International Journal of
Natural Science
(IJNS)

Production, Proximate, Mineral and Sensory Evaluation of Non-Alcoholic Beverage from Tubers: Sweetpotato and Tigernut

Kaida Zubairu Idris, Abba Mansir and Tijjani Ahmad

International Journal of Natural Sciences
ISSN 2958-9126 (Online)
Vol. 3, Issue 1, No. 5, pp 54 - 63, 2022

www.iprjb.org

Production, Proximate, Mineral and Sensory Evaluation of Non-Alcoholic Beverage from Tubers: Sweetpotato and Tigernut

[1*]Kaida Zubairu Idris
Undergraduate Student: Department of Food Science and Technology, Federal University Dutsinma, Katsina
[*]Corresponding Author's E-mail: Idriszubairu09@gmail.com
[2]Abba Mansir
Postgraduate Student: Department of Food Science and Technology, Federal University Dutsinma, Katsina
[*]Corresponding Author's E-mail: Idriszubairu09@gmail.com
[3]Tijjani Ahmad
Undergraduate Student: Department of Food Science and Technology, Federal University Dutsinma, Katsina
[*]Corresponding Author's E-mail: Idriszubairu09@gmail.com

Abstract

Purpose: The production of sweet potato and Tigernut drink was conducted and sampled A, B, C, and D at ratios 100% TND: 0%SPD, 90% TND: 10% SPD, 80% TND: 20%SPD, and 70%TND: 30%SPD respectively.

Methodology: These were analyzed for proximate and mineral analysis using methods described by the Association of Official Analytical Chemists and sensory attributes using Lawless and Heymann (2010) method. The non-alcoholic beverage drinks were examined for moisture, carbohydrate, protein, fat, fiber, and ash contents.

Findings: The proximate analysis of the sweetpotato and Tigernut blended beverage drink revealed that the beverage is a nutrient dense commodity with health promoting ability and high level of fiber, fat, moisture, and protein at the same time low in carbohydrate and ash. There were increase in the mineral contents especially Zn, Na, and K. The mineral content of this beverage is good for adolescence, infants, and groups facing macro-minerals impairments. Highest degree of preference for aroma and general acceptability were observed in sample D, followed by sample C. It was concluded that the processing this beverage drink has the potential of bridging the gap of extreme need for health supporting beverage drinks. It will also impact the marketing of sweet potatoes, increase productivity and providing income for farmers more importantly sweet potato growers.

Unique Contribution to Theory, Practice and Policy: Generally, the formulated beverage drink from the tubers (tigernut and sweet potato) had reasonable nutritional quality and a high rating sensory score in consumer test as expected. Thus can be prepared for commercial purpose to serve as a special beverage with similar constituents as other already existing commercial fruit juices/beverages and to expand the limited use of sweet potato thereby increasing its economic value and reduce the massive importation of tigernut in the country

Keywords: *Proximate Composition, Tubers, Beverages, Sweetpotato, Tigernut, And Beverage Drinks*

International Journal of Natural Sciences
ISSN 2958-9126 (Online)
Vol. 3, Issue 1, No. 5, pp 54 - 63, 2022

www.iprjb.org

INTRODUCTION

The sweetpotato (*Ipomoea batatas,* morning-glory family, *Convolvulaceae*) is an enlarged storage root that comes in various shapes, sizes, and colors. The crop is usually consumed after processing like boiling, baking or making fried chips (Vimala *et al*., 2011). Sweet potato (*Ipomoea batatas* L.) is among the most valuable food crop in the world. Nigeria is the best and the largest producer of sweet potato in Africa with 3.46 million metric tons annually. It is also the second largest producer worldwide after China, with 106 million metric tons (Mwanja, *et al*, 2017).

In Nigeria, sweetpotato production is concentrated in northern part primarily because of the favourable environmental conditions. Sweet potato is a root tuber crop packed with condensed sugars of different form and type and reasonable amount of water content (more than 50%). It contains high quantity of essential vitamins required by humans for growth and development, is an excellent source of vitamin A and C, and the starch content of the fresh roots varies from 6.9 to 30.7%. Besides, they are high in energy and dietary fibre, low in fat, and are important sources of beta-carotene (Aina *et al*., 2010).

The leve of sweet potato utilization in Nigeria is greatly limited to boiling, roasting and frying. Fresh sweet potatoes are perishable and therefore very sensitive to microbial spoilage, even at refrigerated conditions (Xiao *et al*., 2009). Hence, they must be consumed within a few weeks after harvest or be processed into various products (Akissoe *et al*., 2003). Therefore, the development of value added products from sweetpotato would promote its production and consumption and increase its economic value.

Tigernut as a potential crop is among the most commonly utilized tuber in almost all parts of northern Nigeria (Ukpabi & Esther, 2015) but still under-produced despite its massive application industrially. This resulted in much importation of the crop which in turn escalates its commercial price in the countries where it's underproduced. However, no attention has been sufficiently given to the incorporation of other locally available tubers such as sweet potato in order to suppress the high level of importation of tigernut for drink production. Tigernut contains reasonable quantity of both macronutrients and micronutrients. The most derived products of tigernut tubers are oil, flour, and milk.The nuts are valued for their highly nutritious starch content, dietary fibre, carbohydrate (mono, di and polysaccharides). It was also reported to be rich in sucrose (17.4 to 20.0%), fat (25.50%), and protein (8%) (Udeozor, 2012).

Tigernut can be used in the preparation of a local drink called '*kunun aya*' in Hausa language. It is also incorporated into other products such as candy, chocolate, biscuits and cookies (Okudu & Ogubuike, 2016). The Advent of Tigernut-Sweet potato beverage drink from tubers serves as alternative source milk from plant. Among the sources of tuber drink tigernut has received very high research attention but little attention has been given to sweet potato – tigernut blended form of drink. Therefore the objective of this study was to evaluate the effectiveness of Sweet potato incorporation in the preparation of Tigernut drink.

International Journal of Natural Sciences
ISSN 2958-9126 (Online)
Vol. 3, Issue 1, No. 5, pp 54 - 63, 2022

www.iprjb.org

MATERIALS AND METHODS

Sources of materials

Fresh Tiger nuts and sweet potato seeds were purchased from the local market in Dutsinma Katsina State, Nigeria. The chemicals and equipment used were of analytical grade and were obtained from the Department of Food Science and Technology Laboratories, Federal University Dtsinma, Katsina, Katsina State.

Sample preparation

These nuts and sweet potato were sorted; foreign materials, bad/cracked nuts and sweet potatoes which may affect the taste and keeping quality of the drink were removed, washed and rinsed with portable water. The Sweet potatoes were weighed, knife peeled and cut into smaller pieces and used to produce milk.

Tiger nut drink preparation

The method was described by Udeozor, L.O. (2012), 1kg of the fresh tiger nuts was blended several times into slurry with water (6L) in a Q-link auto-clean blender. The slurry was pressed using muslin cloth to extract the milk. The extract was pasteurized at 72^{o}C for 5s. It was homogenized and rapidly cooled.

Sweet potato milk preparation

The sweet potato pieces/chips were immersed into 1% potassium metabisulfite solution. They were rinsed with water and homogenized with the help of blender. Additional water (3 liter/ Kg) and 5% maize malt (as source of external β- and α-amylase enzymes), were added and heated to a temperature of 60°C and maintained at that temperature for 2 hours. The mixture was strained with cheesecloth. It was then pasteurized at 90°C for 10 min and bottled hot. The bottled drinks were cooled under running cold water and stored at room temperature for analysis (Muhammad, S. *et al*, 2013).

International Journal of Natural Sciences
ISSN 2958-9126 (Online)
Vol. 3, Issue 1, No. 5, pp 54 - 63, 2022

www.iprjb.org

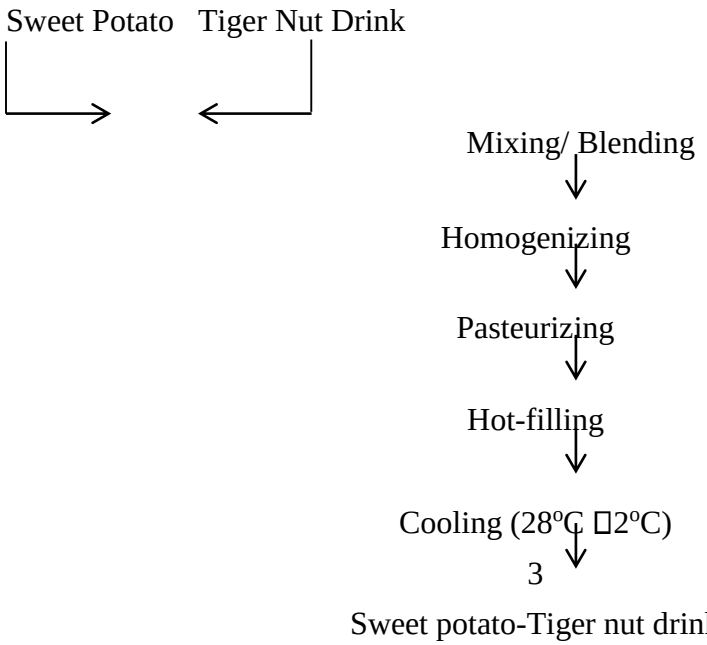

Figure 1: Flow Chart for Tiger Nut-Sweet Potato Drinks Production

Source: Udeozor, L.O. (2012)

Blend Formulation of Tigernut and Sweetpotato Drinks

The prepared sweetpotato and tigernut drinks samples (as shown in figure 3)were mixed using material balance at the ratios of 100:0, 90:10, 80:20, and 70:30 labeled as A, B, C, and D as shown in Table 1. Sample A with the 100% tigernut drink served as the control.

Table 1: Blend Formulation of Sweetpotato and Tigernut Drink

COMPOSITION	A (100% TND)	B (90% TND)	C (80% TND)	D (70% TND)
TND (ml)	500	450	400	350
SPD (ml)	0	50	100	150
TND+SPD (ml)	500	500	500	500

Key: TND = Tigernut Drink; SPD = Sweetpotato Drink

Proximate Analysis

Moisture, ash, crude protein, and crude fibre, were determined according to standard methods (A.O.A.C., 1990), carbohydrate was determined by difference.

International Journal of Natural Sciences
ISSN 2958-9126 (Online)
Vol. 3, Issue 1, No. 5, pp 54 - 63, 2022

www.iprjb.org

Mineral Content Analysis

The mineral content of the products were determined by the AOAC (2010) method using AAS.

Sensory Evaluation

Procedure for this evaluation is as explained by Lawless and Heymann (2010). A seven point Hedonic scale (1-7) was used for the sensory evaluation of the SP-TN Beverage Drink prepared samples using 20 semi-trained sensory assessors and they were trained to score for taste, flavor, colour, and General acceptability independently and objectively (without bias) with a pre-trial scoring test. In the sensory analysis, with the 7-point Hedonic scale, 7 = like extremely, 6 = like highly, 5 = like, 4 = neither like nor dislike, 3 = dislike, 2 = dislike highly and 1 = dislike extremely,

RESULT AND DISCUSSION

Table 2: proximate composition of tigernut-sweetpotato blend

Samples	Moisture	Carbohydrate	Protein	Fat	Fiber	Ash
A	60.02	10	8.5	12.3	7.1	1.08
B	63.72	9	8.2	11.04	6.06	0.98
C	64.5	9	8.1	10.7	5.4	0.7
D	68.14	8.5	8.4	8.46	5.1	0.49

Key: A= 100% TND : 0% SPD; 90% TND : 10% SPD; 80% TND : 20% SPD; 70% TND : 30% SPD; TND= Tigernut drink; SPD= Sweetpotato drink

Proximate Composition

The result for the proximate composition is presented in table 1. There was general increase in the percentage composition of all the analyzed components. The moisture content of the drink ranged from 60.02 % in sample D (70 % TND: 30 & SPD) to 68.14 % in sample A (100 % TND). A continuous increase in the amount of moisture in all the samples was observed. The result is comparable with of Udeozor, L.O. (2012) who analyzed proximate composition of tigernutsoybean milk drink. Although moisture is one of the important constituent in beverage production, the increase in the moisture indicates increase in concentrations of other components and is as a result of blending with sweetpotato drink. Carbohydrates also called saccharides, (the components responsible for the sweet taste of both the tigernut and the sweet potato) were found to be 10.00 %, 9.00 %, 9.00 %, and 8.50 % for sample A, B, C, and D respectively. The sugar content decreases with increased in the percentage of the sweetpotato. Similar observation was made by Maduka and Ire (2018) for fresh tigernut.

International Journal of Natural Sciences
ISSN 2958-9126 (Online)
Vol. 3, Issue 1, No. 5, pp 54 - 63, 2022

www.iprjb.org

However, this amount is still enough for consumption of people that are medically diagnosed and advised to put hands on less sugar containing beverages. The amount may also contribute to the inherent sweetness of prepared blended drink. Protein content of the samples also decreased with the corresponding increase in the sweetpotato quantity of the blend. It was 8.50 % in the control (100% TND) and 8.40% in sample D and it is in line with findings of Nwaoguikpe (2010) on the comparative proximate analysis on small and large types of tigernut. Despite the decrease in percentage protein in the blended samples, consuming blended beverage drink from tubers (tigernut and sweetpotato) may contribute to the amino acids requirements of an individual. The fat contents of the samples were analyzed and result was impressive since tigernut (sample a) drink is seen to contain 12.30 % with slight decline in % fat content of the blended samples. The microscopic dispersed fat particles contained by the beverage would have probably improved the organoleptic attributes of the prepared drink.

Tigernut is known to have good quality fatty acids that have disease extinguishing properties. For this reason, this drink can still be excellent for people suffering from bad cholesterol and other related diseases. Fibre content (which is found to be in the range of 7.10 %- 5.10 % from sample A- D) of the prepared beverage blend was as expected because a study reported by Ndubuise (2009) have shown tigernut to contain higher fiber contents (of 13.29 %) in relation to the rest of root tubers. The result for the fibre content in the samples of blend of (tigernut drink- sweetpotato) drinks is relatively higher in comparison to not only other commercial beverages but also most cereals based food product. And the values are comparable with that of fruits and vegetables as reported by Jimoh Abdulfatai (2013). This fibre has ability to reduce diabetes because it lessens glucose level thereby stabilizes the glucose-insulin proportion in the blood. Ash content of 1.08% was analyzed in the control (sample A). The other blended samples (B, C, and D) have shown uninterrupted decrease in the ash contents. The decrease was probably due to the sweetpotato since tigernut drink was reported to contain 1.80□0.02 (chima *et al*, 2013). Ash content of a given food sample is an indirect measure of the minerals quantity of the food sample. Therefore it can be inferred that the blending of tigernut and sweetpotato drink will quietly yield considerable mineral content.

Table 3: Mineral Composition of Tigernut-Sweet Potato Blend

Samples	Zinc(mg/100g)	Calcium (mg/100g)	Sodium (mg/100g)	Potassium (mg/100g)
A	26.94	63.32	5.83	566.67
B	38.33	58.33	8.38	987.00
C	48.34	42.65	10.83	1056.67
D	53.89	48.33	11.67	1166.67

Key: A= 100% TND: 0% SPD; 90% TND: 10% SPD; 80% TND: 20% SPD; 70% TND: 30% SPD; TND= Tigernut drink; SPD= Sweetpotato drink

International Journal of Natural Sciences
ISSN 2958-9126 (Online)
Vol. 3, Issue 1, No. 5, pp 54 - 63, 2022

www.iprjb.org

Mineral Content

Table 3 shows the mineral composition of drink samples A, B, C, and D produced from tigernut and sweetpotato blends in the ratios 100:0, 90:10, 80:20, 70:30 respectively. The value of calcium (ranged from 42.65-63.32 mg/100g) decreased across the samples. Oladele and Aina, (2007) reported that the tigernut (brown variety) has the high calcium content of (140 mg/100g), therefore the decrease was probably due to supplementation. Potassium which occur between 566.67 – 1166.67 mg/100g and zinc that ranged from 26.94 to 53.67 mg/100g were relatively higher than most commercial beverages. This could be attributed to the appreciable amount of potassium and zinc found in tigernut (Bado, *et al.*, 2015). Zinc plays part in many biological functions such as reproduction. Sodium (5.83 – 11.67 mg/100g range) increased with increase in the level of substitution. Minerals are vital for the overall mental physical well-being and are important constituents of bones, teeth, tissues, muscles, blood, and nerves cells. They generally help in maintenance of acid base balance, response of nerves to physiological stimulation and blood clotting (Ukpabi & Esther, 2015).

Sensory Analyses

Preference of panelists for color, aroma, taste and general acceptability were obtained in this order of increase in preference; D & C (with equal degree of preference) B, and A; B, A & C (with equal degree of preference), and D; A, B & C & D (with equal degree of preference) respectively as shown in Figure 4. Sample D (*70% TND: 30% SPD)* and C (*80% TND: 20% SPD)* were ranked highest among the samples with most preferred test, aroma, and general acceptability with D being slightly higher than C. This high level of preference in samples D and C was as a result of the increase quantity of sweet potato drink in the tigernut. Sample A *(100% TND*) and B (*90% TND: 10% SPD)* have the least preferences in almost all the attributes. This suggests that consumers preferred tigernut drink that is complemented with sweet potato drink due to organoleptic characteristics improvement provided by the sweet potato drink.

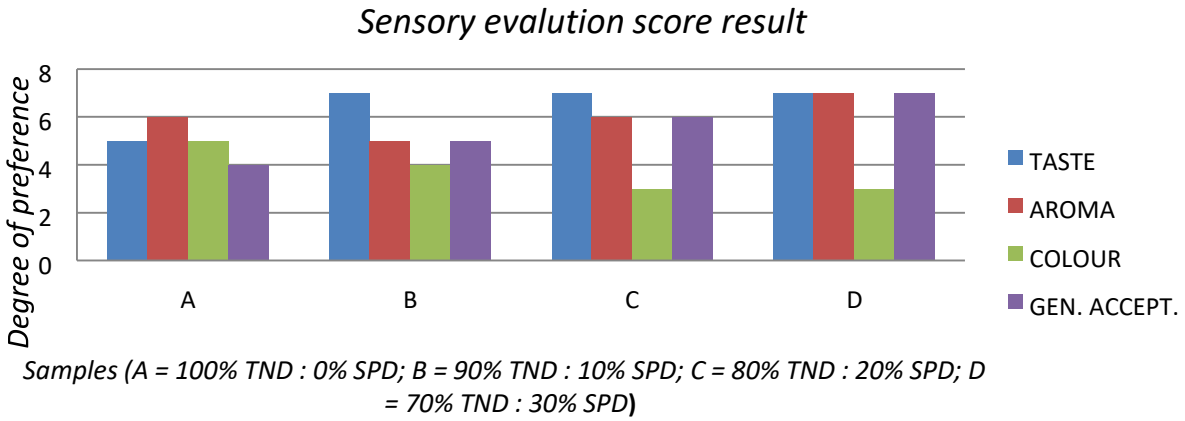

Figure 2: Sensory Evaluation of Tigernut And Sweetpotato Beverage Drink Blend

Conclusion

Generally, the formulated beverage drink from the tubers (tigernut and sweetpotato) had reasonable nutritional quality and a high rating sensory score in consumer test as expected. Thus can be prepared for commercial purpose to serve as a special beverage with similar constituents as other already existing commercial fruit juices/beverages and to expand the limited use of sweet potato thereby increasing its economic value and reduce the massive importation of tigernut in the country.

REFERENCES

Aina, A.J., Falade, K.O., Akingbala, J.O., and Titus, P. (2010). Physicochemical properties of Caribbean sweet potato (*Ipomoea batatas* (L) Lam) starches. Food Bioprocess Tech. 9-16.

Akissoe, N., Hounhouigan, J., Mestres, C., and Nago, M. (2003). How blanching and drying affect the colour and functional characteristics of yam (Dioscorea cayenensisrotundata) flour. *Journal of Food Chemistry*, 82: 257-264.

AOAC (2000) Official Methods of Analysis.Association of official Analytical chemists (17th Edn), Washington DC.

Bado, S., Bazongo, P., Son, G., Kyaw, M.T., Forster, B.P., Nlelen, S., Lykke, A.M., Ouèdragon, A., Bassole, I.H.N. (2015). Physicochemical characteristics and composition of three morphotypes of *Cyperus esculentus* tubers and tuber oils. J. Ana. Methods Chem.;1-8.

Chima, O. A., Abuajah, C. I., Utuk, R. A. (2013). Tigernut milk: A nutritious under-utilized food ingredient. *Food Biochemistry*, 2(2):14-17.

Jimoh Abdulfatai, Saka, A.A., Afolabi, A.S., and Diana, K. (2013). Development and Characterization of Beverages from Tigernut Milk, Pineapple and Coconut Fruit Extracts.

Applied Mechanics and Materials, 248:304-309

Maduka, N., Ire, F.S. (2018). Studies on tigernut-ogi incorporated into basal feed as a potential animal growth enhancer using wistar albino rats as experimental animal. *Journal of Advance Microbiology*, 8(2):1 15.

Muhammad, S., Rehmanullah, K., Shamsurrehman, A., Muhammad, I., and Bibi, M. (2013).preparation and quality evaluation of sweet potato ready to drink beverage *ARPN Journal of Agricultural and Biological Science,* 8(4): 279-282, issn 1990-6145,

Mwanja, Y.P., Goler, E.E., Gugu, F.M. (2017). Assessment of root and vine yields of sweet potato (*Ipomoea batatas* (L.) Lam) Landraces as influenced by plant population density in JosPlateau, Nigeria.international journal of agricultural research, 12(2): 88-92

Ndubisi, L.C. (2009). Evaluation of food potentials of tigernut tubers (*Cyperus esculentus*) and its products (milk, coffee and wine). *M. Sc Dissertation Department of Home Science Nutrition and Dietics University of Nigeria Nsukka*, 1-90.

Nwaoguikpe, R. N. (2010). The phytochemical, proximate and amino acid compositions of the extracts of two varieties of tigernut (*Cyperus esculentus)* and their effects on sickle cell hemoglobin polymerization. *Journal of Medical Sciences*, 1(11):543-549.

Okudu, H.O., Ogubuike, L.A. (2016). Evaluation ofchemical composition of candy developed from tigernut (*Cyperus esculentus*) milk. *African Journal of Food Science and Technology*, 7(1):027-031.

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.

Udeozor, L.O. (2012).Tigernut-Soy Milk Drink: Preparation, Proximate Composition and Sensory Qualities. *International Journal of Food and Nutrition Scienc,e*1(4): 18-26

Ukpabi, U.J., Ukenye, E.A. (2015). An assessment of wholesomeness of imported tiger nut *Cyperus esculentus* used as snack food in Umuahia, Nigeria. *Malaya Journal of Bioscience*, 2(2):132-138.

Vimala, B., Nambisan, B., and Hariprakash, B., (2011). Retention of carotenoids in orange-fleshed sweet potato during processing. *Journal of Food Science and Technology*, 48(4): 520- 524.

Xiao, H.W., Lin, H., Yao, X.D., Du, Z.L., Lou, Z., and Gao, Z.C. (2009). Effects of different pretreatments on drying kinetics and quality of sweet potato bars undergoing air impingement drying. *International Journal of Food Engineering*, 5(5)