Bioactive compounds, chemicals properties, physical and sensory properties of bread produced from wheat (*triticum aestivum l.*), defatted sesame seed (*sesame indicum*) and unripe plantain (*musa paradisiaca*) flour blends

ABSTRACT

This study investigated production of bread produced from wheat, defatted sesame seed and unripe plantain flour blends were evaluate for, bioactive compounds, chemical compositions, physical and sensory properties of bread on February, 2024 at Federal University Wukari, Taraba State, Nigeria. Wheat flour, defatted sesame seed flour were blended with unripe plantain flour in these ratios: 100:0:0 (wheat flour), 90:5:5, 80:10:10 and 70:15:15 (wheat, defatted sesame seed flour, unripe plantain flour). The bread samples were produced from the composite flour blends with other ingredients (fat/margarine, sugar, yeast and salt). The crude fiber, protein content, moisture content, ash content, fat content and the carbohydrate content ranged were 4.16 - 11.66%, 7.07 - 23.05%, 6.58 - 7.78%, 1.05 - 3.84%, 12.92 - 21.36% and 44.00 - 60.42%. The phytochemical properties for flavonoid, tannins and phenol ranged from 0.87 - 1.10, 6.56 - 9.32 and 2.42 - 4.16. The micro mineral (calcium, iron, zinc) ranged from 0.31-0.36 mg/100 g, 3.00-3.30 mg/100 g and 0.92-1.08 mg/100 g. The macro minerals (copper, magnesium and phosphorus) ranged from 0.01 to 0.60 mg/100 g, 0.40 -0.87 mg/100 g and 3.82-4.18 mg/100 g. The antioxidant properties (DPPH scavenging radical and FRAP ferric reducing antioxidant power) ranged from 9.61 – 29.39% and 17.75 - 44.46 mgtrolox/g. The physical properties of the bread samples; width, length, weight and loaf volume ranged from 7.70 - 8.63 cm, 10.49 -11.05 cm, 111.49 - 120.77 g and 321.00 - 524.00 cm^3. The sensory properties of bread samples; Taste, Aroma, Colour, texture, overall acceptability ranged from 6.25-8.00%, 6.05-7.35%, 5.50-7.75%, 6.40-7.10% and 6.55-7.85%. The sensory acceptability of the bread had a mean score that was generally acceptable for sample 80:10:10 (7.85). The defatted sesame seed and unripe plantain flour had a huge effect and improved the bread properties by increasing with chemical compositions of wheat flour.

Keywords: Proximate composition, Antioxidant properties, Phytochemicals properties, Mineral compositions, and Sensory properties

1. INTRODUCTION

“Bread is a universally consumed baked product as a very convenient form of food that is important to all populations” (Elleuch e*t al*., 2011). “Its origin dates back to the Neolithic era and is still one of the most consumed and acceptable staple food products in all parts of the world” (Udeme *et al.,* 2014). “It is a good source of minerals, such as macro nutrients (carbohydrates, protein, and fat) and micro nutrients (minerals and vitamins) that are essential for human health” (Raji *et al*., 2015). “Composite flour can be described as a mixture of several flours obtained from roots and tubers, cereal and legumes etc. with or without the addition of wheat flour” (Raji et al., 2015). “Bread is ready-to-eat, convenient and inexpensive baked product, containing digestive and dietary fibers, which are vital to the human body (Nyadroh *et al.,* 2021). The major ingredients in bread production include flour, fat, sugar and water. Other ingredients added are either optional or added to give a desired sensory attribute” (Okpala, 2011). “It contains a rich source of energy, protein, vitamins especially the B vitamins, minerals and dietary fibre, making it highly nutritive. A recent development for over 20 years has focused on healthy eating, enhancing the utilization of indigenous produce such as

whole wheat, local cereals and legumes in baking industries" (Therdthai, 2014). "In yeast breads, the higher water percentages result in more CO_2 bubbles, and a coarser breadcrumb. According to 100%, flour rest of the ingredients will be in following measurements like leavening agent yeast 2%, sugar 4%, salt 2% and shortening agent (ghee or margarine) 3%" (Cherinet *et a*l., 2022). "Bread is a different food compared to some other common food items, as it is a leavened product obtained from fermentation of wheat flour sugars liberated from starch by the action of natural
flour enzymes. Fermentation is caused by baker's yeast that is the trade name of the organism
Saccharomyces cerevisiae" (Okpala, 2011). "Due to fermentation, sugar is converted to moisture
and CO_2. As water vapor and CO_2 expand due to high temperature, they act as an insulating agent preventing high rate of temperature rise of breadcrumb and the possibility of excessive moisture evaporation. Sugar is added for initiation of fermentation. Salt is added to strengthen the gluten and to convert the action of yeast for controlled expansion of the dough" (Wayo *et al*., 2022).

"Sesame (*Sesame indicum*) from the family of *Pedaliacea* is an important oil seed legume, which
is cultivated in many tropical and subtropical temperate area of the world, Sesame seed is
composed of 50% of lipid and 20% protein" (Neha *et al.,* 2012). "The crop is cultivated both in the

tropic and in temperate zones of the world, where it is grown mostly for the edible oil extracted from its seeds". (Seid, 2022), "Sesame is a source of high quality edible oil with high preservative qualities. The oil is used in the production of perfumes, skin conditioners, and hair creams" (Mehmet *et al*., 2013). "Sesame seeds are rich sources of phytosterols and cadio-protective fibre, minerals and healthy fats. Sesame seeds have the highest total phytosterol content (400-413 mg/100g). Phytosterols are believed to reduce blood levels of cholesterol, enhance immune response and decrease the risk of certain cancers" (Seid, 2022). "Sesame, a bioactive compound derived from sesame has been found to protect the liver from oxidative damage" (Anilakumar *et al*., 2010).

"Defatted Sesame (*Sesamum indicum*) is a plant that belongs to the family *Pedaliaceae* and the genus Sesamum. The genus Sesamum consists of about 36 species, of which the most commonly cultivated worldwide" (Seid, 2022). Nwobasi, (2017) reported that "the proximate analysis indicated that sesame seeds contained 28.37% carbohydrate, 26.63% fats/oil, 23.32% protein, 7.37% moisture, 10.28% crude fibre and 4.02% ash".

"Phytochemical compounds in sesame seed such as sesamin, sesamol, and anthrasesamone have been proved to have in vitro/in vivo antioxidant and antiaging activity" (Hsu *et al*., 2013). sesame seeds showed the presence of alkaloids, flavonoids, phytosterols, saponins and terpenoids in (Blessing *et al*., 2010). “Some alkaloids from plant sources are reported to have medicinal actions such as analgesics, antispasmodics, anticholinergics and anesthetic properties” (Olaleye, 2007). “Flavonoids are used as natural antioxidants in foods and pharmaceutical drugs due to their ability to scavenge reactive oxygen species. Most edible plants show high medicinal value based on the composition of their phytochemical constituents. Some of the reported essential phytochemical compounds include phenolics, tannins, flavonoids, alkaloids and glycoside” (Yu *et al*., 2021).

“Wheat quality means different things, depending on whether you are in the wheat processing chain. These qualities are wheat’s physical qualities, nutritional composition, techno-functional properties, rheology, baking quality and sensorial qualities of bread or pasta production, and consumers’ acceptance of wheat-based food products” (Cherinet *et al*., 2022).

Wheat grains also contain some phyto-antioxidants, including phenolic acids and flavonoids. The most abundant antioxidants in whole grains are phenolic acids, which are highly concentrated in the bran and the germ, both of which are removed to obtain refined flour. Phenolic acids exist as free, esterified and insoluble-bound forms. One of the advantages of bound phytochemicals is their ability to survive digestion in the upper gut, allowing them to reach the colon and, therefore, exert health benefits.

“Wheat flour is attributed to the presence of antioxidants. In addition to the most common antioxidants, such as vitamin C (tocopherols and tocotrienols), vitamin E and carotenoids (Pycia, 2020), wheat grains also contain some phyto-antioxidants, including phenolic acids and flavonoids” (Dauqan *et al*., 2011). “The most abundant antioxidants in whole grains are phenolic acids, which are highly concentrated in the bran and the germ, both of which are removed to obtain refined flour. Phenolic acids exist as free, esterified and insoluble-bound forms” (Yu *et al*., 2021).

“Unripe plantain *Musa paradisiaca* are species of plantain that belong to the family *Musaceae*. Plantain is cultivated in tropical and subtropical regions and is native to Southeast Asia and India. The fruits are starch rich when unripe but when they are ripen the starch turns into simple sugars (sucrose, glucose and fructose). The unripe plantain has been documented as hypoglycemic plant, as it has been noted for its low sugar, as such used in the management of diabetic complications” (Danlami *et al*., 2015).

Unripe plantain is a tropical fruit that constitute a staple food crop in Central and West Africa.

“Over 2.11 million metric tons of plantains are produced in Nigeria annually which contributes substantially to the nutrition of sub-tropical local populations. Starch is the main component of plantain, as well as proteins, fat, ash, and dietary fiber. Plantains are also reported to be a great source of calcium, vitamins A, B_1, B_2, B_3, B_6, C and minerals such as potassium and phosphorus" (Osundahunsi, 2010). Different varieties of plantain are consumed by the households in Nigeria but the most preferred (plantain) varieties are the false horn type (locally known as 'Agbagba').

"The main component of dietary fibre was the insoluble fraction, with a higher level of cellulose

than hemicellulose and lignin. In the insoluble fraction, uronic acid was the most predominant

acidic monosaccharide, while mannose was in the soluble fraction" (Agama-Acevedo *et al*., 2016).

The objective of this study was to evaluate the proximate, phytochemical, antioxidant properties, mineral composition, physical and sensory properties of bread produced from wheat, defatted sesame seed, and unripe plantain flour blends. The biscuit is to enhance the nutritional and health status of the consumers especially patient with diabetes.

2.0 MATERIALS AND METHODS

2.1 MATERIALS

Sesame seed (*Sesamum indicum*), wheat (*Triticum aestivum*), unripe matured plantain (*Musa paradisca*), margarine (fat), yeast, salt and sugar.

2.1.1 Source of material

Sesame seed, wheat and unripe plantain and all other materials was purchased from New market Wukari, Taraba State.

2.2 METHODS

2.2.1 Sample/Raw Material Preparation

The preparation of the raw material that was used in the production of bread alongside the various flow charts showing their unit operation with their sequential production process involved in the final product, which is the bread.

2.2.1.1 Sesame flour preparation and the defatting process

“Sesame seeds were sorted to remove bad seeds and other foreign materials. The seeds were soaked overnight in cold tap water at ambient temperature and the hulls completely removed by floatation technique through hand rubbing” (Chinma *et al.,* 2012). The meal was air dried for 72h and milled. The flour was passed through a sieve and packaged as shown in figure 1 (Ahemen *et al.,* 2018). The flour will be soaked into n-hexane for 72h and tightly covered to avoid evaporation of the hexane, then it will be recovered by sieve and the n-hexane will be squeezed to extra the remaining ethanol. The flour will be sun dried for 72h to allow the residue n-hexane to evaporate.

2.2.1.2 Unripe Plantain Flour Preparation

Unripe Plantain flour was prepared using method described by (Kiin-Kabari, 2013). Plantain was washed, and then water blanched for 5 to 10 min. After blanching, it was water cooled for some before it was peeled manually with the aid of stainless steel kitchen knife and the pulp was cut into uniform slices, drained, and dried in air circulating oven at 65℃ for 20h. The dried plantain pulp were milled into fine powder flour and sieved for even size distribution, packaged in polyethylene container as shown in figure 2.

2.2.2 Bread Preparation

Wheat, defatted sesame and unripe plantain flour blends were formulated as shown in Table 1, with wheat flour (100%) serving as control. The bread were prepared according to modified method of Gernah, (2014) shown in Table 2, a digital electronic weighing balance was used for the weighing of ingredients and mixing was done manually The composite flours and ingredients were thoroughly mixed to optimize consistency in a kitchen mixer at low speed (85rpm) for 5 minutes, final dough temperature of 30 ± 2^{o}C. The dough was then kneaded and left to proof for 45min, scaled into 105g portions, shaped and put into oiled baking pans. Baking was achieved at 220 ± 2^{o}C

Sesame seeds
↓
Sorting
↓
Cleaning
↓
Soaking in water
↓
Dehulling
↓
Hot water blanching at 90^{o}C (5 minutes)
↓
Drying for 72h
↓
Milling
↓
Soaking in ethanol for oil extraction
↓

Drying for 72h

↓

Defatted sesame flour

Figure 1: Flow chart of processed defatted sesame flour modified method

Source: Ahemen *et al*., (2018).

Unripe matured plantain

↓

Washing

↓

Hot water blanching at 90^{o}C (15 minutes)

↓

Peeling

↓

Slicing

↓

Drying

↓

Milling

↓

Sieving

↓

Unripe plantain Flour

Figure 2: Flow diagram of preparation of unripe plantain flour

Source: Kiin-Kabari, (2013)

TABLE 1 Experimental Designs for Composite Flour Formulation

Sample ratio	Wheat Flour (%)	Defatted sesame flour (%)	Unripe plantain flour (%)
100:0:0	100	0	0
90:5:5	90	5	5
80:10:10	80	10	10
70:15:15	70	15	15

Key;

100:0:0= (100% wheat flour, 0% defatted sesame seed flour and 0% unripe plantain),

90:5:5= (90% wheat flour, 5% defatted sesame flour and 5% plantain flour),

80:10:10= (80% wheat flour, 10% defatted sesame and 10% plantain flour),

70:15:15= (70% wheat flour, 15% defatted sesame and 15% plantain flour),

TABLE 2 Experimental Designs for Recipe Formulation for Bread Production

Sample Ratio	Wheat Flour (%)	Defatted sesame flour (%)	Unripe plantain flour (%)	Water (ml)	Fat (g)	Sugar (g)	Yeast (g)	Salt (g)
100:0:0	100	0	0	50	7	5	1	0.5
90:5:5	90	5	5	50	7	5	1	0.5
80:10:10	80	10	10	50	7	5	1	0.5
70:15:15	70	15	15	50	7	5	1	0.5

Key;

100:0:0= (100% wheat flour, 0% defatted sesame seed flour and 0% unripe plantain),

90:5:5= (90% wheat flour, 5% defatted sesame flour and 5% plantain flour),

80:10:10= (80% wheat flour, 10% defatted sesame and 10% plantain flour),

70:15:15= (70% wheat flour, 15% defatted sesame and 15% plantain flour),

Wheat defatted sesame seed and unripe plantain flour blends

↓

Weighing of ingredients

↓

Mixing of ingredients

↓

Kneading

↓

Panning

↓

Proofing (1hr)

↓

Baking (180-220°C for 25-30 minutes)

↓

Bread

↓

Packaging

Figure 3 Flowchart showing the production of bread modified method

Sources: Olubunmi *et al*., (2015).

2.1 ANALYTICAL METHODS

2.2.1 Proximate analysis of bread

2.2.1.1 Determination of crude fat content

Total crude fat in the bread sample was determined using Soxhlet extraction for 3hr starting with n-hexane by AOAC (2010). About 250ml of flat bottom flask were dried in a cabinet dryer and cooled in a dessicator.1.0g of samples was weighed accurately into labeled thimbles. The dried boiling flasks were weighed correspondingly and filled with about 200ml of petroleum ether (boiling point 40-60˚C). The extraction thimbles were plugged tightly with cotton wool. After that, the Soxhlet apparatus was assembled and allowed to reflux for 6hrs. The thimble was removed with care and petroleum ether collected from the top container and drained into another container for re-use. After that, the flask was dried at 72˚C for 30 minute when it is almost free of petroleum ether. After drying, it was cooled in a desiccator and weighed. Then, % crude fat in the bread sample was computed using the formula below:

$$\text{Fat } \% = \frac{(weight\ of\ fat)}{(weight\ of\ sampe)} \times 100$$ Equation (3.1)

2.2.1.2 Determination of moisture content

Moisture content was determined by the AOAC (2010) method. This involved drying to a constant weight at 25˚C and calculating moisture as the loss in weight of the dried bread samples. 5 gram of the sample was weighed into aluminum moisture dish the samples were then dried in an oven at 105 ± 20˚C for 8 hours in hot air oven. The moisture content was calculated using equation 3.2.

% Moisture= $\frac{W1-W2}{W3-W2} \times 100$

Equation (3.2)

Where w_1=weight of sample, w_2= weight of sample and dish after drying and w3= weight of the sample after drying.

2.2.1.3 Determination of ash content

Total ash of the bread sample was determined by Furnace Incineration described by AOAC (2015) method) based on the vaporization of water and volatiles with burning organic substances in the presence of oxygen in the air to CO_2 (Carbon (iv) oxide) at a temperature of 25˚C (dry ash). About 2.0g of finely ground dried sample was weighed into a 277 tared porcelain crucible and incinerated at 45C for 72 hours in an ashing muffle furnace until ash was obtained. The ash were cooled in a desiccator and reweighed. The % ash content in the bread sample will be calculated using equation 3.3.

% Ash $= \frac{(weight\ of\ ash)}{(weight\ of\ sampe} \times 100$ Equation (3.3)

2.2.1.4 Determination of carbohydrates content

The total percentage carbohydrate content in the bread sample was determined by the difference method as reported by (AOAC 2015). This method involved adding the total values of crude protein, lipid, crude fiber, moisture and ash constituents of the sample and subtracting it from 100. The value obtained is the percentage carbohydrate constituent of the sample.

Thus: % =Carbohydrate=100- (% moisture + % fat+% protein+% +% ash) Equation (3.4)

2.2.1.5 Determination of protein content

Protein was estimated by Kjeldal method reported by (AOAC 2015). 8g of the bread samples were taken in preformed beaker and 10g of the catalyst (copper sulphate and sodium sulphate) were added approximately along with 10ml of concentrated sulfuric acid. The mixture was heated at a temperature until it become clear digestion, its volume will be adjusted up to 100ml. 5 ml of each sample was added into the beaker and 10ml of the 0.5 NaOH (Sodium hydrochloride) was added. The heated mixture was in the distillation flask, all the nitrogen which was released in the form of ammonia, were absorbed at the receiving end by 5ml boric acid (2%) containing a drop of methyl red as an indicator. Titrated against N/70 HCl (Hydrochloric acid) was recorded and the volume to be used to restore the pink color. The 'N' and crude protein content was determined using equation 3.5.

% Crude protein= % Nitrogen× 6.25 Equation (3.5)

2.2.2 Determination of Micro Minerals

2.2.2.1 Determination of iron

Spectrophotometer method used by Anon, (2015). Five test tubes are prepared and 2.5 ml of 0.1 M KSCN (potassium thiocyanate) potassium were added to each test tube and mixed thoroughly and 2.5g of sample is placed on a crucible and heated on a hot burner flame till it becomes ash and allowed to cool and the sample ash was transferred into a small beaker and 10 ml of 2.0 M hydrochloride acid was added and carefully stirred for one minute, alongside 10 ml of distilled water. The mixture is filtered and 2.5 ml of 0.1m KSCN (potassium thiocyanate) was added and mixed properly. A spectrometer having a wavelength 485 nm on the ultra-violet light was used to find the absorption and the necessary calculations done.

3.2.2.2 Determination of zinc

Colorimetric method was used to determine magnesium content as outlined by AOAC (2010). About 2ml of Zinc buffer and 2.5ml of eriochrome blue black tea was added to 10ml of the sample. This was allowed to stand for 5 minutes. Absorbance was taken at 520nm using a colorimeter. Zinc was calculated using the equation below.

$$\text{Zinc} = \frac{\text{Ass} \times \text{Css} \times \text{Df}}{Ass \times Sv} \times 100$$

Equation (3.6)

Where As= absorbance of sample, Css= concentration of sample solution, Df= dilution factor, Ass= absorbance solution and Sv= sample volume.

2.2.2.3 Determination of copper

Titrimetry method as described by Lalwani *et al*., (2014). 5.0g of bread sample was placed inside an 8ml of concentrated sulphuric acid and 10 ml of concentrated nitric acid into a heat-resistant beaker. 2-cm^3 aliquot of concentrated nitric acid was constantly added at any time the solution began to darken. The solution was cooled with about 10 ml of distilled water and evaporated to fuming again, and then the solution was made up to mark in 100 ml volumetric flask. 25 ml aliquot of sample digest was pipetted into a beaker and 1m NaOH (Sodium hydrochloride) solution was added to it. Two drops of solo chrome dark blue was then added and immediately titrated against a 0.01M EDTA (Ethylediaminetetracetic acid) solution to the blue end-point.

2.2.3 Determination of macro minerals

2.2.3.1 Determination of phosphorus

Phosphorus stock solution was prepared using the method outline by AOAC (2010). A calibration graph will be prepared by the reading obtained. About 2ml of sample were mixed with be 2ml of sodium cobalt nitrate and allow standing for 30 minutes. About 2ml of water was added to the mixture and centrifuged for 3 minutes, the supernatant were boiled in water for 10 minutes. About 1ml of 1% of hydrochloride solution, 1ml potassium cyanide, and 2ml of distilled water were added to the extract. Absorbance was determined at 520nm using a colorimeter.

2.2.3.2 Determination of potassium

Potassium stock solution was prepared using the method outline by AOAC (2010). A calibration graph will be prepared by the reading obtained. About 2ml of sample were mixed with be 2ml of sodium cobalt nitrate and allow to stand for 30 minutes. About 2ml of water was added to the mixture and centrifuged for 3 minutes, the supernatant were boiled in water for 10 minutes. About 1ml of 1% of hydrochloride solution, 1ml potassium cyanide, and 2ml of distilled water were added to the extract. Absorbance was determined at 520nm using a colorimeter

. The sample solution was determine calculating using the equation:

$$\text{Potassium} = \frac{\mathrm{Ass \times Css \times Df}}{Ass \times Sv} \times 100$$

Equation (3.7)

Where As= absorbance of sample, Css= concentration of sample solution, Df= dilution factor, Ass= absorbance solution and Sv= sample volume.

2.2.3.3 Determination of calcium

Calcium content was determined by photometric method as outlined by (Awonorin, 2014). The instrument was set up according to the manufacture's instruction calcium stock solution was prepared by dissolving 1.271 g calcium in water and diluting to 1 litre and a standard dilute sodium solution was prepared by diluting 10 ml stock sodium solution to 500 ml with water and kept aside. A calibration graph was prepared from the readings obtained. About 5 ml of samples was mixed with 5 mL of uranyl acetate, shaken and allowed to stand for 5 minutes. The samples will be centrifuged and the supernatant obtained and mixed with 1% acetic acid and 0.4 mL of potassium fericyanide. The colourimeter was set to scale 0 with distilled water and the standard dilute sodium. Each solution will be diluted to concentrations of 2, 4, 6, 8, 10 ppm. Starting with the least concentration of 2 ppm, all the standard solution were sucked into the instrument and caused to spray over the non-luminous flame. The reading were recorded and later plotted into a standard curve and used to extrapolate to potassium level in the sample. After the standard, the solutions were siphoned in turns into the instrument with their reading recorded. The sodium content was calculated using Equation (3.8).

$$\text{Calcium (mg/100g)} = 100 \left(\frac{Vt}{W} \times \frac{X}{10^3} \times D\right) \quad \text{Equation (3.8)}$$

Where

W = Weight of sample used

Vt = Total extract volume

X = Concentration sodium from the graph

D = Dilution factor

2.2.4 Determination of antioxidant

2.2.4.1 DPPH Radical Scavenging Assay

DPPH radical scavenging activity of bread samples were measured using the standard method (de- Oliveira *et al.,* 2012). One Milligram (1 Mg) sample was mixed with 2,2-diphenyl-1-picrylhydrazyl solution (10 mL). The mixtures were incubated at 25 C for 30 min. The absorbance of sample solutions was recorded using spectrophotometer (TU-1810 series of UV-visible, General Analysis of General Instrument Co. Ltd., Beijing, China) at 517 nm. The DPPH radical scavenging activity was then calculated by Equation 9 and Gallic acid was used as a reference.

$$\text{DPPH scavenging activity \%} = (As - A) \times 100 \quad (3.9)$$

Where:

A, representative absorbance of standard antioxidant,

While As representative absorbance of the samples.

2.2.4.2 Ferric reducing antioxidant power (FRAP) assay

The reducing power assay of the bread samples was carried out according to the method of Siddeeg *et al.* (2014), with a little modification. One Milligram (1 Mg) of samples were mixed with 200 uL., 10 mg/mL potassium ferricyanide and 200 uL, 0.2 M, pH 6.6 sodium phosphate bufer and they were incubated for 30 min at 50°C, after that, 200 uL, 100 mg/mL of Tri chloro acetic acid was added. The mixtures were also incubated again at the same temperature for 5 min to drop the reaction process. A volume of the reaction mixture (680 uL) was mixed with distilled water (680 uL) and 68 uL of ferric chloride (10 mg/mL). Ascorbic acid (0.3 mM) was used as a reference component for comparison. The absorbance's of samples were reported using spectrophotometer (TU-1810 series of UV-visible, General Analysis of General Instrument Co. Ltd., Beijing, China) at 700 nm.

2.2.5 Determination of phytochemicals

2.2.5.1 Determination of flavonoid

The flavonoid content of the bread samples of (Muanya, 2011). 5g of the powered sample was mixed with 50 ml of 20% aqueous ethanol solution in a flask. The mixture was heated with periodic agitation in water bath for 90 minutes at 55^{o}C; it was then filtered through a filter paper. The residue was extracted with 50 ml of 20% ethanol and both extract reduced to about 40 ml at 90^{o}C and transferred to a separating funnel where 40 ml of diethyl either was added and shaken vigorously. Separation was by partition during which the ether layer was discarded and the aqueous layer reserved. Re extraction by partitioning was done repeatedly until the aqueous layer become clear in colour. The sapinions were extracted, with 60 ml of normal butanol. The combined extracts were washed with 5% aqueous sodium chloride (NaCl) solution and evaporated to dryness in a reweighted evaporation dish. It was dried at 60^{o}C in the oven and reweighted after cooling in a desicator. The process was repeated two more times to get an average. Flavonoid content was determined by difference and calculated as a percentage of the original sample.

2.2.5.2 Determination of tannins

The method of (Muanya, 2011) was used for the determination of tannin contents bread sample. 0.2g of finely ground sample was measured into a 50 ml beaker. 2 ml of 50% methanol was added and covered with parafin and placed in a water bath 77-80^{o}C for 1h and stirred with a glass rod to prevent lumping. The extract was quantitatively filtered methanol to rinse. This was made up to mark with distilled water and thoroughly mixed. 1 ml of sample extract was pipette into 50ml volumetric flask, 20ml distilled water, 2.5 ml Folin Denis reagent and 10 ml of 17% sodium sulfate were added and mixed properly. The mixture was made up to mark distilled water, mixed well and allowed to stand for 20 min when a bluish – green colouration developed. Standard Tannic Acid solutions of range 0-10 ppm were treated similarly as 1 ml of sample above. The absorbance of the Tannic Acid Standard solutions as well as samples were read after colour development on a Spectrnic 21D Spectrophotometer at a wavelength of 760 mm.

2.2.5.3 Determination of carotenoid

Muanya, (2011) described the carotenoid content for bread samples. A measured weight of the sample was dispersed in 10% acetic acid solution in ethanol to form a ratio of 1.10 (10%). The mixture was allowed to stand for 4h at 28^{o}C. It was later filtered; the filtrate was concentrated to one quarter of its original volume by evaporation and treated with drop wise addition of cone aqueous ammonia solution until the alkaloid was precipitated. The carotenoid precipitated was received in a weighted filter paper, washed with 1% ammonia solution dried in the oven at 80^{o}C. Carotenoid content was calculated and expressed as a percentage of the weight of sample analyzed.

2.2.6 Determination of the Physical Quality of the Bread

The physical qualities of the bread were determined by various method listed below under designated headings.

2.2.6.1 Determination of width and length of the bread

The width was determined by using a Vernier caliper to measure breath of the edges of two bread samples. The average of the samples were calculated and reported by in millimeter by modified method of (Bala *et al*., 2015).

2.2.6.2 Determination of weight of the bread

The weight of the bread was determined by modified method of (Adeola, 2018). Samples of two (2) individual set were measured on an analytical weighing balance and their average was taken and reported in grams.

2.2.6.3 Determination of loaf volume

The weight of the loaf volume was determined by modified method of *Adeola, 2018). Loaf weight was determined by dividing the volume of loaf sample volume by bread weight of loaf sample by the bread as follows:

Volume index (cm^3/g) = $\frac{volume\ of\ loaf\ sample}{weight\ of\ loaf\ sample}$ Equation (3.10)

2.2.7 Determination of the sensory properties of bread samples

Method described by Ayoade *et* al., (2010), sensory properties was preformed within 24 hours of baking to evaluate loaf color, crust, aroma, crumb texture, taste, and overall acceptability of the bread samples. The samples were evaluated on 9-point Hedonic scale where 1 = disliked extremely and 9= like extremely. The order of presentation of the sample to the panelist was randomized. The panelists were provided with bottle water to rinse their mouths in between evaluation.

2.4 STATISTICAL ANALYSIS

The results obtained were presented as mean ± standard deviation (SD) of duplicate measurements of variance (One Way-ANOVA) and the data were analyzed using SPSS (Software package for Social science) version 26 software. Statistical significance at 95% confidence limit ($p \leq 0.05$) was accepted, while the mean was separated using Duncan's Multiple Range Test (DMRT).

3.0 RESULT AND DISCUSSION

3.1 PROXIMATE COMPOSITION OF BREAD FROM WHEAT, DEFATTED SESAME AND UNRIPE PLANTAIN FLOUR BLENDS

The result of the proximate composition of bread produced from wheat, defatted sesame seed and unripe plantain flour blend as shown in Table 3.

The crude fiber content had a significant difference ($P \leq 0.05$) for the various samples. The result of crude fiber content shows a ranged from 4.16% to 11.66% respectively. The samples ratio increases: 4.16% (100:0:0), 4.99% (90:5:5), 8.49% (80:10:10) and 11.66% (70:15:15). Sample 70:15:15 (11.66%) has the highest fiber content which may be because both sesame seed and unripe plantain flour are a good source of fiber, from the result as the proportion of sesame seed and unripe plantain increases, there is an increase in the content of fiber (Ogundele *et al*., 2022). Adequate intake of dietary fiber can lower the level of serum cholesterol and reduce the risk of developing hypertension, constipation, diabetes, colon cancer and coronary heart disease. The fiber content might be due to biochemical reactions during baking because of the atmospheric moisture in the heating chamber and the different variation of temperature during baking of the bread in accordance to (Rao, 2017).

The protein content showed a significant difference ($P \leq 0.05$) for the various samples. The protein content ranged from 23.05% to 7.07% respectively. The samples ratio decreases: 23.05% (100:0:0), 16.42% (90:5:5), 11.48% (80:10:10) and 7.07% (70:15:15) respectively. Sample 23.05% (100:0:0) has the highest content of protein due the fact that wheat flour is a good source of plant based protein by 16.42% (90:5:5), showing that the protein content decreases has unripe plantain flour increases but defatted sesame seed flour is also known for is protein content (Ogbonna *et al.,* 2019).During baking protein denatures, because of the heat and the reaction of protein structures and sugar thereby causing desired colour changes. In bread production, the protein content ranges from 12% to 16% greatly increase flours susceptibility to water adsorption (functional property) during baking, the protein quantity and quality are considered important in estimating the overall quality of the bread such as flavour and colour of the bread in accordance to (Laguna *et al*., 2014). Protein is necessary for growth in children and maintenance of worn-out tissues in adults (Ogbonna *et al*., 2019).

The result of the moisture content shown in Table 3 ranged from 6.58% to 7.78% respectively. The samples ratio increases: 6.58% (100:0:0), 7.26% (90:5:5), 7.27% (80:10:10) and 7.07% (70:15:15). Sample 7.27% (80:10:10) has the highest content of moisture. Moisture content variation may be due to humidity in the heating chamber and external factor such condensation during packaging and placement position before analysis because moisture from the atmosphere can form during cooling after baking because of temperature according to (Cherinet, 2020). The moisture content shows a significant difference ($P \leq 0.05$) for the various samples.

The ash content ranged from 1.05% to 3.84% respectively. The samples ratio increases: 1.05% (100:0:0), 1.49% (90:5:5), 1.88% (80:10:10) and 3.84% (70:15:15). Sample 3.84% (70:15:15) has the highest ash content although the ash content increases by the increase of unripe plantain flour in the proportion (Ogundele *et al*., 2022). The result shows that there is a good mineral composition this may be by the addition of defatted sesame flour and unripe plantain flour to wheat flour the ash content increases thereby obtaining a good mineral composition from the bread, which is needed for proper fluid balance, healthy bones and teeth, help muscle relax and contract. In Table 3. The ash content shows a significant difference ($P \leq 0.05$) for the various samples.

The fat content of the various bread samples ranged from 12.92% to 21.36% respectively. The samples ratio decreases: 12.92% (100:0:0), 14.87% (90:5:5), 17.40% (80:10:10), and 21.36% (70:15:15). Sample 21.36% (70:15:15) has the highest fat content, which may be due to the fat content used in the production, and that sesame seed contains high oil and fat content as reported by (Ogundele *et al*., 2022). Increase in fat content down the column may be because fat crystals during stabilization of air bubbles that interface during the mixing process, which may aid to soften the dough according to (Rao, 2017). Fat is responsible for flavour improvement of the final product. The result shows a significant difference ($P \leq 0.05$) for the various samples.

The carbohydrate content ranged from 44.00% to 60.42% respectively. The samples ratio decreases: 60.42% (100:0:0), 57.34% (90:5:5), 48.79% (80:10:10), 44.00% (70:15:15). Sample 60.42% (100:0:0) has the highest carbohydrate content, which may be due to the carbohydrate content in wheat flour, because with is regarded has a carbohydrate crop and the decrease in carbohydrate down the column may be because of increase in defatted sesame seed flour although unripe plantain flour is also a resistant starch (Shodehinde, 2012). Carbohydrates serve as a good source of energy. The result shows a significant difference (P ≤ 0.05) for the various samples.

Table 3 PROXIMATE COMPOSITION OF BREAD.

Sample Ratio (%)	Crude fiber (%)	Crude Protein (%)	Moisture content (%)	Ash (%)	Fat (%)	Carbohydrate (%)
100:0:0	4.16^{d}±0.00	23.05^{a}±0.07	6.58^{d}±0.00	1.05^{d}±0.01	12.92^{d}±0.04	60.42^{a}±0.30
90:5:5	4.99^{c}±0.00	16.42^{b}±0.03	7.26^{b}±0.00	1.49^{c}±0.00	14.87^{c}±0.00	57.34^{b}±0.25
80:10:10	8.49^{b}±0.00	11.48^{c}±0.04	7.27^{c}±0.00	1.88^{b}±0.07	17.40^{b}±0.00	48.79^{c}±0.18
70:15:15	11.66^{a}±0.07	7.07^{d}±0.02	7.78^{a}±0.07	3.84^{a}±0.07	21.36^{a}±0.00	44.00^{c}±0.25

Values are mean ± standard deviation of the proximate composition. Means within each column not followed by the same superscript are significantly different (P ≤ 0.05) from each other using Duncan multiple range test.

Key;

100:0:0= (100% wheat flour, 0% defatted sesame seed flour and 0% unripe plantain),

90:5:5= (90% wheat flour, 5% defatted sesame flour and 5% plantain flour),

80:10:10= (80% wheat flour, 10% defatted sesame and 10% plantain flour),

70:1:155= (70% wheat flour, 15% defatted sesame and 15% plantain flour),

3.2 PHYTOCHEMICAL PROPERTIES OF BREAD FROM WHEAT, DEFATTED SESAME AND UNRIPE PLANTAIN FLOUR BLENDS

The result of the phytochemicals properties of bread from wheat, defatted sesame seed and unripe plantain flour blend as shown in Table 4.

The flavonoid ranged from 0.87 to 1.10 respectively. The samples ratio decreases: 1.10 (100:0:0), 1.01 (80:10:10), 0.94 (90:5:5) and 0.87 (7:15:15). Sample 100:0:0 (1.10) has the highest value for the flavonoid which may be due to the fact that wheat flour contains more flavonoid content, the flavonoid content reduces as defatted sesame and unripe plantain flour increase because sesame is low in flavonoid content, the values showed is in accordance to report by (Shodehinde, 2012). Flavonoids, are a group of plant secondary metabolites, where the molecular framework is categorized by variable phenolic structures, and possess anticancer activity (Yu *et al.,* 2021). The result shows a significant difference ($P \leq 0.05$) for the various samples.

The tannins content ranged from 6.56 to 9.32 respectively8.47 (100:0:0), 6.56 (90:5:5). 7.19 (80:10:10) and 9.32 (70:15:15). Sample 9.32 (70:15:15) has the highest content for tannins that may be because of due to the fact that sesame is low tannins and unripe plantain is rich in tannins in comparison to wheat flour, has the ratio of wheat to plantain flour increases so the rate of tannins (Ijah *et al.,* 2014). Tannis is characterized by phenolic compounds is the presence of at least one hydroxyl-substituted aromatic ring system (Blessing *et al.,* 2010). The result shows a significant difference ($P \leq 0.05$) for the various samples. The phenolic content ranged from 2.42 to 4.16 respectively. 4.16 (100:0:0), 2.42 (90:5:5), 2.56 (80:10:10) and 3.10 (70:15:15). sample 100:0:0 (4.16) has the highest value for the phenolic which may be due to the fact that wheat flour contains more phenolic content, the flavonoid content reduces as defatted sesame and unripe plantain flour increase because sesame is low in flavonoid content, the values showed is in accordance to report by (Shodehinde, 2012). 3.10 (70:15:15) the increase in the phenolic content for the last proportion is due unripe plantain, as unripe plantain is rich in phenol (Laguna *et al.,* 2011).

Phenol aid in plant synthesizes another secondary product that contain a phenol group is basically a hydroxyl functional heterogeneous group present on an aromatic ring, tannins possess antioxidants, with anti-inflammatory, antidiarrhoeal, cytotoxic, antiparasitic, antibacterial, antifungal and antiviral activities (Nwobasi, 2017). The result shows a significant difference ($P \leq 0.05$) for the various samples.

4.3 MINERAL COMPOSITION OF BREAD FROM WHEAT, DEFATTED SESAME AND UNRIPE PLANTAIN FLOUR BLENDS

The result of the mineral composition of bread produced from wheat, defatted sesame seed and unripe plantain flour blend as shown in Table 4 below.

The Calcium (Ca) content in the bread samples ranged from 0.31 to 0.233 mg/100g. The samples ratio follows 0.31mg/100g (90:5:5), 0.33mg/100g (80:10:10), 0.36mg/100g (100:0:0) and 0.36mg/100g (70:15:15). 0.36mg/100g (100% and 70:15:15) has the highest calcium content, wheat flour and defatted sesame seed have been reported to contain significant content of calcium and unripe plantain, which calcium content is slightly negligible in comparison to defatted sesame seed (Ijah *et al*., 2014). Although result show different variation with the blend ratios. The result shows no significant difference ($P \leq 0.05$) for the various samples.

The Iron (Fe) content in the bread samples ranged from 3.00 to 3.30mg/100g. The samples ratio follows 3.00mg/100g (80:10:10), 3.20mg/100g (70:15:15), 3.25mg/100g (100:0:0), and 3.30mg/100g (90:5:5). Sample (90:5:5) 3.30mg/100g appear to have the highest quantity of iron present in it this may be due to the fact that both wheat, defatted sesame flour and unripe plantain contain significant quantity of iron according to report by (Ijah *et al*., 2014). Iron is essential in the blood stream to carry oxygen from the lungs to other part of the body and helps in the formation of hemoglobin. Although result show different variation with the blend ratios. The result shows significant difference ($P \leq 0.05$) for the various samples.

Table 4 PHYTOCHEMICAL PROPERTIES OF SAMPLES

Sample Ratio	Flavonoid	Tannis	Phenolics
100:0:0	1.10^{a}±0.14	8.47^{b}±0.10	4.16^{a}±0.14
90:5:5	0.94^{b}±0.04	6.56^{d}±0.14	2.42^{c}±0.21
80:10:10	1.01^{a}±0.01	7.19^{c}±0.02	2.56^{bc}±0.35
70:15:15	0.87^{b}±0.04	9.32^{a}±0.04	3.10^{b}±0.04

The data values are mean ± standard deviation of phytochemicals properties of the bread. Means within a column not followed by the same superscript are significantly different (P ≤ 0.05) from each other using Duncan multiple range test.

100:0:0= (100% wheat flour, 0% defatted sesame seed flour and 0% unripe plantain),

90:5:5= (90% wheat flour, 5% defatted sesame flour and 5% plantain flour),

80:10:10= (80% wheat flour, 10% defatted sesame and 10% plantain flour),

70:15:15= (70% wheat flour, 15% defatted sesame and 15% plantain flour)

The zinc (Zn) content in the bread samples ranged from 0.40 to 3.30mg/100g. The samples ratio follows 0.90mg/100g (100:0:0), 1.05mg/100g (90:5:5), 1.08mg/100g (80:10:10), and 0.08mg/100g (70:15:15). 1.08mg/100g (80:10:10), and 0.08mg/100g (70:15:15) appear to have the highest quantity of zinc present in it this may be due to the fact that both defatted sesame flour and unripe plantain contain significant quantity of zinc and wheat is low in zinc content according to report by (Ogundele *et al*., 2022). Zinc plays a key role in the regulation of insulin production by pancreatic tissues and glucose utilization by muscles and fat cells (Ogundele *et al*., 2022). Although result show different variation with the blend ratios. The result shows no significant difference ($P \leq 0.05$) for the various samples.

The copper (Cu) content in the bread samples ranged from 0.05 to 0.60mg/100g. The samples ratio follows 0.01mg/100g (100:0:0), 0.02mg/100g (80:10:10), 0.05mg/100g (90:5:5), and 0.60mg/100g (70:15:15). Sample (70:15:15) 0.60mg/100g appear to have the highest quantity of iron present in it this may be due to the fact that both wheat, defatted sesame and unripe plantain flour contain significant quantity of iron and wheat has low copper content according to report by (Oly-Alawuba, 2017). Copper is found in all living organisms and is a crucial trace element in redox chemistry, growth and development (Oly-Alawuba, 2017). Although result show different variation with the blend ratios. The result shows significant difference ($P \leq 0.05$) for the various samples.

The magnesium (Mg) content in the bread samples ranged from 0.40 to 0.87mg/100g. The samples ratio follows 0.40mg/100g (100:0:0), 0.02mg/100g (80:10:10), 0.05mg/100g (90:5:5), and 0.87mg/100g (100:0:0). 0.87mg/100g (100:0:0) appear to have the highest quantity of magnesium present in it this may be due to the fact that both wheat flour contains substantial amount of magnesium, followed by 0.61 (80:10:10) which may be due to the fact of defatted sesame and unripe plantain flour contain low amount of magnesium content. Magnesium helps in muscle and nerve function, blood glucose control, and blood pressure (Oly-Alawuba, 2017).

Table 5 MINERAL COMPOSITION (MG/100G) OF SAMPLES

Sample Ratio	Calcium (Ca)	Iron (Fe)	Zinc (Zn)	Copper (Cu)	Magnesium (Mg)	Phosphorus (P)
100:0:0	$0.36^{a}\pm0.01$	$3.25^{a}\pm0.35$	$0.92^{a}\pm0.02$	$0.01^{d}\pm0.00$	$0.87^{a}\pm0.00$	$3.82^{c}\pm0.01$
90:5:5	$0.31^{a}\pm0.04$	$3.30^{a}\pm0.42$	$1.05^{a}\pm0.07$	$0.05^{c}\pm0.00$	$0.61^{b}\pm0.00$	$3.82^{c}\pm0.01$
80:10:10	$0.33^{a}\pm0.03$	$3.00^{a}\pm0.14$	$1.08^{a}\pm0.11$	$0.02^{b}\pm0.00$	$0.40^{c}\pm0.07$	$4.11^{b}\pm0.01$
70:15:15	$0.36^{a}\pm0.02$	$3.20^{a}\pm0.14$	$1.08^{a}\pm0.04$	$0.60^{a}\pm0.00$	$0.47^{c}\pm0.04$	$4.18^{a}\pm0.03$

The data values are mean ± standard deviation of mineral composition of the bread. Means within a column not followed by the same superscript are significantly different ($P \leq 0.05$) from each other using Duncan multiple range test.

Key;

100:0:0= (100% wheat flour, 0% defatted sesame seed flour and 0% unripe plantain),

90:5:5= (90% wheat flour, 5% defatted sesame flour and 5% plantain flour),

80:10:10= (80% wheat flour, 10% defatted sesame and 10% plantain flour),

70:15:15= (70% wheat flour, 15% defatted sesame and 15% plantain flour),

Although result show different variation with the blend ratios. The result shows significant difference (P ≤ 0.05) for the various samples.

The phosphorus content (P) in the bread samples ranged from 3.82 to 4.18mg/100g. The samples ratio follows 3.82mg/100g (100:0:0), 3.82mg/100g (90:5:5), 4.11mg/100g (80:10:10), and 4.18mg/100g (70:15:15). Sample (70:15:15) 4.18mg/100g appear to have the highest quantity of phosphorus present in it this may be due to the fact that both wheat flour contains substantial amount of phosphorus, followed by 0.61 (80:10:10) which may be due to the fact that defatted sesame and unripe plantain flour contain low amount of phosphorus content. The result shows significant difference (P ≤ 0.05) for the various samples.

3.4 ANTIOXIDANT PROPERTIES OF BREAD FROM WHEAT, DEFATTED SESAME AND UNRIPE PLANTAIN FLOUR BLENDS

The result of the antioxidant properties of bread produced from wheat, defatted sesame seed and unripe plantain flour blend as shown in Table 4 below.

The DPPH content in the bread samples ranged from 9.61 to 29.39%. The samples ratio follows 9.61% (100:0:0), 18.94% (90:5:5), 28.83% (80:10:10), and 29.39% (70:15:15). 29.39% (70:15:15) appear to have the highest quantity of DPPH present in it this may be due to the fact that unripe plantain contain the most significant quantity of phenolic content and wheat flour appear to be low in phenolic content according to report by (Wilson *et al*., 2017). They also reduce the tendency of oxidative deterioration among food product in accordance to a (Danlami *et al*., 2015). They are generally (antioxidant) referred to as free scavenger's radicals that prevent or reduce damages cause by oxidation and oxidative stress; in diet high in antioxidant, they may likely reduce many diseases such as cardiovascular condition and neurodegenerative conditions in accordance to (Wilson *et al*., 2017).

The ferric reducing antioxidant power (FRAP) assay content in the bread samples ranged from 17.75 to 44.46mgtrolox/g. The samples ratio follows 17.75mgtrolox/g (100:0:0), 35.48mgtrolox/g (90:5:5), 43.57mgtrolox/g (80:10:10), and 44.46mgtrolox/g (70:15:15). Sample (70:15:15) 44.46mgtrolox/g appear to have the highest quantity of iron present in it this may be due to the fact that both wheat and unripe plantain flour contain significant quantity of ferric reducing antioxidant power (FRAP) and defatted sesame seed flour has low ferric reducing antioxidant power (FRAP) content according to report by (Soboka *et al.,* 2017). The result shows significant difference ($P \leq 0.05$) for the various samples.

Table 6 ANTIOXIDANT PROPERTIES OF SAMPLES

Sample Ratio	DPPH (%)	FRAP (mg trolox/g)
100:0:0	$9.61^{d}\pm10.25$	$17.75^{a}\pm0.04$
90:5:5	$18.94^{c}\pm12.74$	$35.48^{c}\pm4.75$
80:10:10	$28.83^{b}\pm9.08$	$43.57^{b}\pm0.03$
70:15:15	$29.39^{a}\pm13.73$	$44.46^{d}\pm0.03$

The data values are mean ± standard deviation of phytochemicals properties of the bread. Means within a column not followed by the same superscript are significantly different ($P \leq 0.05$) from each other using Duncan multiple range test.

100:0:0= (100% wheat flour, 0% defatted sesame seed flour and 0% unripe plantain),

90:5:5= (90% wheat flour, 5% defatted sesame flour and 5% plantain flour),

80:10:10= (80% wheat flour, 10% defatted sesame and 10% plantain flour),

70:15:15= (70% wheat flour, 15% defatted sesame and 15% plantain flour)

3.5 PHYSICAL PROPERTIES OF WHEAT DEFATTED SESAME AND UNRIPE PLANTAIN FLOUR BLEND BREAD

The result of the physical properties of bread produced from wheat, defatted sesame and unripe plantain flour blend as shown in Table 5. The bread width ranged from 7.70cm to 8.63cm respectively. The samples ratio follows 7.70cm (70:15:15), 7.96cm (80:10:10), 8.10cm (90:5:5), and 8.63cm (100:0:0). Sample (100:0:0) 8.63cm being the highest width which may be as result of the quantity of sugar used during mixing, sugar causes the dough to be stiff according to (Rao, 2017). The result showing different degree of variation among the different bread samples at a significant difference of ($P \leq 0.05$).

The length of the bread ranged from 10.49 to 11.05cm respectively. The samples ratio follows 10.49cm (70:15:15), 10.99cm (100:0:0), 11.03cm (80:10:10), and 11.05cm (90:5:5). sample (90:5:5) 11.05cm having the highest length, which may be due to the incorporation of the flour blend with wheat flour blend have a dispersed property during and after baking (Gernah, 2014). The usage of sugar has been reported to increase the length of bread product (Rao, 2017). Showing that sugar rich bread usually have lower numeric value for thickness and higher numeric value for diameter or length in accordance to (Gernah, 2014). The result showing different degree of variation among the different bread samples are not significantly different for ($P \leq 0.05$).

The weight of bread ranged from 111.49g to 120.77g respectively. The samples ratio follows: 111.49g (100%), 111.90g (90:5:5), 113.48g (80:10:10) and 120.77 (70:15:15). Sample (70:15:150) 120.77 being the highest weight. The increase in the use of flour proportion, which contains resistant starch shows that it increases in the proportion usage causes stiffness of dough thereby affecting the increase of the final weight of the bread (Rao, 2017) and (Agu, 2014). Weight can be attributed to CO2 during the process of leavening thereby causing an increase in the weight and low-density yeast-raised product according to (Rao, 2017). Sugar content during mixing as also been attributed to weight loss during mixing by many food engineers according to (Rao, 2017). The result showing different degree of variation among the different bread samples at a significant difference of ($P \leq 0.05$).

The loaf volume of the bread ranged from 524.00cm to 321.00 respectively. The samples ratio follows: (100:0:0) 524.00cm^3, (90:5:5), 455.00cm^3 (80:10:10) 389.00cm^3 (70:15:15) 321.00cm^3 respectively. Sample (100:0:0) 524.00cm^3, have the highest spread ratio value. Loaf volume informs about the ability for bread to rise and the quality, which may be because of increase or decrease in protein during blending. Leavening that affect spread ratio as result the biochemical and physiochemical reaction that affect Co_2 from yeast fermentation when the gas is trapped in the food structure and held until it expands during the bread formation (Rao, 2017). The cohesiveness of the bread and is volume is due to the wheat flour (Rao, 2017). The result showing different degree of variation among the different bread samples at a significant difference of ($P \leq 0.05$).

Table 7 PHYSICAL PROPERTIES OF BREAD SAMPLES

Sample Ratio	Width (cm)	Length (cm)	Weight (g)	Loaf volume (cm^3)
100:0:0	$8.63^{a}\pm0.10$	$10.99^{a}\pm0.01$	$111.49^{a}\pm0.02$	$524.00^{b}\pm5.66$
90:5:5	$8.10^{a}\pm0.14$	$11.05^{a}\pm0.07$	$111.90^{b}\pm0.14$	$455.00^{a}\pm7.07$
80:10:10	$7.96^{a}\pm0.04$	$11.03^{a}\pm0.04$	$113.48^{c}\pm0.04$	$389.00^{b}\pm1.41$
70:15:15	$7.70^{b}\pm1.04$	$10.49^{a}\pm0.01$	$120.77^{bc}\pm0.05$	$321.00^{b}\pm1.41$

The data values are mean ± standard deviation of physical properties of the bread. Means within a column not followed by the same superscript are significantly different ($P \leq 0.05$) from each other using Duncan multiple range test.

100:0:0= (100% wheat flour, 0% defatted sesame seed flour and 0% unripe plantain),

90:5:5= (90% wheat flour, 5% defatted sesame flour and 5% plantain flour),

80:10:10= (80% wheat flour, 10% defatted sesame and 10% plantain flour),

70:15:15= (70% wheat flour, 15% defatted sesame and 15% plantain flour).

3.6 SENSORY ACCEPTABILITY OF WHEAT, DEFATTED SESAME AND UNRIPE PLANTAIN FLOUR BLEND BREAD

The result of the sensory properties of bread produced from wheat, defatted sesame seed and unripe plantain flour blend as shown in Table 7.

The taste mean score ranged from 6.25 to 8.00 respectively. The samples ratio follows: (100:0:0) 6.60, (90:5:5) 7.80, (80:10:10) 8.00, (70:15:15) 6.25. Sample (80:10:10) 8.00 appear to be the most preferred bread sample based on taste preference by the panelist. This may be because the sample with less unripe plantain shows to be more acceptable from Table 7, fat and sugar have been said to improve the taste of bread according to (Ijah *et al*., 2014). The result shows a significant difference ($P \leq 0.05$) for the various samples.

The aroma mean score ranged from 6.05 to 7.35 respectively. The samples ratio follows: 6.05 (100:0:0) 6.40, (90:5:5) 7.05, (80:10:10) 7.35and (70:15:15) 6.05. Sample (80:10:10) 7.35 appear to be the most preferred bread sample based on aroma preference by the panelist. Mailard reaction and the degree of baking temperature have been reported to affect aroma acceptability of baked product especially for wheat based baked bread according to (Rao, 2017). The result shows a significant difference ($P \leq 0.05$) for the various samples.

The colours mean score of the bread ranged from 5.50 to 7.75 respectively. The samples ratio follows: (100:0:0) 7.75, (90:5:5) 6.60, (80:10:10) 6.25 and (70:15:15) 5.50. Sample (100:0:0) 7.75 appear to be the most preferred bread sample based on colour appeal which may be because bread is produced from wheat flour. Colour change might because of Maillard reaction, which occur during gelatinization of starch sugar and protein denaturing according to (Rao, 2017). Previous works relating to wheat, unripe plantain and sesame seed shows that sesame seed is the predominant influence of the colour of the final product, which is the case for flours with the highest ratio during blending according to (Agu, 2014). Although result show different variation as blend ratio increases without a specific pattern. The result shows significant difference ($P \leq 0.05$) for the various samples.

Table 8 Sensory Properties of Bread Samples

Sample Ratio	Taste	Aroma	Loaf Colour	Crumb Texture	Overall Acceptability
100:0:0	6.60^{a}±2.06	6.40^{a}±1.70	7.75^{a}±0.91	6.85^{a}±1.63	7.00^{ab}±1.62
90:5:5	7.80^{b}±1.15	7.05^{b}±1.19	6.60^{a}±1.10	6.80^{a}±1.54	7.30^{ab}±1.34
80:10:10	8.00^{b}±1.21	7.35^{b}±1.23	6.25^{a}±1.25	7.10^{a}±1.25	7.85^{ab}±1.39
70:15:15	6.25^{a}±1.71	6.05^{a}±1.67	5.50^{b}±1.50	6.40^{a}±2.01	6.55^{a}±1.85

The data values are mean ± standard deviation of 20 panelists. Means within a column not followed by the same superscript are significantly different (P≤ 0.05).

100:0:0= (100% wheat flour, 0% defatted sesame seed flour and 0% unripe plantain),

90:5:5= (90% wheat flour, 5% defatted sesame flour and 5% plantain flour),

80:10:10= (80% wheat flour, 10% defatted sesame and 1o% plantain flour),

70:15:15= (70% wheat flour, 15% defatted sesame and 15% plantain flour

The texture mean score of the bread ranged from 6.40 to 7.75 respectively. The samples ratio follows: (100:0:0) 6.85, (90:5:5) 6.80, (80:10:10) 7.10 and (70:15:15) 6.40. Sample (80:10:10) 7.10 appear to be the most preferred bread based on crumb texture of the bread during chewing or injection. Crumb texture has been as reported to be influenced by baking temperature and melting of fat and heating of sugar. The coagulation of protein and partial gelatinization, which is partly responsible for the structure of the bread after baking according to (Rao, 2017).

The mean score overall acceptability of the bread ranged from 6.55 to 7.85 respectively. The samples ratio follows: (100:0:0) 7.00, (90:5:5) 7.30, (80:10:10) 7.85 and (70:15:15) 6.55. Sample (80:10:10) 7.85 was the most preferred sample based on all parameters such as taste, colour, aroma and mouth feel because the panelist generally preferred this blend. The appropriate condition and proper preparation method or procedure for baking are usually the condition for baking and affect the final product quality according to (Rao, 2017). This measuring sensory index generally informs the producers which product are marketable viable to be produce according to (Rao, 2017).

4.0 CONCLUSION

The findings showed that the production of bread from wheat, defatted sesame seed flour and unripe plantain flour blends had significant effects on the proximate, phytochemical, antioxidants, mineral, physical and sensory properties of the bread. However, overall acceptability was higher in bread produced with 10% defatted sesame flour and 10% unripe plantain flour (80:10:10), making it the most preferred bread.

Authors' contribution

Both authors carried out the research in a collaborative manner. Author OOO designed the

study, wrote the protocol, performed the statistical analysis and proofread the draft of the

manuscript. Author AJD carried out the literature reviews managed the analyses of the

study and wrote the first draft of the manuscript. Both authors read and approved the final

manuscript.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

Option 2:

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc have been used during writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

Details of the AI usage are given below:

1.

2.

3.

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