Journal of the Society for Human Ecologists in Nigeria (JSHE)
An Annual Publication of the Society for Human Ecologists in Nigeria (SHEN)
Vol. 7 No. 1, 2026 | pp. 1–10 | ISSN: 3026-9083 (Print)

DOI: https://doi.org/10.68064/jshe.2026.ljr4plny

Proximate Composition and Sensory Characteristics of Millet, Date, Peanut and Ginger Flour Blends

Ugboji A.U., Enefola O. S, & Ashaver, V. A.

[1&3] Department of Family and Consumer Science, Joseph Sarwuan Tarka University Makurdi.
[2]Department of Human Nutrition and Dietetics, Joseph Sarwuan Tarka University
[*]ugbojialce1107@gmail.com

Abstract

This study investigated the proximate composition and sensory characteristics of flour blends formulated from millet, date, peanut, and ginger. The study was designed to determine the influence of varying proportions of the selected ingredients on the nutritional composition and sensory quality of the resulting flour blends. Millet, date, peanut, and ginger were processed separately using appropriate procedures involving sorting, washing, drying, roasting where applicable, milling, and sieving. Three flour blends were formulated from millet, date, peanut, and ginger at ratios of 60:25:12:3 (Blend A), 50:30:15:5 (Blend B), and 40:35:20:5 (Blend C), respectively. Proximate composition was determined using standard procedures of the Association of Official Analytical Chemists (AOAC 2010), while sensory evaluation was conducted using porridge prepared from each flour blend. Twenty semi-trained panelists evaluated the products for appearance, aroma, taste, mouthfeel, and overall acceptability using a 9-point hedonic scale. All laboratory determinations were conducted in triplicate. Data were subjected to one-way analysis of variance, and significant differences among means were separated using Duncan's Multiple Range Test at $p \leq 0.05$. Significant differences were observed among the flour blends in moisture, protein, fat, crude fiber, ash, carbohydrate, and energy contents. Moisture content ranged from 7.21 to 8.12%, protein from 11.42 to 15.37%, fat from 6.34 to 11.32%, crude fiber from 4.12 to 5.14%, ash from 2.15 to 2.36%, carbohydrate from 58.60 to 67.85%, and energy value from 379.14 to 399.16 kcal/100 g. Blend C recorded the highest protein (15.37%), fat (11.32%), crude fiber (5.14%), ash (2.36%), and energy (399.16 kcal/100 g), whereas Blend A had the highest carbohydrate content (67.85%). Significant differences were also observed in the sensory characteristics of the products. Mean scores for appearance, aroma, taste, mouthfeel, and overall acceptability ranged from 7.20–8.15, 7.10–8.05, 7.05–8.20, 7.18–8.10, and 7.12–8.18, respectively. Blend B had the highest scores for appearance (8.15), aroma (8.05), taste (8.20), mouthfeel (8.10), and overall acceptability (8.18), indicating greater preference among the panelists. The findings demonstrate that differences in the proportions of millet, date, peanut, and ginger affected the proximate composition and sensory characteristics of the flour blends. Blend B showed the most favorable sensory characteristics, while Blend C provided the highest levels of several measured nutrients. The study concludes that the formulated flour blends have potential for household food preparation and small-scale food production.

Keywords: millet, date, peanut, ginger, flour blends, proximate composition, sensory characteristics.

Introduction

Food security and nutritional improvement remain major global concerns, particularly in developing regions where diets are often dominated by starchy staples with limited protein and micronutrient diversity. In Nigeria, this challenge is more pronounced in rural communities where economic

constraints and limited food diversification contribute to persistent malnutrition. To address these challenges, food scientists have increasingly explored the use of composite flours formulated from locally available crops to improve nutritional quality, functional properties, and consumer acceptability of traditional foods (Chinma *et al*., 2022). Composite flour refers to the blending of two or more raw materials, usually cereals, legumes, and root or fruit-based ingredients, to produce flour with improved nutritional and functional characteristics. Studies have shown that composite flours can enhance protein content, mineral availability, and functional properties such as water absorption, swelling index, and pasting behavior, making them suitable for both household and industrial food applications (Abioye *et al*., 2022).

One cereal grain with high nutritional potential is finger millet (*Eleusine coracana*), locally referred to as *Tamba* in some regions. Finger millet is rich in dietary fibre, calcium, and essential amino acids and has been widely studied for its nutritional and functional benefits in composite food development. When incorporated into composite formulations, it contributes to improved physicochemical properties such as bulk density, viscosity, and antioxidant activity (Chinma et al., 2022). Peanut (*Arachis hypogaea*) is a valuable legume crop known for its high nutritional value, particularly its protein, fats, vitamins, minerals and phytochemical contents. Its substantial nutrient composition makes it an important food ingredient and a useful source of energy and nutrient in food formulations (Ijarotimi, 2022). Dates (*Phoenix dactylifera* L.) provide natural sugars and can contribute to the nutritional and sensory characteristics of formulated food products. The incorporation of date fruit flour into Nigerian food formulations has been associated with changes in nutritional composition and sensory characteristics. Awofadeju et al. (2021) evaluated date palm fruit flour in bread production, while Ahaotu et al. (2021) investigated date-containing composite flour and its application in chin-chin production. These studies demonstrate the potential of date fruit as an ingredient for nutritional and product development purposes. In addition, ginger (*Zingiber officinale*) is widely recognized for its antioxidant, antimicrobial, and flavor-enhancing properties. It not only improves taste and aroma but also contributes bioactive compounds that support health benefits and shelf stability of food products (Ijarotimi, 2022).

The combination of these ingredients—finger millet, dates, peanut, and ginger—offers a promising opportunity for developing a composite flour with desirable nutritional, physicochemical, and sensory characteristics. The different ingredients contribute complementary properties that may influence the proximate composition, functional properties and sensory quality of the resulting flour blends. Resent research on cereal-legume blends have demonstrated that blending different food materials can influence the nutritional composition and sensory acceptability of composite products (Ijarotimi, 2022; Chinma et al 2022).

Physicochemical characteristics such as moisture content, ash content, bulk density, water absorption capacity and swelling characteristics are important indicators of flour quality and potential food applications. These characteristics can vary according to the type, processing condition and proportion of ingredients incorporated into composite flour formulations (Owheruo et al., 2019; Chinma et al., 2022). Proximate composition, including moisture, protein, fat, fibre, ash, carbohydrate and energy content, also provides important information on the nutritional composition of composite flour. In addition, sensory evaluation attributes such as taste, aroma, texture, and overall acceptability is essential for determining the preference and acceptability of developed food products (Alabi et al., 2021; Chinma et al 2022). Therefore, evaluating these characteristics provides a basis for assessing the quality and acceptability of the formulated finger millet, dates, peanut and ginger composite flour for household use.

The increasing interest in composite flour technology, malnutrition continues to be a major concern in many rural communities in Nigeria. Many households rely heavily on staple foods that are rich in carbohydrates but provide limited amounts of protein and essential micronutrients. This pattern of food consumption can increase the risk of protein-energy malnutrition and micronutrient deficiencies, particularly among vulnerable groups. One approach to improving the nutritional quality of commonly consumed foods is the use of composite flour, which allows different locally available ingredients with complementary nutritional properties to be combined.

The combination of finger millet, dates, peanut and ginger offers a practical opportunity to develop a nutrient-rich composite flour from ingredients that are locally available. Finger millet and peanut have been used in the development of composite food products, and studies have shown that changing the proportions of ingredients can affect the nutritional composition, functional properties and sensory acceptability of the resulting products (Fayera et al., 2021; Chinma et al., 2022). Incorporating dates and ginger into the blend may further contribute to the nutritional and sensory qualities of the flour while providing opportunities for food diversification and value addition at the household level, however, there is still limited information on the combined use of finger millet, dates, peanut and ginger in composite flour formulation, particularly regarding the proximate composition and sensory qualities of the resulting product. This gap provides the basis for the present study, which therefore focuses on formulating composite flour from finger millet, dates, peanut and ginger and evaluating its proximate composition and sensory characteristics.

Therefore, this study aimed to formulate composite flour from finger millet (tamba), dates, peanuts, and ginger and evaluate its proximate, physiochemical and sensory properties for potential household food use in Gbajimba, Benue State, Nigeria. Specifically, the study sought to:

1. formulate composite flour using Tamba (finger millet), dates, peanuts, and ginger, ensuring optimal nutrition for families.
2. assess the acceptability and sensory properties of porridge prepared from the formulated flour, including texture, taste, aroma, and overall acceptability among rural consumers.

MATERIALS AND METHOD

Finger millet (*Eleusine coracana*), dates (*Phoenix dactylifera*), peanuts (*Arachis hypogaea*), and ginger (*Zingiber officinale*) were procured from Gbajimba Main Market, Guma Local Government Area, Benue State, Nigeria. All chemicals and reagents used for laboratory analyses were of analytical grade.

Sample Preparation

The individual raw materials were prepared separately before formulation of the composite flour. The preparation procedures were adapted from previously reported methods, with modifications where necessary to suit the materials, equipment and conditions available for the present study.

Preparation of Finger Millet Flour

The preparation of finger millet flour was adapted from the methods reported by Owheruo et al. (2019), Chinma et al. (2022), and Abioye et al. (2022), with modifications to the drying and sieving conditions where necessary. The finger millet grains were manually sorted to remove stones, chaff, damaged grains and other extraneous materials. The sorted grains were washed thoroughly with clean water to remove adhering dirt and other contaminants. The washed grains were spread in clean trays and dried in a hot-air oven at 60°C until they were adequately dried. The dried grains were

allowed to cool to room temperature and then milled using a laboratory mill to obtain flour. The resulting flour was passed through a 250 µm mesh sieve to obtain a relatively uniform particle size and stored in clean, labelled, airtight containers until required for composite flour formulation.

Preparation of Dates Flour

The preparation of dates flour was adapted from the procedure reported by Awofadeju et al. (2021) for processing date palm fruit into flour, with modifications to suit the present study. The dates were manually sorted to remove damaged fruits, spoiled portions and foreign materials. The selected fruits were washed thoroughly with clean water and allowed to drain. The dates were manually deseeded using a clean stainless-steel knife, after which the deseeded fruits were cut into smaller pieces to facilitate uniform drying. The pieces were spread evenly on clean trays and dried in a hot-air oven at **60°C** until adequately dried. The dried date pieces were allowed to cool and milled into flour using a laboratory mill. The flour was subsequently sieved to obtain a relatively uniform particle size and stored in clean, labelled, airtight containers until use.

Preparation of Peanut Flour

The preparation of peanut flour was adapted from the method reported **by** Ijarotimi (2022)**,** with modifications to the roasting conditions used in the present study. The peanut kernels were manually sorted to remove stones, foreign materials, damaged kernels and other defective seeds. The cleaned kernels were roasted in a preheated oven at 120°C for 20 min. After roasting, the kernels were removed from the oven and allowed to cool to room temperature. The cooled kernels were manually dehulled to remove the seed coats and then milled into flour using a laboratory mill. The milled peanut was passed through a sieve to obtain a relatively uniform flour particle size. The resulting peanut flour was transferred into clean, labelled, airtight containers and stored until required for composite flour formulation.

Preparation of Ginger Powder

The preparation of ginger powder was adapted from the method reported by Ijarotimi (2022)**,** with modifications where necessary. Fresh ginger rhizomes were sorted to remove damaged portions, decayed materials and other foreign matter. The selected rhizomes were washed thoroughly with clean water to remove adhering soil and dirt and then peeled. The cleaned rhizomes were sliced into thin, relatively uniform pieces to facilitate efficient and uniform drying. The slices were spread evenly on clean trays and dried in a hot-air oven at 60°C until they were adequately dried. The dried ginger slices were allowed to cool to room temperature before being milled into powder. The resulting powder was sieved to obtain a relatively uniform particle size and stored in clean, labelled, airtight containers until use. All prepared flour and powder samples were stored separately in clean, dry, airtight containers at room temperature and were properly labelled to prevent contamination and mix-up before the preparation of the composite flour blends.

Blend formulation

The processed finger millet, date, peanut and ginger flour were weighed according to predetermined formulation ratios and thoroughly mixed to obtain homogenous composite flour samples. three formulations were produced: Blend A (60:25:12:3), Blend B (50:30:15:5), and Blend C (40:35:20:5). Representing finger millet, dates, peanuts and ginger respectively. Each formulation was packaged in clean, air tight containers and stored under appropriate conditions until analysis.

Table 1: Formulation of Composite Blends

Blend	Finger Millet (%)	Dates (%)	Peanut (%)	Ginger (%)
Blend A	60	25	12	3
Blend B	50	30	15	5
Blend C	40	35	20	5

Proximate Analysis

Moisture, crude protein, crude fat, crude fibre, and ash contents were determined using standard methods of the (AOAC, 2010)**.** Carbohydrate content was calculated by difference, as the difference between 100 and the sum of the percentage of moisture, protein, fat and ash, while the energy value was estimated using Atwater general conversion factor of 4kcal/g for protein 9kcal/g for fat and 4kcal/g for carbohydrate (FAO,2003; USDA FoodData Central, 2024).

Sensory Evaluation

Sensory evaluation of the porridge samples was conducted using twenty semi-trained panelists following standard sensory evaluation procedures described by Stone and Sidel (2004). The evaluation was carried out under controlled conditions to minimize distractions and other environmental factors that could influence sensory judgement, also in accordance with ISO 8589:2007. The three samples were served in identical, clean and odor-free containers and identified with three digits codes rather than their formulations names to minimize identification bias. The samples were presented to the panelist in a randomized order to reduce possible order effects. Panelist were instructed to evaluate each sample independently and to rinse their mouth with potable water between samples to minimize carry-over effects. The samples were evaluated for appearance, aroma, taste, texture, and overall acceptability. Sensory evaluation of the porridge samples was conducted using 20 semi trained panelist using a 9-point hedonic scale ranging from 1=dislike extremely and 9 = like extremely. The use of quantitative reference scale for hedonic assessment was based on ISO 4121:2003.

Statistical Analysis

All determinations were carried out in triplicate and results expressed as mean ± standard deviation. Data were subjected to one-way analysis of variance (ANOVA), and significant differences among means were separated using Duncan's Multiple Range Test (DMRT) at a 5% level of significance ($p \leq 0.05$).

RESULTS

Proximate Composition of Finger Millet, Date, Peanut and Ginger Flour Blends

Table 1 presents the proximate composition of the composite flour blends. Moisture content decreased from 8.12% in Blend A to 7.42% in Blend B and 7.21% in Blend C. The three blends differed significantly in moisture content ($p \leq 0.05$). Protein content increased across the formulations. Blend A contained 11.42% protein, while Blends B and C contained 13.32% and 15.37%, respectively. Blend C had the highest protein content and Blend A the lowest, with significant differences among the blends ($p \leq 0.05$). Fat content followed the same pattern, increasing from 6.34% in Blend A to 8.21% in Blend B and 11.32% in Blend C. The differences were significant ($p \leq 0.05$). Crude fiber increased from 4.12% in Blend A to 4.32% in Blend B and 5.14% in Blend C, and the observed differences were also significant ($p \leq 0.05$). Ash content

increased slightly across the formulations, with values of 2.15%, 2.21%, and 2.36% for Blends A, B, and C, respectively. The differences among the blends were significant ($p \leq 0.05$). Carbohydrate content decreased as the proportion of peanut and dates increased. Blend A had the highest carbohydrate content (67.85%), followed by Blend B (64.52%), while Blend C had the lowest value (58.60%). The differences were significant ($p \leq 0.05$). Energy values increased across the blends, from 379.14 kcal/100 g in Blend A to 388.77 kcal/100 g in Blend B and 399.16 kcal/100 g in Blend C. Blend C had the highest energy value, while Blend A had the lowest, with significant differences among the formulations ($p \leq 0.05$). The results indicate that the increase in peanut and date proportions was associated with higher protein, fat, fiber, ash, and energy contents, while moisture and carbohydrate contents decreased across the formulations.

Table 1: Proximate Composition of Finger Millet, Date, Peanut and Ginger Flour Blends

Blend	Moisture (%)	Protein (%)	Fat (%)	Fibre (%)	Ash (%)	Carbohydrate (%)	Energy (kcal/100 g)
Blend A	$8.12^{a} \pm 0.08$	$11.42^{c} \pm 0.23$	$6.34^{c} \pm 0.15$	$4.12^{c} \pm 0.11$	$2.15^{c} \pm 0.05$	$67.85^{a} \pm 0.44$	$379.14^{c} \pm 2.18$
Blend B	$7.42^{b} \pm 0.06$	$13.32^{b} \pm 0.19$	$8.21^{b} \pm 0.18$	$4.32^{b} \pm 0.09$	$2.21^{b} \pm 0.06$	$64.52^{b} \pm 0.39$	$388.77^{b} \pm 2.45$
Blend C	$7.21^{c} \pm 0.05$	$15.37^{a} \pm 0.21$	$11.32^{a} \pm 0.24$	$5.14^{a} \pm 0.12$	$2.36^{a} \pm 0.07$	$58.60^{c} \pm 0.48$	$399.16^{a} \pm 2.81$

Values are expressed as Mean (n=3) ± Standard Deviation. Means within the same column bearing different superscript letters (a–c) are significantly different at $p \leq 0.05$.

Sensory Characteristics of Porridge Prepared from Finger Millet, Date, Peanut and Ginger Flour Blends

Table 2 presents the sensory scores of the porridge samples prepared from the three flour blends. Appearance scores ranged from 7.20 to 8.15, with Blend B recording the highest score and Blend A the lowest. The difference between Blend B and the other blends was significant ($p \leq 0.05$). Aroma scores ranged from 7.10 to 8.05. Blend B had the highest score, while Blend A had the lowest, and the difference between Blend B and Blends A and C was significant ($p \leq 0.05$). Taste scores ranged from 7.05 to 8.20, with Blend B recording the highest score and Blend A the lowest. Significant differences were observed among the samples ($p \leq 0.05$). Mouthfeel scores ranged from 7.18 to 8.10. Blend B had the highest score and differed significantly from Blends A and C ($p \leq 0.05$). Acceptability scores ranged from 7.12 to 8.18**,** with Blend B recording the highest score and Blend A the lowest. The difference between Blend B and the other blends was significant ($p \leq 0.05$). All the porridge samples had mean scores above 7.00. Blend B (50:30:15:5) recorded the highest scores for appearance, aroma, taste, mouthfeel and overall acceptability and was the most preferred of the three formulations.

Table 2: Sensory Characteristics of Porridge Prepared from Finger Millet, Date, Peanut and Ginger Flour Blends

Blend	Appearance	Aroma	Taste	Mouth feel/ Texture	Overall Acceptability
Blend A	7.20 ± 0.75^{b}	7.10 ± 0.68^{b}	7.05 ± 0.72^{b}	7.18 ± 0.64^{b}	7.12 ± 0.70^{b}
Blend B	8.15 ± 0.62^{a}	8.05 ± 0.58^{a}	8.20 ± 0.54^{a}	8.10 ± 0.60^{a}	8.18 ± 0.57^{a}
Blend C	7.42 ± 0.71^{b}	7.55 ± 0.66^{b}	7.30 ± 0.69^{b}	7.36 ± 0.65^{b}	7.48 ± 0.63^{b}

Values are Mean (n=20) ± Standard Deviation (SD). Means within the same column bearing different superscript letters are significantly different ($p \leq 0.05$)

Discussion

The proximate composition of the composite flour blends showed significant differences ($p \leq 0.05$) among the formulations, indicating that varying the proportions of finger millet, dates, peanuts, and ginger influenced the nutritional quality of the products.

The moisture content of the flour blends may be related to the differences in the proportions of the ingredients used in their formulation. Moisture content is an important quality attribute of flour because excessive moisture can favor microbial growth and reduce storage stability. The relatively low moisture content recorded in the flour blends may favor their storage stability, since lower moisture limits conditions that support microbial growth and other deteriorative reactions. The moisture values obtained in the present study were comparable to those reported for finger millet-based composite flours, where values ranging from 8.14% to 10.06% were observed depending on the ingredients and proportions used in the formulations (Owheruo et al., 2019). Similar findings have also been reported for finger millet and Bambara groundnut flour blends (Chinma et al., 2022).

The higher protein content of some of the blends may be attributed to the greater proportion of peanut flour incorporated into the formulations, since peanut contributes appreciable amounts of plant protein to cereal-based blends. Similar observations have been reported in finger millet–legume formulations, where increasing the proportion of legume flour resulted in higher protein content of the products (Chinma et al., 2022). Comparable variation in protein content has also been reported in finger millet-based composite foods containing groundnut and other protein-rich ingredients (Ijarotimi, 2022). The relatively higher protein values recorded in the present blends therefore demonstrate the contribution of peanut incorporation to the protein content of the formulations.

The variation in crude fat content among the blends may be attributed largely to differences in the proportion of peanut flour used in the formulations. Peanut contains appreciable amounts of oil, and its incorporation into cereal-based blends can increase the fat contribution of the resulting product. Similar findings have been reported for finger millet–legume formulations, where increasing the proportion of the legume component was associated with higher fat content (Chinma et al., 2022). The higher fat contribution of peanut in the present formulations also provides an additional source of dietary energy, which may be useful when the flour is incorporated into energy-dense food products.

The variation in crude fiber content among the blends may be related to the different proportions of finger millet, dates, peanuts, and ginger used in the formulations. Finger millet is a notable source of dietary fiber, while dates also contribute dietary fiber to food products; therefore, changes in the relative amounts of these ingredients can influence the fiber content of the resulting blends (Ijarotimi, 2022; Abioye et al., 2022). Similar variation in crude fiber has been reported in finger millet-based composite products, with the composition of the ingredients and processing conditions influencing the fiber content of the final product (Ijarotimi, 2022; Chinma et al., 2022). The fiber contribution of the blends may therefore increase their dietary fiber content compared with formulations containing lower proportions of fiber-contributing ingredients.

The differences in ash content observed among the composite flour formulations could be due to the different ingredients and the proportions in which they were combined. Finger millet contributes appreciably to the mineral content of flour, while peanut, dates and ginger may also contribute minerals to the blends. Therefore, changing the proportion of these ingredients would be expected to affect the overall ash content of the formulations. Similar differences have been reported in finger millet-based composite products, where the type and proportion of ingredients influenced the

mineral content of the final product (Abioye et al., 2022; Chinma et al., 2022). This suggests that the proportion of ingredients used in a composite flour can play an important role in determining its mineral contribution.

The carbohydrate content varied across the formulations, largely because the ingredients were used in different proportions. Finger millet is an important source of carbohydrate, while peanut contributes more protein and fat. As the proportion of finger millet was changed in relation to peanut and the other ingredients, differences in the carbohydrate content of the resulting flour were observed. Similar changes have been reported in finger millet-based composite products, where varying the proportions of cereal and legume flours affected the carbohydrate content of the final blends (Chinma et al., 2022; Ijarotimi, 2022). The present findings therefore show that the formulation ratio can influence the amount of carbohydrate contributed to the composite flour.

The energy content of the formulations differed according to their proximate composition, particularly the amounts of fat, protein and carbohydrate present in each blend. The formulations containing more peanut may have had higher energy contributions because peanut is relatively rich in fat, and fat provides more energy than protein or carbohydrate. The proportions of the other ingredients may also have contributed to the differences observed among the formulations. Similar variations in energy values have been reported in finger millet-based composite formulations containing legume ingredients (Fayera et al., 2021). Overall, the findings indicate that the choice and proportion of ingredients can influence the energy value of the composite flour.

The sensory responses suggest that the proportions of the ingredients influenced the acceptability of the products. The comparatively favorable response to Blend B may be associated with the balance among finger millet, dates, peanut, and ginger in the formulation. In composite food products, the relative proportions of the component ingredients can affect color, flavor, mouthfeel, and overall preference. Similar effects of formulation on the sensory characteristics of finger millet-based products have been reported by Chinma et al. (2022), who observed differences in consumer acceptability among products prepared from different finger millet and Bambara groundnut flour ratios.

The aroma of the products may have been influenced by the characteristic volatile compounds contributed by ginger, together with the flavor compounds associated with the other ingredients. Ginger contains several volatile and pungent compounds that contribute to its characteristic aroma and flavor, while processing of cereal and legume ingredients can also influence the sensory properties of the final product. The differences among the formulations therefore suggest that the proportion of each ingredient contributed to the sensory profile of the products (Chinma et al., 2022).

The taste responses may similarly reflect the combined effects of the ingredients rather than the contribution of a single component. Dates provide natural sugars, while peanut contributes a characteristic nutty flavor; finger millet also contributes its own distinctive cereal flavor. The balance among these characteristics may explain the more favorable response to Blend B. Previous work on finger millet-based composite products has likewise shown that changes in ingredient proportions can affect taste and overall consumer acceptance (Chinma et al., 2022). Differences in mouthfeel may be related to the composition and functional characteristics of the flour blends. The relative amounts of finger millet, dates, peanut, and ginger can influence the consistency and eating quality of the prepared product. Chinma et al. (2022) similarly reported differences in sensory characteristics among finger millet–Bambara groundnut products prepared at different blend ratios. The present findings therefore suggest that the formulation used for Blend B produced a mouthfeel that was more favorably received by the panelists.

The overall acceptability of the products reflects the combined influence of appearance, aroma, taste, and mouthfeel. The favorable response to Blend B indicates that its particular ingredient ratio provided a sensory profile that was well received by the panelists. This agrees with findings from previous studies showing that the acceptability of composite cereal products is influenced by the interaction of formulation and sensory characteristics (Chinma et al., 2022).

Considering both the proximate composition and sensory responses, Blend B provides a more balanced formulation than selecting a blend solely on the basis of the highest value for an individual nutritional parameter. However, the preference observed in the present sensory evaluation applies to the panelists who participated in the study and should not be interpreted as evidence of general consumer preference.

Conclusion and Recommendations

This study formulated three flour blends from finger millet, dates, peanuts, and ginger at different proportions and evaluated their proximate composition and sensory characteristics. Based on the combined proximate and sensory findings, Blend B is recommended for household food preparation and small-scale production. The following recommendations are made:

1. Nutrition educators and community extension workers should promote the use of finger millet, dates, peanuts, and ginger in composite flour preparation as a means of improving the variety and nutritional quality of household meals.
2. Households and small-scale food processors should consider Blend B (50:30:15:5) for food preparation and small-scale production, as it recorded the most favorable sensory responses among the formulations evaluated.
3. Small-scale food processors and entrepreneurs should adopt appropriate processing, packaging, and hygienic practices in the production and handling of the composite flour to maintain product quality during storage.

REFERENCE

Abioye, V. F., Babarinde, G. O., Ogunlakin, G. O., Adejuyitan, J. A., Olatunde, S. J., & Abioye, A. O. (2022). Varietal and processing influence on nutritional and phytochemical properties of finger millet (*Eleusine coracana*): A review. *Heliyon, 8*(12), e12310. https://doi.org/10.1016/j.heliyon.2022.e12310

Ahaotu, I., Eze, O., & Maduka, N. (2021). Quality assessment of corn-breadfruit-date flour and sensory evaluation of chin-chin prepared using the composite flours. *Advances in Biotechnology & Microbiology, 16*(3), 555940. https://doi.org/10.19080/AIBM.2021.16.555940

Akinola, R., Pereira, L. M., Mabhaudhi, T., de Bruin, F.-M., & Rusch, L. (2020). A review of indigenous food crops in Africa and the implications for more sustainable and healthy food systems. *Sustainability, 12*(8), 3493. https://doi.org/10.3390/su12083493

Alabi, B. E., Adejuyitan, J. A., & Abioye, V. F. (2021). Physical and sensory properties of bread made with wheat and fermented finger millet (*Eleusine coracana* L.) flours. *Asian Food Science Journal, 20*(10), 1–12. https://doi.org/10.9734/afsj/2021/v20i1030354

AOAC International. (2010). *Official methods of analysis of AOAC International* (18th ed., rev. 3). AOAC International.

Awofadeju, O. F. J., Awe, A. B., Adewumi, O. J., & Adeyemo, E. A. (2021). Influence of substituting sucrose with date palm fruit flour (DPFF) on the nutritional and organoleptic properties of bread. *Croatian Journal of Food Science and Technology, 13*(1), 1–6. https://doi.org/10.17508/CJFST.2021.13.1.01

Chinma, C. E., Ibrahim, P. A., Adedeji, O. E., Ezeocha, V. C., Ohuoba, E. U., Kolo, S. I., Abdulrahman, R., Anumba, N. L. O., Adebo, J. A., & Adebo, O. A. (2022). Physicochemical properties, *in vitro* digestibility, antioxidant activity and consumer acceptability of biscuits prepared from germinated finger millet and Bambara groundnut flour blends. *Heliyon, 8*(10), e10849. https://doi.org/10.1016/j.heliyon.2022.e10849

Feyera, M., Dasa, F., & Kebero, K. (2021). Formulation and quality evaluation of finger millet based composite food products. *International Journal of Nutrition and Food Sciences, 10*(3), 59–65. https://doi.org/10.11648/j.ijnfs.20211003.11

Food and Agriculture Organization of the United Nations. (2003). *Food energy: Methods of analysis and conversion factors* (FAO Food and Nutrition Paper No. 77). FAO.

International Organization for Standardization. (2003). *ISO 4121:2003: Sensory analysis—Guidelines for the use of quantitative response scales*. ISO.

International Organization for Standardization. (2007). *ISO 8589:2007: Sensory analysis—General guidance for the design of test rooms*. ISO.

Ijarotimi, O. S. (2022). Nutritional quality, functional property and acceptability of maize (*Zea mays*) based complementary foods enriched with defatted groundnut (*Arachis hypogaea* L.) and ginger (*Zingiber officinale* Roscoe) powder in Wistar rats. *Food Production, Processing and Nutrition, 4*, 13. https://doi.org/10.1186/s43014-022-00091-3

Olurin, T. O., Abbo, E. S., & Oladiboye, O. F. (2021). Production and evaluation of breakfast meal using blends of sorghum, Bambara nut and date palm fruit flour. *Agro-Science, 20*(3), 30–36. https://doi.org/10.4314/as.v20i3.5

Owheruo, J. O., Ifesan, B. O. T., & Kolawole, A. O. (2019). Physicochemical properties of malted finger millet (*Eleusine coracana*) and pearl millet (*Pennisetum glaucum*). *Food Science & Nutrition, 7*(2), 476–482. https://doi.org/10.1002/fsn3.816

Stone, H., & Sidel, J. L. (2004). *Sensory evaluation practices* (3rd ed.). Academic Press.

U.S. Department of Agriculture, Agricultural Research Service. (2024). *FoodData Central*. https://fdc.nal.usda.gov/