JHER, Vol 32(1) September 2025, pp. 202 - 209

Comparative Study of the Proximate and Sensory Properties of Bread Brands Produced in Akure, Ondo State, Nigeria

[1]Adebayo Ibidapo N., [2]Adedipe Abioye; [3]Orimaye Olakunle, M.
[1]Department of Hospitality and Tourism Management,
Federal University Oye Ekiti, Ekiti State
[2]Department of Hospitality and Tourism,
Federal University of Agriculture Abeokuta, Abeokuta Ogun State
[3]Department of Wildlife and Ecotourism Management,
University of Ibadan, Ibadan, Oyo State

Corresponding Author: ibidapoadebayoafiijpwe.edu.ng

Abstract

This study compared proximate composition and sensory properties of five commercially available bread samples in Akure, Ondo State. Loaf samples were purchased fresh, coded A–E, and analyzed within four hours in the Food Analysis Laboratory at the Federal University of Technology, Akure. Proximate analysis carried out in duplicate using official methods of the Association of Official Analytical Chemists (AOAC), and carbohydrate was calculated by difference. A semi-trained panel of 20 assessors used a nine-point hedonic scale to rate sensory attributes. Data were subjected to one-way analysis of variance (ANOVA) and Duncan's multiple range test at $p < 0.05$. Results showed moisture content ranged from 36.00 % (Sample E) to 42.19 % (Sample C); protein from 9.80 % (Sample C) to 11.40 % (Sample E); and fibre from 1.08 % (Sample A) to 2.45 % (Sample E). Sample E consistently achieved the highest mean scores for crust colour (8.25), crumb colour (8.10), aroma (8.55), taste (7.95), texture (7.90), and overall acceptability (8.35). Analysis of variance indicated that Sample E did not differ significantly ($p > 0.05$) from Sample B in several sensory attributes, whereas it differed ($p < 0.05$) from Samples A, C, and D across all measures. These findings demonstrate that Sample E combines optimal proximate composition with superior sensory appeal, highlighting the importance of balancing nutritional quality and consumer preferences in bread production.

Keywords: Proximate Composition, Sensory Evaluation, Bread Quality, Consumer Acceptability, Analysis

Introduction

Bread is among the most widely consumed staple foods worldwide, providing essential macronutrients and energy to diverse populations. Per-capita consumption often exceeds 50 kg per year in many regions, reflecting its role in daily diets and cultural practices (Moretton et al., 2023; Mollakhalili-Meybodi et al., 2023). Its relatively simple production process and adaptability have enabled bread to evolve from basic loaves into a

vast array of products, ranging from traditional white pan breads to specialty and value-added formulations. In recent years, there has been growing interest in composite breads incorporating local flours, such as cassava, taro, plantain, amaranth, chickpea, fava bean, and other legume or by-product ingredients, to enhance nutritional profiles and reduce dependence on imported wheat (Ajani et al., 2020; Udomkun et al., 2022; Banti et al., 2024; Awulachew, 2025).

In Nigeria, bread has become a dietary mainstay in both urban and peri-urban settings. The commercial bakery sector has expanded substantially over the past decade, with numerous small- and medium-scale bakeries offering multiple product lines targeted at distinct market segments (Mbachu, Chukwudozie, & Mbachu, 2023). Competition often centers on price, convenience, shelf life, and sensory appeal. Innovations such as enriched breads (e.g., with local grains or functional ingredients) have been explored under experimental conditions to improve nutrient density and meet consumer demand for healthier options (Gautam, Subedi, & Panta, 2022). However, most studies focus on laboratory-formulated composite breads rather than evaluating the actual products available to consumers in local markets.

Despite numerous investigations (Khalil et al., 2021; Pereira de Freitas & da Silva Lannes, 2024) into composite flour formulations and their physicochemical, nutritional, and sensory characteristics, there remains limited data on the proximate composition and sensory performance of freshly purchased, commercially sold breads in many Nigerian urban centres. Studies on wheat varieties and composite flours often do not capture the variability introduced by different processing methods, ingredient sourcing, and bakery practices as encountered in real-world settings (Ibidapo et al., 2019; Dauda et al., 2024). Such information is critical for benchmarking product quality, guiding producers on formulation adjustments, and informing regulatory standards that ensure consumer safety and satisfaction.

In Ondo State, and specifically in its capital city, the proliferation of township bakeries has outpaced comprehensive quality assessments of their products. While experimental research demonstrates the potential of alternative flours to enhance nutritional and functional properties, the actual nutritional and sensory qualities of breads sold to consumers remain under-documented. This gap impedes stakeholders, regulatory agencies, bakery owners, and consumer advocacy groups, from making evidence-based decisions regarding product improvement, labeling, and standardization.

Furthermore, consumer acceptance depends not only on nutrient content but also on sensory attributes such as crust and crumb appearance, aroma, taste, texture, and overall liking. Prior research (Torbica et al., 2019; Awulachew, 2025) indicates that changes in formulation, especially with composite flours or by-product inclusion, can positively or negatively influence these sensory characteristics, sometimes leading to trade-offs between enhanced nutrition and consumer-pleasing qualities (Martins, Pinho, & Ferreira, 2017). Evaluating how proximate values correlate with sensory ratings in commercially available breads can thus

reveal whether current bakery practices achieve an optimal balance.

Given this context, the present study sought to fill the identified gaps by assessing breads purchased fresh from bakeries in Akure, Ondo State. The objectives were to determine the proximate composition (moisture, protein, fat, ash, fibre, and carbohydrate) of selected commercially available loaf samples and to evaluate their sensory attributes, crust and crumb colour, aroma, taste, texture, and overall acceptability, using a semi-trained panel under controlled conditions. By linking nutritional analysis with consumer perception data, this research aims to provide baseline information that can inform quality control measures, encourage product development aligned with consumer preferences, and support regulatory frameworks in the local bakery industry. Ultimately, these insights may guide bakers in optimizing formulations and processes to deliver breads that satisfy both nutritional guidelines and sensory expectations.

Materials and Methods

Design of the Study: A descriptive, cross sectional comparative design was used to assess proximate composition and sensory attributes of five loaf samples purchased from bakeries in Akure, Ondo State. This design enables simultaneous measurement and comparison of nutritional and sensory parameters without introducing interventions or manipulations.

Sample Procurement and Handling: Five loaf samples, coded A through E, were purchased fresh on the same morning from different bakeries in Akure. Immediately after purchase, each loaf was placed in an insulated container and transported to the Food Analysis Laboratory at the Federal University of Technology, Akure to preserve freshness. Upon arrival, each sample received its code to eliminate bias. Samples were stored at ambient laboratory temperature (25 ± 2 °C) and analyzed within four hours. Prior to analysis, loaves were allowed to equilibrate to room temperature. Under aseptic conditions, representative portions of crust and crumb were removed and homogenized in a laboratory mill. No additional processing such as re baking or toasting was performed, ensuring that analyses reflected the products as sold to consumers.

Proximate Analysis

Homogenized material from each coded sample was analyzed using official methods of the Association of Official Analytical Chemists. Each proximate element is reported briefly as follows:

Moisture content: Measured by oven drying approximately 5 g of homogenized sample at 105 °C until constant weight was achieved. Duplicate determinations were performed. This quantifies water loss and indicates potential shelf stability.

Crude protein: Determined by the Kjeldahl method. Samples underwent acid digestion to convert nitrogen to ammonium sulfate, followed by distillation and titration to quantify total nitrogen, multiplied by 6.25. Analyses were performed in duplicate, providing an estimate of protein level.

Crude fat: Extracted from approximately 3 g of dried homogenate using Soxhlet apparatus with petroleum ether for a set extraction time. The extracted lipid was evaporated to constant weight. Duplicate

assays ensured reproducibility and indicated energy density.

Ash content: Determined by incinerating a known weight of sample in a muffle furnace at 550 °C until white ash remained. Duplicate measurements yield mineral residue as a percentage of dry weight.

Crude fibre: Conducted on defatted residue. Samples underwent sequential acid and alkali digestion, followed by drying and ashing to calculate the indigestible fibre fraction. Duplicate assays provided consistency and insight into dietary fibre content.

Carbohydrate content: Calculated by difference as 100 minus the sum of moisture, protein, fat, ash, and fibre percentages. This approach, performed after all other determinations, estimates available carbohydrate.

All assays were performed in duplicate, and mean ± standard deviation are reported. Proximate analyses were carried out in the Food Analysis Laboratory under controlled conditions, with blanks and reference materials run periodically to verify method accuracy.

***Sensory Evaluation*:** This involved the following:

Selection of Panel: Twenty semi trained assessors, drawn from students and staff familiar with bread consumption, participated. Each panelist provided informed consent. Training sessions introduced them to evaluation attributes and use of the scale, ensuring consistent understanding without disclosing sample identities.

A nine-pont hedonic scale was used for data analysis. Sensory attributes tested were crust colour, crumb colour, aroma, taste, texture, and overall acceptability. Each attribute was rated on a nine-point hedonic scale, where 1 indicates dislike extremely and 9 indicates like extremely. The form included instructions on scale interpretation and space for brief comments.

Samples were presented in coded form (A–E) in randomized order under controlled lighting in a sensory booth. Approximately 20 g of each loaf, at room temperature, was offered on identical plates. Assessors cleansed their palate with water and unsalted crackers between samples.

Sensory scores were compiled and expressed as mean ± standard deviation for each sample and attribute. One-way analysis of variance was performed to detect significant differences among samples for each attribute at $p < 0.05$. Where ANOVA indicated significance, Duncan's multiple range test separated means. Statistical analyses were conducted using SPSS version 25.

Results

Table 1: Proximate Composition of Selected Bread Brands

Bread Brand	Moisture Content(%)	Protein (%)	Fat (%)	Ash (%)	Fibre (%)	Carbohydrate (%)
Sample A	38.24 ± 0.02	10.88 ± 0.04	2.25 ± 0.03	1.22 ± 0.08	1.08 ± 0.04	46.33 ± 0.04
Sample B	38.95 ± 0.04	10.68 ± 0.08	2.43 ± 0.04	1.08 ± 0.06	1.22 ± 0.08	45.64 ± 0.08
Sample C	42.19 ± 0.04	9.80 ± 0.04	1.85 ± 0.04	1.12 ± 0.04	1.15 ± 0.04	43.82 ± 0.06
Sample D	41.36 ± 0.00	10.21 ± 0.02	1.93 ± 0.04	1.06 ± 0.04	1.15 ± 0.04	44.28 ± 0.04
Sample E	36.00 ± 0.02	11.40 ± 0.02	1.75 ± 0.05	0.98 ± 0.04	2.45 ± 0.05	47.42 ± 0.08

Table 1 shows proximate composition of all bread samples (A-E). Moisture content ranged from 36.00 % in Sample E to 42.19 % in Sample C. Protein content varied between 9.80 % (Sample C) and 11.40 % (Sample E). Fat content was lowest in Sample E (1.75 %) and highest in Sample B (2.43 %). Ash content ranged from 0.98 % in Sample E to 1.22 % in Sample A. Fibre content spanned 1.08 % (Sample A) to 2.45 % (Sample E). Carbohydrate, calculated by difference, ranged from 43.82 % in Sample C to 47.42 % in Sample E.

Table 2: Sensory Properties of the Bread Brands

Bread Brand	Crust ($\bar{X}$)	Crumb ($\bar{X}$)	Aroma ($\bar{X}$)	Taste ($\bar{X}$)	Texture ($\bar{X}$)	Overall Acceptability ($\bar{X}$)
Sample A	3.85b	3.85b	3.80b	3.65b	4.00b	3.45b
Sample B	6.45a	6.45a	6.75a	6.10a	6.40a	6.40a
Sample C	3.95a	3.75b	4.65b	4.40b	4.90b	4.15b
Sample D	4.60b	4.65	4.85b	5.05b	5.60b	5.30b
Sample E	8.25a	8.10a	8.55a	7.95a	7.90a	8.35a
LSD 5%	0.194	0.194	0.228	0.319	0.223	0.208

Note: Means (X) with the same letter are not significantly different at the 5% level.

Table 2 summarizes mean sensory scores for crust colour, crumb colour, aroma, taste, texture, and overall acceptability. For crust colour, scores ran from 3.85 (Sample A) to 8.25 (Sample E). Crumb colour scores varied between 3.75 (Sample C) and 8.10 (Sample E). Aroma was rated from 3.80 (Sample A) up to 8.55 (Sample E). Taste scores ranged from 3.65 (Sample A) to 7.95 (Sample E), and texture from 4.00 (Sample A) to 7.90 (Sample E). Overall acceptability scores spanned 3.45 (Sample A) to 8.35 (Sample E). At the 5 % level (LSD: crust = 0.194; crumb = 0.194; aroma = 0.228; taste = 0.319; texture = 0.223; overall = 0.208), Sample E and Sample B did not differ significantly for crumb, aroma, taste, texture, or overall acceptability, whereas Sample E differed significantly from Samples A, C, and D on all attributes.

Discussion

The findings on proximate analysis, as presented in table 1, reveal marked variability across the five coded samples. One sample exhibited the lowest moisture content, placing it within the optimal range for shelf stability and minimizing spoilage risk—an observation echoed in breads partly substituted with plantain flour, which also showed reduced water activity and improved storage potential (Udomkun et al., 2022; Pereira de Freitas & Lannes, 2024). That same sample recorded the highest protein and fibre levels, aligning with reports that protein- and fibre-enriched composite breads (e.g., those incorporating soy or brewers' spent grain) can meet enhanced nutritional targets without drastic compromise to loaf quality (Khalil et al., 2021; Pereira de Freitas & Lannes, 2024). Conversely, the

sample with the highest fat and moisture had the lowest protein, suggesting that formulation choices and processing conditions strongly influence both energy density and nutrient balance, as seen in chickpea-enriched loaves where germination improved protein but altered crumb structure (Gautam et al., 2022).

The sensory evaluation, as shown in Table 2, reflected the proximate findings: the sample with the lowest moisture content and highest protein and fibre also achieved the highest mean scores for crust and crumb appearance, aroma, taste, texture, and overall acceptability. This pattern mirrors studies on fava bean– and black cumin–blended breads, where formulations yielding higher protein and fibre often correspond to favorable sensory attributes (Awulachew, 2025). Conversely, samples exhibiting higher moisture and lower protein and fibre tended to score lower in mouthfeel and flavour, consistent with reports that excessive substitution with certain alternative flours can negatively affect sensory quality (Udomkun et al., 2022; Khalil et al., 2021). These observations underscore that balancing moisture level, protein, and fibre enhancements with appropriate processing is critical to maintain both nutritional benefit and consumer-pleasing sensory properties.

Conclusion

This study demonstrated clear variation in both nutritional composition and sensory performance among five commercially obtained loaf samples. Samples with lower moisture content exhibited greater potential for extended shelf life, while those with higher protein and fibre contents aligned with improved consumer ratings. The sample that combined balanced proximate values with top scores for crust and crumb appearance, aroma, taste, texture, and overall liking exemplifies how nutritional enhancement and sensory appeal can coexist. These results underscore the importance for producers of concurrently targeting nutritional quality and sensory attributes to satisfy consumer expectations and remain competitive.

Recommendations

(1) Bakery producers should optimize formulations to achieve lower moisture content for improved shelf stability.
(2) Product development teams should explore ways to enhance protein and fibre levels.
(3) Quality control managers should implement standardized baking protocols.
(4) Sensory evaluation coordinators (within bakeries or research units) should organize regular sensory panels with representative consumers to track evolving preferences and guide iterative improvements.
(5) Regulatory agencies and laboratory analysts should establish routine quality-check procedures that include proximate composition assays and sensory metric benchmarks, for providing feedback to producers and informing guidelines for acceptable product standards.

References

Adepeju, A. B., Adewa, T. T., Oni, K. O., Oyinloye, A. M., & Olugbuyi, A. O. (2024). Nutrient Rich Complementary Food formulation using Locally Sourced

Compositions. *FUOYE Journal of Pure and Applied Sciences (FJPAS)*, *9*(1), 30-55.

Ajani, R., Oboh, G., Adefegha, S. A., Nwokocha, K. E., & Akindahunsi, A. A. (2020). Sensory attributes, nutritional qualities, and glycemic indices of bread blends produced from cocoa powder flavored yellow-fleshed cassava-wheat composite flours. *Journal of Food Processing and Preservation*, *44*(9), e14673.

Awulachew, M. T. (2025). Effect of partial replacement of wheat with fava bean and black cumin flours on nutritional properties and sensory attributes of bread. In *Proceedings of the 5th International Electronic Conference on Applied Sciences* (Vol. 87, Article 8). https://doi.org/10.3390/engproc2025087008

Balarabe, M. M., Mohammed, S. S. D., & Orukotan, A. A. (2017). Physico-chemical analysis and sensory evaluation of bread produced using different indigenous yeast isolates. *Science World Journal*, *12*(1), 33-37.

Banti, M., Teka, T. A., Agza, B., & Hailu, D. (2024). Proximate, Physical, and Sensory Properties of Bread from Taro–Wheat Composite Flour. *Journal of Food Processing and Preservation*, *2024*(1), 3575144.

Dauda, m. Y., isaac, d., jumare, s. A., shehu, s., maru, a. A., & akintoyese, a. O. (2024). Evaluation of baking quality of bread from composite mixture of wheat flour and p-glabra seed flour. *Fudma journal of sciences*, *8*(1), 19-24.

Gautam, N., Subedi, A., & Panta, O. P. (2022). Comparative analysis of bread properties using germinated and un-germinated chickpea flour. *Nepalese Journal of Research in Chemistry, JiM*, *2*(3), 34–41. https://doi.org/10.3126/nprcjmr.v2i3.76971

Ibidapo, P. O., Osibanjo, A. A., Asiru Wahab, B., Kayode, O. F., Ojo, O. E., & Elemo, G. N. (2019). Proximate Composition and Bread making performance of Selected wheat varieties grown in Nigeria. *Journal of Nigerian Institute of Food Science and Technology www. nifst. org NIFOJ*, *36*(2), 88-95.

Khalil, P., Masood, S., Rehman, A., Iqbal, Z., Islam, Z., Javaid, N., Ilyas, A., Qamar, S., & Zeb, A. (2021). Proximate and sensory analysis of wheat bread supplemented with Nigella sativa oil and Nigella sativa extract. *Pure and Applied Biology*, *10*(4), 1158–1165. https://doi.org/10.19045/bspab.2021.100122

Martins, Z. E., Pinho, O., & Ferreira, I. M. P. L. V. O. (2017). Fortification of Wheat Bread with Agroindustry By-Products: Statistical Methods for Sensory Preference Evaluation and Correlation with Color and Crumb Structure. *Journal of food science*, *82*(9), 2183-2191.

Mbachu, A. E., Chukwudozie, J. C., & Mbachu, N. A. (2023). Comparative assessment of microbial, proximate and sensory quality of bread produced from all-purpose flour and a blend of locally made flour. *Proceedings of the Nigerian Academy of Science*, *15*(2).

Mbachu, A. E., Otuya, W. A., & Mbachu, N. A. (2024). Microbial, Proximate and Sensory Evaluation of Bread Produced from a Blend of Wheat and Corn Flour. *Nigerian Journal of Microbiology*.

Mollakhalili-Meybodi, N., Sheidaei, Z., Khorshidian, N., Nematollahi, A., & Khanniri, E. (2023). Sensory attributes of wheat bread: A review of influential factors. *Journal of Food Measurement and Characterization*, *17*(3), 2172-2181.

Moretton, M., Cattaneo, C., Mosca, A. C., Proserpio, C., Anese, M., Pagliarini, E., & Pellegrini, N. (2023). Identification of desirable mechanical and sensory properties of bread for the elderly. *Food Quality and Preference*, *104*, 104716.

Nasir, S., Allai, F. M., Gani, M., Ganaie, S., Gul, K., Jabeen, A., & Majeed, D. (2020). Physical, textural, rheological, and sensory characteristics of amaranth-based wheat

flour bread. *International Journal of Food Science*, *2020*(1), 8874872.

Olagunju, A. I., Oluwajuyitan, T. D., & Oyeleye, S. I. (2021). Multigrain bread: dough rheology, quality characteristics, in vitro antioxidant and antidiabetic properties. *Journal of Food Measurement and Characterization*, *15*, 1851-1864.

Pereira de Freitas, F. P., & da Silva Lannes, S. C. (2024). Composition and sensory properties of breads supplemented with Brewers' spent grain from three different craft beer styles. *Culinary Chemistry & Health*, https://doi.org/10.1002/cche.10819

Torbica, A., Škrobot, D., Hajnal, E. J., Belović, M., & Zhang, N. (2019). Sensory and physico-chemical properties of wholegrain wheat bread prepared with selected food by-products. *LWT*, *114*, 108414.

Udomkun, P., Masso, C., Swennen, R., Romuli, S., Innawong, B., Fotso Kuate, A., Akin-Idowu, P. E., Alakonya, A., & Vanlauwe, B. (2022). Comparative study of physicochemical, nutritional, phytochemical, and sensory properties of bread with plantain and soy flours partly replacing wheat flour. *Food Science & Nutrition*, *10*, 2290–2307. https://doi.org/10.1002/fsn3.2907

Zula, A. T., Ayele, D. A., & Egigayhu, W. A. (2020). Proximate, antinutritional, microbial, and sensory acceptability of bread formulated from wheat (Triticum aestivum) and amaranth (Amaranthus caudatus). *International Journal of Food Science*, *2020*(1), 9429584.