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Effect of Substituting Wheat Flour with Sweet Potato and Sprouted Soybeans Flour on Bread Quality

Donaldben N.S[1], Ibrahim S.[2], Lindaqueen A.[3]

[1, 3]Department of Food Technology, Federal Polytechnic, Kaura Namoda, Zamfara State, Nigeria
[2]Department of Hospitality Management, Federal Polytechnic, Kaura Namoda, Zamfara State, Nigeria

Abstract: ***Bread was produced from wheat (Trititum,spp) sweet potato (Ipomoea batatas L.) and sprouted soybean (Glycine max) flour blends . Sweet potato and sprouted soybeans were processed into flour and supplemented with wheat flour for bread production. Five samples of bread were produced and denoted as Samples W1 to W5. Sample W1 was the control with 100% wheat flour, while Sample W2 to W5 was supplemented as follows; 85:5:10, 80:10:10, 75:15:10 and 70:20:10 wheat, sweet potato and sprouted soybeans flours. The result of the proximate composition showed that protein, fat, ash and crude fibre contents increased significantly (p<0.05) with supplementation of wheat flour with sweet potato and sprouted soybeans from 9.41 % to 14.64 %, 3.24 % to 5.65 %, 1.48 % to 2.70 % and 0.89 % to 2.83 % respectively. The moisture and carbohydrate contents of the bread samples generally decreased significantly (p<0.05) with supplementation sweet potato and sprouted soybeans flours. The physical properties of the bread loaves such as the weight increased significantly with increasing levels of sweet potato and sprouted soybeans flours which ranged from 174 to 244 g. The loaf volume ranged from 305 to 181 cm3 while the bread specific volume ranged from 0.744 to 1.75 cm3/g. The result of the mineral content indicated that calcium, iron, magnesium, phosphorus and zinc increased significantly with substitution of wheat flour with sweet potato and sprouted soybeans flour. The result of the sensory attributes indicated that there was significant difference (p<0.05) in the appearance, flavor, texture and overall acceptability but there was no significant difference ((p>0.05) in the taste.. The 100% wheat bread recorded the highest scores in all the attributes evaluated.***

Keywords: bread, sweet potato, supplemented, sprouted soybeans, proximate, sensory attributes

1. Introduction

Bread is described as a fermented confectionary product produced mainly from wheat flour, water, yeast and salt by a series of operations including mixing, kneading, proofing, shaping and baking (Dewettinck *et al.*, 2008). The consumption of bread and other baked foods such as biscuits, doughnuts and cakes produced from wheat flour is very popular in Nigeria, but the low protein content of wheat flour, which is the most vital ingredient used for their production has been major concern (Young, 2001). 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 (Aider *et al.*, 2012). 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 (David, 2006).

In developing countries where the supply of animal protein is inadequate to meet the rapid population growth, considerable interests have been shown in supplementing wheat flour with high-protein, high-lysine material (especially legume and oilseed flours, protein concentrates, and isolates) to increase the protein content and improve the essential amino acid balance of flour-based baked products (Young, 2001).

Wheat (*Triticum* spp) is a grass that is cultivated worldwide. Globally, it is the most important human food grain and ranks second in total production as a cereal crop behind maize, the third being rice. Wheat grain is a staple food used to make flour for leavened, flat and steamed breads, cookies, cakes, pasta, spaghetti, macaroni, noodles, couscous and also for fermentation to make beer, alcohol, vodka or biofuel (Abulude, 2005). Sweet potatoes (*Ipomoea batatas* L.) are an excellent source of nutrition and considered as one of nature's most perfect vegetables. Among the world's major food crops, sweet potato produces the highest amount of edible energy per hectare per day (Sukhcharn *et al.*, 2008). Sweet potato consists of about 70% carbohydrates of which the major portion is starch, which can be utilized as a functional ingredient in certain food preparations; The use of sweet potato flour for supplementing with wheat flour on the baking could substantially reduce need for wheat, reduction in the usage of sugar on the products, and increase the value of sweet potato. They are an excellent source of beta-carotene and also a good source of vitamin C and manganese. A mixture of wheat flour and sweet potato flour could make a good baking product, which should increase the nutritive values in terms of fiber and carotenoids and the economic value of the final product. This helps in lowering the gluten level and prevents manifestation of coeliac disease (Jemziya and Mahendran, 2015).

Soy bean *(Glycine max)* a grain legume, is one of the richest and cheapest sources of plants protein that can be used to improve the diet of millions of people especially the poor and low income earners in developing countries because it produces the greatest amount of protein used as food by man. Soybean is an excellent source of protein (40-45%); hence the seeds are the richest in food value of all plant food consumed in the world (Akubor and Ukwuru, 2005). It is an excellent source of protein because it contains all the essential amino acids, is very rich in minerals and is a good source of fat soluble vitamins (Alabi *et al.,* 2007).

Sprouting is the practice of soaking, draining, and leaving seeds or grains until they germinate or sprout. The increasing interest in functional and healthy food products has promoted the use of germinated soya bean flour in the manufacture of foods for human consumption (Farrera-Rebollo and Calderon-Dominguez, 2007). It is known that germination induces increase in free limiting amino acids and available vitamins with modified functional properties of seed components (Jideani and Onwubali, 2009). The objective of this study was therefore to investigate the effect of supplanting wheat flour with sweet potato and sprouted soybeans flour on the proximate composition and nutritional quality of bread.

2. Materials and Methods

2.1 Source of Raw Materials

Wheat flour, soybeans, salt, sugar, and dry baker's yeast were purchased from a local market in Kaura Namoda, Zamfara State. Sweet potatoes were purchased at Kaura Namoda market of Zamfara State. Equipments such as blender, mixer, kneader, bowl, knife, digital weighing scale, measuring cylinder, baking pans and oven were obtained in the Food processing laboratory of Department of Food Technology, Federal Polytechnic, Kaura Namoda. All other chemicals used were of analytical grade. The raw materials were properly cleaned by removing extraneous matter prior to their subjection to different processing treatments.

2.2 Preparation of Raw Materials

2.2.1 Preparation of Sweet Potato Flour

The sweet potato flour was produced using the method described by (Avula, 2005). The sweet potato tubers were peeled and cut into thin pieces manually. The potato slices were then immersed in (1%) potassium metabisulphite for 30 min to prevent browning reactions. Drying of sweet potato slices was done in an oven at 45°C till constant weight. The dried sweet potato chips were milled into flour using the laboratory grinder and passed through 250 µm mesh sieve, packed in airtight containers and stored in the refrigerator till further use. The flow chart for the production of sweet potato flour is shown in Figure 1.

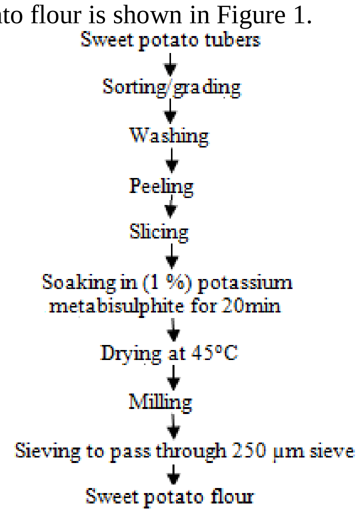

Figure 1: Flow chart for production of sweet potato flour
Source: Modified (Avula, 2005)

2.3 Processing of Sprouted Soybeans

Sprouting soybean flour was produced using the method of (Iwe, 2003) as shown in Figure 2. Soybean seeds (2000 g) were sorted, cleaned, washed and soaked overnight in a stainless steel bucket containing clean tap water. The soybeans were spread on a clean jute bag and covered to screen from direct sun light. Water containing small amount of calcium hypochlorite ($CaClO_4$) to discourage the growth of microorganisms, water was sprinkled twice a day at the intervals of 9 h. The seeds were allowed to germinate for 96 h at room temperature and cabinet dried at 60°C for 8 h, devegetated by hand rubbing, winnowed and milled into flour using hammer mill. The flour was sieved with the aid of a 425 µm sieve to obtain a uniform particle size of flour which was packaged in polyethylene bag and stored at 4-6°C till needed.

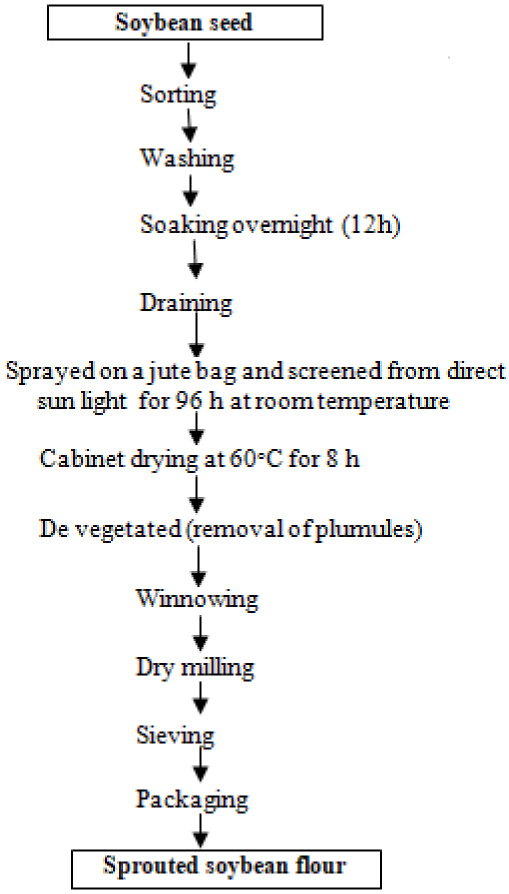

Figure 2: Flow chart for the production of sprouted soy flour.
Source: Modified (Iwe, 2003)

2.4 Formulation of Composite Flour and other Ingredients for Bread Production

Five different samples of bread were produced and coded as A\W1, W2, W3, W4 and W5. Sample W1 served as the control 100% wheat. Samples W2, W3, W4 and W5 are supplemented with sweet potato and sprouted soybeans flours and the other ingredients for bread production are presented in Table 1.

Table 1: Recipe formulation for the production of bread.
Source: Modified Islam et al., (2011)

INGREDIENTS	W1	W2	W3	W4	W5
Wheat flour (g)	100	85	80	75	70
Sweet potato flour (g)	0	5	10	15	20
Sprouted Soybeans flour (g)	0	10	10	10	10
Yeast (g)	3.5	3.5	3.5	3.5	3.5
Fat (g)	20	20	20	20	20
Water (ml)	70	70	70	70	70
Sugar (g)	20	20	20	20	20

2.5 Processing of bread from wheat, sweet potato and sprouted soybeans flour blends

The straight dough method was used to produce the bread. This method involves the addition of all the ingredients (flour, salt, water, sugar, yeast etc) at mixing stage and kneading same to obtain the dough Chauhan, 1992). The different dough samples were placed in baking pans smeared with vegetable oil and was covered for the dough to ferment resulting in gas production and gluten development for about 1 hour. The dough was then baked in the oven at 230°C for 30 minutes. The baked loaves were carefully removed from the pans and allowed to cool and packaged in polyethylene bags for analysis. The flow chart for bread production is shown in Figure 3.

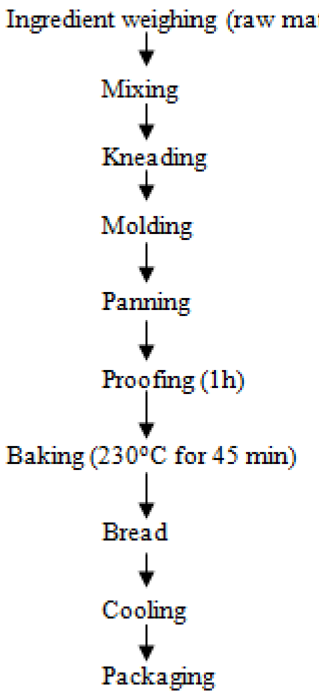

Figure 3: Flow chart for the production bread

2.6 Determination of Physical Properties of the Bread Loaves

The Loaf volume was measured by seed displacement method of (Giami, 2004). Loaf weight was determined by simple weighing using an electronic balance while Specific volume was obtained by dividing the loaf volume of bread by its corresponding loaf weight. Thus, Specific volume = v / wt (cm3/g).

2.7 Proximate Analysis

Proximate composition of the bread samples were analyzed for its moisture, carbohydrate, crude protein, crude fat, crude ash, and crude fibre contents.

2.7.1 Moisture Determination

Moisture content was determined using the air oven dry method (AOAC, 2012). A clean dish with a lid was dried in an oven at 100°C for 30min. It was cooled in desiccators and weighed. Two (2) grams of sample was then weighed into the dish. The dish with its content was then put in the oven at 105°C and dried to a fairly constant weight. The loss in weight from the original sample (before heating) was reported as percentage moisture.

$$\%\ Moisture = \frac{weight\ loss\ (W2-W3)}{Weight\ of\ Sample\ (W2-W1)}\ x\ 100 \quad \ldots\ldots (1)$$

Where: W_1 = weight of dish, W_2 = weight of dish + sample before drying, W_3 = weight of dish + sample after drying.

2.7.2 Crude Protein Determination

The Kjeldahl method as described by AOAC (2012) was used to determine the percentage crude protein. Two (2) grams of sample was weighed into a Kjeldahl digestion flask using a digital weighing balance (3000g x 0.01g 6.6LB). A catalyst mixture weighing 0.88g (96% anhydrous sodium sulphate, 3.5% copper sulphate and 0.5% selenium dioxide) was added. Concentrated sulphuric acid (7ml) was added and 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. Ten (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 HCl. A blank titration was done. The percentage nitrogen was calculated from the formula:

$$\%\ Nitrogen = \frac{(S-B)\times 0.0014\times 100\times D}{sample\ weight} \quad \ldots\ldots\ldots (2)$$

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

2.7.3 Crude Fat Determination

Fat was determined using Soxhlet method as described by AOAC (2012).Samples were 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°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 at 105°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

$$\% \ Crude\ Fat = \frac{weight\ of\ extracted\ fat}{Weight\ of\ Sample} \ x\ 100 \ldots\ldots\ (3)$$

2.7.4 Crude Fibre Determination

The method described by AOAC (2012) was used for fibre determination. Two (2) grams 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°C for 2 h, cooled in a dessicator and weighed. The residue was then transferred in to a muffle furnace and ignited at 550°C for 30 min, cooled and weighed. The percentagecrude fibre content was calculated as:

$$\% \ Crude\ fibre = \frac{Loss\ in\ weight\ after\ incineration}{Weight\ of\ original\ food} \times 100 \ldots\ldots (4)$$

2.7.5 Ash Determination

The AOAC (2012) method for determining ash content was used. Two (2) gram 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 at 550°C for 6-7 h. The dish was cooled in desiccator and weighed soon after reaching room temperature. The total ash was calculated as percentage of the original sample weight.

$$\% \ Ash = \frac{(W3 - W1)}{(W2 - W1)} \ x\ 100 \ldots\ldots\ldots\ldots\ (5)$$

Where:
W1 = Weight of empty crucible,
W_2 = Weight of crucible + sample before ashing,
W_3 = Weight of crucible + content after ashing.

2.7.6 Carbohydrate Determination

Carbohydrate content was determined by difference according to Ihekoronye and Ngoddy (1985) as follows:

$$\% \ Carbohydrate = 100 - (\%moisture + \%Protein + \%Fat + \%Ash + \%Fibre) \ldots\ldots 6$$

2.8 Determination of Mineral Content

The mineral content of the bread samples was determined by using the method described by (Jemziya and Mahendran, 2015). The ash obtained from the ash analysis earlier was used in the determination of the minerals content. The ash was placed in porcelain crucibles, then few drops of distilled water were added, followed by 2ml of concentrated hydrochloric acid. 10 ml of 20% HNO3 were added, evaporated on the hot plate. The samples were filtered through Whiteman filter paper into 100 ml volumetric flask. The mineral elements; iron, magnesium and calcium were determined by atomic absorbance spectrophotometer. The phosphorus in the sample filtrate was determined using Vanadomolybdate reagent at 400 nm using colorimetric method.

2.9 Sensory Evaluation

The five samples of bread were coded and presented to fifteen member panel of judges who are familiar with the product for sensory evaluation. The panelists scored the colour, flavor, taste, texture and overall acceptability of the bread using a nine point hedonic scale, where 9 indicates extremely like and 1 extremely dislike (Ihekoronye and Ngoddy, 1985).

2.10 Statistical Analysis

All analytical determinations were conducted in duplicates. The Experimental data were subjected to analysis of variance (ANOVA) and means separated by Fisher's least significance difference test using Genstat statistical package, version 17.0.

3. Results and Discussion

Table 2: Proimate composition of wheat, sweet potato and sprouted soybeans bread samles

Samples	Protein (%)	Fat (%)	Ash (%)	Crude Fibre (%)	Moisture (%)	Carbohydrate (%)
W1	9.41 ± 0.03^d	3.24 ± 0.03^e	1.48 ± 0.01^e	0.89 ± 0.05^e	32.98 ± 0.23^d	52.00 ± 0.06^b
W2	14.22 ± 0.11^a	5.38 ± 0.04^d	2.22 ± 0.17^d	2.48 ± 0.02^d	29.63 ± 0.09^c	46.07 ± 0.08^a
W3	14.64 ± 0.07^c	5.40 ± 0.07^c	2.56 ± 0.05^c	2.62 ± 0.02^c	29.22 ± 0.11^b	45.56 ± 0.03^a
W4	14.25 ± 0.01^b	5.60 ± 0.00^b	2.65 ± 0.08^b	2.72 ± 0.01^b	29.10 ± 0.01^b	45.68 ± 0.01^a
W5	14.34 ± 0.03^a	5.65 ± 0.01^a	2.70 ± 0.01^a	2.83 ± 0.02^a	28.91 ± 0.03^a	45.57 ± 0.05^a
LSD	**0.17**	**0.09**	**0.02**	**0.04**	**0.12**	**0.93**

Values are means ± SD duplicate determinations Values with different superscript within the same column are significantly different ($p<0.05$).

LSD= Least significant difference. WI=100% wheat flour (control); W2=85% wheat, 5% sweet potato, 10% sprouted soybeans; W3=80% wheat flour, 10% sweet potato, 10% sprouted soybeans; W4=75% wheat, 15% sweet potato, 10% sprouted soybeans; W5=70% wheat, 20% sweet potato, 10% sprouted soybeans.

Table 3: Minarals content of wheat, sweet potato and sprouted soybeans bread samples (mg/100g)

Samples	Calcium	Iron	Magnesium	Phosphorus	Zinc
W1	1.83 ± 0.01^e	3.53 ± 0.01^d	1.62 ± 0.01^d	0.10 ± 0.00^d	2.23 ± 0.02^d
W2	11.47 ± 0.02^d	7.01 ± 0.01^c	12.33 ± 0.03^a	2.71 ± 0.01^c	5.32 ± 0.03^b
W3	11.53 ± 0.03^c	7.09 ± 0.00^a	12.51 ± 0.02^c	2.72 ± 0.01^c	5.22 ± 0.01^c
W4	11.61 ± 0.02^b	7.11 ± 0.03^b	12.43 ± 0.02^b	2.83 ± 0.03^b	5.33 ± 0.02^b
W4	11.22 ± 0.03^a	7.09 ± 0.04^a	12.39 ± 0.03^a	2.77 ± 0.04^a	5.41 ± 0.03^a
LSD	**0.06**	**0.02**	**0.07**	**0.04**	**0.03**

Values are means ± SD duplicate determinations Values with different superscript within the same column are significantly different ($p<0.05$).

LSD= Least significant difference. WI=100% wheat flour (control); W2=85% wheat, 5% sweet potato, 10% sprouted soybeans; W3=80% wheat flour, 10% sweet potato, 10% sprouted soybeans; W4=75% wheat, 15% sweet potato, 10% sprouted soybeans; W5=70% wheat, 20% sweet potato, 10% sprouted soybeans.

Table 4: Physical characteristics of wheat, sweet potato and sprouted soybeans

Samples	Weight of loaf (g)	Volume of loaf (cm^3)	Loaf specific volume (cm^3/g)
W1	174.23 ± 0.62^e	305 ± 1.03^e	1.75 ± 0.41^e
W2	199.54 ± 1.02^d	264 ± 1.00^d	1.32 ± 0.02^d
W3	216.56 ± 2.00^c	221 ± 1.64^c	1.02 ± 0.01^c
W4	230.22 ± 1.45^b	199 ± 2.09^b	0.86 ± 0.02^b
W5	244.83 ± 1.05^a	181 ± 1.65^a	0.74 ± 0.00^a
LSD	**3.73**	**4.05**	**0.01**

Values are means ± SD duplicate determinations Values with different superscript within the same column are significantly different ($p<0.05$).

LSD= Least significant difference. WI=100% wheat flour (control); W2=85% wheat, 5% sweet potato, 10% sprouted soybeans; W3=80% wheat flour, 10% sweet potato, 10% sprouted soybeans; W4=75% wheat, 15% sweet potato, 10% sprouted soybeans; W5=70% wheat, 20% sweet potato, 10% sprouted soybeans.

Table 5: Sensory attributes of bread produced from wheat, sweet potato and sprouted soybeans

Samples	Taste	Appearance	Flavour	Texture	Overall acceptability
W1	7.85 ± 0.00^a	8.65 ± 0.06^a	7.55 ± 0.01^a	7.45 ± 0.04^a	8.40 ± 0.01^a
W2	7.55 ± 0.01^a	6.05 ± 0.05^c	5.20 ± 0.00^d	4.50 ± 0.04^d	7.80 ± 0.03^b
W3	7.60 ± 0.01^a	7.10 ± 0.04^b	6.05 ± 0.06^c	6.95 ± 0.10^a	$7.60^b \pm 0.04^b$
W4	7.85 ± 0.02^a	7.15 ± 0.02^b	6.85 ± 0.05^b	6.00 ± 0.05^b	7.30 ± 0.09^b
W5	7.40 ± 0.02^a	7.10 ± 0.02^b	7.05 ± 0.08^b	5.75 ± 0.03^c	7.55 ± 0.03^b
LSD	**0.71**	**0.52**	**0.50**	**0.85**	**0.75**

Values are means ± SD duplicate determinations Values with different superscript within the same column are significantly different ($p<0.05$).

LSD= Least significant difference. WI=100% wheat flour (control); W2=85% wheat, 5% sweet potato, 10% sprouted soybeans; W3=80% wheat flour, 10% sweet potato, 10% sprouted soybeans; W4=75% wheat, 15% sweet potato, 10% sprouted soybeans; W5=70% wheat, 20% sweet potato, 10% sprouted soybeans.

3.1 Proximate analysis of bread from wheat, sweet potato and sprouted soybeans

The proximate result of the composition bread from wheat, sweet potato and sprouted soybeans flour blends is presented in Table 2. The protein, fat, ash and crude fibre contents of the bread loaves increased significantly ($p<0.05$) with supplementing wheat with sweet potato and sprouted soybeans flour. They ranged from 9.41 to 14.64 % protein, 3.24 to 5.65 % fat, 1.48 to 2.70 % ash and 0.89 to 2.83 % crude fiber respectively. The increase in protein content was due to the high content of protein in the sprouted soybeans flour and also similar trend of increase in protein content was observed in the research of (Joel *et al.,* 2011). Therefore, sprouted soybeans could served as a complementary purpose in increasing the protein content of the bread products based with wheat flour and also helps in providing the limiting protein (lysine and tryptophan). The increased protein content is an indication that supplementation of wheat flour with sprouted soybeans flours greatly improved the protein and nutritional quality of the bread. The increase in ash, crude fibre and fat content was also observed in the work of (Joel *et al.*, 2011) of bread produced from blends of whole wheat and soybeans flour. This indicates that the samples with high percentage of ash will be good sources of minerals. Fibre is good for the body as it increases the stool bulk by acting as a vehicle for faecal water. The moisture and carbohydrates contents on the other hand decreased significantly with increased sweet potato and sprouted soybeans flours substitution. The moisture and carbohydrate ranged from 28.91 to 32.98 % and 5.56 to 52.00 % respectively. The decrease in carbohydrate could be as a result of sprouted soybeans which is a good source of protein.

3.2 Minerals content of bread from wheat, sweet potato and sprouted soybeans

The mineral composition of the composite bread is presented in Table 3. The calcium, iron, magnesium, phosphorus and zinc contents of the bread increased significantly with increase in sweet potato and sprouted soybeans flours from 1.83-11.61 mg/100 g, 3.53-7.11 mg/100 g, 1.62-12.51 mg100 g, 0.10-2.83 mg100 g and 2.23-5.1 mg100 g respectively. Calcium is necessary for supporting bone formation and growth. The Iron is needed for the formation of hemoglobin, the component of blood cell that carries oxygen in the blood stream throughout the body (Grosvenor and Smolin, 2002). Adequate iron in the diet is essential to minimize the incidence of iron deficiency anemia, which is considered as the most common nutritional disorder worldwide (Short and Domagalski, 2013). The values for magnesium, phosphorus and zinc showed no definite trend but varied significantly ($P<0.05$) from one another. Magnesium and phosphorus in the diet affects the metabolism of calcium, and other minerals such as potassium and sodium (Grosvenor and Smolin, 2002). It is important for bone health; is needed as a cofactor for numerous reactions in the body and is also essential for nerve and muscle conductivity. Magnesium is essential to good health because it helps to maintain normal muscle and nerve function, keeps heart rhythm steady, supports a healthy immune system and keeps bones strong. Phosphorus works closely with calcium to build strong bones and teeth. It is stored in the bone as calcium phosphate. Bread rich in these nutrients would enhance the health of both children and adults. The zinc is critical micronutrients for the growth, development, immunity and health of infants, and is known to be limiting nutrients in the diets of infants and young children (Dewey and Brown, 2003).

3.3 Physical Properties of Bread Loaves

The physical characteristics of the bread from wheat, sweet potato and sprouted soybeans flour blends are presented in Table 4. The loaf volume and specific volume of the bread decreased significantly (P<0.05) with increased substitution with sweet potato and sprouted soybeans flours. The control sample (W1) with 100% wheat flour recorded the highest values of 305 cm3 and 1.75 cm3 /g for loaf volume and specific volume while the lowest values of 181 cm3 and 0.74 cm3/g, for loaf volume and specific volume respectively was recorded in sample (W5) 60:20:10 wheat, sweet potato and sprouted soybeans flour. This could be as a result of decrease in the gluten proteins in wheat which lowered the ability of the dough to rise during proofing leading to reduction in the bread volume. The bread weight increased significantly (p<0.05) with increasing levels of substitution with sweet potato and sprouted soybeans flour. The weight of sample (W1) 100% wheat bread is lower than other samples. The same trend was observed by (Olaoye *et a.l,* 2006) in bread production from wheat, plantain and soybeans.

3.4 Sensory attributes of bread from wheat, sweet potato and sprouted soybeans flour

Sensory attributes of composite bread samples produced from wheat, sweet potato and sprouted soybeans flour at different levels of supplementation compared to the control are presented Table 5. The results of evaluation of taste showed no significant difference in the composite bread samples and the control. It is evident that supplementation of wheat with sweet potato and sprouted soybeans does not affect the taste of a bread. From the results that bread prepared from 100% wheat flour had highest score (7.85) This could be due to the bitter taste of some inherent compounds present in sweet potato particularly at high temperature as reported by Ayo *et al*. (2010). .Appearance of bread is very important parameter in judging properly baked bread that not only reflect the suitability of raw material used for the preparation but also provides information about the formation and quality of the product. The supplementation of sweet potato and sprouted soybeans flour into wheat bread resulted in significant decrease in the appearance scores. The results indicated that the bread prepared from 100% wheat flour was scored significantly (P < 0.05) highest (8.65) for appearance while sample (W2) bread with 5 % sweet potato and 10 % sprouted soybeans scored the lowest value of (6.05). The scores for flavor, texture and overall acceptability varied from 5.20-7.55, 4.50-7.45 and 7.30-8.40 respectively. There was decrease in the scores as sweet potato and sprouted soybeans flours were supplemented however the decrease was not significant (P>0.05). The result indicated that the texture of the bread does not varies significantly (P<0.05) between the control sample (W1) with 100% wheat and sample (W3). The bread samples were able to compare favorably with the control sample.

4. Conclusion

The research study indicated that supplementation of wheat with sweet potato at 20 % and sprouted soybeans at 10 % would be accepted by the consumers. The bread had increased proximate and minerals which would be able to enhance the health, growth and well being of the consumers. The incorporation of sweet potato and sprouted soybeans in bread production would promote production, diversification of utilization of the crops in Kaura Namoda, Zamfara of Nigeria.

References

[1] Abulude F.O. (2005). Distribution of selected minerals in some Nigerian white bread. *Nig. Food Journal*. 23: 139-147.

[2] Akubor P.I and Ukwuru M. U., (2005), Functional properties and biscuit making potential of soybean and cassava flour blends,*Journal of plant foods for Human Nutrition,58:1-12*.

[3] Aider, M. Sirois-Gosselin, M. & Boye, J.I. (2012) Pea, Lentil and Chickpea Protein Application in Bread making Journal of Food Research; Vol. 1, No. 4.

[4] Alabi, M. O. and. Anuonye, J. C (2007). Nutritional and sensory attributes of soy-supplemented cereal meals. *Nigerian Food Journal.* 25(1): 100-110.

[5] AOAC (2012). Official methods of analysis 18th ed. Arlington, V.A Association of Official Analytical Chemist PP. 806-842

[6] Avula, R.Y. (2005). Rheological and functional properties of potato and sweet potato flour and evaluation of its application in some selected food products. Ph.D. Thesis. Department of Fruit and Vegetable Technology, University of Mysore, Mysore, India.

[7] Ayo, J.A., Ikuomola, D.S., Esan, Y.O., Onuoha, O.G., Ayo, V.A. and Ekele, V. (2010). Effect of added defatted beniseed on the quality of acha based biscuits. *Continental Journal of Food Science and Technology* 4: 7–13.

[8] Chauhan GS, Zillman RR and NAM (1992). Eskin Dough mixing and bread making properties of quinoa-wheat flour blends. *International Journal of Food Science and Technology*. 27: 701- 705.

[9] David MO (2006). Nigeria No. 1 Market for U.S. wheat: Potential for other grains and seeds. Foreign Agric. Serv. Bull. pp. 1-2.

[10] Dewettinck, K., Bockstaele, V., Kuhne, F., Van de Walle, B., Courtens, T. and Gellynck, X (2008). Nutritional value of bread: Influence of processing, food interaction and consumer perception Rev. J. Cereal sci., 48: 243-257.

[11] Dewey K.G and Brown K.H (2003). Update on technical issues concerning intervention complementary feeding in young children in developing countries and implication for intervention programme. Food Nutr. Bull. 24:5-28.

[12] Farrera-Rebollo, M. and Calderon-Dominguez, G (2007). Changes on dough rheological characteristics and bread quality as a result of the addition of germinated and ongerminated soybean flour. Journal of Food and Bioprocess Technology. 1(2),152-160.

[13] Giami, S. Y., Amasisi, T. and Ekiyor, G. (2004). Comparison of bread making properties of composite flour from kernels of roasted and boiled African breadfruit (*Treculia Africana* decne) seeds. Journal Raw Material Resources 1: 16–25.
[14] Grosvernor M.B and Smolin L.A (2002). Nutrition: From science to life. Harcourt College Publishers, New York, pp. 404- 469.
[15] Ihekoronye, A.I. and Ngoddy, P.O. (1985). Integrated Food Science and Technology. Macmilian Publishers, New York. Pg 296-301
[16] Iwe, M. O. (2003). ‘’The science and Technology of soy bean, Chemistry, Nutrition, Processing, Utilization. Rejoin communication service LTD. Enugu, Nigeria. Pp. 159 and 262.
[17] Jemziya M.B.F and Mahendran T (2015). Quality characteristics and sensory evaluation of cookies produced from composite blends of sweet potato (*Ipomoea batatas* L.) and wheat (*Triticum aestivum* L.) flour. *Sri Lanka Journal of Food and Agriculture.* 1(2): 23-30.
[18] Jideani, V. and Onwubali, F (2009). Optimisation of wheat-sprouted soybean flour bread using response surface methodology. *African Journal of Biotechnolology* 8(22): 6364-6373.
[19] Joel N., Abdulraheem L.O and Zakari U.M (2011). Evaluation of the nutritional and sensory quality of functional breads produced from whole wheat and soya bean flour blends. *African Journal of Food Science* Vol. 5(8):466 - 472,
[20] Olaoye, O.A., Onilude A.A and Idowu, O.A (2006). Quality characteristics of bread produced from composite flours of wheat, plantain and soybeans. Afri. J. Biotechnol., 11: 1102- 1106.
[21] Short M.W and Domagalski J.E (2013). Iron deficiency anemia: Evaluation and management. Amer. Fam. Physician. 87(2):98- 104.
[22] Sukhcharn, S., Riar, C.S. and Saxena, D.C. (2008): Effect of incorporating sweet potato flour to wheat flour on the quality characteristics of cookies. *Afr. J. Food Sci.* 2: 65-72.
[23] Young, J. (2001). Functional bakery products: current directions and future opportunities. *Food Industries Journal* 4: 136-144.