Peertechz

Journal of Food Science and Nutrition Therapy
submitpaper@peertechz.com

Journal of Food Science and Nutrition Therapy Open Access Journal

ISSN: 2641-3043 DOI: https://dx.doi.org/10.17352/jfsnt

Review Article

Influence of Education on the Sustainability of Melon Seed Snacks (*Robo*) Enriched with Sweet Potato in Ilorin, Nigeria

Adeshola Ajoke Babayeju*, Christiana Teniola Gbadebo and Murital Bolaji Kareem

Department of Home Economics and Food Science, Faculty of Agriculture, University of Ilorin, Nigeria

Received: 16 October, 2025
Accepted: 29 October, 2025
Published: 30 October, 2025

***Corresponding author:** Adeshola Ajoke Babayeju, Department of Home Economics and Food Science, Faculty of Agriculture, University of Ilorin, Nigeria,
E-mail: babayeju.aa@unilorin.edu.ng

Keywords: *Robo* snacks; Sweet potato flour; Food sustainability; Nutrition education; Sensory evaluation

Abstract

This study highlights the significance of education in the sustainability of *Robo*, a traditional snack crafted from melon seeds (Citrullus vulgaris) and fortified with sweet potato flour (5% – 50%). Proximate analysis showed moisture (6.60% – 8.24%), ash (23.67% – 36.13%), fiber (4.29% – 5.96%), fat (28.12% – 38.83%), protein (3.34% – 5.80%), and carbohydrate content (6.90% – 33.22%). Sensory ratings ranged from 6.84 to 7.54. Education improves producer skills, raises consumer awareness, and encourages the use of local crops. The 5% and 50% blends received the highest acceptance. In conclusion, education fosters innovation, enhances quality, and supports sustainability. It is recommended to incorporate food education into community programs and training workshops to promote adoption, reduce food waste, and boost the nutritional appeal of indigenous snacks like *Robo*.

Introduction

Malnutrition and food insecurity represent critical public health challenges across sub-Saharan Africa. In Nigeria, inadequate access to affordable, nutrient-rich foods continues to adversely affect household nutrition and community dietary health [1]. Traditional snacks, such as *Robo* (a fried product made from Citrullus colocynthis melon seeds), are valued for their cultural significance and potential for income generation. However, despite being high in fat and protein, the conventional product's insufficient carbohydrate content and low levels of essential micronutrients limit its effectiveness as a balanced food option [2].

The enhancement of the nutritional profile of melon seed snack (*Robo*) and sweet potato (Ipomoea batatas) flour is used as a functional enrichment ingredient. Sweet potatoes hold global importance, ranking as the seventh most produced crop worldwide [3], and offer significant health benefits. It is a rich source of dietary fiber, complex carbohydrates, minerals, and vitamins, particularly β-carotene, a key precursor to Vitamin A [4-6]. Additionally, sweet potato contains bioactive compounds that provide functional health advantages [7,8]. Incorporating this flour effectively increases the energy and micronutrient content of *Robo*, while also improving sensory attributes such as texture and visual appeal, which can boost consumer acceptance [9].

Beyond ingredient science, the sustainability of such food innovations is greatly influenced by educational level. Education is crucial for long-term success, as it helps producers adopt better processing techniques, maintain strict food safety standards, and create innovative marketing strategies. Similarly, educated consumers are more likely to recognize the improved nutritional value, which increases demand for these health-enhancing options [1].

This study investigated the influence of education on the sustainability of sweet potato-enriched *Robo*. Specifically, it evaluates the final nutritional composition and sensory characteristics of the enriched product and assesses how educational awareness among both consumers and producers impacts product acceptance and sustainable production practices.

Citation: Babayeju AA, Gbadebo CT, Kareem MB. Influence of Education on the Sustainability of Melon Seed Snacks (*Robo*) Enriched with Sweet Potato in Ilorin, Nigeria. Food Sci Nutr The. 2025;11(1):021-027. Available from: https://dx.doi.org/10.17352/jfsnt.000056

The findings are intended to inform strategies that foster dietary diversity, improve nutritional intake, and promote economic progress through food innovation.

This study investigates how educational status impacts the acceptance, production, and sustainability of *Robo* enriched with sweet potato. The research focuses on assessing the levels of awareness and educational attainment among consumers and producers, which can drive the development and consumption of nutritionally improved products. Specifically, it examines the sensory properties of *Robo*, a traditional Nigerian snack made from melon seeds and enhanced with sweet potato. The goal is to use ingredients sourced from local producers and develop products that are both appealing to consumers and beneficial to public health and the economic progress of Nigeria.

The main objective assessed the Influence of education on the sustainability of melon seed snacks (*robo*) enriched with sweet potato in Ilorin, Nigeria.

Specifically the objectives

1. Produce *Robo* snack enriched with sweet potato flour blend in Ilorin, Nigeria.
2. Determine the nutritional composition of the *Robo* snack produced from melon seed enriched with sweet potato in Ilorin, Nigeria.
3. Evaluate the sensory attributes of the *Robo* snack produced from melon seed enriched with sweet potato in Ilorin, Nigeria.
4. Assessed the educational intervention of pre- and post of *Robo* snack produced from melon seed enriched with sweet potato among the producers in Ilorin, Nigeria.

Materials and methods

Sample collections included melon seeds and sweet potato samples obtained from Ipata Market in Ilorin, Kwara State, Nigeria, along with common ingredients such as salt, onion, and pepper. Analyses were conducted on processed samples to determine the proximate composition of melon seed snacks, including moisture, ash, crude protein, fat, fiber, and carbohydrates, using Cunniff P [10] methods. All reagents used were of food and analytical grade.

Processing of sweet potato

Figure 1 describes the sequential process for the production of sweet potato flour (Ipomoea batatas). The process begins with the Washing of the harvested tubers to remove external debris. It was peeled to remove the skin, and then slicing the tubers into uniform pieces. The sliced potato underwent a blanching stage before drying. The dried slices are then subjected to Milling to reduce particle size. The resulting product is refined through sieving to ensure uniform particle size before the final stages of packaging and storage.

Figure 2 shows the complete, multi-stage production process for the sweet potato-enriched melon seed snack. The flow was segmented into three primary phases: Melon Seed Preparation, Sweet Potato Flour Preparation, and Final Snack Formulation.

Washing
↓
Peeling
↓
Slicing
↓
Blanching
↓
Drying
↓
Milling/Grinding
↓
Sieving
↓
Packaging
↓
Storage

Figure 1: Sweet Potato Flour Production Flow.

Preparation of Melon Seeds and Sweet Potatoes Snack
Shelling and Drying Melon Seeds
↓
Roasting Melon Seeds (15 min)
↓
Blending Roasted Melon Seeds
↓
Mixing with Salt, Ground Dry Pepper, and Onion Leaves
↓
Deflating the Mash (Kneading with 200ml Hot Water for 30 min)
↓
Collecting and Storing the Extracted Oil
↓
Peeling and Slicing Sweet Potatoes
↓
Blanching Sweet Potato Slices
↓
Drying Sweet Potato Slices
↓
Milling Sweet Potato Slices into Flour
↓
Substituting Defatted Melon Flour with Portions of Sweet Potato Flour (5, 10, 20, 30, 50%)
↓
Mixing and Kneading All Materials into a Cakelike Mass
↓
Molding into Ball Shapes
↓
Frying in Extracted Oil (10 min until Brown and Hard)
↓
Cooling
↓
Packaging in Airtight Containers
↓
Storage

Figure 1: Production of Melon Seed Snacks Supplemented with Sweet Potato Flour.

Phase 1: Melon Seed Preparation (Traditional *Robo* Base).

Citation: Babayeju AA, Gbadebo CT, Kareem MB. Influence of Education on the Sustainability of Melon Seed Snacks (*Robo*) Enriched with Sweet Potato in Ilorin, Nigeria. Food Sci Nutr The. 2025;11(1):021-027. Available from: https://dx.doi.org/10.17352/jfsnt.000056

The process starts with the initial preparation of the melon seeds through shelling and drying. The dried seeds are then subjected to roasting for a duration of 15 minutes. The roasted seeds are subsequently blended into a paste. This paste is then mixed with seasoning agents, specifically salt, ground dry pepper, and onion leaves. To reduce fat content, the resulting mash undergoes defatting via kneading with 200 ml of hot water for 30 minutes. The extracted oil is then collected and stored for later use in the frying stage.

Phase 2: Sweet Potato Flour Preparation.

This phase runs in parallel, beginning with the peeling and slicing of the sweet potatoes. The slices are then immediately blanched before being subjected to drying. The dried slices are subsequently ground into flour and then Sieved (implied in the previous figure's description) to ensure uniformity.

Phase 3: Final Snack Formulation and Finishing.

The enhancement step involves substituting defatted melon flour with specific portions of the newly prepared sweet potato flour, testing ratios of 5%, 10%, 20%, 30%, and 50%. This combined dry material is then mixed and kneaded into a cohesive, cake-like mass. The mass is then manually molded into ball shapes. These balls are then fried in the extracted oil for approximately 10 minutes until they achieve a brown, hard consistency. The finished snacks are removed and allowed to cool. The process concludes with packaging in airtight containers and subsequent Storage.

Sample Preparation and Experimental Design: The *Robo* snack was formulated using a combination of melon seed paste and sweet potato flour at varying substitution levels to assess their impact on nutritional and sensory quality. The substitution levels of sweet potato flour were set at 5%, 10%, 20%, and 50%, with a control sample (0%) containing 100% melon seed flour for comparison.

Sample formulation: The mixing ratios of melon seed flour and sweet potato flour for the *Robo* snacks are provided in the table below (Table 1).

The data were analyzed with descriptive statistics, while comparisons between samples and treatments were conducted using ANOVA with a significance level of $p \leq 0.05$.

Table 1: Proportionate Mixing Ratio for Sample Formulation.

Sample Code	Melon Seed Flour (%)	Sweet Potato Flour (%)
M	100	0
MSP1	95	5
MSP2	90	10
MSP3	80	20
MSP4	70	30
MSP5	50	50

Key: Sample M – 100% Melon Seed; Sample MSP195:5% Melon Seed Sweet Potato; Sample MSP190:10% Melon Seed Sweet Potato; Sample MSP295:5% Melon Seed Sweet Potato; Sample MSP380:20% Melon Seed Sweet Potato; Sample MSP470:30% Melon Seed Sweet Potato; Sample MSP550:50% Melon Seed Sweet Potato.

Proximate analysis

The proximate composition of the melon seed snacks was analyzed for moisture, ash, crude protein, crude fat, crude fiber, and carbohydrates by difference using the Cunniff P [10] method: Moisture Content: Determined through oven drying, with initial and final weights recorded.

Ash content: Measured by igniting the sample in a muffle furnace and assessing residual ash. Crude Protein: Measured using the Kjeldahl method, converting nitrogen content to protein percentage. Crude Fat: Extracted with a Soxhlet apparatus and n-hexane, with percentages calculated from weight difference.

Crude fiber: Determined by boiling the sample with acid and alkali, then weighing the residue after ashing. Carbohydrate Content: Calculated by subtracting the sum of moisture, ash, crude fiber, crude protein, and crude fat from 100%.

Results

The analysis of melon seed snack samples reveals diverse nutritional attributes, including moisture, ash, fiber, fat, protein, and carbohydrate (CHO) content, with statistical significance indicated by different superscripts ($p < 0.05$). The moisture content varied notably, with Sample M (100% melon seed) having the lowest at 6.60%, which enhances shelf stability, while Sample MSP2 (90% melon seed, 10% sweet potato) had the highest at 8.24%. Other samples ranged from 6.68% to 7.99%. Fat content was highest in Sample M at 36.13%, providing a rich flavor profile, whereas Sample MSP4 had the lowest fat content at 23.67%. The remaining samples had fat levels between 25.68% and 32.48%. Fiber content also varied, with Sample MSP2 leading at 5.96%, which promotes digestive health, while MSP5 recorded the lowest at 4.29%. Other samples ranged from 4.57% to 5.73%. Ash content, indicative of mineral presence, ranged from 3.34% (MSP5) to 5.80% (Sample M), highlighting diverse mineral profiles that may attract consumers. Sample M excelled in protein content at 38.83%, making it ideal for those seeking high-protein snacks, while Sample MSP4 had the lowest protein content at 28.12%. Protein levels in other samples varied between 29.93% and 36.49%. Carbohydrate content also showed significant differences, with Sample M at 6.90% (suitable for low-carb diets) and Sample MSP4 at 33.22% (a good energy source). Other samples ranged from 12.26% to 28.85%, catering to various dietary needs. Overall, this analysis emphasizes the nutritional versatility of melon seed snacks, enabling manufacturers to develop products that meet diverse consumer preferences and health goals (Table 2).

Sensory evaluation of melon seed snacks made from blends of melon seed and sweet potato

The table summarizes the sensory evaluation of Melon seed snacks based on five attributes: appearance, texture, flavor, taste, and overall acceptability. Higher scores indicate better quality ($p < 0.05$). Sample MSP5 (50:50% Melon Seed Sweet Potato) had the best appearance score of 7.54, while MSP1 (95:5%) had the lowest at 7.08. For texture, MSP3 (80:20%) scored highest at 7.36, with MSP1 at 6.84. In terms of flavor, MSP2 led with 7.40, while MSP1 had the lowest score at 6.98.

Citation: Babayeju AA, Gbadebo CT, Kareem MB. Influence of Education on the Sustainability of Melon Seed Snacks (*Robo*) Enriched with Sweet Potato in Ilorin, Nigeria. Food Sci Nutr The. 2025;11(1):021-027. Available from: https://dx.doi.org/10.17352/jfsnt.000056

Table 2: Proximate Composition of *Melon Seed Snacks Made* from Blends of Melon Seed and Sweet Potato.

Sample	Moisture	Fat	Fiber	Protein	Ash	Carbohydrate
M	6.60^{e} ± 0.09	36.13^{a} ± 0.12	5.73^{b} ± 0.02	38.83^{a} ± 0.03	5.80^{a} ± 0.059	6.90^{f} ± 0.32
MSP1	7.99^{b} ± 0.03	32.48^{b} ± 0.07	5.61^{c} ± 002	36.49^{b} ± 0.05	5.17^{b} ± 0.06	12.26^{e} ± 0.06
MSP2	8.24^{a} ± 0.05	31.54^{c} ± 0.03	5.96^{a} ± 0.06	33.52^{c} ± 0.01	4.68^{c} ± 0.01	16.07^{d} ± 0.12
MSP3	6.68^{d} ± 0.09	26.52^{d} ± 0.03	4.99^{d} ± 0.03	29.93^{e} ± 0.12	4.25^{d} ± 0.01	27.62^{c} ± 0.14
MSP4	6.81^{c} ± 0.05	23.67^{f} ± 0.06	4.57^{e} ± 0.08	28.12^{f} ± 0.14	3.60^{e} ± 0.02	33.22^{a} ± 0.18
MSP5	6.76^{c} ± 0.06	25.68^{e} ± 0.06	4.29^{f} ± 0.05	31.09^{d} ± 0.09	3.34^{f} ± 0.02	28.85^{b} ± 0.27

Values with different superscripts within the same column are significantly different ($p < 0.05$).
Key: Sample M – 100% Melon Seed; Sample MSP195:5% Melon Seed and Sweet Potato; Sample MSP190:10% Melon seed and Sweet Potato; Sample MSP2 95:5% Melon Seed and Sweet Potato; Sample MSP380:20% Melon Seed and Sweet Potato; Sample MSP470:30% Melon seed and Sweet potato.

For taste, MSP5 scored 7.46, significantly higher than other samples, with MSP2 and MSP4 at 7.04. Overall acceptability was highest for MSP5 at 7.76, compared to MSP1 at 7.18 and other samples: M (7.30), MSP2 (7.44), MSP3 (7.40), and MSP4 (7.42) (Table 3).

Educational intervention

The target group was the traditional *Robo* producer in Ilorin metropolis. In the experimental group employing the traditional method for preparing *Robo*, baseline assessments indicated a generally modest understanding of nutritional sustainability. Pretesting of 20 students revealed that a substantial proportion scored below 50%, with limited awareness of how conventional processing techniques, such as roasting, grinding, seasoning, and frying of melon seeds, might influence the overall nutritional quality and longevity of viability of the snack. The findings underscore the necessity for targeted educational interventions to enhance understanding and promote sustainable practices in local food production.

Pre intervention assessment

The scores were moderate, suggesting participants found the product somewhat acceptable but not particularly appealing. **Color**: 5.2 ± 1.1, **Aroma**: 4.8 ± 1.3, **Taste**: 5.0 ± 1.2, **Texture**: 4.7 ± 1.4, and **Overall Acceptability**: 5.1 ± 1.2. **Texture** and **Aroma** were the lowest-rated attributes, indicating areas most in need of improvement.

Post intervention assessment

After the intervention, all attributes scored above **7**, moving into the "like moderately" to "like very much" range. This shows a substantial improvement in the product's sensory qualities. **Color**: 7.4 ± 0.8, **Aroma**: 7.1 ± 0.9, **Taste**: 7.3 ± 0.7, **Texture**: 7.0 ± 0.9, and **Overall and Acceptability**: 7.2 ± 0.8.

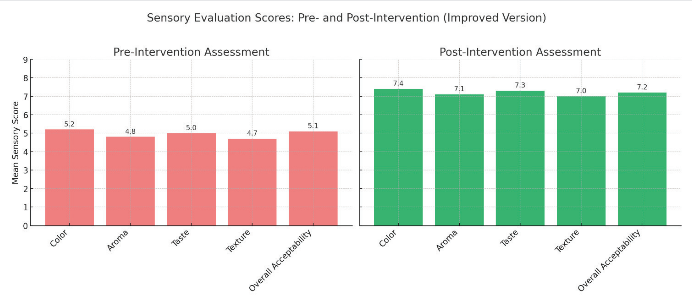

Table 3: Sensory Properties of *Melon Seed Snacks M*ade from Blends of Melon Seed and Sweet Potato.

Sample	Appearance	Texture	Flavour	Taste	Overall Acceptability
M	7.34^{a} ± 0.98	7.06^{a} ± 1.38	7.08^{a} ± 1.32	7.24^{a} ± 1.61	7.30^{ab} ± 1.45
MSP1	7.08^{a} ± 1.12	6.84^{a} ± 1.28	6.98^{a} ± 1.27	7.10^{a} ± 1.52	7.18^{b} ± 1.29
MSP2	7.16^{a} ± 1.15	7.36^{a} ± 1.16	7.40^{a} ± 1.11	7.04^{a} ± 1.41	7.44^{ab} ± 0.95
MSP3	7.42^{a} ± 1.10	7.02^{a} ± 1.24	7.14^{a} ± 1.11	7.26^{a} ± 1.16	7.40^{ab} ± 1.05
MSP4	7.48^{a} ± 1.07	7.24^{a} ± 1.22	7.02^{a} ± 1.15	7.04^{a} ± 1.25	7.42^{ab} ± 0.99
MSP5	7.54^{a} ± 1.34	7.02^{a} ± 1.38	7.13^{a} ± 1.22	7.46^{a} ± 1.16	7.76^{a} ± 1.12

Values with different superscripts within the same column are significantly different ($p < 0.05$).
Key: Sample M – 100% Melon Seed; Sample MSP195:5% Melon Seed Sweet Potato; Sample MSP190:10% Melon Seed and Sweet Potato; Sample MSP2 95:5% Melon Seed and Sweet Potato; Sample MSP380:20% Melon Seed and Sweet Potato; Sample MSP470:30% Melon Seed and Sweet Potato; Sample MSP550:50% Melon Seed and Sweet Potato.

Educational intervention design and assessment

The study's core hypothesis posits that education is a critical determinant of the sustainability and market acceptance of fortified traditional foods. Therefore, a formalized educational protocol was incorporated into the research design to test this relationship rigorously. This intervention was systematically structured to elevate the technical capacity of producers and the nutritional literacy of consumers.

Procedure structure and delivery

The educational section was conducted for four weeks, comprising four discrete, two-hour instructional sessions administered at weekly intervals. The instructional approach blended theoretical instruction with practical, demonstrative learning to ensure effective knowledge transfer.

Session Focus	Major Group	Principal Competencies Targeted
Session 1: Nutritional Efficacy	Consumers & Producers	Detailed comprehension of micronutrient deficiencies, the functional role of β-carotene in *Ipomoea batatas*, and its contribution to dietary diversification.
Session 2: Optimized Processing and Hygiene	Producers	Mastery of Hazard Analysis and Critical Control Points (HACCP) principles, rigorous sanitation protocols, and best practices for raw material preservation and thermal processing.

Citation: Babayeju AA, Gbadebo CT, Kareem MB. Influence of Education on the Sustainability of Melon Seed Snacks (*Robo*) Enriched with Sweet Potato in Ilorin, Nigeria. Food Sci Nutr The. 2025;11(1):021-027. Available from: https://dx.doi.org/10.17352/jfsnt.000056

Session 3: Market Strategy and Value Chain	Producers	Development of cost-efficient packaging solutions, accurate nutritional labeling (transparency), and strategic market positioning for value-added snacks.
Session 4: Sensory Perception and Innovation Acceptance	Consumers	Training in objective sensory evaluation metrics and understanding the compelling rationale for modifying traditional staples to address contemporary health imperatives.

Measuring educational impact: The value of the intervention was measured using a pre- and post-test assessment model applied to all participant cohorts.

Cognitive gain assessment: A validated, 15-item questionnaire was deployed before the first session (baseline pre-test) and immediately following the final session (post-test). The instrument measured knowledge acquisition in areas such as food safety, awareness of Vitamin A deficiency, and the specific nutritional characteristics of the sweet potato. The net gain in percentage score served as the definitive metric for measuring cognitive improvement.

Sustainability outcome metrics: The long-term impact on product sustainability was subsequently assessed by integrating the following empirical outcomes:

Consumer behavioral shift: Evidenced by the post-intervention sensory evaluation results (e.g., the significant improvement in acceptability, and the articulated willingness-to-purchase.

Producer practice adoption: Documented through observational data regarding adherence to the newly trained hygiene standards and the sustained implementation of optimized packaging techniques in routine production.

Discussion of findings

The tables provided details the proximate composition of the formulated *Robo*, Sample MSP5 (50:50% Melon Seed and sweet potato) received the highest score for appearance, with a mean value of 7.54. Conversely, Sample MSP2 (95:5% Melon Seed and sweet potato) was favoured for both texture and flavour, achieving mean scores of 7.36 and 7.40, respectively. According to Banureka and Mahendran, taste is the primary determinant of product acceptability. Although there were no significant differences in taste among the samples ($p \le 0.05$), Sample MSP5 (Melon Seed and sweet potato), containing 50% sweet potato flour, had the highest mean taste score of 7.46. Furthermore, Sample MSP5 also attained the highest overall acceptance rating. These findings indicate that the sensory attributes of melon seed and sweet potato *Robo* are comparable to 100% *Robo* in terms of appearance, flavour, taste, texture, and overall acceptability, with the *Robo* sample containing 50% sweet potato being the most preferred samples, including the parameters of moisture, ash, fiber, fat, protein, and carbohydrate (CHO) content, with mean values and standard deviations. Statistical significance is denoted by different superscripts within the same column ($p < 0.05$).

Moisture content ranged from 6.608.24% to 8.24%, showing significant variation among the samples. Sample MSP2 (95:5% Melon Seed and sweet potato) had the highest moisture content at 8.24%, while sample M contained the least moisture at 6.60%. There was a general increase in the moisture content of the *Robo* samples that contained sweet potato. The moisture content of food is one of the most important and widely used indicators for assessing the quality of dried processed foods. It measures yield and the amount of food solids and can directly indicate economic value, stability, and quality. The variation in moisture content among the samples suggests differences in shelf stability, as higher moisture levels could be associated with spoilage caused by microorganisms.

The fat content in the *Robo* samples varied from 23.67% in Sample MSP4 (composed of 70% Melon Seed and 30% sweet potato) to 36.13% in Sample M (100% Melon Seed). The data indicate that as the proportion of Melon Seed decreased and sweet potato increased, the fat levels tended to decline. This suggests that the addition of sweet potato contributed to a reduction in the fat content of the *Robo* samples. These findings are consistent with those of Salami, et al. [12], who studied *Robo* enriched with orange-fleshed sweet potato. Similarly, Adeyeye, et al. [12] reported comparable fat content values in *Robo* made from melon and watermelon seeds.

Fat is essential for synthesizing steroids and hormones in the body, serving as a critical solvent for these bioactive compounds. Furthermore, fat acts as a reservoir for essential fatty acids and plays an important role in transporting fat-soluble vitamins, including A, D, E, and K. Additionally, fat is the most calorie-dense macronutrient, providing about 9 calories per gram, which is higher than that of protein and carbohydrates.

The fiber content across the *Robo* samples ranged from 4.29% to 5.96%. Notably, Sample MSP1 (95% Melon Seed and 5% sweet potato) exhibited the highest fiber content at 5.96%, while Sample MSP5 (50% Melon Seed and 50% sweet potato) had the lowest at 4.29%, suggesting that the latter contained relatively less dietary fiber. The results highlighted a significant decrease in fiber content with the increasing substitution of sweet potato flour. These results were higher than the 3.19% fiber content reported in melon-based *Robo* enriched with orange-fleshed sweet potato, although similar values (5.97% - 6.31%) were found in *Robo* made from melon and watermelon seeds according to Adeyeye, et al. [2]. Crude fiber is beneficial for human digestion [13], and according to Lattimer and Haub [14], there is a correlation between fiber intake and a reduced risk of coronary heart disease and certain cancers.

In terms of protein content, Sample M (100% Melon Seed) had the highest level at 38.83%, while Sample MSP4 (70% Melon Seed and 30% sweet potato) recorded the lowest at 28.12%. Similar to the trend observed in fat content, protein levels declined as the proportion of Melon Seed was reduced and sweet potato content increased. This indicates that incorporating sweet potato resulted in lower protein content in the *Robo* samples. The protein content was slightly lower than the 40.30% noted by Osuolale and Olayiwoola [15] in *Robo*

Citation: Babayeju AA, Gbadebo CT, Kareem MB. Influence of Education on the Sustainability of Melon Seed Snacks (*Robo*) Enriched with Sweet Potato in Ilorin, Nigeria. Food Sci Nutr The. 2025;11(1):021-027. Available from: https://dx.doi.org/10.17352/jfsnt.000056

produced with pepper and 41% in *Robo* made without pepper. However, the protein values were marginally higher than those reported by Salami, et al. [11], which ranged from 29.72% to 32.41% for *Robo* enriched with orange-fleshed sweet potato, and from 30.18% to 30.90% for *Robo* derived from watermelon and melon seeds as outlined by Adeyeye, et al. [2].

The 100% Melon *Robo* (sample M) showed the highest level of ash content at 5.08%, while Sample MSP5, which is a 50:50 mix of Melon Seed and sweet potato, had the lowest ash content at 3.34%. This finding suggests that when the amount of sweet potato is increased in these blends, the ash levels significantly decrease. The ash content can provide valuable information regarding the mineral quality of the biscuits. The lower ash levels found in the *Robo* biscuits containing sweet potato might indicate a decrease in the micronutrient quality of these blends.

This observation contrasts with research by Salami, et al. [11], which found that the ash content increased with a higher proportion of sweet potato flour in the blends. Kiin-Kabari, et al. [16] explained that the ash content in food items represents their total mineral composition, as it consists of the inorganic residue left after moisture and organic components are removed through heat treatment.

From a nutritional standpoint, ash contributes to the metabolism of other organic substances, such as fats and glucose. In a study by Ojinnaka and Agubolum [17] on the nutritional and sensory characteristics of cookies made from cashew nut and wheat, the analysis revealed protein content ranging from 7.76% to 11.84%, moisture content from 3.11% to 5.13%, fat content from 16.41% to 44.34%, crude fiber from 0.46% to 1.24%, ash content from 1.82% to 5.95%, and carbohydrate content from 34.30% to 68.00%. Consequently, a decrease in ash content could signal a reduction in mineral content.

Sample MSP (50:50% Melon Seed and sweet potato) had the highest carbohydrate content of 33.22%, while the control, sample M, had the lowest carbohydrate content at 6.90%. The results showed that incorporating sweet potato flour significantly increased the carbohydrate content of the formulated *Robo.* The higher carbohydrate levels in the *Robo* made with blends of sweet potato flour suggest that sweet potato may contain higher levels of carbohydrates. Carbohydrates serve as a source of energy and warmth for various bodily functions. If they are insufficient, the body might need to use protein and body fat to generate the necessary energy. This can potentially lead to the depletion of body tissues, as noted by Kure, et al. [18]. Therefore, the increased carbohydrate content of the *Robo* is an advantage, as it provides the body with energy needed for metabolic and catabolic activities. Overall, the proximate composition analysis offered valuable insights into the nutritional makeup of the *Robo* samples. The variations in macronutrient content among the samples highlight the potential to formulate *Robo* with specific nutritional attributes by adjusting the proportions of melon seed and sweet potato flour in the blend. These findings enhance the understanding of the nutritional qualities of the *Robo* samples, which may be important for food product development and dietary planning.

The analysis of the sensory evaluation parameters revealed no significant differences in preferences for the *Robo* samples. Among the various samples, the *Robo* made from melon seed and sweet potato flour blends demonstrated notable preferences.

Conclusion

The sensory evaluation revealed that the intervention led to marked improvements across all sensory attributes. Participants responded more positively to the color, aroma, taste, texture, and overall acceptability after changes were implemented. This suggests that the intervention was effective and significantly enhanced the consumer acceptability of the product.

Recommendations

Based on the findings, it was recommended that consumers should use a 50:50 blend of melon seed and sweet potato flour for the best taste and quality. Additionally, more snack varieties should be created using different flour combinations to reach a wider audience. Further research is needed on the shelf life of both *Robo* and potato, as well as gathering more consumer feedback to enhance the product in the Ilorin metropolis.

Acknowledgement

The authors extend their gratitude to the mothers in Ilorin Metropolis communities in Kwara State, Nigeria, who took part in the study. We also want to acknowledge the hard work of the journal editors and our anonymous reviewers. Thank you for your contributions.

Author contributions

The authors certify their contribution to the paper as follows:

All authors have taken responsibility for the entire content of the manuscript and have consented to its submission to the journal. They have reviewed all the results and approved the final version of the manuscript.

Adeshola, Ajoke Babayeju, (PhD) supervised the research, participated in the educational intervention workshop, contributed to manuscript preparation, analyzed and interpreted the results, and acted as the corresponding author.

GBADEBO, Christiana Teniola (PhD) contributed in the area of organizing the community members, used, collated data, reviewed, and edited the manuscript thoroughly.

All authors reviewed the results and approved the final version of the manuscript.

Consent to participate: This work has been submitted is approved by all authors.

Consent for publication: All authors consented to submit this manuscript for publication in this journal.

References

1. Asogwa V. Poor education policy and food insecurity in Nigeria. Daily Trust Newspaper. 2024. Available from: https://dailytrust.com/poor-education-policy-and-food-insecurity-in-nigeria/

2. Adeyeye SAO, Bolaji OT, Abegunde TA, Adebayo AO, Tiamiyu HK, Adebayo IF. Evaluation of nutritional composition, physico-chemical, and sensory properties of 'Robo' (a Nigerian traditional snack) produced from watermelon (Citrullus lanatus) seeds. Food Res. 2020;4(1):216–233. Available from: https://www.myfoodresearch.com/uploads/8/4/8/5/84855864/_28__fr-2019-230_adeyeye_2.pdf

3. Laveriano SR, Rodríguez MJ, Herman LAE, Torruco Uco JG, Carrillo NH. Current status and perspectives in processing, nutritional, and functional characteristics of sweet potato. Food Rev Int. 2022;38(5):839–864.

4. Wang S, Nie S, Zhu F. Chemical constituents and health effects of sweet potato. Food Res Int. 2016;89:90–116. Available from: https://doi.org/10.1016/j.foodres.2016.08.032

5. Agu HO, Yunana R, Jideani AIO. Development and acceptability of snacks from yellow-fleshed sweet potato and wheat flours. J Food Process Preserv. 2020;45(1):e14851. Available from: https://doi.org/10.1111/jfpp.14851

6. Dery EK, Carey EE, Ssali RT, Low JW, Johanningsmeier SD, Oduro I, Boakye A, Omodamiro RM, Yusuf HL. Sensory characteristics and consumer segmentation of fried sweet potato for expanded markets in Africa. Int J Food Sci Technol. 2020;56(3):1419–1431. Available from: https://doi.org/10.1111/ijfs.14847

7. Parveen R, Zubair M, Khan A, Ghaffar A. Bioactive compounds in sweet potato: role in health promotion. Food Rev Int. 2020;36(3):225–241.

8. Mohanraj R, Sivasankar S. Sweet potato (Ipomoea batatas [L.] Lam)—A valuable medicinal food: a review. J Med Food. 2014;17(7):733–741. Available from: https://doi.org/10.1089/jmf.2013.2818

9. Ubbor SC, Arukwe DC, Ezeocha VC, Nwoso ON, Iguh BN, Nwibo OG. Production and quality evaluation of ready to eat extruded snacks from flour blends of acha-cowpea and sweet potato starch. FUDMA J Sci. 2022;6(4):245–253. Available from: https://doi.org/10.33003/fjs-2022-0604-1071

10. Cunniff P; Association of Official Analytical Chemists. Official methods of analysis of AOAC International. 16th ed. Gaithersburg (MD): AOAC; 2012.

11. Salami KO, Dauda AO, El Imam AM, Abdulhameed FO. Quality, microbiological, and sensory properties of "Robo" supplemented with orange-fleshed sweet potato flour. J Agric Appl Biotechnol. 2023;2(1):1–8. Available from: https://doi.org/10.52493/j.jaab.2023.1.32

12. Adeyeye SAO, Oyewole OB, Obadina O, Adeniran OE, Oyedele HA, Olugbile A, Omemu AM. Effect of smoking methods on microbial safety, polycyclic aromatic hydrocarbon, and heavy metal concentrations of traditional smoked fish from Lagos State, Nigeria. J Culin Sci Technol. 2016;14(5). Available from: https://doi.org/10.1080/15428052.2016.1185072?urlappend=%3Futm_source%3Dresearchgate

13. Ayinde TA, Ajibade BA. Proximate and functional properties of Kokoro (Maize-Beniseed) blends. Afr J Food Sci. 2012;6(5):78–82.

14. Lattimer JM, Haub MD. Effects of dietary fiber and its components on metabolic health. Nutrients. 2010;2(12):1266–1289. Available from: https://doi.org/10.3390/nu2121266

15. Osuolale JK, Olayiwoola AS. Development and quality evaluation of defatted groundnut and melon kernel flour-based ethnic product Robo. Afr J Food Sci. 2014;8(6):311–315. Available from: https://doi.org/10.5897/AJFS2014.1166

16. Kiin-Kabari DB, Mbanefo CU, Akusu OM. Production, nutritional evaluation, and acceptability of cookies made from a blend of wheat, African walnut, and carrot flours. Asian Food Sci J. 2021;20(6):60–76. Available from: https://doi.org/10.9734/afsj/2021/v20i630310

17. Ojinnaka MC, Agubolum FU. Nutritional and sensory properties of cashew nut-wheat-based cookies. Am J Food Nutr. 2013;3(3):127–134. Available from: https://doi.org/10.5251/ajfn.2013.3.3.127.134

18. Kure AO, Donaldben NS. Nutritional evaluation of bread produced from orange-flesh sweet potato flour, starch, and residue flour. Asian J Food Res Nutr. 2024;3(4):1245–1258. Available from: https://doi.org/10.9734/ajfrn/2024/v3i4213

Citation: Babayeju AA, Gbadebo CT, Kareem MB. Influence of Education on the Sustainability of Melon Seed Snacks (*Robo*) Enriched with Sweet Potato in Ilorin, Nigeria. Food Sci Nutr The. 2025;11(1):021-027. Available from: https://dx.doi.org/10.17352/jfsnt.000056