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Effect of Addition of Three Leaf Yam Flour on Dough Properties and Sensory Qualities of Bread

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Abstract

The effect of three leaf yam flour addition at 5%, 10% and 15% substitution level, dough properties, proximate analysis and sensory qualities of bread were investigated. The values for moisture content ranged from 25.2% to 29.5% with sample A (100%WF) significantly different ($p \leq 0.05$) from all the other samples. Protein and fat contents ranged from 11.9% to 13.00% and from 1.46% to 4.67% with sample D (15%TLYF) significantly different ($p \leq 0.05$) from the other samples. Ash and fibre contents ranged from 0.64 to 1.11% and 0.90 to 5.40%, respectively. Total Available Carbohydrate (TAC) ranged from 48.82% to 59.78% with sample D (15%TLYF) been significantly different ($P \leq 0.05$) from the other samples. Result for physical characteristics showed that volume of bread samples ranged from 157.45cm^3 to 158.6cm^3 with sample F (10%CF) the least and sample A (100%WF) the highest while weight ranged from 340.04g to 412.66g with sample B the lowest and sample G the highest. Sensory evaluation result for bread showed that samples A (100% WF, B (5%TLYF), E(5%CF) and F(10%CF) were most preferred for crust color, taste, texture and overall acceptability. Alveograph studies of bread dough gave work done (W) ranging from 126 to 307 with 15% cassava flour as the lowest and 100% Wheat flour the highest, while extensibility ratio of dough ranged from 41-76 with sample C (10%TLYF) as the least and (10%CF) as the highest. Work done and extensibility results of bread dough decreased with an increase in substitution level, while ratio of resistance to extensibility (P/L) increase with an increase in substitution for three leaf yam composite dough. The presence of three leaf yam flour addition improved the nutritional qualities of the bread in terms of protein, fat and ash while carbohydrate content reduced which is to an advantage, while addition affected the sensory and physical properties adversely.

Keywords: three- leaf- yam, flour, dough properties, Sensory qualities, bread

1. Introduction

Bread is a bakery product priced for its taste, aroma and texture. It is a staple food prepared by baking dough of flour and water (Osuji, 2006), the consumption of which is steady and increasing in Nigeria (Edema et al., 2005). Wheat flour is generally the main ingredient for bread and baked product in Nigeria in particular and in the world generally. In many developing countries bread consumption is continually expanding and there is increasing dependence on imported wheat. Most of these countries however grow staples other than wheat that can be used for bread.

In Nigeria, wheat production is limited and wheat flour imported to meet the local flour needs for bakery products which results in huge burden on the external reserves of our nation (Giami et al., 2004). Efforts have been made to promote the use of composite flour in which flour from locally grown crops and high protein seeds replace a portion of wheat flour for use in bread, thereby decreasing the demand for imported wheat and producing protein enriched bread (Olaoye et al., 2006; Eke-Ejiofor & Owuno, 2012).

Cassava (*Manihot esculenta crantz*) is a perennial crop, which grows well in tropical poor soil and can withstand drought. Its flour is used for bread making and the manufacture of biscuits, Pastries and snack foods and therefore requires a reliable supply of cassava flour with constant quality (Defloor, 1995).

Nigeria ranks highest in the production of cassava (DYFMC, 2002; International Institute for Tropical Agriculture IITA 2005). According to Giami et al. (2004) and Akobundu (2005) up to 20% substitution of cassava flour had no adverse sensory and organoleptic effect on bread while more development was still being expected. FAO (2006) reported that flour from indigenous raw materials could be added in proportions that will not affect the original and intended color, flavor and the particle size of the product adversely.

Three-leaf-yam (*Dioscorea dumetorum)* is a good source of carbohydrate, protein, vitamins and minerals when compared with other species of yam (Eka, 1985). It is easily identifiable by its trifoliate compound leaves which resemble other flowering plant with stomata occurring only on the low surface (Onwueme, 1978).

This yam is underutilized and has not been fully studied as other yam species. This may be as a result of the challenges faced by this species which is a severe hardening that develops post harvest due to bruising and this makes the tuber difficult to cook.

Cassava/wheat composite is doing well in term of bread making despite its low protein content which is deficient in lysine. It is expected that three-leaf-yam composite flour with wheat should do as much as or better than cassava.

There are several composite bread readily available and investigated, but there is little information on the use of three leaf yam flour in composite bread.

The objectives of this work therefore are to produce flour from three leaf yam and to evaluate the effect of addition of three leaf yam flour on dough properties and sensory qualities of bread.

2. Materials and Methods

2.1 Materials

Three-leaf-yam tubers (*Dioscorea dumetorum*) were purchased from Elele main market in Ikwerre Local Government Area of Rivers State. The wheat flour was purchased from Port Harcourt flour mill, while High Quality Cassava Flour (HQCF) was from Ego Farms Resources Rukpokwu. Ingredients such as margarine, yeast, sugar, and salt were purchased from mile three market all in Port Harcourt. Rivers State, Nigeria.

2.1.1 Chemicals

Chemicals used for all analysis were obtained from the Analytical Laboratory, Department of Food Science and Technology. Rivers State University of Science and Technology and were all of analytical grade.

2.1.2 Preparation of Three-Leaf-Yam Flour

Figure 1 shows the procedure for the preparation of three-leaf-yam flour. Healthy tubers of three-leaf-yam were washed, peeled and cut into cylindrical slices using a clean stainless knife. The slices were blanched in 25g sodium metabisulphite solution for 30 minutes in cold water, to prevent enzymic browning. The slices thereafter were drained and dried at 60^0C for 12 hours, cooled and milled into flour to pass through a 150μm mesh sieve to obtain uniform particle size flour. The flour were then stored in a food grade plastic airtight container for the preparation of bread used for further analysis.

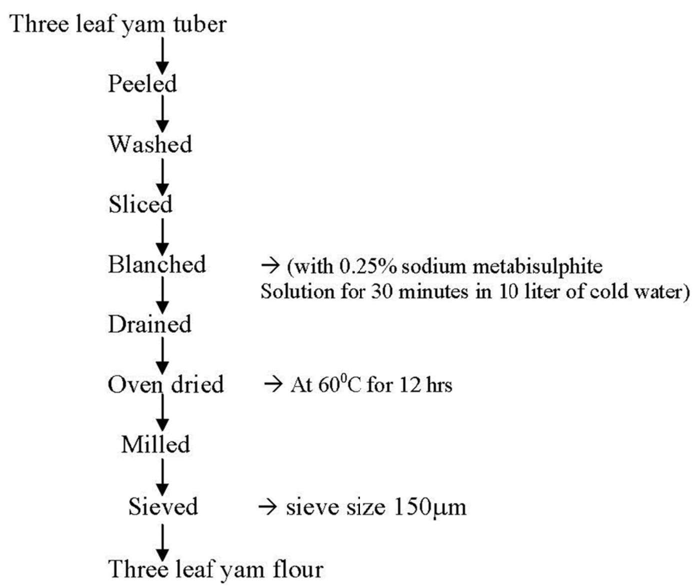

Figure 1. Flow chart for the production of three leaf Yam Flour

Source (Eke-Ejiofor & Owuno 2012)

2.1.3 Three Leaf Yam, Cassava and Wheat Flour Blends

Seven blends were prepared by mixing varied proportions of three leaf yam, cassava and wheat flour. Flour ratio of 0.5%, 10% and 15% blends of wheat/cassava and wheat/three leaf yam flour were used for bread baking.

Table 1. Recipes for production of Bread

Ingredients	Quantites
Flour	250g
Yeast	7.5g
Sugar	25g
Margarine	7.0g
Salt	2.05
Water	115ml

Sources: Fox and Cameroon (1982).

Table 2. Composition of wheat/three leaf yam andWheat/cassava flour used for bread production

Samples	Level of substitution		
	WF (%)	TLYF (%)	CF (%)
A = 100% WF	100	-	-
B = WF/TLYF/CF	95	5	-
C = WF/TLYF/CF	90	10	-
D = WF/TLYF/CF	85	15	-
E = WF/TLYF/CF	95	-	5
F= WF/TLYF/CF	90	-	10
G= WF/TLYF/CF	85	-	15

Keys:

WF = Wheat flour TLYF = Three-leaf-yam flour CF = Cassava flour

2.2 Method for Preparation of Bread (Sponge Fermentation Method)

The sponge fermentation method was used in the making of bread using formulation in Tables 1 and 2.

150g of the flour and 75mls of the water was mixed with all the yeast, and sugar. The resulting dough was allowed to ferment for 30 minutes and mixed with the remaining flour, water and all other ingredient for 10-15 minutes using a spiral mixer (model spio). Dough was further placed in a mixing bowl and allowed to proof for 30 minutes in an electric digital control incubator (model 9053A) at 35^0C. The dough was then knocked back to remove large bubbles of gas that were trapped and kneaded in a spiral mixer for 5 minutes. The smooth dough obtained was cut into sizes, weighed and allowed to ferment for 1 hour at ambient temperature and baked at 200^0C for 30 minutes. The bread was cooled, weighed and packaged.

2.3 Sensory Evaluation

Composite flour bread samples were subjected to sensory evaluation and the following attributes, namely, taste, crust-color, flavor, texture, crumb structure and overall acceptability were evaluated. A twenty (20) man panelist was drawn from the Department of Food Science and Technology. Necessary precaution was taken to prevent carry-over of flavor, by ensuring that panelist rinsed their mouth with water after each stage of sensory evaluation. Panelists were regular consumers of bread and were neither sick at the time of evaluation nor allergic to wheat, cassava and three- leaf- yam based products. A well structured questionnaire was used to assess the above attributes using a 9 point hedonic scale to measure the degree of likeness (Anonymous 2008).

2.3.1 Proximate Composition of Bread

The proximate composition of bread samples was determined using the AOAC (1990) methods for moisture, ash, protein, fat and fibre. Total carbohydrate was calculated by difference of moisture, ash, protein, fat and fibre.

2.4 Determination of Volume and Specific Volume

The volume of the bread was calculated by measuring the length (L), Height (H) and Breadth (B) and then using the formula.

$$\text{Volume} = L \times H \times B.$$

While specific volume was calculated using the formula below.

$$\text{Specific volume} = \frac{\text{mass}}{\text{volume}}$$

2.5 Statistical Analysis

Results were analyzed statistically using analysis of variance (ANOVA) and Duncan's multiple-range test (DMRT) was used to differentiate between the mean values. All the analysis were done with SPSS (16.0) software.

3. Results and Disscusion

3.1 Mean Sensory Scores for Wheat/Cassava and Wheat/Three-Leaf Yam Composite Bread

Bread quality is based on the loaf volume or loaf specific volume and this correlates with flour, protein content and quality, and also includes the internal features of the bread. Tripple et al. (1982) described bread quality to include various attributes such as color, flavor, taste, appearance and texture.

Result of sensory evaluation of wheat/cassava and wheat/three- leaf-yam composite bread from seven different blends is shown in Table 3. Sensory attribute showed a significant difference ($P \leq 0.05$), with an increase in the level of substitution, for all the attributes investigated which include (crust color, taste, texture crumb structure and overall acceptability). Color ranged from 4.70-7.80, with the sample D (85%WF: 15% TLYF) as least and sample A (100%WF) as the most preferred. Bread crust as applied here refers to the outside layer of the loaf, which is characterized by its smooth and golden brown color. The score for crust color decreased significantly ($p \geq 0.05$) as three-leaf yam and cassava flour substitution level increased. Bread sample D with 15% three-leaf-yam flour had the lowest score for crust color indicating that crust color was not attractive at that level of substitution. The same observation was made by Sanful (2011) for Taro and Whole Wheat Flour Composite Bread.

Table 3. Mean sensory result of Wheat/Cassava and Wheat/three-leaf-yam composite Bread

Sample code	Crust Color	Taste	Flavor	Texture	Crumb structure	Overall Acceptability
A	7.80 ± 1.10^{a}	6.30 ± 1.68^{a}	6.55 ± 1.60^{a}	7.30 ± 1.03^{a}	7.15 ± 1.92^{a}	7.65 ± 0.93^{a}
B	5.50 ± 1.76^{bc}	4.50 ± 1.50^{cd}	4.90 ± 1.61^{bcd}	5.05 ± 1.90^{b}	4.20 ± 2.01^{c}	5.45 ± 1.73^{bcd}
C	5.30 ± 2.15^{bc}	4.95 ± 1.66^{bcd}	4.65 ± 1.72^{cd}	4.90 ± 1.94^{b}	4.55 ± 2.03^{bc}	4.75 ± 1.97^{cd}
D	4.70 ± 2.15^{c}	3.75 ± 1.91^{d}	3.85 ± 1.56^{d}	4.45 ± 1.73^{b}	4.10 ± 1.15^{c}	4.25 ± 2.17^{d}
E	6.10 ± 1.88^{b}	6.10 ± 1.68^{ab}	5.30 ± 1.55^{bc}	5.60 ± 1.63^{b}	5.35 ± 1.92^{bc}	6.15 ± 1.87^{b}
F	6.15 ± 2.34^{b}	5.80 ± 2.19^{ab}	5.90 ± 1.86^{ab}	5.40 ± 2.34^{b}	5.10 ± 2.31^{bc}	6.10 ± 2.17^{b}
G	5.75 ± 2.09^{bc}	5.25 ± 2.02^{abc}	5.35 ± 1.46^{bc}	5.30 ± 2.31^{b}	5.70 ± 1.83^{b}	5.90 ± 2.49^{bc}

Means with different superscript in the same column are significantly different ($P \leq 0.05$).

Keys:

TLYF = Three leaf yam
A = WF 100% wheat flour
B = 90% wheat flour: 5% TLYF
C = 95% wheat flour: 10% TLYF
D = 85% wheat flour: 15% TLYF
E = 95% wheat flour: 5% cassava flour
F = 90% Wheat flour: 10% cassava flour
G = 85% wheat flour: 15% cassava flour

Taste of bread ranged from 3.75-6.30, with the sample D (85%WF: 15% TLYF) as least and sample A (100%WF) as the most preferred. The taste of the bread refers to the sweet sensation caused in the mouth in contact with the bread, due to the sweetening agent. The taste characteristics of bread are important in determining the overall acceptability of the product. Bread taste in the present study diminished significantly as three-leaf yam and cassava flour substitution level increased from 5-15% respectively, showing a significantly difference ($p>0.05$) from the control in terms of taste.

Flavor of bread samples ranged from 3.85-6.55, with the sample D (85%WF: 15% TLYF) as least and sample A (100%WF) as the most preferred.

Texture of bread ranged from 4.45 -7.30 while crumb structure of bread ranged from 4.10 – 7.15 with the sample D (85%WF: 15% TLYF) as least and sample A (100%WF) as the most preferred in both cases. Crumb texture was observed to reduce significantly with increased three-leaf-yam and cassava flour substitution level, when compared with the control sample which is 100% wheat flour. Texture is the quality attribute that can be decided by touch, the degree to which it is rough or smooth, hard or soft of a product. The reduced textural quality observed in this study as substitution increased can be attributed to the gradual replacement of wheat protein component with less gluten containing substances. The baking conditions (temperature and time variables), state of the bread components (such as fibers, starch, gluten etc.) and the amounts of absorbed water during dough mixing, all contribute to the final texture of breads (Gomez et al., 2003). The control sample had a significantly higher score ($p\leq0.05$) for texture and crumb structure when compared to the other samples. However, no significant difference for texture ($p\geq0.05$) was found between the control and the other bread samples.

Overall acceptability of bread ranged from 4.25-7.65 with sample A (100%WF) as most preferred of all. Product acceptability decreased with an increase in the level of substitution from 5% -15% for both wheat/three-leaf-yam and wheat/cassava composite bread. The overall acceptability expresses how the consumers or panelists accept the product. The control (100% wheat flour bread) had the highest score for overall acceptability followed by the 5, 10 and 15% cassava flour bread. The bread with the highest three-leaf-yam flour (15%) was the least acceptable because it had the lowest score for overall acceptability. The baking qualities of wheat composite flour products are often impaired as well as the organoleptic attributes of the products, because of the dilution of the gluten content (Dewettinck et al., 2008; Jideani and Onwubali, 2009). Thus, different combinations of both synthetic and organic improvers such as cissus gum as reported by Owuno et al. (2012), malt flour, vital wheat gluten and ascorbic acid can be included in dough formulation to improve the baking and sensory qualities of the product (Rodriguez et al., 2006).

3.2 Physical Properties of Wheat/Cassava and Wheat/Three Leaf Yam Bread

Loaf volume is an important indicator for identifying bread characteristics because it provided quantitative measurement of baking performance. Volume of bread samples ranged from 656.98cm^3 to 1518.60cm^3 with sample D (85%WF: 15%TLYF) having the lowest value and sample A (100% WF) having the highest values. The wheat/cassava and wheat/three-leaf-yam bread decreased in volume with an increase in level of substitution. Bread samples at higher cassava and three leaf yam flour substitution levels showed lower loaf volume when compared to the control. A pronounced decrease of loaf volume was exhibited in bread sample with 15% three-leaf-yam and cassava flour. The significant decrease in loaf volume at higher three-leaf-yam flour substitution levels was attributed to the gluten dilution effect (Krishnan et al., 1987), despite the fact that inclusion of three- leaf- yam flour improved the protein quality of the bread as seen in Table 4. Substitution of three-leaf-yam flour which contains non- gluten networks into the bread formulation caused an adverse effect on carbon dioxide gas production and retention during dough proofing that exerted lower loaf volume.

Weight of bread samples ranged from 340.04g to 412.66g with sample B (95%WF: 5%TLYF) having the lowest weight and sample G (85% WF: 15%CF) having the highest weight. The three-leaf-yam composite bread samples showing lower loaf weight could be related to the findings of Eke-Ejiofor (2015), who studied the functional properties of cassava and three-leaf-yam starches in the production of salad cream and reported a dispersibility value of 85% for cassava and 81% for three-leaf-yam indicating less weight. To support this finding, Kulkani et al. (1991) reported that dispersibility determines the tendency for flour to move apart from water molecules and reveals its hydrophobic action. Weight of the bread samples increased at higher flour substitution levels as volume decreased. Bread with 15% cassava flour had the highest weight (412.66 g).

Table 4. Physical characteristics of wheat/cassava and wheat three-leaf-yam composite Bread

Sample	**Volume**(cm^{3})	**Weight(g)**
A	1518.60^{a}	403.04^{b}
B	740.22^{d}	340.04^{g}
C	657.51^{e}	340.40^{f}
D	656.89^{f}	340.75^{e}
E	1095.90^{b}	371.53^{d}
F	1057.45^{b}	375.39^{c}
G	914.05^{C}	412.66^{a}

Means with different superscript in the same column are significantly different ($P \leq 0.05$).

Keys:

A = WF 100% wheat flour B = 90% wheat flour: 5% TLYF C = 95% wheat flour: 10% TLYF
D = 85% wheat flour: 15% TLYF E = 95% wheat flour: 5% cassava flour F = 90% Wheat flour: 10% cassava flour
G = 85% wheat flour: 15% cassava flour

3.3 Proximate Analysis of Wheat/Cassava and Wheat/Three-Leaf-Yam Bread

Table 5 shows the proximate analysis result of wheat/cassava and wheat/three-leaf-yam composite bread. Moisture content ranged from 25.20% to 29.50% with samples B and C (95%WF: 5%TLYF; 90%WF: 10%TLYF) having the lowest and sample A (100%WF) having the highest. The composite bread samples had lower moisture content which may also have an implication in there keeping quality. Eddy (2004) and James (1984) reported a lower moisture content of the samples which ranged from 11.17%-18.10%. However, different food materials have different capacity for absorbing/retaining moisture which may exist as occluded or absorbed water. As a result, it can be deduced that even at the high baking temperature, some moisture will be found in the samples as observed during the study. The range of values for moisture content implied that the flour blends had good storage potential, since it is known that moisture and water activity of a product determine greatly its keeping quality (Ajani et al., 2012). While high moisture content has been associated with short shelf life of a product as they encourage microbial proliferation that lead to spoilage (Ezeama, 2007).

Table 5. Proximate Composite of wheat/cassava and wheat/three-leaf- yam composite bread

S/N	% Mc	% protein	% fat	% Ash	% Fibre	TAC
A	29.50^{a}	11.90^{c}	1.46^{f}	0.64^{g}	5.05^{b}	51.51^{e}
B	25.20^{f}	11.94^{c}	2.46^{e}	0.90^{e}	4.72^{C}	54.01^{c}
C	25.20^{f}	12.50^{b}	3.23^{b}	0.98^{d}	5.40^{a}	53.46^{d}
D	28.80^{b}	13.00^{a}	4.67^{a}	1.11^{a}	3.60^{f}	48.82^{f}
E	25.70^{e}	11.97^{c}	2.60^{d}	0.99^{c}	4.69^{d}	54.05^{c}
F	25.90^{d}	11.17^{d}	3.00^{c}	1.01^{b}	3.83^{e}	55.09^{b}
G	27.30^{c}	11.05^{e}	1.31^{g}	0.66^{f}	0.90^{g}	59.78^{a}

Means with different superscript in the same column are significantly different ($P>0.05$).

Keys:

MC= Moisture content TAC=Total available carbohydrate A = WF 100% wheat flour
B = 90% wheat flour: 5% TLYF C = 95% wheat flour: 10% TLYF D = 85% wheat flour: 15% TLYF
E = 95% wheat flour: 5% cassava flour F = 90% Wheat flour: 10% cassava flour G = 85% wheat flour: 15% cassava flour

Protein content ranged from 11.05% to 13.00% with sample G (85%WF: 15%CF) having the lowest and sample D (85WF: 15%TLYF) having the highest. Inclusion of three-leaf-yam flour increased protein content more than in cassava at the same level, which decreased with substitution. To support the increase in protein, Alozie et al.

(2009) reported that three-leaf-yam like any other yam tuber is a very good source of protein, with protein content of three-leaf-yam ranging from 7.0 – 11.37% and the presence of some essential amino acid, Eke-Ejiofor and Owuno (2012) also reported a protein content of 13% for three-leaf-yam flour. According to the findings of Eddy (2004) and James (1984), protein content of wheat/cassava composite bread are relatively low because cassava is a poor source of protein (Oyenuga, 1992; Okaka & Isieh, 2002*).*

Fat content ranged from 1.31% to 4.67% with sample G (85%WF: 15%CF) having the lowest and sample D (85%WF: 15%TLYF) having the highest. Fat increased with inclusion of three-leaf-yam flour, but decreased with cassava flour substitution. Agiriga (2014) reported fat content of 1.31 to 3.23% with increased level of whole wheat flour substitution in the flour blends. Fat plays a significant role in the shelf life of food products and as such relatively high fat content could be undesirable in food products. This is because fat can promote rancidity in foods, leading to development of unpleasant and odorous compounds (Ihekoronye & Ngoddy, 1985).

Ash content ranged from 0.64% to 1.11% with 100% wheat flour bread as the lowest and 15% wheat/three-leaf-yam composite flour bread as the highest. Ash also followed the same trend as the fat content. Generally, the ash content of composite bread samples increased with an increase in the level of substitution, implying that the flour used for substitution may have positively impacted inorganic nutrient in the composite bread. The same observation was made by Banu et al. (2012) who reported that addition of 3 to 30% wheat bran stream (WBS) to the white flour increased the ash content.

Fibre decreased with increase in substitution with content ranging from 0.90% to 5.40%. Sample G (85% WF: 15% CF) having the lowest and sample C (90% WF: 10% TLYF) having the highest, while carbohydrate ranged from 48.82% to 59.78% with sample D (85% WF: 15% TLYF) having the lowest and sample G (85%WF: 15% CF) having the highest. Carbohydrate decreased with the inclusion of three-leaf-flour but increased with the addition of cassava flour. The increase in carbohydrate observed with the addition of cassava flour may be attributed to its high carbohydrate content and the higher carbohydrate content in the bread makes it a quick source of metabolisable energy and assist in fat metabolism (Malomo et al., 2011)

3.4 Dough Properties (Alveography Studies)

Table 6 shows the extensibility ratio (P/L) and the mechanical work of deformation (w). Work done ranged from 126 x 10^4 to 307 x 10^4 with (15%CF) as lowest and (100%WF) as the highest.

Table 6. Alveograph properties of Bread dough from wheat/cassava and wheat/three-leaf-yam flour

Samples	Energy of the dough/work done (w) (x10^{-4}J/g)	Resistance of extensibility ®	Extensibility (mm) (L)	Ratio of Resistance to extensibility P/L
A	307 ± 0.71^{a}	52^{c}	78^{b}	0.90^{f}
B	222 ± 0.71^{d}	42^{de}	19^{d}	2.40^{c}
C	203 ± 071^{e}	41^{c}	15^{e}	3.00^{b}
D	203 ± 0.71^{e}	43^{d}	15^{e}	3.10^{a}
E	294 ± 0.71^{b}	72^{b}	87^{a}	0.93^{e}
F	228 ± 0.71^{c}	76^{a}	60^{c}	1.40^{d}
G	126 ± 0.71^{f}	43^{d}	78^{b}	0.61_{g}

Means with different superscript in the same column are significantly different from each other ($P \leq 0.05$).

Keys:

A = WF 100% wheat flour B = 90% wheat flour: 5% TLYF C = 95% wheat flour: 10% TLYF

D = 85% wheat flour: 15% TLYF E = 95% wheat flour: 5% cassava flour F = 90% Wheat flour: 10% cassava flour

G = 85% wheat flour: 15% cassava flour

It was observed that there was a significant difference for work done in joules ($P \geq 0.05$) from the control (100% wheat flour) in comparison with composite dough. The mechanical work done decreased with an increase in level of substitution for both wheat/three-leaf-yam and wheat/cassava flour. This is in agreement with the findings of Giami et al., (2004) who reported decrease in work done and extensibility with increase in the level of fluted pumpkin flour substitution for wheat. Work done in Joules was reduced with the presence of wheat/TLY and wheat/cassava composites addition. A 27.68% decrease was observed between 100% wheat dough which was used as control and the 5% wheat/TLY composite dough, while 33.87% decrease was observed between the control (WF) and the 10 and 15% wheat/TLY composite dough. 5% wheat/cassava composite dough had work done reduced by 4.23%, While 10 and 15% wheat/cassava composite dough showed 25.73 and 58.95% decrease in work done respectively. The work done for 10% inclusion for both TLY and cassava are less than that reported by Misra et al. (1991) who reported a decrease in work value (W) of up to 38% for wheat-soy blend at 10% replacement level and attributed it to a weakening and destabilization of wheat flour gluten following the incorporation of soybean protein. El-Soukkary (2001) also reported that dough weakening in wheat flour pumpkin blend can also be attributed to a decrease in wheat gluten because of dilution effect.

while extensibility ratios of the dough ranged from 41 to 76 with sample C (10%TLYF) the least and (10%CF) the highest work done and extensibility results of bread dough decreased with an increase in substitution level, while ratio of resistance to extensibility (P/L) increase with an increase in substitution for three-leaf-yam composite dough.

The stretching characteristics of wheat flour dough are the resistance of the dough extension and the extent to which it can be stretched before breaking. Dough volume and loaf volume depends upon the amount of carbonic acid developed by the yeast (gas production) and on the amount of gas retained by the dough. The lower the extensibility, the greater the gas loss. While high gas loss lead to a slow rising dough resulting in small loaf volume.

4. Conclusion

Results of this study has shown the possibility of producing bread of acceptable quality from wheat based composite flours such as three-leaf-yam flour (TLYF) and cassava flour (CF). Addition of three-leaf-yam flour up to 5% level showed no significant adverse effect on the sensory quality of the bread such as taste, crust color, flavor, texture and crumb structure.

Bread supplemented with three leaf yam flour was said to be beneficial in terms of improving the nutritional values of the products especially protein and ash, as bread is an important staple food with a consumption pattern that is steady and increasing in Nigeria.

References

Agiriga, A. O. (2014). Effect of whole wheat flour on the quality of wheat-baked bread. *Global Journal of Food Science and Technology, 2*(3), 127-133.

Ajani, A. O., Oshundahunsi, O. F., Akinoso, R., Arowora, K. A., Abiodun, A. A., & Pessu, P. O. (2012). Proximate Composition and Sensory Qualities of SnacksProduced from Breadfruit Flour. *Global Journal of Science Frontier Research Biological Sciences, 12*(7), 1-9.

Akobudu, E. N. T. (2005). Bread making technology and ingredient For bread making. A paper presented at a training workshop on the use of cassava/wheat composite flour and non bromate additives for making bread and other confectionaries. Held at Micheal Okpara University of Agriculture, Umudike on the 10-12 October 2006.

Alozie, Y., Akpanabiatu, M. I., Eyong, E. U., Umoh, I. I., & Alozie, G. (2009). Amino acid composition of Dioscorea dumetorum varieties. *Pak. Journal of Nutrition., 8*(2), 102-105. http://dx.doi.org/10.3923/pjn.2009.103.105

Anonymous (2008). Bread World Records (ln Germany). www.burheinland.De/brotweltrekord/BWR-WDRT-TV 140905.pelf

AOAC. (1990). Methods of the Association of official chemists official methods of Analysis (15th Ed., p. 1141). Virginia Association of Analytical Chemists USA.

Banu, I., Georgeta, S,, Violeta, S. I., & Luliana, A. (2012). Effect of the addition of wheat bran on dough rheology and bread quality. *Food Technology, 36*(1), 39-42.

Defloor, I. (1995). Factors governing the bread-making potential of cassava flour in wheatless bread receipes. Ph.D. Dissertation. kathnolieke University, Leuven.

Dewettinck, K., Van, B. F., Kuhne, B., Van, W. D., Courtens, T. M., & Gellynck, X. (2008). Nutritional value of bread: Influence of processing, food interaction and consumer perception. *Journal of Cereal Science, 48*, 243-257. http://dx.doi.org/10.1016/j.jcs.2008.01.003

Eddy, N. O. (2004). Effect of processing on the chemical composition of some Nigerian food crops. M.Sc Theses, University of Uyo, Uyo Nigeria.

Edema, M. O., Sanni, L. O., & Sanni, A. I. (2005). Evaluation of Maize Soybean flour blends for sour maize bread production in Nigeria. *Afr. J. Biotechnol., 4*(9), 911-918.

Eka, O. U. (1985). The Chemical Composition of yam tubers. In G. Osuji (ed), *Advances in yam research: The biochemistry and technology of the yam tubers* (51-74). Enugu: Biochemcial society of Nigeria.

Eke-Ejiofor, J., & Owuno, F. (2012). Functional and pasting properties of wheat/three leaf yam (Dioscorea dumetorum) composite flour blend. *Global Research Journal of Agricultural and Biological Science, 3*(4), 330-335.

Eke-Ejiofor, J. (2015). Physico-chemical and pasting properties of starches from cassava, sweet potato and three-leaf-yam and their application in salad cream production. *International Journal of Biotechnology and Food Science, 3*(2), 23-30.

El-Soukkary, F. A. H. (2001). Evaluation of pumpkin seed products for bread fortification. *Plant Foods for Human Nutrition, 56*, 365-384. http://dx.doi.org/10.1023/A:1011802014770

Ezeama, C. F. (2007). Food Microbiology: Fundamentals and Applications. Natural Prints, Lagos.

Food and Agricultural Organization (FAO 2006). Food and Agriculture Bulletin on Food Security. Retrieved March 2006, from www.fao.org/docrep/x5030E/x15032E06. htm

Fox, B. A., & Cameroon, A. G. (1982). Food Science and Chemical Approach (4th Ed., pp. 288, 296). Holder and Stoughton Educational Mill Road Dunton Green London,

Giami, S. Y., Amasisi, T., & Ekiyor, G. (2004). Comparison of bread making properties of composite flour from kernels of roated and boiled African bread fruit (Deculia Africana decne) seeds. *Journal of material Research, I*(1), 16-25.

Gomez, M., Ronda, F. B., Caballero, P., & Apesteguía, A. (2003). Effect of dietary fibre on dough rheology and bread quality. *European Food Research and Technology, 216*, 51-56.

International Institute of Tropical Agriculture (11TA, 2005). Production of cassava flour. Research papers.

Ihekoronye, A. I., & Ngoddy, P. O. (1985). Integrated Food Science and Technology for the Tropics (2nd ed., pp. 50, 139-148, 172-190). London: Macmillan publishers.

James, E. G. (1984). Analytical Chemistry of Foods Blackie Academic and professional: London.

Jideani, V., & Onwubali, F. (2009). Optimization of wheat-sprouted soybean flour Bread using response surface methodology. *African Journal of Biotechnology, 8*(22), 6364-6373.

Krishnan, P. G., Chang, K. C., & Brown, G. (1987). Effect of commercial Oat bran on the characteristics and composition of bread. *Cereal Chemistry, 64*(1), 55-58.

Kulkaini, K. D., Kulkani, D. N., & Ingle, U. I. M. (1991). Sorghum Malt based weaning Formulations preparation,functional properties and nutritive values. *Food and Nutrition Bulletin, 13*(4), 322-327.

Malomo, S. A., Eleyinmi, A. F., & Fashakin, J. B. (2011). "Chemical composition, rheological properties and bread making potentials of composite flours from breadfruit, breadnut and wheat". *African Journal of Food Science, 5*(7), 400-410,

Misra, P., Usha, M. S., & Singh, S. (1991). Soy-wheat flour blends: Chemical, rheological and baking characteristic. *J. Food Sci. Technology, 29*, 89-91.

Okaka, J. C, & Isieh, M. I. (2002). Development and Quantity evaluation of cowpea wheat biscuits. *Nig. Food Journal, 8*, 56-62.

Olaoye, O. A., Onilude, A. A., & Idowu, O. A. (2006). Quality characteristic of bread produced from wheat, plantain and soybeans flour. *Afr. Food Biotechnol., 5*(11), 1102-1106.

Onwueme, I. C. (1978). *The Tropical tuber crops, yam, sweet potatoe, cocoyam* (pp. 86-87). John Willey and Sons Limited, New York.

Osuji, C. M. (2006). Importance and of additives in bead making. A paper presented at a training workshop on the use of cassava/wheat composite flour and non bromate additives for making bread and other confectionaries. Held at Mich. Okpara University of Agriculture, Umudike on the 10-12 October 2006.

Owuno, F., Eke-Ejiofor, J., & Wordu, G. (2012). Effect of cissus (Cissus populnea) gum on dough rheology and quality of Wheat cassava composite bread. *Journal of Food Agriculture and Environment, 10*(2), 132-136.

Oyenuga, V. A. (1992). Nigeria's foods and feeding stuffs. The chemistry and nutritive value, Ibadan university press.

Rodriguez, E., Jimenz, A., Fernandex-Bolanos, J., Guilten, R., & Heredia, A. (2006). Dietary fibre from vegetable products as source of functional ingredients. *Trends in Food Science and Technology, 17*, 3-5. http://dx.doi.org/10.1016/j.tifs.2005.10.002

Sanful RE (2011).Organoleptic and Nutritional Analysis of Taro and Wheat Flour Composite Bread. *World* J*ournal of Dairy and Food Sciences, 6*(2), 175-179.

Tripple, L. H., Preston, K. K. and Kilborn, R. H (1982). Implication of the term strength as related to wheat flour quality. Proceedings of 7th cereal and bread congress, Prague, held June 28th – July 2nd.