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Evaluation, Physicochemical and Sensory Properties of Composite Bread Produced from Wheat, Sweet Potatoes and Cashew Nut Flour

O. O. Tanko [a*], T. O. Hussaina [b] and N. S. Donaldben [a]

[a] *Department of Food Technology, Federal Polytechnic, Kaura Namoda, Zamfara State, Nigeria.*
[b] *Department of Science Laboratory Technology, Federal Polytechnic, Kaura Namoda, Zamfara State, Nigeria.*

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The physicochemical properties of Wheat, sweet potato and cashew nut flour blends were studied. The sweet potatoes were washed; peeled; sliced; dried, and milled to Flour. The cashew nuts were also sorted, cleaned and processed into Flour. The Wheat, sweet potato and cashew nut Flour were proportioned into different samples G_1 (100:00:00). Control samples were 100 % wheat flour, G_2 (80:10:10), G_3 (70:20:10) and G_4 (60:30:10) respectively. Bread from these different proportions was formulated. The functional, proximate, physical properties and sensory properties were determined. GENSTAT Statistical Software (version 17.0) was used for data analyses. The Data obtained showed the following ranges for Bulk density (0.83-0.84 g/ml), water absorption capacity (3.65-5.78 g/g), oil absorption capacity (1.73-2.76 g/g), swelling index (7.22-7.94) and pH (5.95-6.00). Proximate compositions of the Bread showed the following ranges for moisture (30.14-34.68 %), protein (7.89-13.03 %), fat (8.82-952 %), fibre (1.23-4.34 %), ash (0.56-2.02 %) and

**Corresponding author: Email: stepdonald82@hotmail.co.uk;*

carbohydrates (38.86-51.37 %). The physical properties of the Bread ranged from 210.60-247.50 g, 1.27-2.40 mm, 328.70-440 cm^3 and 1.33-2.10 for loaf weight, oven spring, loaf volume and specific volume, respectively. Sensory evaluation findings indicated that up to 30 % substitution of sweet potato flour and 10 % cashew nut flour for wheat flour was acceptable in bread formulation.

Keywords: Bread; Sweet potato; cashew nut; functional, proximate; swelling index; moisture; physical properties.

1. INTRODUCTION

"Bread can be said to be a fermented confectionary product produced mainly from wheat flour, water, yeast and salt by a different process involving mixing, kneading, proofing, shaping and baking" [1]. "Bread is an important staple food in both developing and developed countries and constitutes one of the most important sources of nutrients such as carbohydrates, protein, fibre, vitamins and minerals in many people's diets worldwide" [2]. "Bread consumption in Nigeria is steadily increasing because it is convenient and ready-to-eat food customarily consumed at breakfast, lunch, and sometimes dinner" [3]. "No household or family in Nigeria does not consume Bread at least once a day since its consumption cuts across socioeconomic classes and is acceptable to children and adults. Bread has gained wide consumer acceptance for many years in Nigeria" [4,5]. "However, Bread and other baked products are relatively expensive, as they are produced from Wheat, which, due to climatic conditions, does not grow well in the tropics and has to be imported" [6].

"Sweet potato (SP) is the world's most important food crop and an essential staple in Nigeria and other developing countries" [7]. "It is a low-input crop used as a vegetable, a desert, a source of starch and animal feed" [7]. "Sweet potato (SP) production was reported to be 112.8 million tons (in 115 countries) in 2017, and China is the leading producer, followed by Nigeria and Tanzania, Indonesia, and Uganda" [8]. "Sweet Potato production and consumption in Africa, Asia, South American continents, and Caribbean islands have recently increased tremendously. Sweet potato is the most abundantly grown root crop in Africa. Cashews are very nutritious and a medium for essential minerals, including copper, calcium, magnesium, iron, phosphorus, potassium and zinc. Sodium is also present in small quantities. Cashew nuts are vital for the healthy development of bones, muscles, tissue and body organs. It contains low amounts of sugar, which are safe for diabetic patients" [9]. The specific objectives of this research were to determine the potential of sweet potato and cashew nut flour blends in the production of biscuits.

"Composite Flour is a mixture of several flours obtained from roots and tubers, cereal and legumes, with or without wheat flour" [10]. "Usually, the aim of producing composite Flour is to get a product products components. Blended Flour is considered advantageous in developing countries because it can reduce the importation of wheat flour and encourages the use of locally grown crops such as Flour" [11,12]. Noorfarahzilah et al. [13] also defined "composite flour as a mixture of flours obtained from tubers which are rich in starch, such as yam, cassava, potato, and protein-rich Flour and cereals, without or with wheat flour that is created to satisfy specific functional characteristics and nutrient composition" For example, Wheat with sweet potatoes [14,15], Wheat and cassava [16,17], Wheat and many legumes [18,19], millet [20,21] or without wheat flour [22,23,24] and other composites [25,26,27].

The aim of this research is to evaluate the physicochemical properties of Bread prepared from blends of Wheat, sweet potato and cashew flour.

2. MATERIALS AND METHODS

2.1 Source of Materials

Sweet potato, SP (*Ipomoea batatas*), and baking materials: Wheat flour (Dangote), sugar (Dangote), yeast (Instant dry yeast), baking powder (STK Royal), margarine (Simas), salt, filled milk (Cowbell), were purchased from a Supermarket in Kaura Namoda, Zamfara State. Packaging material: polyethene ziplock double zipper storage bags were purchased from the Gusau Central Market, Zamfara. Cashew nut was purchased from the Lokoja Central Market, Kogi State. All laboratory materials and reagents used were of analytical grade. Raw materials were adequately cleaned by removing extraneous matter before their subjection to different processing treatments.

2.2 Sample Preparations

2.2.1 Preparation of sweet potato (SP) flour

Sweet potato (SP) flour was prepared according to the method of Avula [28], with slight modification. SP tubers were washed and peeled manually with knives, keeping them in water to prevent enzymatic browning. The tubers were trimmed and sliced thinly (manually) and oven dried at 60^{0}C, milled, sieved (0.5mm), packed in a polyethene bag and labelled accordingly (Fig. 1).

2.2.2 Preparation of Cashew nut (CF) Flour

"The raw cashew nuts seeds were sorted to remove the stones, foreign materials and unwholesome cashew nuts. The nuts were soaked in water for two minutes and sun-dried, ready for roasting. The nuts were roasted for fifteen minutes using the open pan roasting method. A wooden hammer was used for manual shelling of the nuts. The roasted cashew nuts were then oven-dried, and the peels or covering taste were removed by squeezing and then winnowed to obtain the cream-coloured cashew nuts. After grading, the roasted cashew nuts were milled using an ATLAS milling machine (model no. YL 112M-4, Japan) and sieved (0.3 mm aperture size sieve). The cashew nuts flour was packaged in a polyethene bag and stored at a low temperature (5ºC), described" by Russel [29] with modifications.

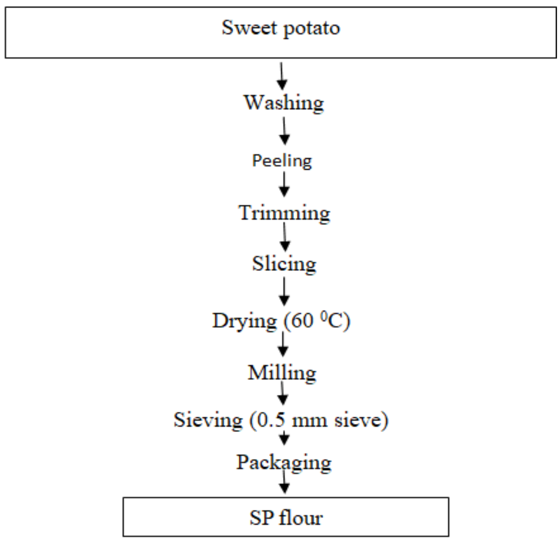

Fig. 1. Flow chart for the preparation of sweet potato (SP) Flour

Source: Avula [28] with modification.

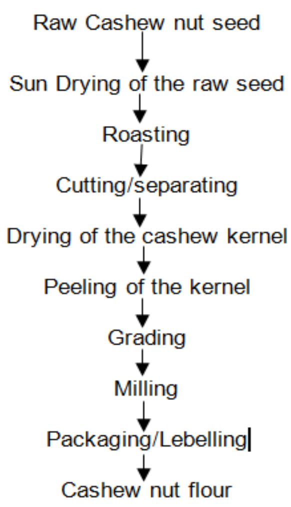

Fig. 2. Flow Process for the production of cashew nut flour

Source: Russel [29] with modification

2.3 Blend Formulation

Various flour blends of wheat flour (WF), Sweet potato flour (SP) and Cashew nut flour (CF) were produced with 10, 20 and 30 per cent SP into wheat flour, respectively, as described in Table 2.

2.4 Production of Bread

The Straight dough method produced Bread and composite bread [30] (Fig. 3). Ingredients (wheat flour or composite Flour, fat, water, instant dry yeast, sugar and salt) (Table 2) were mixed in various proportions for 15 min. After mixing, the dough was appropriately kneaded until soft, moulded, and shaped into greased pans for proofing. The dough was proofed in a proofing cabinet for 2 hours at 50^{0}C and then baked in a pre-heated electric oven at 230^{0}C for 30 min. Bread samples were de-panned, cooled, and packed in polyethene bags, which were stored at ambient temperature till subsequent analyses.

Table 1. Blend formulation

Sample/Code	WF	SP	CF
G_1	100	00	00
G_2	80	10	10
G_3	70	20	10
G_4	60	30	10

Table 2. Ingredients for production of bread

Component	Bread composition **
Flour (g)*	100
Yeast (g)	2.5
Sugar (g)	5
Salt (g)	1
Fat (g)	3.00
Baking powder (g)	-
Egg (whole)	-
Skimmed milk (g)	-
Water (ml)	65

** Wheat or composite Flour*
***Source: Igbabul et al. [30] with modification*

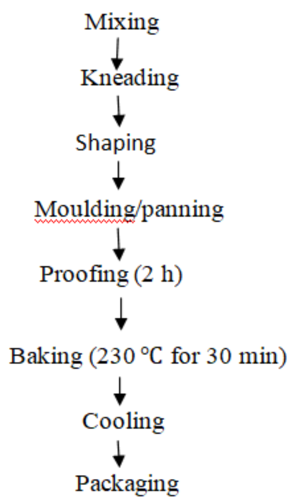

Fig. 3. Flow process for the production of Bread and composite Bread
Source: Igbabul et al. [30] with modification.

2.5 Determination of the Functional Properties of Flour and Composite Flours

"Functional properties (Bulk density, water and oil absorption capacity, gelation capacity, swelling index, emulsification capacity and pH) of the flour blends for bread production were carried out in accordance to the methods described" by [31].

2.5.1 Bulk density

A 10 mL graduated cylinder was weighed dry and gently filled with the flour sample up to the 10 ml mark. The bottom of the cylinder was tapped gently on a laboratory bench several times. This continued until no further diminution of the test flour sample in the cylinder after filling to mark was observed. The Weight of the cylinder plus Flour was measured and recorded. Bulk density is expressed as:

$$Bulk\ density\ (g/ml) = \frac{Weight\ of\ the\ sample\ (g)}{volume\ of\ sample\ (ml)} \quad (1)$$

2.5.2 Water/Oil absorption capacity (WAC/OAC)

About one gram sampl mixed with 10 ml distilled water or 10 ml of vegetable oil of known density (0.99 mg/ml) for 5 min on a magnetic stirrer at 1000 rpm. The mixture was centrifuged (Model: SM 800B Uniscope Surgifriends Medicals, England) at 3500 rpm for 30 min, and the volume of the supernatant was noted. WAC or OAC was calculated and expressed as g of water or oil absorbed or retained per g of sample.

$$Water\ Absorption\ Capacity\ (\%) =$$

$$\frac{Amount\ of\ water\ added - Free\ water}{Weight\ of\ sample} \times density\ of\ water \times 100 \quad (2)$$

$$Oil\ Absorption\ Capacity (\%) =$$

$$\frac{Amount of oil\ added - Freeoil}{Weight of sample} \times density of oil \times 100 \quad (3)$$

2.5.3 Swelling index

Ten grams (10 g) of the sample was introduced into a graduated cylinder with the dry Bulk volume noted. Therefore, 100ml of boiling water was mixed thoroughly with the piece in the cylinder. The book was measured after 10mins, and the swelling index was calculated as follows:

$$SwellingIndex \left(\frac{\text{mL}}{\text{g}}\right) = \frac{\text{Change in Volume of Sample (ml)}}{Original\ WeightWeight\text{ of Sample}} \quad (4)$$

2.5.4 pH determination

Ten grams (10 g) of each sample was suspended in 100 ml distilled water and mixed in a warring blender. The pH of the mixture was measured in duplicate using a pH meter (Model Lab tech digital 152 R) earlier standardised using buffer solutions of 4.01 and 9.20. The electrode was rinsed with distilled water and dipped into the homogenate, allowing sufficient time for stabilisation before taking the reading.

2.6 Determination of Proximate Composition of the Breads

The proximate composition of the blends was determined by the standard methods described by the AOAC (2012). Carbohydrate content was determined by difference [31].

2.6.1 Moisture

Moisture content was determined using the air oven drying method. A clean dish with a lid was dried in an oven (GENLAB, England B6S, serial no: 85K054) at 100^0C for 30min. It was cooled in a desiccator. 2 g of sample was weighed into the dish. The dish with its content was then put in the oven at 105°C and dried to a fairly constant weight. The loss in Weight from the original sample (before heating) was reported as a percentage of moisture.

$$\%\ Moisture = \frac{weight\ loss\ (W2-W3)}{Weight of Sample\ (W2-W1)} x\ 100 \quad (5)$$

$Where$
$W1 = Weight\ of\ dish,$
$W2 = weight\ of\ dish + sample\ before\ drying,$
$W3 = Weight\ of\ dish + sample\ after\ drying.$

2.6.2 Crude protein

The Kjeldahl method was used to determine crude protein. The sample weighed two grams (2 g) into a Kjeldahl digestion flask using a digital weighing balance (3000g x 0.01g 6.6LB). A catalyst mixture weighing 0.88g (96% anhydrous sodium sulphate, 3.5% copper sulphate and 0.5% selenium dioxide) was added. Concentrated sulphuric acid (7ml) was added, and the flask was swirled to mix the content. The Kjeldahl flask was heated gently in an inclined position in the fume chamber until no sample particles adhered to the side of the flask. The solution was heated more firmly to make the liquid boil with intermittent shaking of the flask until a clear solution was obtained. The answer was allowed to cool and diluted to 25ml with distilled water in a volumetric flask. 10 ml of the diluted digest was transferred into a steam distillation apparatus. The digest was made alkaline with 8 ml of 40% NaOH. 5 ml of 2% boric acid solution was added to the receiving flask, and three drops of the mixed indicator were dropped. The distillation apparatus was connected to the receiving flask with the delivery tube dipped into the 100ml conical flask and titrated with 0.01 M HCl. A blank titration was done. The percentage of nitrogen was calculated from the formula:

$$\% \, Nitrogen = \frac{(S-B)\times 0.0014\times 100\times D}{sample\ weight} \quad (6)$$

Where, S = sample titre, B = Blank titre, S - B = Corrected titre, D = Dilution factor
% Crude Protein = % Nitrogenx 6.25 (correction factor).

2.6.3 Crude fat

Crude fat was determined using the Solvent extraction method. Five gram (5 g) sample was weighed into a thimble, and loose plug fat-free cotton wool was fitted into the top of the thimble with its content inserted into the bottom extractor of the Soxhlet apparatus. A flat bottom flask (250ml) of known Weight containing 150-200ml of 40-60^{0}C hexane was fitted to the extractor. The instrument was heated, and fat was extracted for eight hours. The solvent was recovered, and the flask (containing oil and solvent mixture) was transferred into a hot air oven (GENLAB, England B6S, serial no: 85K054) at 105^{0}C for one h to remove the residual moisture and to evaporate the solvent. It was later transferred into a desiccator to cool for 15 min before weighing. The percentage fat content was calculated as

$$\% \, CrudeFat = \frac{Weight\ of\ extracted\ fat}{Weight\ of\ Sample}\ multiplied\ by\ 100 \quad (7)$$

2.6.4 Crude fibre

Two gram (2 g) of the sample was extracted using diethyl ether. This was digested and filtered through the California Buchner system. The resulting residue was dried at 130 ± 2^{0}C for two h, cooled in a desiccator and weighed. The residue was then transferred into a muffle furnace (Shanghai box type resistance furnace, No.: SX2-4-10N), ignited at 550^{0}C for 30 min, and cooled and weighed. The percentage crude fibre content was calculated as follows:

$$\% \, Crude\ fibre = \frac{Loss\ in\ weight\ after\ incineration}{Weight\ of\ original\ food} \times 100 \quad (8)$$

2.6.5 Ash

Two grams **(**2 g) of the sample was weighed into an ashing dish which had been pre-heated, cooled in a desiccator and weighed soon after reaching room temperature. The crucible and content were then heated in a muffle furnace (Shanghai box type resistance furnace, No.: SX2-4-10N) at 550^{0}C for 6-7 h. The dish was cooled in a desiccator and weighed soon after reaching room temperature. The total ash was calculated as a percentage of the original sample weight.

$$\% \, Ash = \frac{(W3-W1)}{(W2-W1)} x\ 100 \quad (9)$$

Where:
$W1 = Weight\ of\ empty\ crucible,$
$W2 = Weight\ of\ crucible + sample\ before\ ashing,$
$W3 = Weight\ of\ crucible + content\ after\ ashing.$

2.6.6 Carbohydrate

Carbohydrate content was determined by difference, viz:

$$\% \, Carbohydrate = 100 - (\% \, Moisture + \%Protein + \%Fat + \%Ash\ \ \% \, Fibre) \quad (10)$$

2.7 Determination of the Physical Properties of the Breads

The physical properties (loaf weight, oven spring, loaf volume, and specific volume) of the Bread were determined using standard methods described by [32].

2.7.1 Loaf weight

The bread samples were weighed using a weighing balance (Model KD- BN (CN), V5 0-2010).

2.7.2 Oven spring

Each of the dough's heights was measured before baking using a straight-edged metric rule, and the size of the loaf was measured again after baking. The difference in the height of the respective loaves was recorded as the oven spring.

$$Oven\ Spring = Height\ after\ baking - Height\ before\ baking \quad (11)$$

2.7.3 Loaf volume

The determination of loaf volume was by a modification of the seed displacement method [33]. Loaf volume was measured at 50 min. The loaves were removed from the oven. A box of fixed dimensions (27.5 ×11 ×12.5 cm) of internal volume 3781.25 cm^3 was filled with pearl millet grain; a straight edge ruler was used to cut off all grains above the container rim. The grains were poured out and weighed (W_1). A weighed loaf was placed in the container, and the weighed seeds were used to fill the container and levelled off as before. The overspill was weighed (W_2), and from the WeightWeight obtained, the volume of pearl millet displaced by the loaf was calculated using the following equation.

$$Loaf volume(cm^3) = \frac{W_2 \times actual\ volume\ of\ container}{W_1} \quad (12)$$

$Where$
$W1 =$
$Weight\ of\ pearl\ millet\ that\ filled\ the\ container$
$W2 =$
$WeightWeight\ of\ pearl\ millet\ grains\ displaced\ by\ the\ loaf$

2.7.4 Specific volume

The specific loaf volume was determined by dividing it by its corresponding Weight (cm^3/g). Thus, it is the ratio between loaf volume and loaf weight.

$$Specific\ Volume\left(\frac{\mathrm{cm}^3}{\mathrm{g}}\right) = \frac{Loaf\ Volume}{Loaf\ \mathrm{Weight}} \quad (13)$$

2.8 Determination of the Sensory Attributes of the Breads

Test for acceptability: "A semi-trained panel of 20 judges of male and female staff and students of the Department of Food Technology, Federal Polytechnic, Kaura Namoda, Zamfara State, was used. The panellists were educated on the respective descriptive terms of the sensory scales and requested to evaluate the various bread samples for taste, appearance, texture, aroma and overall acceptability using a 9-point Hedonic scale, where nine was equivalent to like significantly and one meant dislike highly. The coded samples were presented randomly, and portable water was provided for rinsing of the mouth in between the individual evaluations" [31].

3. RESULTS AND DISCUSSION

3.1 Functional Properties of the Composite Flour

"The functional properties of a food material are parameters that determine its application and end use" [34]. "They are those physicochemical properties of food proteins that determine their behaviour in the food systems during processing, storage and consumption. It usually shows that the food materials under investigation will interact with other food components directly or indirectly, affecting processing applications, food quality, and ultimate acceptance" [35]. "The functional properties of the composite flours determine the food application and end use of such materials for other applications" [36].

"Bulk density of Flour is used to evaluate the flour weight, handling requirement and the type of packaging materials suitable for storing and transporting food materials" [37]. "Bulk density reflects the load the samples can carry if allowed to rest directly on one another" [38]. "The bulk density ranged from (0.83 to 0.84 g/ml). Sample G_1 and G_2 had the lowest Bulk density, and the highest were recorded in samples G_3 and G_4. Sweet potato flour inclusion in wheat flour increased Bulk density in composite Flour. It was reported that the structure of the starch polymers influences Bulk density, and the loose structure of the starch polymers could result in low Bulk density" [39]. A similar range of Bulk density values (0.60-0.85 g/ml) has been reported by Ndife et al. [40].

"Water absorption capacity is the ability of the product to incorporate water, and water inhibition is an essential functional trait in food such as sausages, custards and dough" [41]. "It also refers to water retained by a food product following filtration and application of mild pressure of centrifugation" [42]. "The water absorption capacity ranged from (3.65 to 5.78 g/g) and Wheat recorded significantly ($p<0.05$) the lowest water absorption capacities than other flour samples. The high value in water absorption capacities in the composite flours may be attributed to the high protein contents recorded in their composite flours" [43]. "It has been suggested that flours with high water absorption capacity, as seen in the composite of Wheat and sweet potato Flour, will be very useful in bakery products, and this could prevent staling by reducing moisture loss and also help maintain the freshness of Bread, cakes and sausages and could favour their use as soup thickener" [42].

Table 3. Functional properties and ph of flour blends

Sample	Bulk Density (g/ml)	WAC (g/g)	OAC (g/g)	Swelling index	Ph
G_1	0.83^a±0.00	3.65^a±2.17	2.75^a±0.04	7.94^a±0.03	6.00^a±0.05
G_2	0.83^a±0.01	5.78^b±0.02	2.76^b±0.00	7.56^b±0.05	5.95^b±0.00
G_3	0.84^a±0.00	4.68^c±0.35	1.73^c±0.01	7.35^c±0.08	5.13^c±0.01
G_4	0.84^a±0.00	5.41^d±0.01	2.52^d±0.01	7.22^d±0.01	6.00^a±0.00
LSD	0.05	0.21	0.06	0.02	**0.17**

Values are means ± standard deviations of triplicate determinations. Means in the same column with different superscripts differ significantly (p<0.05).

Key: G_1= 100 % wheat flour, 00 % sweet potato flour and 00 % cashew nut flour, G_2= 80 % wheat flour, 10 % sweet potato flour and 10 % cashew nut flour, G_3= 70 % wheat flour, 20 % sweet potato flour and 10 % cashew nut flour, G_4= 60 % wheat flour, 30 % sweet potato flour and 10 % cashew nut flour. LSD= Least significant difference

Table 4. Proximate composition of the breads

Sample	Moisture	Protein	Fat	Fibre	Ash	Carbohydrate
G_1	30.14^a±0.02	7.89^a±0.01	8.82^a±0.01	1.23^a±0.01	0.56^a±0.01	51.37^a±0.01
G_2	32.16^b±0.06	13.01^b±0.00	9.52^b±0.01	4.34^b±0.03	2.02^b±0.01	38.95^b±0.06
G_3	34.68^c±0.78	12.46^c±0.06	9.20^c±0.01	3.65^c±0.05	1.15^c±0.06	38.86^b±0.74
G_4	33.24^d±0.07	12.34^d±0.01	9.13^d±0.00	3.83^d±0.00	1.23^c±0.00	40.23^b±0.06
LSD	0.31	0.02	0.09	0.05	0.24	2.63

Values are means ± standard deviations of triplicate determinations. Means in the same column with different superscripts differ significantly (p<0.05).

Key: G_1= 100 % wheat flour, 00 % sweet potato flour and 00 % cashew nut flour, G_2= 80 % wheat flour, 10 % sweet potato flour and 10 % cashew nut flour, G_3= 70 % wheat flour, 20 % sweet potato flour and 10 % cashew nut flour, G_4= 60 % wheat flour, 30 % sweet potato flour and 10 % cashew nut flour. LSD= Least significant difference

"Oil absorption capacity measures the ability of food material to absorb oil" [35]. "Oil absorption capacity is the flavour-retaining capacity of Flour which is very important in food formulations" [44]. "The results of the oil absorption capacity of flour samples showed that sample G_2 was significantly ($p<0.05$) higher than the other three samples, and the least was recorded in sample G_3. The high oil absorption capacity in sample G_2 could be attributed to its flour protein content. The oil absorption capacities of the composite flours tended to increase with the increase in protein content since the protein in foods influences fat absorption" [45].

The swelling index is a function of loose particles [23]. "The swelling index of flours is often related to their protein and starch contents" [46]. "The swelling power of flours shows the degree of the water absorption of the starch granules in the flours" [47]. There were significant differences ($p<0.05$) in the swelling power among the flours (G_1 to G_4); the swelling index ranged from 7.23 to 7.94 among the composite flours. According to [48], a higher protein content in Flour may cause the starch granules to be embedded within a stiff protein matrix, which subsequently limits the access of the starch to water and restricts the swelling power.

The pH of the Flour samples was significantly ($p>0.05$) different from each other, but the highest pH contents were recorded in models G_1 and G_4. The most negligible pH content was recorded in sample G_3. The pH values of samples G_1 and G_4 are not significantly ($p>0.05$) different. Based on the pH values reported in this study, the composites could easily be used in pastry and bakery manufacturing because of their exciting pH, indicating appreciable levels of starch safety [49]. The pH values are similar to the findings of [50].

3.2 Proximate Composition of the Bread

"Among the control bread samples and others, the moisture contents are significantly ($p>0.05$) different, but the moisture contents of the Bread showed an increased value with the addition of sweet potato flour. The increased moisture content with the addition of sweet potato flour could be attributed to the fact that Wheat contained more hydrophilic constituents than orange flesh sweet potato, which binds water and renders them unavailable" [51]. This trend is similar to the findings Ufot and Inemesit [52] reported for wheat-unripe plantain flour composite bread, respectively.

Table 5. Physical properties of the breads

Sample/ parameters	Loaf weight (g)	Oven spring (mm)	Loaf Volume (cm^3)	Specific volume cm^3/g
G_1	$210.60^a±0.77$	$1.27^a±0.06$	$440.60^a±0.78$	$2.10^a±0.01$
G_2	$225.70^b±0.81$	$1.65^b±0.07$	$400.10^b±0.08$	$1.78^b±0.01$
G_3	$238.60^c±0.67$	$2.15^c±0.07$	$371.60^c±0.70$	$1.56^c±0.00$
G_4	$247.50^d±0.68$	$2.40^d±0.14$	$328.70^d±0.71$	$1.33^d±0.00$
LSD	1.02	0.56	3.06	0.06

Values are means ± standard deviations of triplicate determinations. Means in the same column with different superscripts differ significantly (p<0.05).

Key: G_1= 100 % wheat flour, 00 % sweet potato flour and 00 % cashew nut flour, G_2= 80 % wheat flour, 10 % sweet potato flour and 10 % cashew nut flour, G_3= 70 % wheat flour, 20 % sweet potato flour and 10 % cashew nut flour, G_4= 60 % wheat flour, 30 % sweet potato flour and 10 % cashew nut flour. LSD= Least significant difference

"Proteins are significant constituents of body enzymes, antibodies, hormones, and fluids such as blood and milk. They are essential to all life and help to form structural, supporting and protective tissues such as muscles, cartilage, skin, hairs and nails" [53]. The values of the protein contents of the bread samples are significantly (p<0.05) different. With the addition of sweet potato and cashew nut flour, protein values increased, but lower protein values were recorded for the control bread samples. Soison *et al*. [54] reported "low sweet potato starch protein content. The increased protein contents in the composite Bread could be attributed to the addition of cashew nut flour". The result does not agree with the findings of Greene and Bovel-Brenjamin [55], which reported 7.7 and 7.5 % protein content in Bread supplemented with sweet potato flour.

"Fat acts as a lubricating agent, which improves the quality of the Bread in terms of texture and flavour. Also, fat provides energy and is essential as it carries fat-soluble vitamins A, D, E and K" [56]. "The bread samples also recorded increased fat values with the addition of sweet potato and cashew nut flour. The crude fibre contents of the composite Bread compare favourably with the wheat control bread but are higher than the control bread. But more excellent fibre contents are found in sample G_2 bread. The increase resulted from the high fibre content in sweet potato flour. Fibre consumption has been linked to decreased incidence of heart disease, various types of cancer and diverticulosis" [57]. "Also, high levels of fibre in foods help in the digestion of foods and contribute to the health of the gastrointestinal tract and system in men by aiding normal bowel movement, thereby reducing constipation problems which can lead to colon cancer" [58]. Sample G_2 recorded the highest ash content. Low ash contents were observed in Bread produced from sample G_1.

"Carbohydrate provides heat and energy for all body activities. As such, inadequacy can cause the body to divert proteins and body fat to produce needed energy, which might lead to the depletion of body tissues" [59]. "The addition of cashew nut flour significantly reduced the carbohydrate contents of the composite Bread of Wheat and sweet potato Flour due to the higher carbohydrate content in sweet potato than wheat" [60].

3.3 Physical Properties of the Loaves of Bread

Physical properties can be measured or observed without changing the chemical nature of the substance. Including sweet potato and cashew nut flour significantly (p<0.05) affected the physical properties of ordinary wheat control bread. Mais [61] observed similar results. "The observed increase in WeightWeight of composite Bread more than the Bread from 100 % wheat resulted from less retention of carbon-dioxide gas in the blended dough, providing a dense bread texture. The higher moisture contents of the composite loaves observed in the proximate composition could have contributed to the higher loaf weight relative to 100 % wheat bread" [52]. This study's results align with the findings of [62] and [52], who reported "increased bread loaf weight with the increased substitution of wheat flour with sweet potato and unripe plantain, respectively".

Table 6. Sensory evaluation of the breads

Sample	Taste	Appearance	Texture	Aroma	Overall acceptability
G_1	7.60^a±0.83	6.00^a±0.76	7.13^a±0.74	7.47^a±0.83	7.60^a±0.63
G_2	6.20^b±0.77	6.60^b±0.83	6.73^b±0.88	6.73^b±0.70	6.60^b±0.83
G_3	6.40^c±0.51	5.40^c±0.51	6.07^c±0.70	6.20^c±0.67	7.20^a±0.56
G_4	6.73^c±0.59	4.67^d±0.62	6.33^c±0.49	6.13^c±0.64	6.20^b±0.68
LSD	0.31	0.33	0.30	0.31	0.50

Means in the same column with different superscripts differ significantly (p<0.05)

"The dilution effect of the wheat gluten was the reason for the observed increased oven spring in composite breads concerning the breads produced from 100 %. The gluten fraction is responsible for the elasticity of the dough by causing it to extend and trap the carbon dioxide generated by yeast during fermentation. When gluten thickens under the influence of heat during baking, it serves as the framework of the loaf, which becomes relatively rigid and does not collapse" [63]. "The loaf volume and specific volume of the composite loaves of sweet potato and cashew bread are significantly lower than the Bread produced from 100 % wheat flour. This trend could be due to the reduced amount of gluten and the lower ability of the dough to enclose air" [64]. "The substitution of wheat flour with sweet potato and cashew nut flour may have reduced the gluten content, and this might explain the observed decreases in some of the baking characteristics of the composite loaves of Bread. Several other researchers had also observed a reduction in the loaf volume and specific volume of Bread when non-wheat Flour was incorporated into wheat flour" [65]. "Reduction in these baking characteristics with the addition of sweet potato and cashew nut flour could lower the acceptability of the bread samples. The lower specific loaf volume of the loaves of Bread could be responsible for their higher loaf weights" [66].

Sensory Attributes of the Loaves of Bread:

"Sensory evaluation is an essential criterion for assessing quality in the development of new products and for meeting consumer requirements and is usually carried out towards the end of the product development or formulation cycle" [67].

Taste is a sensory parameter affecting food products' quality and acceptability. The 100 % wheat bread tasted better (p<0.05) than other products. The taste scores of the Bread of sample G_3 were not significantly (p>0.05) different.

According to Sudha et al. [68], progressive increase in supplementation with non-wheat Flour, appearance turns darker, leading to lower acceptability. Contrary to the above assertion by [68], composite loaves of Bread of sweet potato and cashew nut flour were significantly (p<0.05) not acceptable in appearance than Bread produced from 100 % wheat flour. The appearance turned more acceptable in 100 % loaves of Bread than in the other samples (G_2, G_3 and G_4).

The 100 % wheat bread had the highest textural score, significantly (p<0.05) different from other bread samples. Lower textural values were recorded in sample G_3 loaves of Bread. Aroma is another attribute that influences the acceptability of baked goods products even before they are tasted**.** Also, bread samples of 100 % wheat were significantly high in aroma. This could be attributed to the fact that Panelists were too used to the aroma of loaves of Bread produced from wheat flour than other breads of non-wheat Flour.

Overall acceptability was determined based on quality scores obtained from the taste, appearance, texture and aroma evaluation. The decrease in the general acceptability of composite Bread in this study was reported in another study on wheat/yam mixed Bread by [69]. Melba [32] and Joseph *et al*. [70] reported similar decreased overall acceptability of Wheat-based Bread supplemented with plantain and ripe banana slices flours, respectively.

4. CONCLUSION

Composites Flour was produced from wheat flour, sweet potato and cashew nut flour and was used in the bread formulation. The Bulk density, water absorption capacity, oil absorption capacity, swelling index and pH of the Flour blend favourably with the wheat flour. Generally, the protein, fat, fibre and ash contents of the Bread display higher ranges than the control sample of 100 % wheat bread. The study showed that the Bread produced from sweet potato and cashew nut flour was higher WeightWeight than the Bread made from wheat flour. The loaf volume of the Bread made from wheat flour is significantly higher than other bread samples. It also showed that wheat bread tasted better than sweet potato and cashew nut flour bread samples. The results of the overall acceptability of the Bread revealed that wheat flour could be supplemented with sweet potato and cashew nut flour without significantly affecting the general acceptability of the Bread.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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