

# Nutritional Composition and Quality Acceptability of Soft Candy (Toffee) Made from Tiger nut

Ani, I.F.<sup>1\*</sup>, Adeoye, B.K.<sup>1</sup>, Ngozi, E.O.<sup>1</sup>, Kehinde, Z. A.<sup>1</sup>

<sup>1</sup> Department of Nutrition and Dietetics, Ben Carson Snr School of Medicine and Surgery, Babcock University, Ilishan-Remo, Ogun State, Nigeria

\*Corresponding author

**Abstract:** - Tiger nut is an important food crop for certain tribes in Africa. Nutritive, digestive and disinfective value of Tiger nut has been documented. This research work was intended to improve the recipe for preparation of toffee by incorporating tiger nut milk, as a nutritional enrichment because of its nutritional benefits. Toffee a soft candy was made into three samples; sample B (100% cow milk), sample C (50% milk and 50% tiger nut milk) and sample D (100% tiger nut milk), these were compared with Sample A (commercial toffee; Éclairs). Nutrient composition, quality acceptability and microbial count were determined. Sample D had the highest moisture, carbohydrate, dietary fiber, crude fiber and the lowest crude protein, crude fat contents. These were all significant ( $p > 0.05$ ) Sample A (commercial sample; éclair's) was ranked highest for flavor, color, texture, taste, texture, and overall acceptability. Samples C and D were ranked lowest in texture and taste, sample B was above average for all parameters and sample C and D were above average for flavor, Odor, Color and Overall acceptability, which were all significant at  $p > 0.05$ . value ranged from  $1.0 \times 10^{-1}$  to  $6.4 \times 10^{-2}$  for samples B to D, For total fungal count, sample C had the highest count of  $1.7 \times 10^{-2}$  for day 0, and  $6.4 \times 10^{-2}$  for 4 weeks and sample B had the lowest count of  $1.0 \times 10^{-1}$  for day 0 and 4 weeks. Sample B had a total count of  $1.0 \times 10^{-1}$  for both day 0 and 4 weeks. There were no bacterial growth in samples C and D.

**Key Words:** Nutrient composition, Quality Acceptability, Tiger Nut, Toffee

## I. INTRODUCTION

Tiger nut (*Cyperus esculentus*) an underutilized tuber of family Cyperaceae, produces rhizomes from the base of the tuber that is somewhat spherical [1]. It is a tuber that grows freely and is consumed widely in Nigeria, other parts of West Africa, East Africa, parts of Europe particularly Spain, as well as in the Arabian Peninsula [2]. Recently, there is awareness for increased utilization of tiger nut [3] and [4]. [5], revealed that tiger nut tubers have high calcium, sodium and phosphorus and low magnesium, manganese, iron, zinc and copper mineral contents. The high values of calcium found, are adequate for bone and teeth development in infants. The presence of other minerals such as iron is highly important because of its requirement for blood formation. [6], also confirmed that tiger nut is high in starch, oil, minerals, and vitamins E and C which all add to the nutritional quality of tiger nut.

Candy, also called sweets, toffees or lollies is a confection that features sugar as a principal ingredient. The category, called sugar confectionery, encompasses any sweet confection, including chocolate, chewing gum, and sugar candy. Vegetables, fruit, or nuts can also be inculcated to produce candy or toffees with higher nutritional quality

Food habits of young people (children and adolescents) are such that they consume more of sweetened beverages, sweets, fruit candy and chocolate [7], as a result, they will benefit from this toffee made with tiger nut. Thus, there is a need to improve on the nutritional quality of these products so that the nutritional needs of young people could be met. In addition, toffee produced with milk cannot be consumed by people with lactose intolerance [8]. Moreover, tiger nut tubers have been underutilized over the years.

Toffees are chewable confectionery items containing sugar, milk solids and butter or vegetable fat as the major ingredients. Due to their taste and flavor, they enjoy wide popularity. This popularity could be put to proper use by increasing the nutritive value of toffees in terms of proteins, minerals and vitamins [9].

Incorporation of fruit into toffee contributes towards improving the nutritional content of the toffees [10], carried out a work on fortification of fruit and Ginger toffees with Soybean for protein rich toffees and reported the possibility of supplementation of natural ingredients for fruit based toffee making.

## II. MATERIALS AND METHODS

The yellow variety of tiger nut (*Cyperus esculentus*) tubers were purchased from a local market in Ilishan Remo, Ogun state, Nigeria. The margarine, sugar, evaporated milk and commercial toffee (Éclairs) were bought at Babcock University Superstore, Ilishan-Remo Ogun state.

### *Preparation of tiger nuts milk*

The yellow variety of tiger nut (*Cyperus esculentus*) tubers were thoroughly sorted to remove the stones, pebbles and bad ones before it was weighed. The sorted tiger nuts were washed with clean tap water after which it was blended with an electric blender and sieved with a muslin material to extract milk of fine consistency

*Preparation of toffee*

Sample B :in a non-stick pan, 250ml of evaporated milk was poured, 250ml of water was added, also 220gm of sugar and 30gm of butter, then stirred. The mixture was then heated over a medium heat stove, continuously stirred until the mixture became thick. One teaspoon vanilla essence was then stirred properly into the mixture. It was then poured and spread in a baking tray that was brushed with butter, then cut into shapes while still warm and refrigerated.

Sample C: was prepared by replacing the milk with 50% tiger nut milk and 50% evaporated milk. Sample D: had the milk replaced with 100% tiger nut milk

*Determination of Proximate Composition*

The samples were analyzed for moisture, ash, crude fiber, crude protein, crude fat, carbohydrate, gross energy and dietaryfiber.The Samples were analyzed using Association of Official Analytical Chemist [11] methods.

*Sensory analysis:*

The toffee samples were compared to commercially produced toffee(Éclair’s Cadbury plc), Sample A. A ten-membered untrained panel which consisted of students of Nutrition and Dietetics Department, of Babcock University, Ogun State, was used to evaluate the various sensory parameters (flavor, color, taste, texture and overall acceptability) on a 9 point hedonic scale.

*Data Analysis:*

Data obtained were subjected to analysis of variance (ANOVA) and the mean were separated by the Least Significant Difference (LSD) using SPSS version 20.0

*Microbiological Analysis*

Duplicate samples types were taken at 0 day and 4 weeks andanalyzed separately for fungal and bacteria activity.

III. RESULTS AND DISCUSSIONS

The values obtained for Moisture content ranged from 1.26 % to 4.25 %, sample A with the lowest value and sample D with the highest value. Crude protein values ranged from 4.09% to 7.63%. Crude fat values ranged from 26.91 % to 33.54 %, sample D with the lowest value and sample A has the highest value. Crude fiber value ranged 0.23 % to 0.87 %, sample A with the lowest values and sample D has the highest value. Ash values ranged from 1.47 % to 1.95 %. Carbohydrate value ranged from 54.75% to 63.05%. Gross energy values ranged from 6.48 % to 11.57 %. Dietary fiber values ranged from 2.45 % to 3.16 %. The differences were all significant (p<0.05).

The moisture content of the samples were in contrast with the result of the moisture content of Bael fruit toffees by [12],who got a mean of 11.03%. Crude fat and crude protein were higher than in soft date toffee by[9]. Toffee made from tiger nut will have healthy fat because it is plant based.

Table 1 Proximate Analysis (%)

VARIABLES	SAMPLES			
	A	B	C	D
MOISTURE CONTENT	1.26 <sup>d</sup> ±0.20	1.39 <sup>c</sup> ±0.20	1.45 <sup>b</sup> ±0.20	4.25 <sup>a</sup> ±0.20
CRUDE PROTEIN	7.63 <sup>a</sup> ±0.05	6.38 <sup>b</sup> ±0.11	5.60 <sup>c</sup> ±0.06	4.09 <sup>d</sup> ±0.11
CRUDE FAT	33.54 <sup>a</sup> ±0.02	31.87 <sup>b</sup> ±0.02	29.89 <sup>c</sup> ±0.02	26.91 <sup>d</sup> ±0.03
CRUDE FIBRE	0.23 <sup>d</sup> ±0.02	0.61 <sup>c</sup> ±0.03	0.76 <sup>b</sup> ±0.02	0.87 <sup>a</sup> ±0.02
ASH	1.95 <sup>a</sup> ±0.02	1.85 <sup>b</sup> ± 0.03	1.74 <sup>c</sup> ±0.02	1.47 <sup>d</sup> ±0.02
CARBOHYDRATE	54.75 <sup>d</sup> ±0.04	57.75 <sup>c</sup> ±0.02	60.72 <sup>b</sup> ±0.07	63.05 <sup>a</sup> ±0.06
GROSS ENERGY	11.57 <sup>a</sup> ±0.00	11.40±0.00	9.35 <sup>c</sup> ±0.00	6.48 <sup>d</sup> ±0.00
DIETARY FIBRE	2.45 <sup>d</sup> ±0.03	2.86 <sup>c</sup> ±0.02	2.95 <sup>b</sup> ±0.02	3.16 <sup>a</sup> ±0.03

Sample A - commercial toffee  
 Sample B - 100% Evaporated milk  
 Sample C - 50% Evaporated milk and 50% Tiger nut milk  
 Sample D - 100% tiger nut milk

The sensory mean scores of the different samples of toffee, for color, the value ranged from 6.10 to 7.70, the highest value is 7.70(sample A) and the lowest is 6.10 (sample D), this was significantly different (p>0.05), Odor values for the samples ranged from 5.50 to 7.70, the highest value is 7.70 (sample A)

and the lowest is 5.50 (sample C), Texture values for the samples ranged from 4.20 to 8.00, the highest value is 8.00 (sample A) and the lowest value 4.20 (sample D), for taste the value for the sample ranged from 4.40 to 8.20, the highest is

8.20 (sample A) and the lowest 4.40 (sample C, D), significantly different ( $p>0.05$ ).

Sample A (commercial toffee) had the highest value for color, odor, texture, taste and overall acceptability, followed by sample B (100% milk), the lowest was sample C (50% milk

and 50% tiger nut milk), sample D(100% tiger nut milk) had a higher acceptability than sample C (50% milk and 50% tiger nut milk), these were significantly different at ( $p>0.05$ ). The result obtained from this study differs from the findings of [9] in terms of color, appearance, texture, flavor, taste and overall acceptability of the product.

Table 2. Sensory Evaluation

SAMPLES	COLOUR	ODOUR	TEXTURE	TASTE	OVERALL ACCEPTABILITY
A	7.70 <sup>a</sup> ±0.68	7.70 <sup>a</sup> ±1.25	8.00 <sup>a</sup> ±0.82	8.20 <sup>a</sup> ±0.79	8.20 <sup>a</sup> ±0.79
B	7.10 <sup>ab</sup> ±0.99	6.90 <sup>ab</sup> ±0.99	7.00 <sup>a</sup> ±1.70	7.30 <sup>a</sup> ±1.42	7.50 <sup>a</sup> ±1.85
C	6.30 <sup>b</sup> ±1.83	5.50 <sup>b</sup> ±1.72	4.60 <sup>b</sup> ±1.84	4.40 <sup>b</sup> ±2.37	5.20 <sup>b</sup> ±1.23
D	6.10 <sup>b</sup> ±1.66	5.80 <sup>b</sup> ±1.87	4.20 <sup>b</sup> ±2.20	4.40 <sup>b</sup> ±2.17	5.70 <sup>b</sup> ±2.17

Sample A - commercial toffee

Sample B - 100% Evaporated milk

Sample C - 50% Evaporated milk and 50% Tiger nut milk

Sample D - 100% tiger nut

Table 3 shows the range of microbes in the samples. The result obtained shows that the value ranged from  $1.0 \times 10^{-1}$  to  $6.4 \times 10^{-2}$  for samples B to D, sample A (commercial sample: Éclairs) was the control and had no microbial growth. For fungal count, sample C had the highest count of  $1.7 \times 10^{-2}$  for day 0, and  $6.4 \times 10^{-2}$  for 4 weeks and sample B had the lowest count of  $1.0 \times 10^{-1}$  for day 0 and 4 weeks. For bacteria total count, sample B has a total count of  $1.0 \times 10^{-1}$  for both day 0 and 4 weeks and other samples had no bacteria growth. Sample A had no microbial growth which is as a result of preservatives added commercially to the product which inhibits candy spoilage.

The result of the study provides information on the nutrients content, acceptability and microbial count of tiger nut toffee. Tiger nuts are rich in energy giving nutrient carbohydrate, they are fairly low in protein content. The acceptability of tiger nut toffee was above average.

Processing method or techniques either increased or decreased the nutrient contents of tiger nut. Generally, all the processing methods (heating process) significantly increased carbohydrate content of tiger nut, although the increase in carbohydrate could also be due to the sugar added during the preparation of toffee.

Table 3. Microbiological Quality of Toffee Samples Stored For Four Weeks

	Weeks	Samples			
		A	B	C	D
<b>Total bacteria</b>	0	-	$1.0 \times 10^{-1}$	-	-
<b>(cfu/ml)</b>	4	-	$1.0 \times 10^{-1}$	-	-
<b>Total fungal</b>	0	-	$1.0 \times 10^{-1}$	$1.7 \times 10^{-2}$	$4.0 \times 10^{-1}$
<b>(cfu/ml)</b>	4	-	$1.0 \times 10^{-1}$	$6.4 \times 10^{-2}$	$8.0 \times 10^{-1}$

Sample A - commercial toffee

Sample B - 100% Evaporated milk

Sample C - 50% Evaporated milk and 50% Tiger nut milk

Sample D - 100% tiger nut milk

IV. CONCLUSION

Tiger nuts and its product could be used in the diet, to supplement other food products. More research should be done on how to make tiger nut toffee a success so that people with lactose intolerance can consume toffee, more studies should also be done on the preservation of the Tiger nut toffee.

REFERENCES

[1]. Devries F. and Feuke T (1999) Chufa (Cyperus esculentus) A weedy cultivar or cultivated weed? Econ. Bot., 45: 27-37  
 [2]. Abaejoh, R., Djomdi, I. and Ndojounkeu, R. (2006). Characteristics of tigernut (Cyperus esculentus) tubers and their

performance in the production of a milky drink. J. Food Process Preservatives, 30: 145-163  
 [3]. Belew M. A. and Abodunrin, A. O. (2006). Preparation of kunnu from unexploited rich food source: Tigernut (Cyperus esculentus). World Journal of Dairy and Food Sciences. 1: 19-21.  
 [4]. Belew, M.A and Belew, K.Y. (2007). Comparative physico-chemical evaluation of tiger nut soybean and coconut milk sources. Int. J. Agric. Biol., 9: 785-787  
 [5]. Shaker, M. A., Ahmed, M. Gaafar, Amany M. Basuny and Shereen L. Nassef (2009). Chufa Tubers (Cyperus esculentus L.): As a New Source of Food. World Applied Sciences Journal 7(2): 151-156.  
 [6]. Jing S. Ebeydulla R., Zeng-hui C., and Yao-xiang W. (2016) Nutritional profiles of tiger Nut (Cyperus esculentus) plants organs

- during its growth cycle. *African Journal of Biotechnology* 15(22): 1050-1057
- [7]. Larson N.I, Story M.T, Nelson M.C (2009), Neighborhood environments: disparities in access to healthy foods in the U.S. *American Journal of Preventive Medicine* 36(1):74-81
- [8]. Tuula H. Vesa , Philippe Marteau and RiittaKorpela (2013). Lactose Intolerance. *Journal of the American College of Nutrition*, 19(2): 165-175.
- [9]. Khapre, A.P. and Umar, A.S. (2006) Standardization of technology for development of Soft date (*Pheonixdactylifera*) toffee as a nutritional enrichment of confectionery. *Asian J. Dairy & Food Res*, 35(4) 2016:335-337
- [10]. Chauhan S.K. and Sharma R.C. (1997) Fortification of fruits and ginger with soybean for protein rich toffees. *The Indian Journal of Nutrition and Dietetics*. Volume 34(5): 134-139
- [11]. AOAC, (2005) Official methods of analysis 18th ed. Washington: Association of Official Analytical Chemist.
- [12]. Devendra Kumar Bhatt and Shweta Verma (2016) A Study on Development of Herbal Food Product- Bael (*Aegle Marmelos*) Fruit Toffee. *Journal of Environmental Science, Toxicology and Food Technology* .Volume 10(3): 05-14