Evaluation, Physico-Chemicaland Sensory Properties of Composite Bread Produced from Wheat, sweet potato and Cashew nut flour.

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. Breads from these different proportions were 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 breads 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 carbohydrates (38.86-51.37 %). The physical properties of the breads 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 volumeand specific volume respectively. Sensory evaluation findingsindicated that up to 30 % substitution of sweet potato flour, 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 described as a fermented confectionary product produced mainly from wheat flour, water, yeast and salt by a different processes 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 carbohydrate, protein, fibre, vitamins and minerals in the diets of many people worldwide [2]. The consumption of bread in Nigeria is on a steady increase because it is a convenient and ready to eat food normally consumed at breakfast, lunch, and sometimes dinner [3]. There is no household or family in Nigeria that does not consume bread at least once a day, since its consumption cut across socioeconomic class and is acceptable to both children and adults. Bread has gained wide consumer acceptance for many years in Nigeria [4]; [5]. Bread and other baked products are however relatively expensive, as they are produced from wheat which, as a result of climatic reasons, does not grow well in the tropics and has to be imported [6].

Sweet potato (SP) is the world's most important food crops and an important staple in Nigeria and other developing countries [7]. It is a low input crop and is used as 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]. SP production and consumption in Africa, Asia, South American continents, and Caribbean islands are increased tremendously in recent times. Sweet potato is the most abundantly grown root crops in Africa. Cashews are very nutritious and source of essential minerals, including copper, calcium, magnesium, iron phosphorus, potassium and zinc. Sodium is also present in very small quantity. Cashew nuts are vital for the health development of bones, muscles, tissue and body organs. It contains low amount of sugar which are safe for diabetic patients [9]. This research was carried out to determine the potential of sweet potato and cashew nut flour blends in the production of biscuits.

Composite flour can be defined as a mixture of several flours obtained from roots and tubers, cereal, legumes, with or without the addition of wheat flour [10]. Usually, the aim of producing composite flour

is to get a product that is unique than the individual components. Composite flour is considered advantageous in developing countries as it reduces the importation of wheat flour and encourages the use of locally grown crops 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].
This research was carried out to evaluate the physico-chemical properties of bread prepared from blends of wheat, sweet potato and cashew flour.

2.0 MATERIALS AND METHODS

2.1 Source of Materials

Sweet potato, SP (*Ipomeabatatas*), 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 KauraNamoda, Zamfara State. Packaging material: polyethylene 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 properly cleaned by removing extraneous matter prior to 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 slightmodification. 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 polyethylene bag and labeled accordingly (Figure 1).

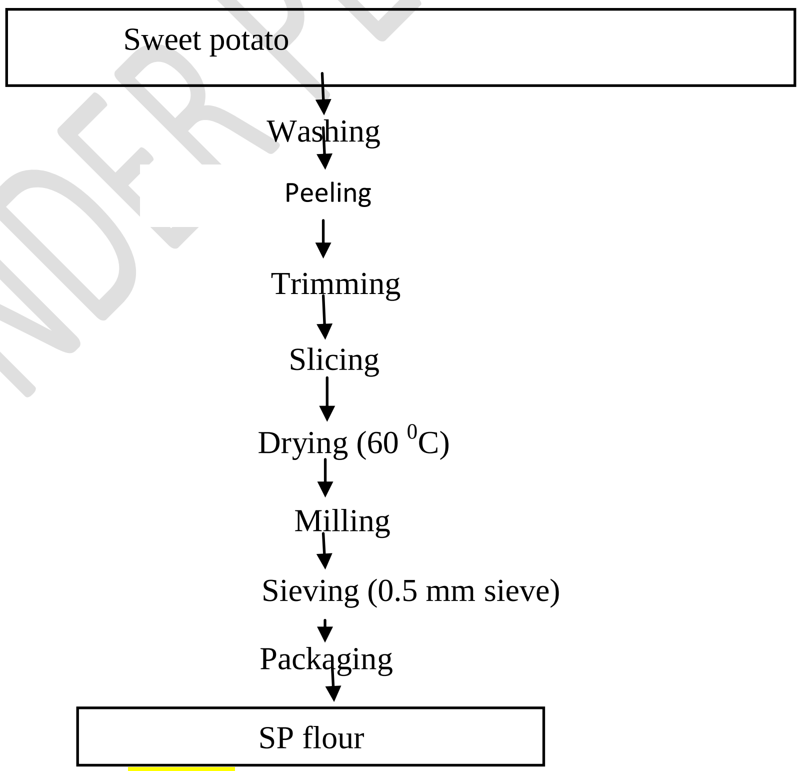

Figure 1: Flow chart for the prepared of sweet potato (SP) flour
Source: Avula[28] with modification.

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 a period of fifteen minutes using the open pan roasting method. Wooden hammer was used for manual shelling of the nuts. The roasted cashew nuts were then oven dried and the peels or covering tasta were removed by squeezing and then winnowed to obtain the cream coloured cashew nuts. After grading, the roasted cashew nuts were milled using 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 polyethylene bag and stored at low temperature (5ºC). As described by Russel [29] with modifications.

Raw Cashew nut seed
↓
Sun Drying of the raw seed
↓
Roasting
↓
Cutting/separating
↓
Drying of the cashew kernel
↓
Peeling of the kernel
↓
Grading
↓
Milling
↓
Packaging/Lebelling
↓
Cashew nut flour

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 percent SP into wheat flour, respectively, as described on Table 2.

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

2.4 Production of bread

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

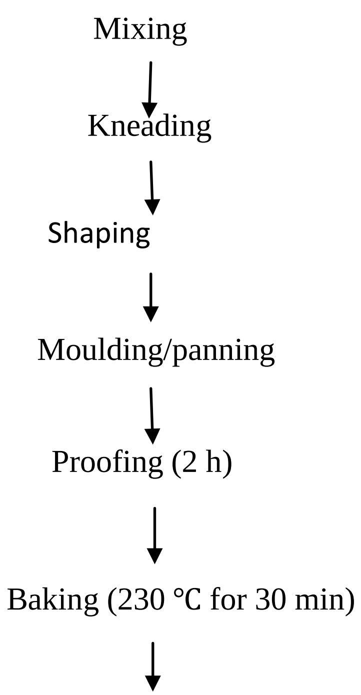

Figure 3: Flow chart for the production of bread and composite bread
Source: Igbabul*et al.* [30]with modification.

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 determined according 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 10ml mark. The bottom of the cylinder was then 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. Weight of cylinder plus flour was measured and recorded. Bulk density was expressed as:

$$Bulk\ density\ (g/ml) = \frac{weight\ of\ sample\ \ (g)}{volume\ \ of\ \ sample\ \ (ml)} \text{.....................} \qquad (1)$$

2.5.2 Water/Oil absorption capacity (WAC/OAC)

One gram (1 g) of the sample was 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 UniscopeSurgifriends Medicals,England) at 3500 rpm for 30 min and the volume of the supernatant noted. WAC or OAC was calculated and expressed as g of water or oil absorbed or retained per g of sample.

$$WaterAbsorptionCapacity(\%) = \frac{Amountofwateradded - Freewater}{Weightofsample} \times densityofwater \times 100 \qquad (2)$$

$$OilAbsorptionCapacity(\%)$$

$$= \frac{Amountofoiladded - Freeoil}{Weightofsample} \times densityofoil \times 100 \qquad (3)$$

2.5.3 Swelling index

Ten gram(10 g) of the sample wasintroduced into a graduated cylinder with the dry bulk volumenoted. Therefore, 100ml of boiling water was added to thesample in the cylinder and mixed thoroughly. The volume wasmeasured after 10mins and swelling index was calculated as:

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

2.5.4 pH determination

Ten gram (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 standardized 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 stabilization 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 desiccator and weighed. 2 g of sample was then weighed into the dish. The dish and its content was then put in the oven at 105°C and dried to a constant weight. The loss in weight from the original sample (before heating) was reported as percentage moisture.

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

$Where$

$W1 \ = \ weight\ of\ dish,$

$W2 \ = \ weight\ of\ dish\ +\ sample\ before\ drying,$

$W3 \ = \ weight\ of\ dish\ +\ sample\ after\ drying.$

2.6.2 Crude protein

The Kjeldahl method was used to determine crude protein. Two gram (2 g) of sample was weighedinto 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 flask swirled to mix content. The Kjeldahl flask was heated gently in an inclined position in the fume chamber until no particles of the sample was adhered to the side of flask. The solution was heated more strongly to make the liquid boil with intermittent shaking of the flask until clear solution was obtained. The solution was allowed to cool and diluted to 25ml with distilled water in a volumetric flask. 10 ml of diluted digest was transferred into a steam distillation apparatus. The digest was made alkaline with 8ml of 40% NaOH. To the receiving flask, 5ml of 2% boric acid solution was added and 3 drops of mixed indicator was 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 percentagenitrogen 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 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. Flat bottom flask (250ml) of known weight containing 150-200ml of 40-60^{0}C hexane was fitted to the extractor. The apparatus was heated and fat extracted for 8h. The solvent was recovered and the flask (containing oil and solvent mixture) was transferredinto a hot air oven (GENLAB, England B6S, serial no: 85K054) at 105^{0}C for 1 h to remove the residual moisture and to evaporate the solvent. It was later transferred into desiccator to cool for 15 min before weighing.Percentagefat content was calculated as

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

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 2 h, cooled in a desiccator and weighed. The residue was then transferred in to a muffle furnace (Shanghai box type resistance furnace, No.: SX2-4-10N) and ignited at 550^{0}C for 30 min, cooled and weighed. The percentagecrudefibre content was calculated as:

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

2.6.5 Ash

Two gram (2 g) of 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 was 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 percentageof the original sample weight.

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

$Where$:

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

2.6.6 Carbohydrate

Carbohydrate content was determined by difference, viz:

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

2.7 Determination of the Physical Properties of the Breads

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

2.7.1 Loaf weight

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

2.7.2 Oven spring

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

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

2.7.3 Loaf volume

Determination of loaf volume was by a modification of the seed displacement method of [33]. Loaf volume was measured 50 min. after 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 leveled off as before. The overspill was weighed (W_2) and from the weight obtained, volume of pearl millet displaced by the loaf was calculated using the following equation.

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

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

2.7.4 Specific volume

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

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

2.8 Determination of the Sensory Attributes of the Breads

Test for acceptability: A semi-trained panel of 20 judges made up of male and female staff and students of the Department of Food Technology, Federal Polytechnic, KauraNamoda, Zamfara State was used. The panelists 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 9 was equivalent to like extremely and 1 meant dislike extremely. Presentation of coded samples were done randomly and portable water was provided for rinsing of mouth in between the respective evaluations [31].

3.0 RESULTS AND DISCUSSION

Table 3: Functional Properties and Phof Flour Blends

Sample	Bulk Density (g/ml)	WAC (g/g)	OAC (g/g)	Swelling index	Ph
G_1	$0.83^{a}\pm0.00$	$3.65^{a}\pm2.17$	$2.75^{a}\pm0.04$	$7.94^{a}\pm0.03$	$6.00^{a}\pm0.05$
G_2	$0.83^{a}\pm0.01$	$5.78^{b}\pm0.02$	$2.76^{b}\pm0.00$	$7.56^{b}\pm0.05$	$5.95^{b}\pm0.00$
G_3	$0.84^{a}\pm0.00$	$4.68^{c}\pm0.35$	$1.73^{c}\pm0.01$	$7.35^{c}\pm0.08$	$5.13^{c}\pm0.01$
G_4	$0.84^{a}\pm0.00$	$5.41^{d}\pm0.01$	$2.52^{d}\pm0.01$	$7.22^{d}\pm0.01$	$6.00^{a}\pm0.00$
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.

3.1 Functional Properties of the Composite Flour

Functional properties of a food material are parameters that determine its application and end use [34]. They are those physico-chemical properties of food proteins that determine their behaviour in food system 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]. 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 storage and transportation of food materials [37]. Bulk density is a reflection of 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_2had the lowest bulk density and the highest were recorded in sample G_3 and G_4. Sweet potato flour inclusion in wheat flour resulted in increased bulk density in composites flour. It has been reported that bulk density is influenced by the structure of the starch polymers and loose structure of the starch polymers could result in low bulk density [39]. Similar range of bulk density values (0.60-0.85 g/ml) have been reported by Ndife*et al*. [40].

Water absorption capacity is the ability of product to incorporate water and water inhibition is an important functional trait in food such as sausages, custard 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 significant ($p<0.05$) lowest water absorption capacities than other flour samples. The high value in water absorption capacities in the composite flours recorded 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].

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 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 increase in protein content since the protein in foods influences fat absorption [45].

Swelling index is a function of loose particles [23]. 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 of samples were significantly ($p>0.05$) different from each other but recorded the highest pH contents was recorded in sample G_1 and G_4. The least pH content was recorded in sample G_3. The pH values of sample 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 interesting pH which would indicate appreciable levels of starch safety [49]. The pH values are similar to the findings of [50].

Table 4: Proximate Composition of the Breads

Sample	Moisture	Protein	Fat	Fibre	Ash	Carbohydrate
G_1	$30.14^{a}\pm0.02$	$7.89^{a}\pm0.01$	$8.82^{a}\pm0.01$	$1.23^{a}\pm0.01$	$0.56^{a}\pm0.01$	$51.37^{a}\pm0.01$
G_2	$32.16^{b}\pm0.06$	$13.01^{b}\pm0.00$	$9.52^{b}\pm0.01$	$4.34^{b}\pm0.03$	$2.02^{b}\pm0.01$	$38.95^{b}\pm0.06$
G_3	$34.68^{c}\pm0.78$	$12.46^{c}\pm0.06$	$9.20^{c}\pm0.01$	$3.65^{c}\pm0.05$	$1.15^{c}\pm0.06$	$38.86^{b}\pm0.74$
G_4	$33.24^{d}\pm0.07$	$12.34^{d}\pm0.01$	$9.13^{d}\pm0.00$	$3.83^{d}\pm0.00$	$1.23^{c}\pm0.00$	$40.23^{b}\pm0.06$
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.

3.2 Proximate composition of the breads

Among the control bread samples and others, the moisture contents are significantly ($p>0.05$) different but the moisture contents of the breads 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 rendered them unavailable [51]. This trend is similar to the findings reported by Ufot and Inemesit[52] for wheat-unripe plantain flour composite breads respectively.
Proteins are major constituents of body enzymes, antibodies, many hormones as well as body fluids such as blood and milk. They are essential to all life and help to form structural, supporting and protective tissues such as muscles, cartilages, 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 protein contents of sweet potato starch. The increased protein contents in the composite breads could be attributed to the addition of cashew nut flour. The result is not in agreement with the findings of Greene and Bovel-Brenjamin[55] reported 7.7 and 7.5 % protein contents found in bread supplemented with sweet potato flour.
Fat acts as 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 along fat soluble vitamins A, D, E and K [56]. The bread samples also recorded increased values of fat with the addition of sweet potato and cashew nut flour. The crude fibre contents of the composite breads compare favourably with the wheat control bread but higher than the control breads. But greater fibre contents are found in sample G_2 breads. The increased was as the result of 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 digestion of foods and also contribute to the health of the gastrointestinal tract and system in man 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 breads produced from sample $G_{1.}$

Carbohydrate provides heat and energy for all forms of body activities and as such its inadequacy can cause the body to divert proteins and body fat to produce needed energy and this might lead to depletion of body tissues [59]. Addition of cashew nut flour significantly reduced the carbohydrate contents of the composite breads of wheat and sweet potato flour due to the higher carbohydrate content in sweet potato more than wheat [60].

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	$210.60^a \pm 0.77$	$1.27^a \pm 0.06$	$440.60^a \pm 0.78$	$2.10^a \pm 0.01$
G_2	$225.70^b \pm 0.81$	$1.65^b \pm 0.07$	$400.10^b \pm 0.08$	$1.78^b \pm 0.01$
G_3	$238.60^c \pm 0.67$	$2.15^c \pm 0.07$	$371.60^c \pm 0.70$	$1.56^c \pm 0.00$
G_4	$247.50^d \pm 0.68$	$2.40^d \pm 0.14$	$328.70^d \pm 0.71$	$1.33^d \pm 0.00$
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.

3.3 Physical properties of the breads

Physical properties are properties that can be measured or observed without changing the chemical nature of the substance. The inclusion of sweet potato and cashew nut flour significantly ($p<0.05$) affected the physical properties of normal wheat control bread. Mais[61] observed similar results. The observed increase in weight of composite breads more than the bread from 100 % wheat was as a result of less retention of carbon-dioxide gas in the blended dough, providing dense bread texture. The higher moisture contents of the composite breads observed in the proximate composition could have contributed to the higher loaf weight relative to 100 % wheat bread [52]. The results of this study are in-line 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.

The dilution effect of the wheat gluten was the reason for the observed increased oven spring in composite breads in relation to 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 coagulates 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 breads of sweet potato and cashew are significantly lower than the bread produced from 100 % wheat flour. The reason for this trend could be due to the reduction in the amount of gluten and a 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 breads. Several other researchers have also observed reduction in the loaf volume and specific volume of bread when non wheat flours were incorporated to wheat flour [65]. Reduction in these baking characteristics with the addition of sweet potato and cashew nut flour could lower acceptability of the bread samples. The lower specific loaf volume of the breads could be responsible for their higher loaf weights [66].

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 ($p<0.05$)

Sensory attributes of the breads

Sensory evaluation is an important criterion for assessing quality in the development of new products and for meeting consumer requirements [67] and usually carried out towards the end of product development or formulation cycle.
Taste is a sensory parameter that affects the quality and acceptability of food products. The 100 % wheat bread tasted significantly ($p<0.05$) better than other products. Taste scores of bread of sample G_3 were not significantly ($p>0.05$) different from each other.

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

The 100 % wheat bread had the highest textural score and was significantly ($p<0.05$) different from other bread samples. Lower textural values were recorded in sample G_3 breads. Aroma is another attribute that influences the acceptability of baked good 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 breads produced from wheat flour than other breads of non-wheat flour.

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

4. CONCLUSION

Composites flour were produced from wheat flour, sweet potato and cashew nut flour and were used in the formulation of bread. The bulk density, water absorption capacity, oil absorption capacity, swelling index and pH of the flours blends compared favourably with the wheat flour. Generally, the protein, fat, fibre and ash contents of the bread display higher contents than the control sample 100 % wheat bread. The study showed that the breads produced from sweet potato and cashew nut flour were of higher weights than the bread produced from wheat flour. The loaf volume of the bread produced from wheat flour is significantly higher than for other bread samples. It also showed that wheat bread tasted better than other bread samples formulated from sweet potato and cashew nut flour. The results of the overall acceptability of the breads revealed that wheat flour can be supplemented with sweet potato and cashew nut flour without greatly affecting the overall acceptability of the bread.

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