FUDMA Journal of Sciences (FJS)
ISSN online: 2616-1370
ISSN print: 2645 - 2944
Vol. 7 No. 5, October, 2023, pp 34 - 38
DOI: https://doi.org/10.33003/fjs-2023-0705-1993

PRODUCTION AND QUALITY EVALUATION OF ENRICHED BREAD FROM FLOUR BLENDS OF WHOLE WHEAT, BAMBARA NUT, SOYBEANS AND CASHEW NUT SEED

Nakakana Hussaina, Sherifat Adeniran Misbah, Hassan Shehu Mohammed, *Abdullahi Haruna

Department of Biochemistry, Faculty of Life Sciences, Ahmadu Bello University, Zaria-Nigeria

*Corresponding authors' email: get2haruna@gmail.com

ABSTRACT

Bread is a staple food prepared from dough of flour and water, usually by baking. Throughout recorded history, bread has been very popular around the world. It is one of humanity's oldest foods, having been of great importance since the dawn of Agriculture. The major ingredient in bread production is wheat flour which is very expensive. The study was conducted to produce enriched bread from composite flour blend of whole wheat, soybeans, bambara nut and cashew nut seed. Four samples were produced of varying ratio mixes and then subjected to proximate, microbiological and sensory evaluation analysis. The result from the proximate analysis indicated that the nutritional value of the product increased significantly with the incorporation of flour composite. Sample A was rated highest for moisture (26%), sample B (16%) ash, sample C (18.5%) protein, (15.8%) fat respectively. Also sample C was the most accepted in terms of sensory qualities indicating improved bread quality. The result for micro biological qualities of the product indicated that the product is fit for human consumption. An enriched and nutritious adequate bread can be produced by substituting whole wheat flour with other flour composite. The study therefore based on its findings recommended that the product should be subjected for mineral and vitamin analysis to determine the micro nutrient content of the product and also its anti- nutritional composition.

Keywords: Flour, Food, mold, yeast, Proximate, sensory

INTRODUCTION

Bread is a staple food prepared from dough of flour and water, usually by baking. Throughout recorded history, bread has been very popular around the world. It is one of humanity's oldest foods, having been of great importance since the dawn of Agriculture (Olaoye *et al.,* 2006). In Nigeria, it is one of the most widely consumed food sources. Bread is generally made by baking dough which has wheat flour, water, yeast and salt as its main ingredient. These ingredients undergo a series of a process involving weighing, mixing, kneading, shaping, proofing and baking before the product is ready-to-eat. Other ingredients which may be added include flours of other cereals, fat, malt flour, soy flour, emulsifiers, milk, sugar, fruits, among others (Iwe *et al.,* 2014). Nutritionally, bread contains a high percentage of carbohydrate and fat both of which are needed for energy, while vitamins, minerals, protein, and other nutrients are relatively in a small portion. Bread is, however, relatively expensive, being made from wheat grains which are imported from foreign countries. The importation of wheat, therefore, causes an immense drain on the economic effect on agricultural and technological development. Wheat is the grain of choice in bread making due to its high gluten content, though, there have been reports of bread made from flours of other cereals grains such as maize, oats, rye, and barley; roots like cassava in combination with wheat flour (Falade and Akingbala, 2008).

Whole wheat is one of the most important staple foods for humans. It has been shown that the whole grain is a concentrated source of essential nutritional components such as vitamins, minerals, protein, fat and fiber while the refined grain is mostly starch (Aboaba *et al.,* 2010). The consumption of whole wheat food products is currently receiving attention in view of the health benefits as a good source of minerals and fiber. The potentials of whole wheat and inexpensive good protein source such as Bambara nut in bread making have not yet been tapped. Soybean is one of the most important oil and protein crops of the world (Hegazy and Ibrahim, 2019, Alabi *et al.,* 2007). Soybean it is an excellent source of protein because it contains all the essential amino acids, is very rich in minerals and is a good source of fat-soluble vitamins (Alabi *et al.,* 2007). Moreover, phytochemicals like isoflavones, contained in soybeans are effective cancer-preventive agents for lowering risks of various cancers, is also involved in prevention of osteoporosis via its phytoestrogen effects and in the prevention of neovascularization in ocular conditions (Abdullah *et al.,* 2011). Hence Soybean is regarded as the richest in food value of all plant foods consumed in the world (Mannay and Shadaksharaswany, 2005). Bambara nut is a legume species of African origin and is widespread in south of the Sahara African. Food legumes play crucial roles in fighting against malnutrition. It is therefore necessary that their levels of consumption, which are already too low in a number of developing countries, should be increased. Legumes serve as a source of protein to a large proportion of the population in the poor countries of the world by being the least expensive and easily stored and transported non-processed protein source (Satin, 2018). Bread is an important staple food product of which its consumption rate is steadily increasing in Nigeria. It is however, relatively expensive, being made from imported wheat that is not cultivated much in the tropics for climate reasons (Edema *et al.,* 2015). Although there is now a substantial amount of available composite bread technology, such bread still requires at least 70% wheat flour to be able to use (Satin, 2018; Eggleston *et al.,* 2012). Therefore, the objective of this study was to produce acceptable enriched bread from whole wheat grain and Bambara nut.

MATERIALS AND METHODS

Materials

The materials used for the production of enriched bread include: Bambara nut, soybeans, cashew nut. MacConkey agar/nutrient agar, Potato dextrose agar, 10% tartaric acid, sterilized ringer's solution,, Ringer's solution, plate count agar, measuring cylinder and weighing balance, atomic absorption spectrophotometer (AAS) and starter culture.

Production of Soybeans into flour

The soybean was bought and sorted of different particles such as stones, sand etc. the sorted soybean was washed with from remove dirt and the natural coating, it was steeped in hot water for ten minutes. Dehulling was then carried out on the soybean. Another thorough washing was carried out. Drying of the soybean was then carried out for three hours in the open sun. Milling was carried out on the dried soybean. Shade drying was done on the milled, after this, sieving was done and the sieved soybean was labelled as soybean flour.

Processing of Bambara nut into flour

The Bambara nut were sorted, it was ensured that all foreign material that served as contaminants were removed, the Bambara nut was dehulled and washed. It was dried using the cabinet dryer, the dried Bambara nut was milled into fine flour, the flour was sieved and collected in an empty container.

Processing of cashew nut into flour

Fried cashew nut was purchased from the market, it was sorted and all dirt were removed, it was milled and sieved. the fine flour was collected and packaged into an airtight container.

Production of the Bread

All ingredients were initially dry mixed in a bowl and later water was mixed with the original dry mix until soft dough that could easily be handled was produced. The straight dough method described by (Eggleston *et al*., 2015) was followed. The dough was manually kneaded before molding into shapes. Dough proofing was carried out for the different proofing time at room temperature and baked at 2100ºC for 25 min. After baking, the dough was brought out in each case from the oven and immediately depanned by knocking out. The knocked-out bread was then placed on a wooden table to cool and to avoid condensation.

Table 1: Ratio Formulation (g)

Sample	Wheat Flour	Bambara nut	Cashew	Soy beans
A	700	100	100	100
B	600	100	100	200
C	500	100	100	300
D	Commercially made			

Proximate Analysis of the Bread

The product was analyzed for moisture, crude protein, (formal titration). Crude lipids, ash crude fiber and available carbohydrate according to the method recommended by the association of Official Analytical Chemist (1984).

Microbial Analysis

The following microbial analysis were conducted: total plate count for enumeration aerobic bacteria using standard plate count method recorded by (Larry and James, (2001). was used. Coliform count for the enumeration of coliform bacteria using standard plate count method according to (Larry and James, (2001). Yeast and mould count (for enumeration of yeast and mould) using standard plate count method according to (Larry and James, (2001).

Organoleptic Test (Sensory Evaluation)

The sensory evaluation of the bread was done by untrained panel of 20 judges on 9-point hedonic scale. A Performa of this scale was given to judges on whom different attributes like appearance, taste, aroma, flavor, texture, and overall acceptability are mentioned. All evaluations were conducted at room temperature. Bread was presented in small plates, labeled with three digits English alphabets.

Statistical Analysis

All experiments and analyses were carried out in triplicates and the mean was calculated. Data were subjected to analysis of variance (ANOVA) using a general linear model Wahua (1999). Duncan multiple range test was used to separate means where significant differences existed Duncan (1955).

RESULTS AND DISCUSSION

Table 2: Proximate Composition of enriched bread samples

Parameter	A	B	C	D
Moisture	26.0 ± 0.00^{d}	24.5 ± 0.01^{b}	23.4 ± 0.08^{a}	25.5 ± 0.07^{c}
Protein	14.05 ± 0.07^{b}	16.50 ± 0.14^{c}	18.50 ± 0.14^{d}	5.10 ± 0.14^{a}
Fat	10.6 ± 0.07^{b}	$13.\ 5\pm0.07^{a}$	15.8 ± 0.01^{d}	4.55 ± 0.07^{a}
Ash	1.50 ± 0.00^{a}	16.0 ± 0.00^{a}	1.63 ± 0.04^{a}	8.25 ± 9.55^{a}
Fiber	4.30 ± 0.00^{b}	5.15 ± 0.07^{c}	6.00 ± 0.00^{d}	2.15 ± 0.07^{a}
Cho	43.90 ± 0.00^{c}	39.3 ± 0.98^{b}	34.6 ± 0.28^{a}	61.3 ± 0.35^{d}

(Mean of sample in the same column with the same superscript are not significantly different p>0.05).

Key:

Sample A: whole wheat (700g), Bambara nut (100g), soybeans (100g) cashew nut (100g)
Sample B: whole wheat (600g), Bambara nut (100g), soybeans (100g), cashew nut (200g)
sample C: whole wheat (500g), Bambara nut (100g), soybeans (100g), cashew nut (300g)

Table 2. present the proximate composition of enriched bread sample. For moisture, sample C (23.4±0.08) has the lowest moisture content while sample A (26.0±0.00) has the highest moisture content. There is no significant difference among the samples at ($p>0.05$). For protein content, sample D (5.10±0.14) has the lowest protein content while sample C (18.50±0.14) has the highest protein content. For fat composition of samples, sample D (4.55±0.07) has the lowest fat content while sample C (15.8±0.01) has the highest fat content. For ash content, Sample A (1.50±0.00) has the lowest ash content, sample D (8.25±9.55) has the highest ash content. the value range indicated significant difference among the samples at ($p>0.05$). For fiber, sample D (2.15±0.07) has the lowest fiber content while sample C (6.00±0.00) has the highest fiber content. For Carbohydrates, Sample C (34.6±0.28) has the lowest carbohydrate content while sample D (61.3±0.35) has the highest carbohydrate content which shown no significant difference at ($p>0.05$).

Table 3: Result of Sensory Evaluation Analysis of Enriched Bread Sample

Sample	Colour	Taste	Flavour	Texture	Overall acceptance
A	7.95±1.23[a]	7.60±1.14[ab]	7.15±1.04[a]	6.65±1.31[a]	7.80±1.00[a]
B	7.80±1.00[a]	7.25±1.21[a]	7.10±1.25[a]	7.50±1.50[ab]	7.60±1.27[a]
C	15.95±2.9[a]	8.15±0.93[b]	7.80±1.28[a]	7.65±1.39[a]	8.0o5±1.10[a]
D	17.90±2.73[a]	7.15±1.42[a]	7.20±1.15[a]	7.15±1.50[ab]	7.30±1.03[a]

(Mean of sample in the same column with the same superscript are not significantly different p>0.05).

Key:

Sample A: whole wheat (700g), Bambara nut (100g), soybeans (100g) cashew nut (100g)
Sample B: whole wheat (600g), Bambara nut (100g), soybeans (100g), cashew nut (200g)
sample C: whole wheat (500g), Bambara nut (100g), soybeans (100g), cashew nut (300g)

Table 3 present result of sensory evaluation analysis of bread produced from flour blend of whole wheat, Bambara nut, soybeans and cashew nut seeds. For color the value ranges from 7.80 – 17.90%. Sample B (7.80%) had the least value while sample D (17.90%) recorded the highest value range. The level of significant difference indicates no significantly different ($p>0.05$). For taste, the value ranges from 7.15 – 8.15%. Sample D (7.15%) recorded the least value while sample C (8.15%) had the highest value. No significant difference was observed among samples at ($p>0.05$). For Flavour, the value obtained ranged from 7.10 - 7.80%. Sample B (7.10%) had the least value while sample C (7.80%) recorded the highest value. There is no significant difference in flavor perception among the samples ($p>0.05$). The value obtained for texture range from 6.65 - 7.65%. Sample A (6.65%) while sample C (7.65%) recorded the highest value. For texture, same value was obtained for all the samples 6.65%. There is no significant difference in texture perception among the samples ($p>0.05$). Furthermore, for overall acceptability, the value ranged from 7.30 - 8.05%. Sample D (7.30%) had the least value while sample C (8.05%) recorded the highest value. There is no significant difference in overall acceptance among the samples ($p>0.05$).

Table 4: Total Plate Count of Enriched Bread Sample

Sample	Colonies count	CFu/g	Gram reaction	Microscopic identification
A	5 x 10^{-1}	<1.0 x 10^{2}	Gram +ve rod	Bacillus species
B	7 x 10^{-1}	<1.0 x 10^{2}	Gram +ve rod	Bacillus species
C	8 x 10-^{1}	<1.0 x 10^{2}	gram +ve rod	Bacillus species
D	12 x 10-1	1.2 x 102	gram +ve rod	Bacillus species
			gram +ve cocci	Staphylococci species

The able above table (4) on the total plate count indicate that sample A, B, C and D recorded colonies count of 7x10-1 CFu/g, 76x10-1 CFu/g, 126x10-1 CFu/g and 158x10-1 CFu/g respectively. The Gram Reaction for Sample A, B, and D all have a Gram-positive reaction and Sample C has a Gram-positive reaction as well. The Microscopic Identification indicate that sample A and Sample B are identified as Staphylococci spp (species) based on microscopic examination, sample C is identified as Bacillus spp (species) based on microscopic examination. Sample D is identified as Staphylococci based on microscopic examination.

Table 5: Coliform Count of Enriched Bread Sample

Sample	Colonies count	CFu/g	Gram reaction	Microscopic identification
A	Nil	Nil	Nil	Nil
B	Nil	Nil	Nil	Nil
C	Nil	Nil	Nil	Nil
D	Nil	Nil	Nil	Nil

The table 5 showns result for coliform count which indicates that no colony was counted, no gram reaction was observed and no micro- organism was isolated

Table 6: Yeast and Mould Count of Enriched Bread Sample

Sample	Colonies count	CFu/g	Gram reaction	Microscopic identification
A	2 x 10^{-1}	<1.0 x 10^{-2}	Gram +ve black powdery	Mould spp
B	3 x 10^{-1}	<1.0 x10^{-2}	Gram +ve black powdery	Mould spp
C	3 x 10^{-1}	<1.0 x10^{-2}	Gram +ve black powdery	Mould spp
D	6 x10^{-1}	<1.0 x 10^{2}	Gram +ve black powdery	Mould spp

Table 5. present the result of the yeast and mould count of samples. Sample A, B, C and D recorded a colony count of 5x10-1 CFu/g, 66x10-1 CFu/g, 97x10-1 CFu/g and 53x10-2 CFu/g respectively. The Gram Reaction observed. All samples (A, B, C, D) have a Gram-positive reaction. The microscopic identification reveals that All samples (A, B, C, D) are identified as Mould spp (species) based on microscopic examination. The description provided is "Gram +ve black powdery," indicating the appearance and color of the observed mould growth.

Discussion

The sensory evaluation analysis of the enriched bread samples provided valuable insights into the sensory attributes that influenced the overall quality and acceptability of the bread. These findings have implications not only for sensory scientists but also for nutritionists and food product developers.

In terms of color, the results revealed that Sample A obtained the highest score, indicating its visually appealing color. The blend of whole wheat, Bambara nut, soybeans, and cashew nut in sample A contributed to the attractive color observed by the panelists. Color evaluation is an important aspect of food quality assessment, as it influences consumer perception and acceptance (Figueiredo-Muniz et al., 2023). Sample B received the highest score, suggesting that the incorporation of a higher proportion of cashew nut resulted in a more favorable flavor profile. The taste buds of the panelists were tantalized by the interplay of taste, smell, and texture, which collectively contribute to the overall sensory experience of flavor. This is in contrast with a study conducted by Christiana and Henry (2019). Flavor is a key driver of food preference and consumer acceptance. Texture evaluation revealed that Sample B had the highest score, indicating a superior mouth feels experience. This is also differ with a study conducted by Christiana and Henry (2019). The formulation blend with a higher proportion of cashew nut contributed to the desired consistency and viscosity, enhancing the overall sensory encounter. This is in similar with a study reported by (Bourre et al., 2019). Texture plays a crucial role in food enjoyment and can impact satiety and perceived quality, when it comes to taste. Sample B outperformed the other samples, demonstrating its superior taste profile. The combination of ingredients, including the higher proportion of cashew nut, contributed to a more desirable taste experience. This is in contrast with a study reported by (Iwe *et al.*, 2014) and similar with a work reported by Yusufu and Ejeh, (2018). Taste perception is influenced by various factors, including the activation of taste receptors and the presence of specific flavor compounds.

The evaluation of overall acceptability revealed that Sample B received the highest mean score, indicating its superior sensory experience and consumer preference. The formulation blend enriched with a higher proportion of cashew nut resulted in a product that was more widely accepted and satisfying to the panelists. This is similar with a study conducted by Christiana and Henry (2019). Overall acceptability is a crucial measure of consumer satisfaction and determines the market success of food products.

The results of the total plate count, coliform count, and yeast and mold count provide important information regarding the microbiological quality and safety of the food samples. These results have implications for food quality and consumption: Total Plate Count: The total plate count indicates the overall microbial load present in the samples. The higher the colony count, the greater the microbial contamination. In this case, Sample D had the highest colony count, suggesting a higher level of microbial contamination compared to the other samples. This could indicate poor hygiene practices during processing or storage, which may compromise the safety and shelf life of the product. High microbial counts can lead to spoilage, quality deterioration, and potential foodborne illnesses if pathogenic microorganisms are present. This is in line with a study carried out by (Daniyan and Nwokwu, 2011). Coliforms are a group of bacteria used as indicators of fecal contamination and the possible presence of pathogenic microorganisms. In this analysis, no coliform colonies were detected in any of the samples. This is a positive result, indicating that the samples were free from coliform bacteria, which are typically associated with unsanitary conditions and may indicate the presence of harmful bacteria such as Escherichia coli. This is in contrast with a work reported by Udeme et al., (2014). The absence of coliforms suggests better hygiene and lower risks of foodborne illnesses. Yeasts and molds are common spoilage microorganisms that can negatively affect the quality and shelf life of food products. The presence of molds can lead to visual and sensory changes, such as off-odors, discoloration, and texture alterations. In this case, all samples exhibited the presence of mold colonies, with Sample D having the highest count. This in line with a study reported by Adeleke and Odedeji, (2010). Although molds can be a natural part of the environment, their presence in high numbers indicates potential contamination or inadequate storage conditions. It is important to note that not all molds are harmful, but some may produce mycotoxins, which can be detrimental to human health if consumed in large quantities.

CONCLUSION

This research work revealed the absence of the colonies growth in the study samples and they were within the acceptable safety range. So care should be taken by manufacturing industries to prevent contamination in the processes of producing bakery products as it can has health effects or can be dangerous on the consumers health. Appropriate handling and safety method should be practices during the course of production.

REFERENCE

AACC. “Approved Methods of the American Association of Cereal Chemists. American Association of Cereal Chemists”, Incoperated; Strain. Paul, Minnesota, United Stated of America, 2000

Aboaba, O. O. Obakpolor, E. A. (2007). “The leavening ability of bakers’ yeast on dough prepared with composite flour (Wheat/Cassava)”, Afr ica Journal of Food Sci ence. 4: 325-329, 2007

Alabi, M.O. Julian, Anuonye. “Nutritional and sensory attributes of soy-supplemented cereal meals”, DO - 10.4314/nifoj.v25i1.33658; 2007/11/23. Nigerian Food Journal (ISSN: 0189-7241), 25:1, 2007

Abdullah, F. A. Viquar, Fatima, Q. Khalida, J. Shoeb, Q. “Preventive effects of phytoestrogens against postmenopausal osteoporosis as compared to the available therapeutic choices”, An overview. doi: 10.4103/0976-9668.92322. 2011 Jul-Dec; 2(2): 154–163, 2011

AOAC. “Official Methods of Analysis 14th ed. Association of official Analytical Chemists”, 1984

Bourré, L. Frohlich, P. Young, G. Borsuk, Y. Sopiwnyk, E. Sarkar, A. Michael, T. Nickerson, Yongfeng, A, I, Dyck, A. Malcolmson, L. “Influence of particle size on flour and baking properties of yellow pea, navy bean, and red lentil flours”, first published: 30 april 2019. https://doi.org/10.1002/cche.10161, 2019

Christiana, O. E. Henry, E. E. “Production, Quality Evaluation and Acceptability of Bread from Wheat, Bambara Groundnut and Yellow Root Cassava Flours”, International Journal of Food Bioscience. Vol: 2, Issu: 1, 11-17, 2019

Duncan, D.B. "Multiple Range and Multiple F-Test". Biometrics, 11, 1-5, 1955

Eggleston, G. Omoaka, P. F. Thechioha, D. O. "Development and Evaluation of products from cassava flour as new alternatives to wheaten breads", Journal of Food Science and Agriculture. 56:377-385, 2012

Daniyan S. Y., Nwokwu O. E. "Enumeration of microorganisms associated with the different stages of bread production in FUTMIN bakery, Nigeria". *International Research Journal of Pharmacy. 2011;2(7):88–91, 2011*

Eggleston, G. Omoaka, P. F. Thechioha, D. O. "Development and Evaluation of products from cassava flour as new alternatives to wheaten breads", Journal of Food Science and Agriculture. 56:377-385, 2015

Edema, M. S. Sanni, L. O. Sanni, A. I. "Evaluation of Maize soyabean flour blends for soya maize bread production in Nigeria", Africa Journal of Biotechnology. 4(9):911-918, 2015

Figueiredo Muniz, V. R. G. Ribeiro, I. S. Beckmam, K. R. L. Godoy, R. C. B. "The impact of color on food choice". Brazilian Journal of Food Technology, 26, e2022088. https://doi.org/10.1590/1981-6723.08822, 2023

Falade, K. O. Akingbala, J. O. "Improved nutrition and national development through the utilization of Cassava in baked foods", In: Robertson GL, Lupien Journal of Research (editions.) International Union of Food Science and Technology, 2019

Hegazy and Ibrahim. "Nutritional and sensory attributes of soy-supplemented cereal meals", DO - 10.4314/nifoj.v25i1.33658; 2007/11/23. Nigerian Food Journal (ISSN: 0189-7241), 25: 1, 2019

Iwe, M. O. Okereke, G. O. Agiriga, A. N. "Production and Evaluation of Bread Made from Modified Cassava Starch and Wheat Flour Blends", Agrotechnology.. 4: 133, 2014

Larry, M. James, T. P. "Aerobic Plate Count. United state food and drug adminiration", 10/7800: 29, 2001

Mannay, S. Shadaksharaswany, C. M. "Foods: Facts and Principles", (2nd editions.). New Age International Limited. Publishers. New Delhi, India, 2005

Olaoye, O. A. Onilude, A. A. Idowu, O. A. "Quality Characteristics of Bread produced from composite flours of wheat, plantain and soybeans", Africa Journal of Biotechnology. 5: 1102-1106, 2006

Satin, M. "Bread without wheat: novel ways of making bread from cassava and sorghum could reduce the 3 road world's dependence on imported wheat for white bread", New Science. 28: 56-59, 2018

Udeme, J. Josiah, I. Helen, S. A. Mercy, O. A. Sesan, A. A. "Microbiological, Nutritional, and Sensory Quality of Bread Produced from Wheat and Potato Flour Blends", International Journal of Food Science. 2014; 671701. Published online 2014 Aug 11. doi:10.1155/2014/671701, 2014

Wahua, T. A. T. "Applied Statistics for Scientific Studies. Macmillan Publishing", Lagos, page, 45: 22, 1999

Yusufu, M. I. Ejeh, D. D. "Production of Bambara Groundnut Substituted Whole Wheat Bread: Functional Properties and Quality Characteristics". Journal of Nutrition and Food Science. 2018, 8:5 DOI: 10.4172/2155-9600.1000731, 2018