PROCESS OF PRODUCTION OF NUTRITIONAL TIGERNUT DRINK AND HEALTH BENEFITS

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ABSTRACT

The need to create awareness regarding some local, nutritious, unutilized and affordable healthy food substances around us cannot be overemphasized. Diversification in non-alcoholic, natural milk production could help to improve dietary intake of average Nigerians. Tigernut (*Cyperus esculentus lativum*) is a monocotyledonous plant belonging to the family *Cyperaceae* with numerous species. This study determined the production of nutritious tigernut milk drinks, processes and health benefits. Proximate analysis and consumer acceptability of the tigernut, coconut, date, banana and ginger blended drink was carried out using a standard procedure. Dried tigernuts, coconut, dates, ginger and ripped banana in the ratio of 60: 15: 10: 5: 5 grams respectively were sorted out, processed, blended, sieved and homogenized. Consumer acceptability of the product was determined by a taste panelist using the parameters of appearance, organoleptic, texture, colour, aroma, taste and overall acceptability with a 9-point hedonic scale by 20 untrained panelists. Data were expressed using mean ± standard error (SE) of the proximate analysis and its composition showed highest moisture content (78.45 ± 0.081), dry matter (17.36 ± 0.081), carbohydrate (9.20 ± 0.046), crude protein (6.30 ± 0.033) and low in crude ash (1.18 ± 0.024) and crude fibre (0.68 ± 0.026). Appearance and mouth feel scored the highest (95%), taste (94%), general acceptability (90%), texture (87%), consistency (86%) and aroma (85%). Generally, the sample was accepted in terms of sensory quality and therefore, recommend due to its high nutritive and health implication as well as its availability, affordability and solution to some health-related challenges in our society today.

Keywords: Tigernut, health benefits, processed, consumer acceptability

INTRODUCTION

Tigernut (*Cyperus esculentus lativum*), commonly known as earth almond or yellow nut grass belong to division-Magnoliophyta, Class- Liliopsida, Order-Cyperales, Family-Cyperaceae and genus-Cyperus esculentus. It is an underutilized crop that produces rhizomes from the base and tubers that are somehow spherical in shape (Bamishaiye and Bamishaiye, 2011). The nut is a highly adaptable crop and grows very well under a wide range of climatic and soil conditions. It is found throughout the tropics, subtropics and warm temperature regions. The tuber grows and is consumed widely in Nigeria, Arabian Peninsula, west and east Africa and Europe especially in Spain (Gambo and Da'u, 2014). In Nigeria, three varieties of this nut are cultivated though only brown and yellow are readily available in the market and are called Akiausa in Igbo, Ofio in Yoruba, Aya in Hausa languages (Adejuyitan,2011). The nuts are usually preserved naturally by sun drying for about one to three months before storage and dehydrating process ensures longer shelf life, prevent rot and microbial growth, securing quality and its nutritional level (Bamishaiye and Bamishaiye, 2011; Gambo and Da'u, 2014). Tigernut can be eaten raw, dried, roasted, grated and can be subjected to other processes and uses such as fuel, baking flour, fish baits, animal

feeds, coffee, chocolate drinks, beverage making and milk drinks as outlined (Rita, 2009; Belewu and Abodunrin, 2006).

The high percentage of carbohydrates (mono-, di- and polysacharides), fibre, oil and its moderately high level of protein, minerals especially calcium, magnesium, iron, phosphorous and potassium, vitamins C and E makes tigernut a good source of food for humans and animals as well (Bamishaiye and Bamishaiye, 2011). It is very affordable and cheap source of nutrition for all levels of economic groups.

Tigernut milk drink

The origin of milk making with tigernut fruit is exclusive to the Spaniards which may have introduced by the Arabs.

The drink, "*Kunnu aya* " as called by Northern Nigeria is a healthy, nourishing and energy giving drink recommended by expert to be taken all the time especially in dry hot weather. The tigernut milk is an ideal drink for individual who do not tolerate cow's milk due to its absence of lactose, casein, sugar or protein milk or cholesterol (Belewu and Abodunrin, 2006). In Spain, the milk drink is referred as *chufa de horchata* and is so much rich in carbohydrates, protein, unsaturated fats, minerals, vitamins- C and E and in enzymes that help in food digestion (Bamishaiye and Bamishaiye, 2011). The beverage as referred to by some people is rich in high moisture content (Ariyo, *et al.,* 2021).

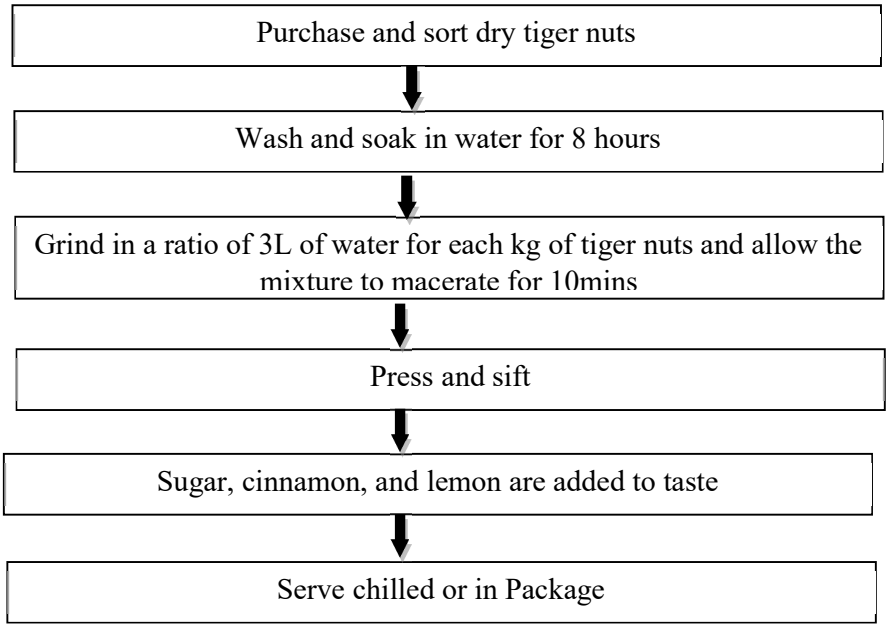

Figure 1: Flow chart of Production process of tiger nut milk, (Bamishaiye and Bamishaiye, 2011).

Health benefits of Tigernut and its food components

Cyperus esculentus is rich in oil used in making soap and as a lubricant for fine machinery (Ndubuisi, 2009). The oil has a mild, pleasant flavour and is considered as food oil similar but high quality to olive oil. The oil has high content of Vitamin E (alpha-tocopherol) and higher oxidative stability than other oils, due to its content of polyunsaturated fatty acids and gamma-tocopherol. Tiger nut is rich in meristic acid, oleic acid and linoleic acid and is valued for the high starch dietary fibre carbohydrate oil and mineral content especially phosphorus and potassium (Moore, 2004; Makut, *et al., 2018).* . It contain high energy content including starch, fats, sugars and proteins, soluble glucose and oleic acid. Tiger nuts are rich in minerals (phosphorous, potassium) and vitamins E and C having antioxidant effect against fats ideal for coronary heart disease (Chukwuma *et al.,* 2010). It help to prevent heart disease, cancer, especially of the colon, reduce cholesterol, aid digestion,

flatulence and diarrhea due to presence of digestive enzymes like amylase, catalase and lipase. It keeps one fuller than other foods with the same number of calories and stimulates growth of beneficial bacteria in the digestive tract. Certain functional health properties, treatment and prevention of such condition as colon cancer, such health coronary heart disease, obesity, diabetes, and Gastrointestinal disorders, dysentery, diarrhea has been attributed to consumption of tigernut due to its high content of soluble glucose (Ariyo, *et al*., 2021).

Date is fruit rich in phenolic compounds, that confers it antioxidant, antimicrobial and antimutagenic properties. The fruits contain less than 40% moisture and about 80% sugar (Borchani *et al.,* 2010; Hasnaoui *et al*., 2011). Other nutritional components present in it include ash, fibre, small amounts of protein and fat, potassium and trace elements like boron, cobalt, copper, fluorine, magnesium, manganese, selenium, and zinc (Al-Shahib: Borchani *et al.,* 2010).

Coconut kernel is rich in carbohydrates, fats, protein, moisture, crude fibre and ash. Percentage of oil in the kernel is the measure of the richness of coconut kernel. It is a good source of both water and oil-soluble vitamins.

Banana fruit/ pulp is known for its constituent of soluble and non-soluble dietary fiber and phenolic compounds which act as laxative during constipation. Present of abundant calcium, nitrogen, magnessium and phosphorus and potassium help to maintain the health of kidney and build new health tissues intake (Pereira and Maraschin, 2015; Zafar *et a*l., 2011).

Ginger spices have been used for flavor, taste and aroma of foods in various culture many years ago. Early cultures realized the value of spices in preservation of foods as well as their medicinal value (Ene-Obong *et al*., 2015).

METHODOLOGY

The flowchart for the step by step processing of Tigernut drink is shown below:

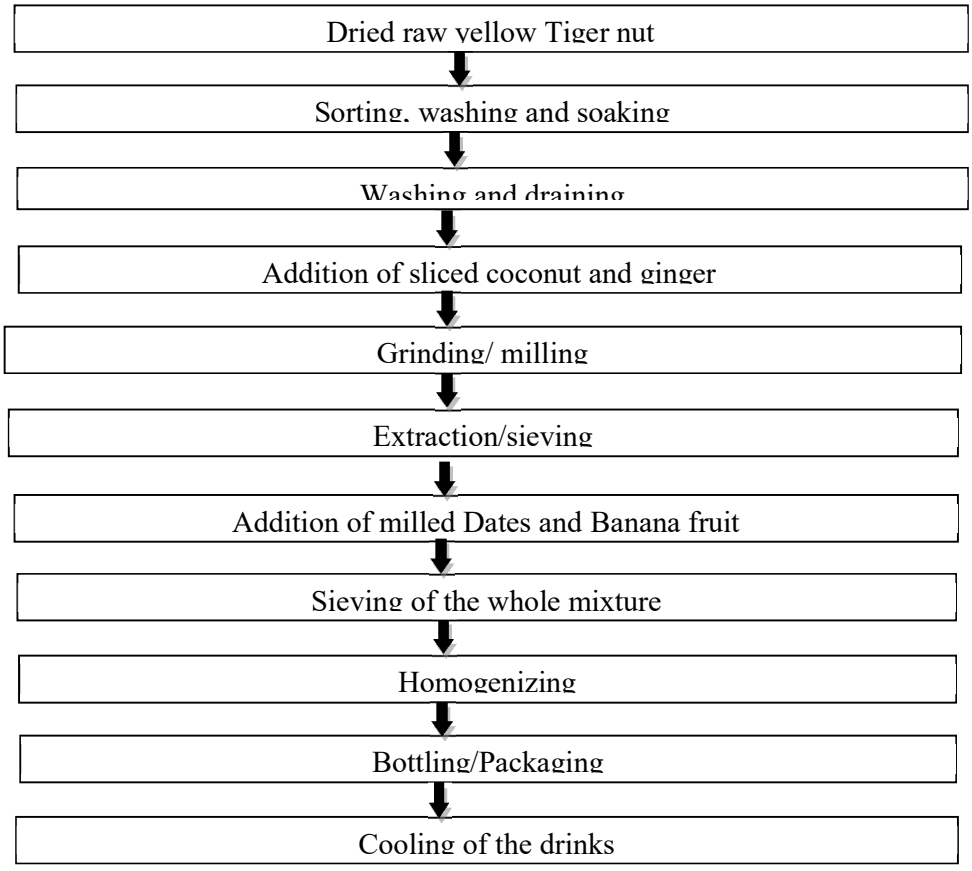

Figure 2: Flow processing chart for nutritional Tigernut milk drink production (Adejuyitan, 2011 modified).

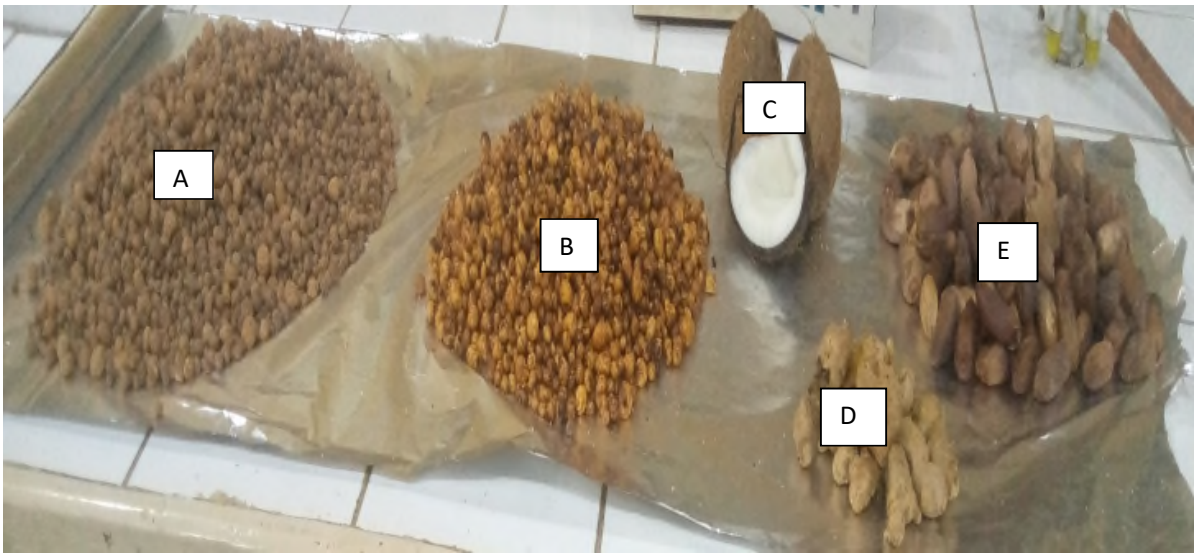

Figure 2: Showing raw materials used for the Tigernut drink (A=Raw dried tiger nuts, B=Sorted, washed and soaked nuts, C=Coconut meat, D=Ginger and E=sorted dates)

Collection and formulation of Tigernut nutritional milk drink

Collection of raw materials: Dried Tiger nuts (*Cyperus esculentus),* Date palm (*Phoenix dactylifera*) and Ginger (*Zingiber officinale*) were purchased from Iddo market and Coconut (*Cocos nucifera*) bought from Oyinbo market, all in Lagos State Nigeria. The samples were properly packaged in new purchased polyethylene bags and brought to Microbiology Laboratory, Department of Biological science, Yaba College of Technology, Yaba, Nigeria for processing.

The dried tigernuts were sorted out, to remove extraneous materials, cracked nuts and seeds which may negatively affect the taste and quality, washed to remove dirts, soil particles and other unwanted materials. Extraction and formulation of the tigernut nutritive drink was carried out using the method described by Udeozor (2012) with some modification. The washed nuts were steeped in a clean water 1/3 (g/l) for two days, each day washed and replaced with fresh clean water. The ratio of tigernut, coconut, dates, banana and ginger were 60: 15: 10:10: 05 respectively. After two days, *Cyperus esculentus* were washed, drained and placed in a clean transparent plastic bucket. About two medium sized coconut were broken, washed and sliced (5mm thickness) into the prepared tigernut with prepared sliced ginger. About 25- 30 pieces of dates were cut open to remove the seeds, washed and soaked for about 1- 5hours and the ripped banana back was removed and milled separately. The prepared tigernut with the sliced coconut and ginger was then ground with the addition of 4 litres of clean water for effective blending. The mixture was strained with a muslin cloth (300 µm pore size) to separate the chaff from the milk. Then the blended dates and banana was added to the strained tigernut, mixed and sieved again for perfect separation of chaff from the milk. The resulting tigernut milk drink sample obtained were packaged with clean new plastics, bottled and stored in a refrigerator at $4^{\circ C}$ for further analysis and ready to use.

Proximate composition

Moisture, crude protein, total ash, crude fibre and carbohydrate contents were determined using standard methods (Udeozor, 2012). Briefly, oven drying method at 105^{oC} for 5 hours for moisture determination, micro-Kjeldahl method for crude protein, total ash was obtained by igniting 2 g sample at 550^{oC} for 4 hours

using muffle furnace, crude fibre was determined using digestion method and carbohydrate was estimated by difference [100 - (% water + % protein + % fat + % ash + % crude fibre)]. Crude fat was determined using standard soxhlet extraction method with diethyl ether as the solvent (Moisture, crude protein, total ash, crude fibre and carbohydrate contents were determined using standard methods (Rowland *et al.,* 2017).

Sensory evaluation

Sensory qualities sampled with the product to twenty member panelists both students and staff include; appearance, taste, consistency, aroma, texture and overall acceptability of samples were evaluated in School of Science, Yaba college of Technology, Yaba Lagos State Nigeria. Evaluations were based on hedonic descriptive scale 1-5 as shown in table 2. Instructions were given to assessors in the basic taste panel procedure to make their own assessment on the sample being investigated (Sanful, 2009).

RESULT:

Figure 3. FINISHED PRODUCT (TIGERNUT NUTRITIONAL DRINK)

Table 1: Proximate composition of tiger nut drink[1]

Sample	Crude Protein	Carbohydrate	Dry matter	Crude fat	Crude ash	Crude Fibre	Moisture content
Mean ± SE	6.30 ± 0.033	9.20 ± 0.046	17.36 ± 0.081	4.14 ± 0.044	1.18 ± 0.024	0.68 ± 0.026	78.45 ± 0.081

[1]Values represent the mean ± standard error of the proximate analysis of tiger nut drink. It reveals that the mean of crude protein is 6.30 (se = 0.033), mean of carbohydrate is 9.20 (se = 0.046), dry matter is 17.36 (se = 0.081), crude fat is 4.14 (se = 0.044), crude ash is 1.18 (se = 0.024), crude fibre is 0.68 (se = 0.026) and moisture content is 78.45 (se = 0.081).

A look at the percentage composition of the proximate analysis of tigernut drink shows that it comprised 67% moisture, 15% dry matter, 8% carbohydrate, 5% crude protein, 3% crude fat and 1% crude ash and crude fibre respectively (see fig. 4 below).

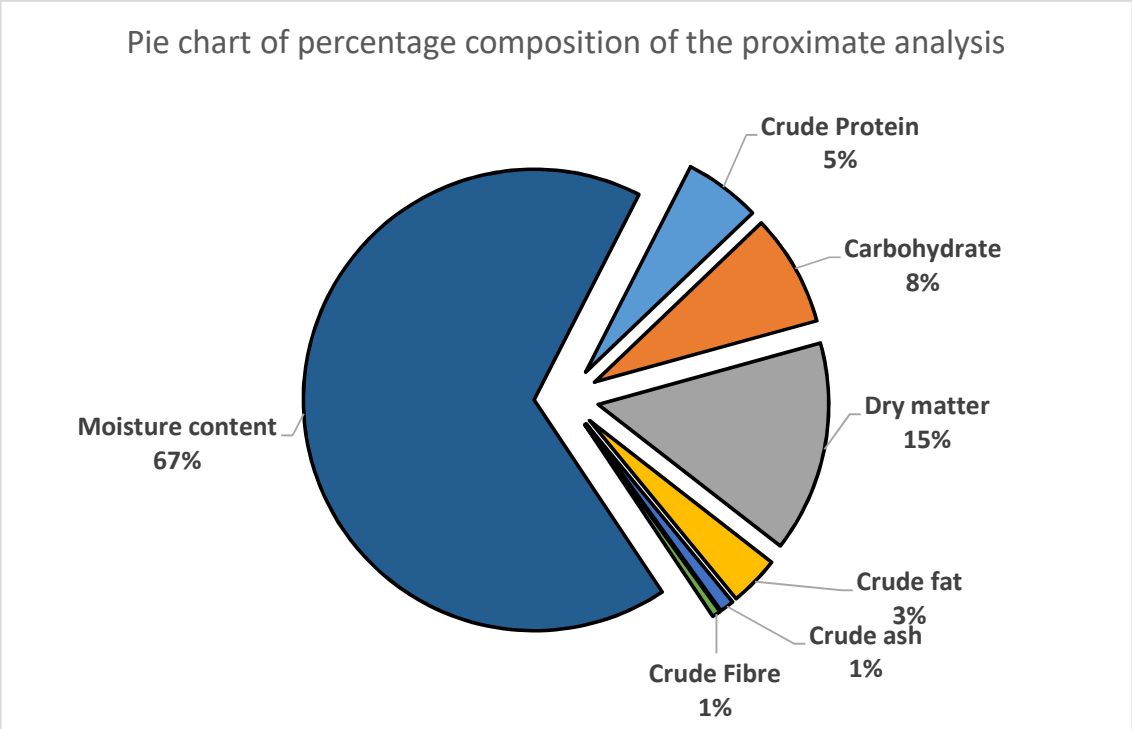

Figure 4: Percentage proximate of tigernut drink

Table 2: Hedonic Scoring for assessment of consumer acceptability of tigernut nutritional drink.

Scale	Appearance	Taste	Mouth feel	Aroma	Consistency	Texture	General Acceptability
1	5	5	5	5	5	5	5
2	4	4	4	4	4	4	4
3	3	3	3	3	3	3	3
4	2	2	2	2	2	2	2
5	1	1	1	1	1	1	1
% Rated Scores	95	94	95	85	86	87	90

NB: Excellent = 5; Very good = 4; Good = 3; Fair = 2; Poor = 1; Very smooth = 5, Smooth = 4; Neutral = 3; Lumpy = 2; Very lumpy = 1

DISCUSSION

The proximate analysis of the tigernuts table 1 revealed that mean and standard error of moisture content 78.45 ± 0.081 showed the highest proportion but lower than that soymilk according to Nwoke, *et al.* (2015), followed by dry matter 17.36 ± 0.081. The mean and standard error of carbohydrate is 9.20 ± 0.046 which is higher than that reported for soybeans by Bayero, *et al*. (2019), followed by crude protein 6.30 ± 0.033 which was lower than that found in soybeans (Amao, Taiwo, Ajibade and Aliu, 2021; Bayero, *et al.*, 2019). Crude fat is 4.14 ± 0.044, crude ash 1.18 ± 0.024 and crude fibre 0.68 ± 0.026. The high moisture content, a characteristic of beverage/fruit drink is a reflection of its ability to quench taste, increase microbial growth and consequently high rate of microbial contamination which affect the safety of the drink. High moisture content affect the stability and storage period (shelf life) of the product. The sensory evaluation shown the highest scores for appearance and mouth feel (95%) each, Taste (94%), general acceptability (90%), texture (87%), consistency (86%) and aroma (85%). The high percentage scored in appearance and mouth feel could be due to the presence of smoothening property of ripped banana and the presence of fat which promote good

mouth feel respectively (Udeozor, 2012). The high score for taste could be attributed to the sweetening properties of dates palm fruits. The high aroma and general acceptability of the product could be as a result of satiety and flavor associated with ginger and banana and makes it better for commercialization (Ariyo, *et al*., 2021).

CONCLUSION

There is need to increase utilization and awareness of tigernut drink as a milk substitute especially for its economics and health benefits. The non- lactose, non-alcoholic content drink serves both young and old of all sexes as well, the content is natural and materials found around us. The high price of imported milk and milk products, for example, with the poor production in Nigeria and in Africa generally, made the consumer ready to accept tigernut nutritional milk drink, a plant source as alternative drink.

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