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Effect of Water Yam and Soybean Composite Flours on the Quality of Wheat Based Bread

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Abstract: ***The water yam and soybean were produced into flours and used to substitute wheat flour at different proportions. Five bread samples were produced from the proportion of wheat/water yam/soybean flours as 80%:10%:10% (B), 75%:15%:10% (C), 70%:20%:10% (D), 65%:25%10% (E) and 100% wheat was the control sample (A). The developed breads were subjected to functional, pasting, mineral and vitamin analysis. Subsequently, the functional analysis showed, water and oil absorption capacity, foaming capacity increased (p≤0.05) significantly while the reverse was the case for swelling index and gelation temperaturebut the bulk density didn't decrease (p≥0.05) significantlywith increasing amount of water yam flour addition at constant soybean level. Pasting analysis showed Peak, trough, breakdown, final and set back viscosities of the flour blends decreased (p≤0.05) significantly, while peak time and pasting temperature increased (p≤0.05) significantly with increasing amount of water yam flour at constant soybean flour inclusion. The mineral content of the bread also indicated that Potassium, phosphorus, calcium, Iron and sodium content increased (p≤0.05) significantly while zinc content decreased (p≤0.05) significantly. The vitamin content of the bread samples also indicated that thiamine, niacin, ascorbic acid, folate increased (p≤0.05) significantly while riboflavin didn't increased (p≥0.05) significant in the composite bread samples. The nutritional content of wheat-water yam-soybean composite flours bread was nutrient dense product.***

Keywords: Wheat, water yam and soybean flours, functional, pasting, mineral and vitamin analysis

1.Introduction

Bread is a fermented confectionary product produced mainly from wheat flour, water, yeast and salt by a series of processes involving mixing, kneading, proofing, shaping and baking (Dewettinck *et al.*, 2008). It is an important stable food in both developing and developed countries and constitutes one of the most important sources of nutrients such as carbohydrates, protein, fiber, vitamins and minerals in the diets of many people worldwide (Aider *et al*., 2012). It is one of the many convenient breakfast foods widely consumed in Nigeria by both young and old (Chima and Gernah, 2007). Wheat (*Triticum spp*) is grass widely cultivated for its seed, a cereal grain which is a worldwide staple food (Shewry *et al.*, 2009). Wheat, the basic ingredient in bread production is imported into Nigeria involving huge expenditure of foreign exchange leading to high cost of bread (Olaoye *et al*., 2006). Due to high cost of wheat which increases the cost of bread, composite flours are recommended for bread production (Olaoye *et al*., 2006). The successful use of composite flour has been variously reported in different literatures (Oloaye, 2006). Composite flours have been used extensively in the production of baked goods. In countries where malnutrition poses a serious problem especially among children, composite flours which have better nutritional quality would be highly desirable. Composite flour technology refers to the process of mixing various flours from tubers, cereal and legumes with or without addition of wheat flour in proper proportions to make economic use of locally cultivated crops to produce high quality food products (Owuanam, 2007).

Water yam (*Discorea alata*) is a food crop with potential for partial replacement of wheat in bread making. Water yam flour can serve as a source of energy and nutrients (carbohydrates, beta-carotene and minerals) and can dietary fiber to processed food products. Addition of various proportions of water yam flour to wheat flour can enhance its nutritive values in terms of fiber and bioactive compounds such as resistant starches, dioscorine, diosgenin and water soluble polysaccharides (Harijono *et al.*, 2013). Dioscorine, water soluble storage protein of water yam is reported to inhibit ACE (angiotensin converting enzyme) activity (Liu *et al.*, 2007) which plays an important role in management of hypertension. Soyabean (*Glycine max*), a legume of major dietary and economic importance in Nigeria is an excellent source of protein. Lee *et al.* (2007) reported that soybean is an important source of proteins (40%), lipids (20%), minerals (5%), and B vitamins for human nutrition. Apart from being an excellent source of cheap proteins, it also contains all essential fatty acids, magnesium, lecithin, riboflavin, thiamine, fiber and folic acid (Bolarinwa, 2016). Soybean protein in particular, as compared with animal protein has been reported to be effective in improving hypercholesterolemia and reducing body weight (Aoyama *et al.*, 2000 and Coulibaly and Kouakou, 2012). Hence soybean is the richest in food value of all plant foods consumed in the world (Bolarinwa, 2016).

2.Materials and Methods

Water yam (*Dioscorea alata*) was obtained from a farmer in Oju Local Government of Benue State, Nigeria. Wheat flour, sugar, salt margarine and dried yeast and soybean Wurukum market, Makurdi, Benue State, Nigeria. Measuring scale, oven, bowls, spoons, rack, plastics, sieving (250 µm mesh sieve) and Pans were obtained from the Department of Food Science and Technology, Federal University of Agriculture, Makurdi, Nigeria.

Preparation of Water Yam Flour preparation
The dried chips were milled to pass through 250 µm mesh sieve to obtain the flour. The Diososcorea alata flour (DAF) was stored separately from the wheat flour in a

tightly covered plastic jars to prevent moisture re-absorption. The flow chat for water yam flour production is showed in figure 1.

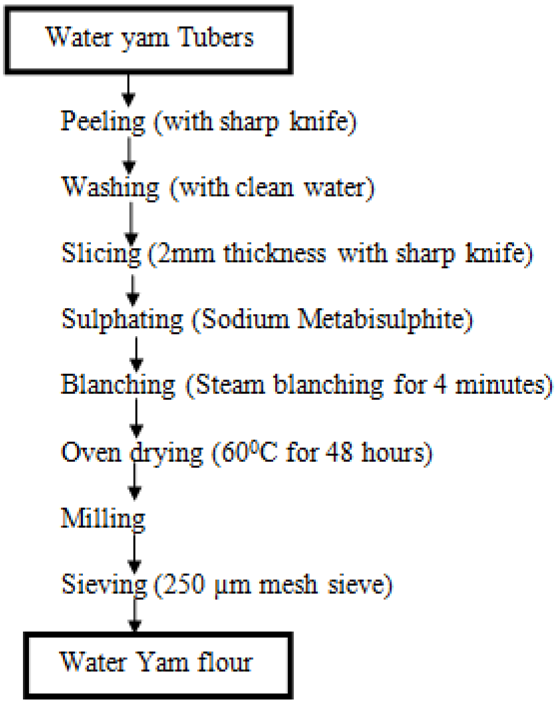

Figure 1: Flow chart for the production of water yam flour
Source: (Olaoye, 2006)

Composite flour preparation

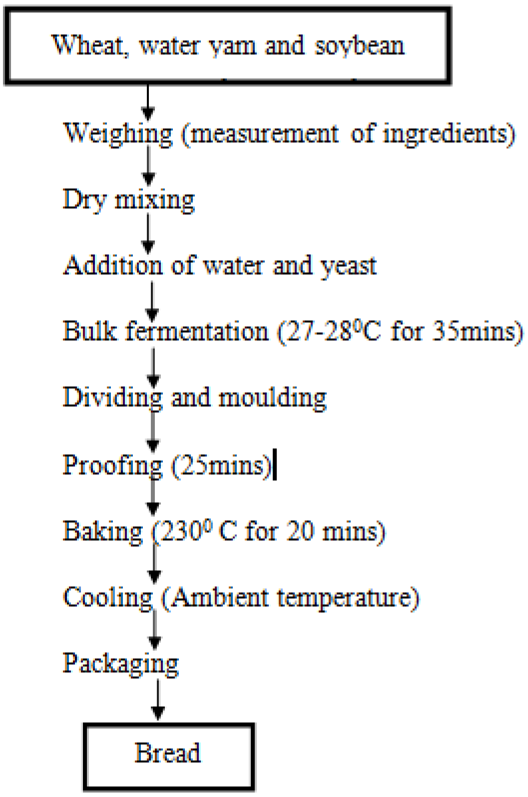

Figure 2: Flow chart for composite Bread production.
Source: (Olaoye, 2006)

Blend formulation of wheat, water yam and soybean flours

Five flour blends, each containing wheat, water yam and soybean were prepared by mixing flours in the proportion of 80:10:10 (B), 75:15; 10 (C), 70:20:10 (D), 65:25:10 (E). The control sample was 100% wheat flour (A). The five samples were packaged in black low density polyethylene bags and stored at room temperature until use for analysis and bread production.

Baking process

The five blends of composite flour were baked into bread using the modified method of (Olaoye, 2006). The wheat flour and composite flour were mixed with 5g salt, 10 g yeast, 7g sugar in 250 ml water followed by manual mixing for 5 min to obtain dough. The dough was kneaded for some minutes. The kneaded dough was transferred into the baking pans greased with plasticized fat and covered with basins. The dough was allowed to ferment for 35 mins at room temperature in the baking pans. The fermented dough was then allowed to undergo proofing for 25mins at relative humidity. The bread samples were cooled to room temperature and used for analysis.

Functional properties of wheat, water yam and soybean Composite flours

The method of AOAC (2012) was used to determine the bulk density. Weight of 10ml capacity graduated measuring cylinder was gently filled with the sample and the bottom of the cylinder was tapped on the laboratory bench several times until there was no further dimunition. The bulk density was taken as the weight of the sample divided by the volume of sample. The modified method of Abbey and Ibeh (1988) was used to determine the water and oil absorption capacity (WAC and OAC) and swelling power.10g of the flour samples was mixed (in a varl-whirl mixer) with 10ml of distilled water and allowed to stand for 30 minutes at ambient room temperature (28-29^{0}C) before being centrifuged at 5, 000 rpm for 30 minutes. Measuring out the volumes of the supernatants was used to find the volumes of the remaining absorbed liquids (water and oil). Multiplication of the respective absorbed volumes by the respective liquid density (mass/volume) was used to get the expression of the WAC and OAC in g liquid/g sample. The method of (Onwuka, 2005) was used. A suspension of 10% of the sample in a test tube was prepared and the aqueous suspension in a boiling water bath, with continuous stirring was heated. The temperature after 30secs gelatinization was visually noticed as the gelatinization temperature was recorded.

Pasting properties of wheat, water yam and Soybean Composite flours

The flour samples (2.5g) were weighed into a dried empty canister, and 25ml of distilled water was dispensed into the canister containing the sample. The slurry was thoroughly mixed and the canister was well fitted into the Rapid Visco Analyser (RVA) as recommended. The slurry was heated from 50 to 95^{0}C with a holding time of 2 min followed by cooling to 50^0C with 2 min holding time. Peak, trough, breakdown, final and set back viscosities as well as peak time and pasting temperature were read from the pasting profile with the aid of thermocline for windows software connected to a computer (Awulo, 2017).

Proximate composition of the wheat, water yam and Soybean flours (%). Ingredients (g/100g)

Samples of composite flour were analyzed to determine their moisture, crude protein, fat, fiber content, total ash and carbohydrate levels according to (AOAC, 2012).

Mineral and vitamin analysis of bread from wheat, water yam and soybean composite flours

The bread produced from wheat, water yam and soybean were subjected to mineral content determination. The method of AOAC 2012 was used to determine the potassium, Iron and sodium content of the bread. Phosphorus was determined by the vanadomolybdate colorimetric method of Giami (2005). Zincand calcium was determined using the atomic absorption spectrophotometer. Vitamin analysis; thiamine determination was done following the method of AOAC (2012). Riboflavin, Niacin, Ascorbic Acid and folate were determined using high performance liquid Chromatography (HPLC).

Statistical analysis

Data obtained was subjected to Analysis of Variance (ANOVA) followed by Tukey's Least Significant Difference (LSD) test to compare treatment means; differences was considered significant at 95% ($P\leq0.05$) using (SPSS Version 21 software).

3. Results and Discussion

Functional analysis of the composite flour

Result of the functional properties of wheat, water yam and soybean composite flours is depicted in Table 1. The bulk density did not decreased ($p\geq0.05$) significantly. The value of bulk density ranged from 0.68-0.73g/ml. Lower density in the blends compared with 100% wheat flour could be as a result of reduction in carbohydrate content which has been reported to have high bulk density (Gernah *et al.*, 2011). The density of flour is important as it affects mixing, packaging and transportation. The oil and water absorption capacities increased ($p\leq0.05$) significantly with increased substitution of water yam flour with wheat at constant soybean leveltheir values ranged from 0.60-0.99g/ml and 0.99-1.46g/ml respectively, the swelling index decreased ($p\leq0.05$) significantly. The results of these values are in agreement (Horsfall *et al.,* 2007). The increase in oil absorption capacity showed that the blends would be useful in bakery products where hydration to improve handling is desired. The increase in water absorption capacity could be due to high water absorption capacity of the water yam, soybean and wheat composite flours which probably improved the structural matrix for holding water and other components (Jideani, 2011). (Jain *et al*., 2015) reported a water holding capacity of 2.86g/g for wheat groundnut concentrate flour bread. The value of the swelling index ranged from 0.97-1.14. The results of these values are in agreement (Ocheme *et al.*, 2018). The swelling power or capacity of flour granules is an indication of the extent of associative forces within the granule or it is the indication of the water absorption index of the granules during heating (Ocheme *et al.*, 2018). Decrease in the swelling index could be due to weak bond forces in water yam and soybean flours (Adebowale *et al.*, 2008b) while the foaming capacity increased ($p\leq0.05$) significantlyfrom 29.42-34.29ml/g. The results of these values are within the range reported by (Abioye *et al.*, 2011 and Ocheme *et al.*, 2018). The increase in foaming capacity could be due to the protein content in soybean present in the flour. Brou *et al.* (2013) reported that foaming capacity is positively correlated with protein contents. The gelation temperatureincreased ($p\leq0.05$) significantly from 63.54-66.94. The results of these values are within the range reported by (Eke *et al.*, 2018). Increasing fiber content appears to delay gelation and subsequently its temperature. Thus, higher heat energy is required to attain significant gelation. Gelling temperature might be associated with the relative ratio of amylase and amylopectin (Ayenor, 2010), in the composite flour. Case *et al.* (2008) reported that waxy and regular maize gelatinize at 62-72°C, whereas high-amylose starches begin to swell below 100°C, temperatures greater than 130°C are required to fully disperse these starches. This is because more amylose molecules are involved in the crystalline regions of the high amylose starch than in waxy and regular starches (Shi *et al.*, 1998).

Table 1: Functional properties of wheat, water yam and soybean Composite flour

Samples	Bulk density (g/ml)	Oil Absorption Capacity (ml/g)	Water Absorption capacity (ml/g)	Swelling Index	Foaming capacity	Gelatinization Temperature (^{0}C)
100:0:0	$0.73^a\pm0.01$	$0.60^a\pm0.06$	$0.99^a \pm 0.06$	$1.14^c\pm0.01$	$29.42^a\pm0.01$	$66.94^e\pm0.07$
80:10:10	$0.72^a\pm0.00$	$0.63^a\pm0.16$	$1.30^b\pm0.44$	$1.11^{bc}\pm0.01$	$31.17^b\pm 0.22$	$66.62^d\pm0.34$
75:15:10	$0.71^a\pm0.00$	$0.68^a\pm0.01$	$1.41^c \pm 0.01$	$1.07^b\pm 0.05$	$33.20^c\pm 0.13$	$65.82^c\pm0.23$
70:20:10	$0.69^a\pm0.01$	$0.85^b\pm 0.04$	$1.44^c\pm 0.01$	$1.00^a \pm0.00$	$33.99^d\pm 0.01$	$64.45^b\pm0.06$
65:25:10	$0.68^a\pm0.00$	$0.99^c\pm 0.00$	$1.46^c\pm 0.01$	$0.97^a\pm0.00$	$34.29^e\pm 0.01$	$63.54^a\pm 0.16$
LSD	0.05	0.04	0.04	0.04	0.24	0.30

Values are means ± standard deviation of duplicate determination

Means with same superscript down thecolumn are not significantly ($p\geq0.05$) different

Keys: A = (100 % wheat flour control), B = (80% wheat flour, 10% water yam flour and 10% Soybean flour), C = (75 % Wheat flour, 15% Water yam flour and 10% Soybean flour), D = (70 % Water flour, 20% Water yam flour and 10% Soybean) and E = (65 % Wheat flour, 25% Water yam flour and 10% Soybean flour).

LSD: Least Significant Difference

Pasting analysis of the composite flours

The result of the pasting properties of wheat, water yam and soybean composite flours are as shown in Table 2. Pasting property is one of the most important properties that influence quality and aesthetic consideration in the food industry since they affect texture and digestibility as well as the end use of starch based food commodities (Onweluzo and Nnamuchi, 2009). The peak, trough, break down, final and setback viscosities decreased ($p \leq 0.05$) significantlyfrom 283.50-249.55, 206.26-188.48, 80.99-40.90, 405.21-371.06, -404.21 and 206.11-142.49 while the peak time and pasting temperature increased significantly ($p \leq 0.05$) with increasing substitution of water yam flour with wheat at constant soybean level. The results of these values are within the range reported by (Naofumi, 2014 and Ocheme *et al.*, 2018). That the final viscosities of the composite flours decreased with the increased in the level of substitution. Peak viscosity is an index of the ability of starch to swell freely before their physical break down (Sanni *et al.*, 2006). Trough is the minimum viscosity value in the constant temperature phase of the RVA pasting profile and it measures the ability of the paste to withstand break down during cooling (Sanni *et al.*, 2006). Breakdown viscosity is the difference between peak viscosity and hold viscosity. Final viscosity is commonly used to define the quality of particular starch based flour, since it indicates the ability of the flour to form a viscous paste after cooking and cooling. It gives a measure of the resistance of paste to shear force during stirring (Adebowale *et al.*, 2005). Setback viscosity is calculated by subtracting peak viscosity from final viscosity. The higher the setback viscosity the lower the retrogradation of the flour paste during cooling and the lower the staling rate of the product made from the flour (Adeyemi and Idowu, 1990). The peak time and pasting temperatures increased ($p \leq 0.05$) significantly from 5.40-6.45 mins and 65.42-70.54^{0}C respectively. The results of these values are in agreement (pharm and Naofumi, 2014) that the peak time of composite flours increased with the increase in the level of substitution. Peak viscosity is the measure of the cooking time (Adebowale*et al.*, 2005). Pasting temperature is the temperature at which initial rise in viscosity occurs when starch granules and proteins begin to absorb water and swelled as the temperature increased (Adeyemi and Idowu, 1990)

Table 2: Pasting properties of wheat, water yam and Soybean Composite flours

Samples	Peak Viscosity (RVU)	Trough Viscosity (RVU)	BreakdownViscosity (RVU)	Final Viscosity (RVU)	Setback Viscosity (RVU)	Peak Time (mins)	Pasting Temperature (^{0}C)
100:0:0	283.50^{e}± 0.54	206.26^{e}±0.07	80.99^{e}±0.03	405.21^{e} ±1.45	206.11^{e}±1.45	5.40^{a}±0.04	65.42^{e}±0.05
80:10:10	266.72^{d}±1.79	198.64^{d}±0.49	65.71^{d}±0.39	400.20^{d}±0.19	188.48^{d}±0.56	5.73^{b}±0.00	66.37^{d}±0.02
75:15:10	251.93^{c}± 0.08	192.55^{c}±0.76	54.99^{c}±1.42	380.48^{c}±0.61	151.06^{c}±1.46	5.79^{c}±0.01	67.98^{c}±0.06
70:20:10	250.58^{b}±0.57	190.85^{b}±0.19	43.55^{b}±0.65	376.09^{b}±0.15	147.09^{b}±2.84	5.85^{d}±0.01	68.16^{b}±0.02
65:25:10	249.55^{a}±0.65	188.48^{a}±0.56	40.90^{a}±0.04	371.06^{a}±0.15	142.49^{a}±0.58	6.45^{e}±0.09	70.54^{a}±0.06
LSD	1.01	1.68	2.62	3.00	1.50	0.05	0.15

Values are means ± standard deviation of duplicate determination

Means with same superscript in the same column are not significantly ($p \geq 0.05$) different. Keys: A = (100 % wheat flour control), B = (80% wheat flour, 10% water yam flour and 10% Soybean flour), C = (75 % Wheat flour, 15% Water yam flourand 10% Soybean flour), D = (70 % Water flour, 20% Water yam flour and 10% Soybean) and E = (65 % Wheat flour, 25% Water yam flour and 10% Soybean flour). *LSD:* Least Significant Difference

Proximate Composition of the raw wheat, water yam and Soybean flours (g/100g)

The result obtained from the proximate analysis of the wheat, water yam and soybean flours are as shown in **Table 3**. The water yam flour had the highest moisture content of (12.49%) followed by that of the wheat flour (9.73%) and the soybean flour had the least moisture content of (9.40%). The moisture content indicated that the water yam flour had more moisture in it than either of the other two flours. This is consistent with the moisture contents of cocoyam flour (10.47%) reported due to the fact that root and tubers flour retain more moisture than that of cereals (Ogunlakin *et al.*, 2012). Ndife J (2011) also reported that moisture content of cassava flour (11.90%) was higher than that of maize flour (8.05%) and soya bean flour (6.38%). For the crude protein, soybean flour had the highest crude protein content (38.71%). Water yam flour had (10.55%) of crude protein while wheat flour had the least crude protein content of (9.48%). The protein content of the current wheat flour study was close to the protein content (11.07%) of wheat bread HAR 2501 varieties grown under Arsi and Bale climate condition reported by (Bekele and Shimelis, 2011). Also the protein content of soybean flour is in agreement with protein content reported by (Kure and Daniel, 1998) and the protein content of yam flour (Apiotola and Fashakin, 2013). The fat content of the soybean flour (10.13%) indicated that it was far greater than those of the wheat flour (1.41%) and water yam flour (0.95%). Similar crude fat content (10.20%) of soybean flour was reported by (Ndife *et al.*, 2011 and Abebe *et al.*, 2018). Soybean, being an oil seed has more oil in it compared to wheat and water yam tubers. This led to the high fat content of the soybean flour compared to the other flours. Soybean has been reported to contain appreciable amount of minerals and fat. Also fat acts as flavour returner and help to improve sensory qualities of baked products (Apotiola and Fashakin, 2013, Joel, 2011). It was also observed, that the ash content of soybean flour was the highest (3.22%) followed by that of the water yam flour (2.00%). While wheat flour had the least ash content of (0.21%) ; this value is close to the work conducted by (Bekele and Shimelis, 2011). The low ash content of the wheat flour could be as a result of the fact that wheat flours have very little amount of minerals compared to soybean and water yam. The ash content results showed that the soybean flour contained the highest minerals. The crude fiber content results indicated that the soybean flour had the highest crude fiber content of (6.28%) followed by that of water yam (1.80±0.42). This is nearly the same with the crude fiber content (6.75%) of soybean flour reported by (Mesfin and Shimelis, 2013). Wheat flour had the least crude fiber content of (0.79%). The high crude fiber content of soybean flour could be as a result of the remains of the dried radicles and hulls (Abebe *et al.,* 2018). Also, the carbohydrate value range from 32.48-78.51%. Wheat flour has the highest carbohydrate value of (78.51%) followed by water yam (72.25%) while soybean has the least value of (32.48%). The total carbohydrate content indicates that these types of flour are classified as food of the group 1 or food energy and starch (FOA, 1998 and Apotiola and Fashakin, 2013). The values above agree with those reported in the commercial label for similar products. Carbohydrates provide a great part of the energy in all human diets. In the diet of poor people, especially in the tropics, up to 85% of the energy may come from this source. On the other hand, in the diet of the rich people in many countries the proportion may be as low as 40%. However, the cheapest and easily digestible fuel of humans is carbohydrate. Carbohydrates are components of body substances needed for the regulation of body processes. The chemical composition of the composite flours has been shown to affect both physico-chemical properties and nutritional quality of their products (Dhingra and jood, 2001; Akhtar *et al.*, 2008 and Mashayekh *et al.*, 2008).

Table 3: Proximate Composition of the wheat, water yam and Soybean flours (%). Ingredients (g/100g)

Nutrients	Wheat	Water Yam	Soybean	LSD
Moisture	9.73^{b}±0.06	12.49^{c}±2.12	9.40^{a}±0.14	2.77
Protein	9.48^{a}±0.01	10.55^{b}±0.01	38.71^{c}±0.43	9.25
Fat	1.41^{b}±0.02	0.95^{a}±0.07	10.13^{c} ± 0.00	1.73
Ash	0.4^{a}± 0.15	2.00^{b}±0.57	3.22^{b}±1.03	1.20
Fiber	0.79^{a}±0.01	1.80^{b}±0.42	6.28^{c}±1.03	1.00
Carbohydrate	78.51^{c}±0.71	72.25^{b}±3.13	32.48^{a}±0.59	6.21

Values are means ± standard deviation of duplicate determination

Means with same superscript in the same column are not significantly (p≥0.05) different

Keys: A = (100 % wheat flour control), B = (80% wheat flour, 10% water yam flour and 10% Soybean flour), C = (75 % Wheat flour, 15% Water yam flourand 10% Soybean flour), D = (70 % Water flour, 20% Water yam flour and 10% Soybean) and E = (65 % Wheat flour, 25% Water yam flour and 10% Soybean flour).

LSD: Least Significant Difference

Minerals analysis of bread from wheat, water yam and soybean composite flours

The mineral analysis result of bread produced from wheat, water yam and soybean composite flour is presented in **Table 4.** The potassium, phosphorus, calcium, Ironand Sodium content of the bread increased (P≤0.05) significantly. Their results ranged from 773.48-799.04mg/100g, 0.38-0.63mg/100g, 0.47-0.65mg/100g, 1.84-2.20mg/100gand 0.30-0.88mg/100g respectively. The trend is in arrangement with the work of (Slavin, 1999, Haros *et al.*, 2001, Ndife *et al.*, 2011, Isaac *et al.*, 2012, Michael *et al.*, 2013, Joel *et al.*, 2014 and Abebe *et al.*, 2018) the zinc content of the bread decreased (P≤0.05) significantly, it ranged from 0.50-0.68mg/100g, the trend is in agreement with the work of (Onabanjo and Ighere, 2014). The high values of phosphorus, potassium, sodium, calcium and Iron in the samples were attributed to the presence of soybean in the blends. The USDA (2011) show that soybean is high in these minerals. The decrease in the Zinc content is attributed to the low zine content of water yam used in the blends) as zinc from wheat and soybean couldn't compensate the low level of zinc in water yam. (Ossagie, 1992) reported water yam to be low in Zinc content.

Table 4*:* Mineral analysis of bread from wheat, water yam and soybean composite flours

Samples	Potassium	Phosphorus	Zinc	Sodium	Calcium	Iron
100:0:0	773.48^{a}±0.71	0.38^{a}±0.45	0.70^{c}±0.02	0.30^{a}±0.01	0.47^{a}±0.01	1.84^{a}±0.01
80:10:10	779.29^{b}±0.09	0.50^{b}±0.01	0.65^{bc}±0.01	0.49^{b}±0.09	0.50^{a}±0.01	1.87^{ab}±0.01
75:15:10	784.44^{bc}±0.77	0.54^{b}±0.01	0.62^{b}±0.01	0.59^{c}±0.01	0.57^{b}±0.01	1.88^{ab}±0.01
70:20:10	788.15^{c}±4.48	0.60^{c}±0.01	0.56^{a}±0.01	0.68^{d}±0.01	0.60^{bc}±0.01	1.94^{b}±0.03
65:25:10	799.04^{d}±0.07	0.63^{c}±0.01	0.51^{a}±0.01	0.88^{e}±0.02	0.65^{c}±0.02	2.20^{bc}±0.01
LSD	5.80	0.05	0.06	0.06	0.08	0.09

Values are means ± standard deviation of duplicate determination

Means with same superscript down the column are not significantly (p≥0.05) different

Keys: A = (100 % wheat flour control), B = (80% wheat flour, 10% water yam flour and 10% Soybean flour), C = (75 % Wheat flour, 15% Water yam flour and 10% Soybean flour), D = (70 % Water flour, 20% Water yam flour and 10% Soybean) and E = (65 % Wheat flour, 25% Water yam flour and 10% Soybean flour).

LSD: Least Significant Difference

Vitamin analysis of bread from wheat, water yam and soybean composite flours

Result of vitamin content of bread from wheat, water yam and soybean composite flours are as shown in **Table 5.** Vitamin B_1, B_2, B_3, Vit Cand folate increased ($p \leq 0.05$) significantly. Their value ranged from (0.86-0.99 mg/100g, 0.04-0.08 mg/100g, 0.45-0.65 mg/100g, 1.24-17.14 mg/100g and 53.93-55.29 µg/100g) respectively. This trend supports the claim of (Michael *et al.*, 2013). The high value of Vit B_1, B3, Vit C and folate in the samples were attributed to the presence of soybean in the blends. The USDA (2011) show that Soybean is high in these Vitamins. Vitamin B_1 releases energy from carbohydrate and also aids normal growth. Increase in Riboflavin is attributed to the compositional diference of vitamins between the crops used in the blends. Riboflavin is a factor in energy metabolism and tissue formation. Vitamin C is an important factor in the development and maintenance of bones, cartilage, teeth and gums (FOA/WHO/UNU, 1994). (Liu *et al.*, 2007) reported water yam to be carrier of high amount of Vitamin C. The vitamin B_9 content was observed to be increasing with addition of water yam at constant soybean level. Folate aids in red blood cell formation, play a role in the prevention of neural tube disorders, acts as co-enxymes for carboxylase, essential for synthesis of lipids.

Table 5*:* Vitamin analysis of bread from wheat, water yam and soybean composite flours

Samples	**Thiamine (B_1)**	**Riboflavin (B_2)**	**Niacin (B_3)**	**Ascorbic Acid (Vit C)**	**Folate (B_9)**
100:0:0	$0.86^a \pm 0.00$	$0.04^a \pm 0.00$	$0.45^a \pm 0.00$	$1.24^a \pm 0.03$	$53.93^a \pm 0.05$
80:10:10	$0.87^a \pm 0.00$	$0.04^a \pm 0.01$	$0.53^b \pm 0.01$	$16.72^b \pm 0.41$	$53.94^a \pm 0.07$
75:15:10	$0.89^a \pm 0.01$	$0.06^a \pm 0.01$	$0.57^b \pm 0.01$	$16.98^c \pm 0.05$	$54.09^b \pm 0.01$
70:20:10	$0.95^b \pm 0.01$	$0.07^a \pm 0.40$	$0.64^c \pm 0.00$	$17.04^d \pm 0.08$	$54.09^b \pm 0.74$
65:25:10	$0.99^b \pm 0.01$	$0.08^a \pm 0.00$	$0.65^c \pm 0.00$	$17.14^d \pm 0.01$	$55.29^c \pm 0.73$
LSD	0.20	0.06	0.07	0.05	0.05

Values are means ± standard deviation of duplicate determination

Means with same superscript down thecolumn are not significantly ($p \geq 0.05$) different

Keys: A = (100 % wheat flour control), B = (80% wheat flour, 10% water yam flour and 10% Soybean flour), C = (75 % Wheat flour, 15% Water yam flour and 10% Soybean flour), D = (70 % Water flour, 20% Water yam flour and 10% Soybean) and E = (65 % Wheat flour, 25% Water yam flour and 10% Soybean flour).

LSD: Least Significant Difference

4. Conclusion

The study was able to develop composite flour from wheat, water yam and soybean for bread which were able to meet the functionality of raw material which determine product quality and process effectiveness. Also, the pasting, mineral and vitamin analysis were elucidated. Bread samples have increased nutrients which are desirable for good health and wellbeing. This would save a lot of foreign exchange used on wheat importation, reduced the cost of bread production and provide nutritious bread to combat malnutrition problems of all aged group in developing countries and enhanced food security. From the research, supplementation is hereby recommended to improve the nutritional quality of bread and bakery products in general.

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