b]	4.19±0.69	7.41±1.18	1.54±2.73	13.97±1.4	16.04±1.09	56.85±1.41	401.36(1686 KJ)

S= soaked U = unsoaked * = soaked for 12 hours, malted for 1 week and devegetated

a = dried at 55 ○C for 48 hours b= air dried at room temperature for 24 hours and roasted at 150 C for 3 hours

Percentage changes on the proximate composition and energy value of tiger nuts due to processing (soaking, drying, roasting and malting) effects

Table 2: provides the charge increments and diminishes on standard introduction of tiger nuts due to medicines. Drenching of latest tiger nuts (12 hours) multiplied starch via way of means of 8.42 % and faded protein values via way of means of 15.94 %. There had been no massive adjustments (< 5 %) in particles, fiber, fats and power values. Malting of latest tiger nuts multiplied protein via way of means of 5.11 %, fiber 4.60 %, sugar 29.08 % and diminished particles via way of means of 12.75 %, fats 36.47 % and power values via way of means of 14.96%. Drying of unmalted tiger nuts multiplied carb via way of means of 5.25 %, particles 8.72 %, fats 11.45 %, and faded fiber via way of means of 19.84 %. There had been no massive adjustments in protein (+0.46 %) and power values (+2.74 %). Drying of malted tiger nuts multiplied particles via way of means of 10.00 %, fats 31.81 %, and starch 33.16 % and faded fiber via way of means of 16.21 % and power values 11.45 %. Broiling of unmalted tiger nuts multiplied the protein via way of means of 64.55 %, particles 24.83 %, sugar 22.22 % and faded fiber via way of means of 12.68 % and fats via way of means of 10.23 %. There became no massive extrade in power esteem (0.08 %). Simmering of malted tiger nuts multiplied protein values via way of means of 13.55 %, particles 23.08 %, and sugar 35.57 % and faded fiber via way of means of 8.73 %, fats 45.29 %.

Table 2: Percentage increases / decreases on the proximate composition and energy content (per100 g) due to processing (soaking, malting, drying and roasting) effects

	Protein %	Ash %	Crude fibre %	Crude fat %	CHO %	Energy %
Soaking*	-15.94	-2.01	+2.23	-0.66	+8.42	-3.68
Malting**	+5.11	-12.75	+4.60	-36.47	+29.08	-14.96
Drying (U) a	+0.46	+8.72	-19.84	+11.45	+5.25	+2.74
Drying (M) b**	-8.39	+10.00	-16.21	+31.81	+33.16	-11.45
Roasting (U)	+64.55	+24.83	-12.68	-10.23	+22.22	+0.08
Roasting (M) b**	+13.55	+23.08	-8.73	-45.29	+35.57	-16.79

U = unmalted M= malted CHO = Carbohydrate * = soaked for 12 hours

**= soaked for 24 hours, malted for 1 week and devegetated

a = dried at 55 ○C for 48 hours b= air dried at room temperature for 24 hours and roasted at 150 C for 3 hours c= control

Mineral and vitamin content of tiger nuts

This suggests the micronutrient (mineral and nutrient) introduction of new, dried and simmered and malted tiger nuts in keeping with one hundred g. Magnesium (Mg) values of tiger nuts went from 95.32 - 140.ninety six mg, potassium (K) 106.44 - 427.ninety two mg, phophorus (p) 121.78 - 195.95mg, calcium (ca) 24.42 - 62.29 mg, sodium (Na) 15.77 - 18.27 mg, copper (Cu) 0.08 - 0.ninety nine mg, iron (Fe) 1.60 - 4.03 mg and zinc (Zn) 0.32 - 2.forty six mg. The L-ascorbic acid characteristics went from 30.90 - 88.89 mg and diet E 2.22 - 5.26 mg in keeping with one hundred g of test. Macro element complement confirmed that Mg values for handled and untreated unmalted tiger nuts went from 122.79 - 140.ninety six mg and that of handled and untreated malted tiger nuts turned into from 95.32 - 108.sixty six mg.

Table 3: Mineral and vitamin content of tiger nuts (mg/ 100g)

Sample	Mg	Cu	Fe	K	P	Zn	Ca	Na	Vit C	Vit E
Unmalted										
Fresh (U)	140.96±	1.590.10±	0.01 2.57±	0.30 265.12±	2.82 131.51±	5.70 0.37±	0.21 24.42±	1.34 18.27±	3.74 30.90 ±	0.51 5.26 ±0.1
Dried [a]	122.79±	1.48 0.68±	0.25 3.82±	0.27 415.09±	0.93 179.90±	0.79 2.46±	0.01 36.92±	1.62 17.73±	2.28 31.52±	0.23 4.71± 0.37
Roasted [b]	131.07±1.56	0.99±0.34	4.03±0.25	427.92±0.63	195.95±3.57	2.43±0.40	35.57±1.59	16.95±0.25	84.66±0.10	2.22±0.10
Malted										
Fresh (S)**	108.66±	1.61 0.08±	0.01 1.60±	0.38 106.44±	0.51 121.78±	0.88 0.32±	0.02 40.98±	1.55 16.50±	1.87	
Dried [a]	95.32±1.58	0.57±0.14	2.25±0.42	185.36±3.98	166.84±1.15	2.31±0.52	62.29±1.71	17.41±	2.26	
Roasted [b]	100.09±	1.60 0.84±	0.23 2.56±	0.38 197.25±	0.24 181.86±	1.31 2.30±	0.20 60.13±	1.47 15.77±	3.21 59.94±	0.34 4.16± 0.31

S= soaked U = unsoaked * = soaked for 12 hours ** = soaked for 24 hours before malting for 1 week

a = dried at 55 °C for 48 hours b= air dried at room temperature for 24 hours and roasted at 150 C for 3 hours

Percentage changes on the mineral content of tiger nuts due to processing (soaking, drying, roasting and malting) effects

This indicates the progressions with inside the increments and diminishes on mineral and nutrient substance of tiger nuts due to medicines. Malting of latest tiger nuts increased Ca through 84.16 % and dwindled Mg through 14.92 %, K 55.69 %, Cu 12.5 %, Fe 31.28 %n and 4.92 %. There had been no first rate adjustments P (+2.20 %) and Na (- 3.34 %). Drying of unmalted tiger nuts increased Zn through 100 %, Cu 100 % and dwindled Mg through 43.70 %, P 11.59 % and Na 37.28 %. There had been no massive adjustments in Fe (- 4.03 %), Ca (- 2.27 %) and K (+1.20 %). Drying of malted tiger nuts increased Cu through 100 %, Zn 100 %, and dwindled Mg through 49.11 %, P 20.52 %, Ca 11.82 %, Na 38.80 % and Fe 18.62 %. There had been no massive adjustments K (+1.02 %) Cooking of unmalted tiger nuts increased Cu through 100 %, Zn 100 %, P 4.60% and dwindled Mg through 40.47 %, Ca 6.74 % and Na through 40.58 %. There had been no massive adjustments in Fe (+ 0.24 %) and K (+3.34 %).

Vitamin and zinc content of tiger nuts products (milk and wine)

The nutrient and zinc content material of tiger nuts objects (milk pay attention and wine). Ascorbate (L-ascorbic acid) upsides of tiger nuts objects went from 6.18 mg - 7.eight mg/100ml, diet E 0.22 mg - 0.seventy five mg/a hundred ml, diet B1 (Thiamin) 0.80mg - 1.25 mg/100ml,

diet B2 (riboflavin) 0.35 mg - 0.59mg/a hundred ml and diet B12 (cyanocobalamin) 0.03 ug - 0.05 ug/100ml.

Table 4: Vitamin and zinc content tiger nuts products (milk and wine) per 100ml

	Vit C mg	Vit E mg	VitB1 mg	Vit B2 mg	Vit B12 mg	Zinc mg
Tiger nuts milk extract*	6.18 ±0.34	0.64± 0.26	0.80± 0.35	059 ±0.11	0.05± 0.02	0.11± 0.11
24 hr fermented wine	7.15 ±0.18	0.75± 0.01	1.08± 0.12	0.46 ±0.16	0.0± 0.00	0.07 ±0.21
36 hr fermented wine	7.81± 0.15	0.22± 0.13	1.25 ±0.25	0.35 ± 0.13	0.03± 0.01	0.04± 0.14

*Tiger nuts milk extract / plain tiger nuts

Microbial count / load of tiger nuts products (milk / wine)

Table 5 provides the microbial matter of tiger nuts items (milk and wine) at 37 ○C among 24 - forty eight hrs. Plain tiger nuts milk had 8.0 x 102 cfu/ml, lemon tiger nuts milk 5.0 x 102 cfu/ml, 24hr matured tiger nuts wine 3.0 x 102 cfu/ml and 36 hr elderly tiger nuts wine-b 5.0 x 102 cfu/ml. The amount of agreement with inside the 24 hr matured wine dwindled with enlargement in time/duration of maturation and improved once more after 36 hr of maturation. Plain tiger nuts milk had maximum noteworthy microbial burden (8.0 x 102 cfu/ml) and 24 hr elderly tiger nuts wine had least microbial burden.

Keeping quality of tiger nuts products (milk, coffee and wine)

Table 5 presents the keeping nature of tiger nuts items considering explicit ecological circumstances. Tiger nuts espresso had most elevated keeping quality reach values (≥2 months-≥10 months) than tiger nuts milk (≥ 6hrs - ≥2 weeks) and tiger nuts wine (≥ 6hrs - ≥1 month) at 27 - < 17 ○C. Plain tiger nuts milk saved best for 6 hours at 27 - 30 ○C, 24 hrs at <17 ○C and 4 days at < 0 ○C.

Table 5 Keeping quality of tiger nuts products (milk, coffee and wine)

Sample	Room temperature 27 - 30 ○C	Refrigerator < 17 ○C	Freezer < 0○C
Plain tiger nuts milk*	≥ 6hours	≥ 24hours	4 days
Lemon tiger nut milk*	≥ 12hours	≥ 36hours	≥ 2 weeks
24hr fermented wine*	≥ 12hours	≥ 36hours	≥ 1 month
36 hr fermented wine*	≥ 6hours	≥ 24hours	≥ 1 month
Malted tiger nuts coffee**	≥ 2 months	≥ 5 months	≥ 10 months
Unmalted tiger nuts coffee**	≥ 2 months	≥ 5 months	≥ 10 months

* Sample in corked plastic bottles ** Ground coffee samples packed in nylon backs and stored in air tight containers Note= Keeping quality values are minimum value

Sample Room temperature Refrigerator Freezer

27 - 30 ○C < 17 ○C < 0○C Plain tiger nuts milk* ≥ 6hours ≥ 24hours 4 days

Nutritive value of tiger nuts as widely consumed raw

Tiger nuts are high in carb, fat and fiber content. New tiger nuts are high in dampness content. Nonetheless, dried tiger nuts are low in dampness with higher convergence of supplements. Tiger nuts could be eaten new or dried as snacks by youthful and old (youngsters, teenagers, grown-ups, pregnant and lactating moms) for its high energy and preventive or defensive supplements.

Tiger nuts in contrast with other dull roots and tubers have strangely, altogether higher fat substance and could offer more than 73 % of fat to a youngster`s day to day fat need and more than 49 % of fat to a grown-ups day to day fat prerequisite (FAO/WHO/UNU, 2002). Fat substances of tiger nuts are somewhat like that of nuts and seeds yet are higher than that of oats and contrasts well and that of soya beans (Achinewhu, 1989). Tiger nuts fiber values from the discoveries are in accordance with the reports of Umerie et al. (1998) and Addy and Eteshola (1984).

Protein content of tiger nuts fell inside the scope of values detailed by different specialists (Umerie et al. , 1997; Temple et al. , 1990; Addy and Eteshola, 1984; TTSL, 2005).

Effect of processing of on nutrient composition of tiger nuts

Variety in dampness content of tigenuts, appear to be the primary driver of variety in protein, starch, unrefined fiber, rough fat, debris and nutrient substance (Table 1). Higher dampness worth of doused new tiger nuts (51. 93 %) might be ascribed to water ingestion by the tuber tissue cells during splashing.

In any case, low dampness content of dried and broiled tiger nuts (4. 19 - 5. 47 %) was because of dampness misfortune during drying and cooking process. The level of the impact of handling on nutritive worth of tiger nuts relies upon the awareness of supplement to different circumstances (heat, oxygen, pH and light) winning during handling (Bender, 1973; Morris et al. , 2004; MAFF, 1981). Sugar levels of tiger nuts fundamentally expanded because of each handling technique (dousing, malting, drying and simmering). Expansion in carb esteem because of dousing (by 8. 42 %) might be ascribed to starch transformation to basic sugars (glucose and fructose) by corrupting chemicals, for example, diastatic, alpha and beta amylase (Bender, 1973; Morris et al., 2004). Expansion in carb esteem because of malting process by (29. 08 %) might be ascribed to alpha-amylase action what separates complex carbs to basic sugars which are used and put away in the plant tissues during development cycle and dampness misfortune. Carb worth of tiger nuts expanded between 5.25 - 33.16 % due to drying and this might be ascribed to dampness misfortune (centralization of supplement). Expansions in carb levels because of broiling (22.22 % - 35.57 %) might be credited to starch hydrolysis because of warming. Huge reductions in fat qualities were seen in malted and broiled tiger nuts. Debris upsides of tiger nuts expanded because of drying and broiling. This might be credited to the centralization of supplement (mineral debris) because of dampness misfortune.

Conclusion and Recommendations

Tiger nuts and its item could be utilized in slims down by youthful and old, pregnant and lactating moms, for its high energy, iron and nutrients C and E content. Supplement content of tiger nuts and its items could be utilized in supplementing or enhancing supplements from other food sources other bland roots and tubers like natural products, oats and vegetables. Tiger nut milk could be utilized as a decent substitute for cow milk and other vegetable milks. Tiger nut items (milk, espresso and wine) could be mixed with various organic products, for example, banana, pawpaw, pear, apple and so on as a reviving food or utilized as a base in natural product servings of mixed greens. There is need for additional improvement of items in view of tiger nuts for families and business purposes to guarantee food security.

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