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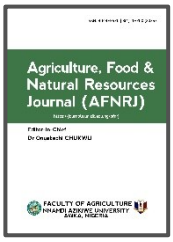

Original Article

Proximate composition and sensory properties of soy drink sold in Nnamdi Azikiwe University, Awka, Nigeria

OPEN ACCESS

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A B S T R A C T

A comparative study on the proximate composition and sensory properties of a laboratory-produced soy drink to those sold by vendors on the Nnamdi Azikiwe University (NAU) Awka campus was carried out. A total of six soy drink samples were randomly collected from different recognized selling points (Food Science and Technology (FST) food club = L1; Multipurpose Hall (MPH) = L2; Ifite school gate = L3; Faculty of Agriculture = L4; and Science Village = L5) in NAU, including a laboratory-produced sample (L0), and were subjected to proximate and sensory evaluation using standard procedure. The moisture, fat, protein, ash, fiber, and carbohydrate values ranged from 60.4-78.3, 0.56-2.5, 4.1-7.03, 0.22-3.01, 2.36-3.83 and 11.2-27.3%, respectively. It was observed that the soy drink sample from L1 had the highest values for protein (7.03%) and fat (2.5%) with the least moisture (60.4%), while the sample from L5 had the least carbohydrate value (11.2%). The soy sensory attributes of colour, taste, aroma, mouthfeel, and overall acceptability scored within ranges of 5.2-6.8, 1.8-7.8, 2.05-7.45, 4.1-6 and 2.65-7.4, respectively. The soy drink from L1 had the highest score for overall acceptability (7.4) with the acceptability index score of 82.2%, seconded by the L5 sample (62.9%). Hence, the soy drink from FST Food Club was the best among those tested.

K E Y W O R D S : *NAU main campus, Proximate composition, Sensory properties, Soy drink, Vendors*

INTRODUCTION

Soy drink is an aqueous extract from soybeans. It is increasingly valued globally not only as a dairy substitute but also for its nutritional ability in improving protein consumption especially for the populations that are lactose intolerant or those seeking for plant-based diets. In Nigeria, Soy drink offers a locally producible means to enhance protein intake as under nutrition and protein deficiency have remain a public health concern (Raque *et al.,* 2023).

Recently, reviews have shown that locally produced Soy drink sold commercially has substantial variability in their nutrients with protein, fat and micronutrient contents strongly influenced by soybean variety, processing techniques and formulation (Raque *et al.,* 2023). For example, a public health assessment in Calabar metropolis found Soy samples sold locally had moisture (86%), protein (4.4%), fat (1.37%), ash (2.22%) and carbohydrate (5.94%) (Ejimofor *et al.,* 2023) while in another work, Soy drink made from intermediate soy products processed with different steeping times showed differences in protein (3.05%), fat (4.5%), ash (0.5%), fiber (0.21%), moisture (84.45%) and carbohydrate (15.67%) (Emmanuel *et al.,* 2022).

Beyond proximate composition, sensory properties are vital determinants for considering the choice of the consumer for Soy drink (Sara *et al.,* 2024). Studies have also reported that a plant-based milk drink alternatives such as soy-based drinks usually

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score differently across sensory attributes based on its processing techniques (Sara *et al.,* 2024).

In majority of Nigerian university campuses, Soy drink is commonly produced and sold by informal vendors. The nutritional and sensory profile variation in the locally sold Soy drink by vendors has both nutrition and safety implications. Despite this evidence in the variation of the Soy drink sold by vendors, there appears to be a limited data on Soy drink sold by vendors within university communities. Thus, the present study which addressed these gaps by comparing the proximate composition and sensory properties of a laboratory produced Soy drink to those sold by vendors in NAU main campus.

MATERIALS AND METHOD

Research Design and Source of Raw Materials

Completely randomized design was used in the study with 6 soybeans selling points and replicated 3 times. The raw soybeans and the plastic bottles were purchased from Eke-Awka market in Awka South Local Government Area, Anambra State of Nigeria.

Processing and Sampling of Soy Drink

The laboratory Soy drink sample (L0) was produced according to the method as described by Kohli *et al.* (2017), where soybean was sorted to remove stones and unwanted materials. It was then washed and soaked for 18 hours in water (1 kg/4 liters of water). The soybean was rinsed and blanched in hot water after soaking. It was drained, manually dehulled and milled with kitchen blender (Sonik brand) and sieved in the ratio of 3:1 water to soybeans meal to remove the okara. The Soy drink was then pasteurized at the temperature of 72˚C for 15minutes. The Soy drink was bottled in sterilized bottles and allowed to normalize with room temperature before refrigeration. While the other samples were randomly collected from different recognized selling points (FST food club as sample L1, Multipurpose Hall (MPH) as L2, Ifite school gate as L3, Faculty of Agriculture as L4 and Science village as L5) in Nnamdi Azikiwe University, Awka campus. Three individual soy drink sample were collected from each sampling location. Each sample was analyzed separately and the results were recorded. The mean value of the three replicates was calculated and used as the representative value for each as the vendors reported not to be the producer and they are usually supplied to by the major producers.

Proximate Analysis

The proximate composition was done according to the method of AOAC (2010) as described by Odoh *et al*. (2025) while the carbohydrate was obtained by estimation (100 - (% moisture + % protein + % fat + % fiber + % ash)).

Sensory Properties

Sensory properties were determined according to the method of Iwe (2002) using a 9-point Hedonic scale to evaluate the aroma, mouth feel, colour, taste and overall acceptability of the Soy drink. Twenty semi-trained panelists consisting of students and staff of FST Department familiar with soy drink was used to conduct the test. The samples were coded and presented in identical containers and served to the panelists using small labeled toast cups. Potable water was provided for rinsing of mouth after each sampling.

Statistical Analysis

The generated data from the findings were subjected to statistically analysis of one-way analysis of variance (ANOVA) using SPSS (version 23) with mean separated using Duncan multiple range test at $p<0.05$.

RESULTS

Proximate Composition Soy Drink Samples

Significant differences ($p<0.05$) were observed in all proximate parameters across the samples, except for the fiber content between the laboratory sample (L0) and FST food club sample (L1), and between the MPH (L2) and Ifite gate (L3) samples as shown in Table 1. The ash, moisture, fat, fiber, protein and carbohydrate content ranged from 0.22 to 3.01, 60.4 to 78.3, 0.56 to 2.5, 2.36 to 3.83, 4.10 to 7.03, 11.2 to 27.3 %, respectively. It was discovered that the FST food club Soy drink had the least moisture (60.4 %) and highest protein (7.03 %) and fat (2.5 %) while the science village Soy drink sample had the least fat content of 0.56 %.

Table 1: Proximate Composition of Laboratory and Vended Soy Drink in NAU Awka Campus

Sample	Ash (%)	Moisture (%)	Fat (%)	Fiber (%)	Protein (%)	Carbohydrate (%)
L0	$0.56^{e}\pm0.0$	$70.7^{c}\pm0.1$	$0.89^{d}\pm0.2$	$2.36^{d}\pm0.1$	$6.67^{b}\pm0.1$	$18.7^{d}\pm0.2$
L1	$0.91^{d}\pm0.1$	$60.4^{f}\pm0.1$	$2.50^{a}\pm0.3$	$2.46^{d}\pm0.4$	$7.03^{a}\pm0.1$	$13.9^{e}\pm0.1$
L2	$1.78^{c}\pm0.1$	$60.6^{e}\pm0.1$	$1.92^{c}\pm0.1$	$3.83^{a}\pm0.2$	$4.50^{e}\pm0.4$	$27.3^{a}\pm0.1$
L3	$2.01^{b}\pm0.0$	$65.9^{d}\pm0.1$	$2.01^{b}\pm0.1$	$3.73^{a}\pm0.1$	$4.10^{f}\pm0.2$	$22.2^{c}\pm0.1$
L4	$3.01^{a}\pm0.1$	$73.5^{b}\pm0.2$	$0.77^{e}\pm0.2$	$3.42^{b}\pm0.0$	$5.10^{d}\pm0.2$	$25.3^{b}\pm0.1$
L5	$0.22^{f}\pm0.2$	$78.3^{a}\pm0.1$	$0.56^{f}\pm0.1$	$2.70^{c}\pm0.2$	$6.47^{c}\pm0.1$	$11.2^{f}\pm0.0$

Values are mean scores ± standard deviation of duplicate determination of 3 samples. Means with the same superscript in the same column are not significantly different ($p<0.05$). Where L0 = Laboratory Soy drink, L1 = FST food club Soy drink, L2 = MPH Soy drink, L3 = Ifite gate Soy drink, L4 = Faculty of Agriculture Soy drink and L5 = Science village Soy drink.

Sensory Evaluation Soy Drink Samples

The colour, taste, aroma, mouthfeel and overall acceptability ranged from 5.20 to 6.8, 1.8 to 7.8, 2.05 to 7.45, 4.1 to 6 and 2.65 to 7.4, respectively as seen in Table 2. The taste aroma and overall acceptability of the FST food club Soy drink significantly differed ($p<0.05$) from all other samples and also ranking the best and highest overall acceptable value of 7.4 (meaning, liked slightly) with acceptability index of 82.2 %.

Table 2: Sensory Evaluation of Laboratory and Vended Soy Drink in NAU Awka Campus

Sample	Colour	Taste	Aroma	Mouthfeel	Overall acceptability
L0	$6.25^{a}\pm1.5$	$1.80^{e}\pm1.0$	$2.05^{e}\pm1.2$	$4.10^{b}\pm2.3$	$2.65^{d}\pm1.6$
L1	$6.44^{a}\pm1.6$	$7.80^{a}\pm1.3$	$7.45^{a}\pm1.3$	$5.25^{a}\pm1.3$	$7.40^{a}\pm1.1$
L2	$5.90^{b}\pm1.7$	$4.30^{c}\pm1.4$	$4.30^{c}\pm1.6$	$6.00^{a}\pm1.6$	$4.90^{b}\pm1.5$
L3	$5.20^{b}\pm1.5$	$3.85^{d}\pm1.4$	$3.30^{d}\pm1.7$	$4.05^{b}\pm1.9$	$4.00^{c}\pm2.0$
L4	$6.80^{a}\pm1.7$	$4.90^{c}\pm2.3$	$4.95^{b}\pm2.2$	$5.92^{a}\pm1.5$	$5.55^{b}\pm2.0$
L5	$6.45^{a}\pm1.3$	$6.00^{b}\pm1.7$	$5.50^{b}\pm1.4$	$5.50^{a}\pm1.8$	$5.66^{b}\pm2.2$

Values are mean scores ± standard deviation of twenty replications evaluation. Means with the same superscript in the same column are not significantly different ($p<0.05$). Where L0 = Laboratory Soy drink, L1 = FST food club Soy drink, L2 = MPH Soy drink, L3 = Ifite gate Soy drink, L4 = Faculty of Agriculture Soy drink and L5 = Science village Soy drink.

DISCUSSION

Proximate Composition Soy Drink Samples

The similarities in their fiber content could be attributed to their dehulling efficiency (Obi, 2021). The least value of moisture (60.4%), highest protein of 7.03% with 2.5% fat in FST food club soy drink suggests a more concentrated product likely due to processing differences such as bean-to-water ratio during grinding and sieving, and length of boiling (Gesinde *et al.,* 2008). While the least fat content of 0.56% in science village soy drink and variation in the protein and fat content could be attributed to soybean variety and quality, water-to-soybean ration, extraction efficiency, filtration and sieving, heat treatment and processing conditions and formulation differences. The different soybean varieties naturally contain different levels of protein and fat due to soil, climate and storage; amount of water used during extraction would greatly affect its composition as more water leads to lower protein and fat while less water leads to higher concentration of nutrients; processing steps like soaking and grinding determines how much protein and fat are extracted into the drink; heavy filtration removes suspended solids such as protein and fat, then reducing their final concentration in the drink; excessive heating can cause slight fat separation affecting its measured values; and formulation differences such as additives which can reduce the relative percentage of protein and fat (Shurtleff & Aoyagi, 2013).

The values of moisture, ash, fat could be compared to be within close range with the findings of Oladele and Ofure (2020) (60.5 to 79 %, 0.29 to 0.3 %, 0.75 to 2.63 %, respectively) on Soy drinks of five samples, while the fiber content obtained is higher than the reported value of 0.13 to 0.33 % by Obi (2021) for home and industrial made Soy drink. The protein content obtained from the study is in line with the value of 6.36 to 7.38 % reported by Obi (2021) for home and industrial made Soy drink.

Sensory Evaluation Soy Drink Samples

Based on the sensory result as seen in the Table 2, the taste, aroma and overall acceptability of the FST food club Soy drink were higher than all other samples and also ranked the best and highest overall acceptable value of 7.4 (meaning, liked slightly) with acceptability index of 82.2 %. This could be attributed to its highest fat (2.5%) and protein (7.03%) content with lowest moisture content of 60.4%, indicating that its composition creates the most desirable balance of creaminess (fat), flavor intensity (protein) and mouth feel (less dilution) for consumers. This is supported by the assertion of Raquel *et al.* (2023) that the fat improves creaminess, smoothness and flavor release, low moisture means less dilution and protein contributes to the structure and thickness giving balance body.

Acceptability index measures how a food product is well received by the targeted consumers. It is calculated from the sensory evaluation scores and expressed in percentage. Higher acceptability index above 70% is generally considered that the food product is approved by the consumers and below the 70% suggest dissatisfaction and need for further improve (Meilgaard *et al.,* 2007).

CONCLUSION AND RECOMMENDATIONS

It was also observed that the Soy drink sample produced and vended by FST food club ranked highest in the protein value with the maximum acceptability index. The findings from this investigation validates the reports that the locally processed and vended Soy drinks come with variations in their nutrient and sensory profile due to the soybean variety and quality, water-to-soybean ratio, extraction efficiency, filtration and sieving, heat treatment and formulation differences. This study provides

baseline data that could inform future policy decision aimed at standardizing the quality and consistency of soy drink sold within the NAU Awka main campus. Based on the outcome of the study, FST food club soy drink could be recommended and its standard processing method by also adopted aginst the existing standard used by the laboratory processed soy drink.

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Authors' Contributions

ENO designed the study, reviewed literature and methodology, supervised the sample and data collection and prepared the manuscript. CEI participated in the literature and methodology review, laboratory data collection, result presentation and statistical analysis. ECI supervised all review and laboratory data collection. All the authors read and approved the final manuscript.

Ethical statement

Not applicable

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