

Nutritional, Sensory and Microbiological Quality Assessment of fortified Zobo Drink: A Home-Prepared Traditional Nigerian Beverage

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Abstract

The specific objective of this study was to assess the nutritional, microbiological and sensory qualities of the home-made zobo which was fortified with soybean milk. The Nutritional, safety and sensory analysis of zobo drink (A home-prepared Traditional Nigeria beverage) were assessed. The Nutrient content was enriched with soybean. The beverage was prepared using traditional methods with or without fortification with soybean at the ratio of 2:1 (v/v). Similar samples of the beverage were also brought from the vendors and compared with the laboratory prepared samples. Nutrient values were evaluated on the samples from vendors as well as fortified samples using AOAC while bacteriological quality were analysed using Nutrient and MacConkey agar. Sensory evaluation was carried out on the local beverage fortified with soybean using 1 to 9 hedonic scale by 48 panelists. Chemical analysis revealed an improved nutrient content in zobo drink fortified with soybean compared with home-prepared and laboratory beverage. The values of protein, fat and carbohydrate content of fortified and home prepared beverage were 3.0 ± 0.8 g, 9.0 ± 0.8 g, 6.8 ± 0.8 g and 2.5 ± 0.6 g, 8.5 ± 0.7 g, 6.5 ± 0.7 g respectively comparing the results of laboratory samples monitored along critical control points of processing of the beverage with vendors samples, it was revealed that no pathogenic organisms were recorded. The result of microbiological quality showed that the following microorganisms were isolated from vendors samples (*E. coli*, *Klebsiella* sp. *Bacillus* sp.). The fortified beverage could be a source of contribution to the daily nutrient intake of an individual and should be made available in Nigerian markets to improve the Nutritional status.

Keywords: Beverage; Home-prepared; Non-alcoholic beverage; Nutritional quality; Traditional Nigerian beverage

Introduction

Zobo drink is one of the locally made beverages in Nigeria and Africa. It is prepared through an indigenous technology from plant (roselle) flower, scientifically known as *Hibiscus sabdariffa* which belongs to a plant family *Malvaceae*.

People prefer zobo drink to the carbonated drinks because it is rich in natural carbohydrate, protein, antioxidants, vitamin C, calcium, magnesium and zinc. It is non-alcoholic, medicinal and has low glycemic index [1,2].

Zobo is becoming acceptable in social gathering because it is economically affordable and attractive to many people more than soda [3]. Increase in religious and health campaigns against alcoholic beverages in Nigeria and the consequent decrease in the consumption of alcoholic beverages in certain areas has afforded Zobo drink great potential as a local alternative to imported red wines in particular and alcoholic beverages in general [4].

Recently, zobo drink has become a main source of income in many homes both in rural communities and more in the urban areas where cottage business has increased due to support from the government through the poverty alleviation schemes, thereby alleviating poverty among the people [5].

Based on the numerous merits of zobo drink, many researchers had worked on examining its nutritional value, sensory quality and medicinal properties. Zobo was found to be very rich in vitamin C, other antioxidants and minerals (such Potassium, Sodium and Phosphorus) but low protein [3,4,6]. This accounts for its limitation to solve protein-energy malnutrition.

After fortifying it with other foods, shelf life of zobo was more enhanced and its drink was more acceptable among the populace. Fasoyiro et al. [6] flavoured Roselle extract (zobo) with orange, pineapple

and apple. Adesokan et al. [7] blended zobo drink with extract of ginger and garlic. Ezearigo et al. [8] worked to increase the shelf of zobo by fortifying it with 4 natural spices namely, ginger, garlic, cinnamon and nutmeg.

There is dearth in knowledge in regard to the impacts of soybean to zobo drink. Yet, soy bean has high nutritional value and its milk is found to be rich in protein and isoflavone, with shelf life of six month when packed in tetra pack and some weeks when it is stored in the refrigerator [9]. This study was designed to assess the quality of zobo drink fortified with soy milk.

Materials and Methods

This study was carried out in Ibadan, Oyo state, Nigeria between January 2015 and June 2016.

Production of Zobo drink

Zobo drink was produced locally by extraction from the sorrel calyx (*Hibiscus sabdariffa*). The plant was rinsed properly before boiling in water for about 15 min with ginger. After boiling, it was sieved and flavored with pineapple flavor. The drink was cooled, packaged and refrigerated. Zobo drink was prepared by simulating the traditional method.

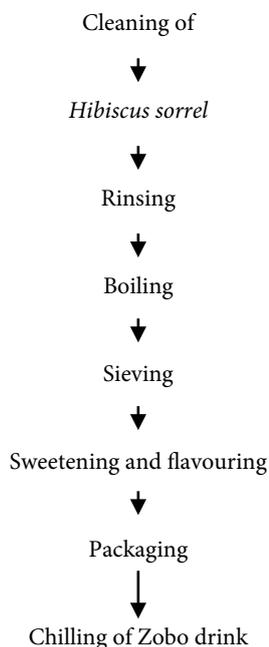
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Home preparation of Zobo



Nutritional analysis

Nutrient values were evaluated using the methods of the Association of analytical chemist [10]. Bacteria counts were analysed using nutrients, MacConkey and MRS agar using pour plate method of Harrigan and McCance [11].

Sensory evaluation of Zobo drink

Sensory quality was determined using Tukey's multiple range tests. The Least Significant Difference (LSD) was calculated using Analysis of Variance (ANOVA) according to Larmond [12].

For the sensory quality assessment of Zobo drink fortified with soybean, forty eight (48) panelists were recruited from the staff and students of the faculty of technology, University of Ibadan and others from the public, 24 females and 24 males participated in the study. A sensory evaluation was made on the local beverages fortified with soybeans using 1 to 9 hedonic point-scales.

Statistical analysis

Analysis of Variance (ANOVA) and the Fisher (LSD) test for multiple comparisons were used to determine significant differences between the test beverage G1 and II values. Statistical Analysis was conducted using statview student TM software (Version 4, Abacus concepts Inc, Berkeley, Ca, USA) significant was assumed at $P < 0.05$.

Results

Proteins, carbohydrate, fat, ash and moisture content of zobo samples are presented in Table 1. Fortified Zobo (FZ) had the highest protein value of 3.0 ± 0.8 g/100 g while laboratory prepared zobo drink had 2.5 ± 0.6 /100 g. Commercially prepared Zobo drink had the least value of 2.3 ± 0.9 g.

The carbohydrate content of FZ, LZ and CZ were 9.0 ± 0.8 g, 8.5 ± 0.7 g and 8.3 ± 0.8 g respectively.

From the result, fat content of the beverage as presented by Table 1 shows that fortified zobo drink had the highest fat content of 6.8 ± 0.8

g. LZ had fat content of 6.5 ± 0.7 g and CZ had the least value of 6.2 ± 0.8 g.

The highest ash content was present in zobo sample FZ with the value of 1.8 ± 0.3 g. LZ had 1.5 ± 0.2 g while the least ash content (1.3 ± 0.1 g) was found in CZ. The moisture content of CZ, LZ and FZ are 95.1 ± 0.4 g, 94.5 ± 0.5 g and 92.5 ± 0.4 g respectively.

Table 2 presents the mineral and vitamin C composition of zobo drinks. The highest (3.5 ± 0.5 mg) Calcium content was found in FZ, followed by 3.0 ± 0.4 mg (LZ) and the least value (2.8 ± 0.3 mg) was in CZ. On Phosphorus value, FZ had the highest Phosphorus concentration of 2.0 ± 0.5 mg, LZ had 1.8 ± 0.2 mg and CZ had the least value of 1.7 ± 0.1 mg.

Potassium content of FZ, LZ and CZ were 2.6 ± 0.4 mg, 2.4 ± 0.3 mg and 2.0 ± 0.2 mg respectively. Likewise, copper values of FZ, LZ and CZ were 0.5 ± 0.03 mg, 0.4 ± 0.02 mg and 0.2 ± 0.01 mg respectively.

The result of Manganese content revealed that FZ had the highest value of 1.8 ± 0.3 mg; LZ had 1.5 ± 0.2 mg while CZ had the least value (1.2 ± 0.1 mg). Vitamin C content in FZ was the highest value (1.5 ± 0.3 mg), followed by CZ and LZ with ascorbate value of 1.0 ± 0.8 mg and 1.0 ± 0.2 mg respectively (Table 2).

The microbial count from fortified (enriched) recipe for Zobo (Z) is presented in Table 3. The mean values of CZ had high bacterial counts and thereby *E. coli*, *Klebsiella* sp., *Proteus* spp. and *Bacillus* sp. were found at the stage of steeping, sieving, boiling and packaging respectively. For laboratory prepared LZ, 2.0×10^2 cfu/ml counts was recorded during steeping, sieving, but no growth during boiling and packaging. Similarly, for FZ, 2.0×10^2 cfu/ml was recorded for steeping and sieving while no growth was found after boiling and packaging (Table 3).

It was observed that after boiling the products (LZ, FZ) with high temperature, no growth was recorded, because of the hygienic conditions given to the laboratory zobo (LZ) and fortified zobo (FZ) prepared for all the samples.

Mean value of forty eight (48) judge's scores. Mean for each attribute followed by the same letters are not significantly different by Turkey's test. Higher values indicate greater preference.

The sensory evaluation of the beverage is presented on the Table 4. A significant difference was observed in taste, aroma, colour,

Beverage	Protein	CHO	Fat	Ash	Moisture
Cz	2.3 ± 0.9	8.3 ± 0.8	6.2 ± 0.8	1.3 ± 0.1	95.1 ± 0.4
Lz	2.5 ± 0.6	8.5 ± 0.7	6.5 ± 0.7	1.5 ± 0.2	94.5 ± 0.5
Fz	3.0 ± 0.8	9.0 ± 0.8	6.8 ± 0.8	1.8 ± 0.3	92.5 ± 0.4

CZ: Commercially prepared Zobo drink; LZ: Locally prepared Zobo drink; FZ: Fortified Zobo drink

Table 1: Proximate composition of locally produced beverage (g/100 g sample).

Beverage	Calcium	Phosphorus	Potassium	Copper	Manganese	Vit C
CZ	2.8 ± 0.3	1.7 ± 0.1	2.0 ± 0.2	0.2 ± 0.01	1.2 ± 0.1	0.8 ± 0.01
LZ	3.0 ± 0.4	1.8 ± 0.2	2.4 ± 0.3	0.4 ± 0.02	1.5 ± 0.2	1.0 ± 0.2
FZ	3.5 ± 0.5	2.0 ± 0.5	2.6 ± 0.4	0.5 ± 0.03	1.8 ± 0.3	1.5 ± 0.3

Table 2: Mineral and vitamin C composition of Zobo drink (mg/100 g).

Beverage	Steeping	Sieving	Boiling	Packaging
CZ	<i>E. coli</i>	<i>Klebsiella</i> sp.	<i>Proteus</i> spp.	<i>Bacillus</i> sp.
LZ	2.0×10^2	2.0×10^2	No growth	No growth
FZ	2.0×10^2	2.0×10^4	No growth	No growth

Table 3: Total bacterial counts of laboratory and Fortified Zobo (cfu/ml).

consistency and overall acceptability of the products as shown in Table 4. The overall acceptability of fortified zobo drink showed that majority of the judge's preferred Fortified Zobo (FZ) which had the mean score of 7.3 while commercial zobo drink (CZ) had the mean score of 5.3. There was significant difference between commercial zobo drink (CZ) and fortified zobo drink (FZ) samples ($p < 0.05$).

Discussion

Nutritional quality of home-prepared fortified Zobo drink

It was evident that the raw materials used in preparing the unfortified locally prepared zobo especially Hibiscus Sorrel, are deficient in protein by the result of the proximate composition [3]. The result of this study revealed that fortified zobo had more nutritional quality than the locally prepared and commercial zobo, in terms of Protein, Carbohydrate, Fat, Calcium, Phosphorus, Potassium, Maganesse and Vitamin C.

This increase in nutrient density especially of protein of the fortified zobo can be traced to the inclusion of soybean which is a plant food with inexpensive and convenient high protein quality [13]. The fortified zobo stands as a nutrient dense beverage useful to combat malnutrition and contribute to meeting the daily requirement of protein intake of many Nigerians.

Food fortification according to Shelton [14] is an essential element in nutrition strategies to alleviate protein deficiencies. Apart from protein, the carbohydrate, lipids, mineral and vitamin content of the beverage had been enhanced.

Sensory quality of home-prepared fortified Zobo drink

The sensory attributes (Taste, Aroma, colour, consistency and overall acceptability) of the beverage (z) results revealed that if the beverage was placed on the market, fortified zobo drink would be the best preferred by the consumers.

Microbiological quality of home-prepared fortified Zobo drink

Whereas for commercially prepared beverage especially samples collected from the rural areas, pathogenic organisms such as *E. coli*, *Klebsiella* sp. and *Bacillus* sp. were isolated from the finished products offered for sale to the public. It could be due to the unhygienic practices on the part of the producers of the beverage, poor personal hygiene, poor handling and poor source of water for the preparation of the beverage, and also the use of non-sterile packaging materials [15].

The bacteria isolates identified in this present study were similar to those reported by earlier workers. The presence of microorganisms observed in the beverage suggested that the raw materials contained some microbes either right from the source or during handling and even may be present in the containers used

Conclusion

In conclusion, the result of this study revealed that the home-prepared traditional Nigerian beverage (Z) can be fortified with soybeans. This fortified beverage with soybean had an increase in

macronutrients and was also widely accepted. The fortified beverage could be a source of contribution to daily nutrient intake of an individual and should be made available in Nigerian markets to improve the Nutritional status. The local producers were counseled to produce their beverages under hygienic conditions necessary. Good water should be used with clean containers while they should improve on their packaging system.

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Product	Taste	Aroma	Colour	Consistency	Overall Acceptability
CZ	5.2a	5.3a	6.8b	6.0a	5.3b
LZ	6.6b	7.3b	7.0b	6.8a	7.3a
FZ	7.0a	7.7a	7.8a	6.8a	7.3a

Table 4: Sensory attributes of Fortified Zobo.