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Quality Evaluation of Bread from Wheat and Plantain Peel Composite Flour

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Abstract

The study was carried out to evaluate the functional properties, proximate composition, physical characteristics and sensory properties of wheat and plantain peel flour composite bread at substitution levels of 0%, 5%, 10%, 15% and 20%. Result of the functional properties of the wheat and plantain peel composite flours revealed that water absorption capacity, oil absorption capacity and swelling index increased significantly ($p<0.05$) from 1.29 to 1.37g/ml, 1.63 to 2.03g/ml and 6.88 to 7.78g/ml respectively. However, the bulk density was not significantly different ($p>0.05$) from samples A to D (1.40g/ml) while sample E had the highest value of 1.51g/ml. The proximate composition results showed that there were significant increases ($p<0.05$) in the crude protein (15.29-24.04%), crude fibre (0.01-0.25%) and ash contents (0.08-0.77%) in the composite bread samples. However, the control sample had the highest moisture (29.64%) and the highest fat (2.47%) values. The physical characteristics result revealed that samples A, B and E had the highest loaf length of 12.98cm which were significantly different ($p<0.05$) from samples C (11.98cm) and D (12.48cm). There was significant decrease ($p>0.05$) in the height (8.99-5.99cm) and weight (232.99g-223.98g) of the bread samples. The control sample had the highest loaf height of 8.99cm while the composite bread sample E had the lowest height (5.99cm). Samples A and B had same weight values (232.99g) which decreased significantly ($p>0.05$) to 223.98g in sample E. The oven spring increased significantly ($p<0.05$) from 16.98cm in samples A and B to 25.98cm in sample E. Sensory evaluation results showed overall acceptability scores within the range of 6.73 to 8.93. The study concluded that the levels of 5-10% of plantain peel flour (PPF) incorporation provided optimal results, balancing nutritional enhancement with acceptable physical and sensory properties suggesting potential commercial viability for bread enriched with moderate levels of PPF.

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Keywords

Plantain peel flour, wheat flour, functional properties, proximate composition, sensory properties.

Introduction

Bread is a staple food consumed globally; its primary ingredient, wheat flour, valued for its unique gluten forming properties contributing to the structure and texture of the bread (Ktenioudaki and Gallagher, 2012).

However, there is growing interest in incorporating alternative flour sources to enhance nutritional profile and functional properties of bread. Plantain peel flour is one such promising alternative, which not only offers potential health benefits but also addresses environmental concerns related to food waste.

Bread provides essential nutrients such as carbohydrates, proteins, fibre, vitamins and minerals, making it a cornerstone of balanced diets around the world. It is convenient and an affordable food item that can be enriched with additional nutrients to address dietary deficiencies. For many populations, bread is primarily a source of energy and nutrients, contributing significantly to daily caloric intake (Igbabul *et al.,* 2014).

The functional properties of wheat flour, such as its ability to form a viscoelastic dough, are crucial for bread making (Rosell *et al.,* 2010). However, refined wheat flour (white flour) has low nutritional value compared to whole grains and the potential for gluten-related disorders in some individuals (Sapone *et al.,* 2012). These concerns have prompted research into alternative ingredients that can be blended with wheat flour to produce healthier and more diverse bread products.

Plantain (*Musa paradisiaca*) is a tropical staple food which is often consumed as a carbohydrate source. The peel, which is discarded as a waste, is rich in dietary fibre, essential minerals and bioactive compounds with antioxidant properties (Aurore *et al.,* 2009).

The utilization of plantain peel flour in bread making not only enhances the nutritional value of its final product but also contributes to waste reduction and environmental sustainability.

The objective of this study therefore, was to evaluate the use of plantain peel flour as a partial substitute for wheat flour in bread production.

Materials and Methods

Source of Materials

Matured ripe plantain, wheat flour, margarine, salt, sugar and yeast were purchased from High Level Market, Makurdi, Benue State.

Preparation of Plantain Peel Flour

According to Anyasi *et al.,* (2018), mature, ripe plantains were selected and thoroughly washed. The fruits were then peeled and the peels were sliced into uniform pieces.

The slices were oven dried until the moisture content was reduced to below 10 %. The dried peel slices were finely ground with the hammer mill equipped with a fine screen. To ensure uniformity, the resulting flour was sieved to achieve a consistent particle size. The plantain peel flour was then packaged in airtight containers and stored in a cool, dry place.

Blend Formulation of Composite Flour from Wheat and Plantain Peel

Five samples, A – E, were designed for this study. Sample A which had 100 % wheat flour served as the control while samples B – E had 5 %, 10 %, 15 % and 20 % plantain peel flour incorporated in them respectively.

Bread Production

Bread loaves were produced using each of the formulated flour blends. The straight dough method of bread making as described by Igbabul *et al.,* (2014) was used. This method involved the addition and mixing of all ingredients and plantain peel flour to obtain the dough. After thorough kneading, the dough was allowed to ferment and develop before being knocked back and then molded into cylindrical shape. After molding, the dough was placed in a well-oiled pan where it was proofed for 40 minutes prior to baking. The bread samples were baked at 230ºC for 45 minutes. The bread loaves were then allowed to cool before packing for analysis.

Proximate Analysis of the bread samples from wheat and plantain peel flour

The AOAC (2012) method was used to determine the protein, moisture, fat, crude fibre and ash contents of the bread samples. Differences were used to calculate the carbohydrate content.

Functional Properties of the bread samples from wheat and plantain peel flour

Determination of Water Absorption Capacity

The method described by Onwuka (2005) was used. About 1 g of the flour sample was weighed into a 15 ml centrifuge tube and suspended in 10 ml water.

It was shaken on a platform tube rocker for 1 minute at room temperature. The sample was allowed to stand for 30 min and centrifuged at 1200 × g for 30 min. The volume of free water was read directly from the centrifuge tube.

$$\text{WAC (\%)} = \frac{(\text{Amount of water added} - \text{free water}) \times \text{density of water} \times 100}{\text{Weight of sample}}$$

Determination of Bulk Density

Bulk density of sample was determined using the method of Onwuka (2005). 10 g of each sample was weighed into 50 ml graduated measuring cylinder. The sample was packed by gently tapping the cylinder on the bench top 10 times from a height of 5 cm. The volume of the sample was recorded.

$$\text{Bulk Density (g/ml)} = \frac{\text{weight of sample of sample}}{\text{volume of sample after tapping}}$$

Determination of Oil Absorption Capacity

The method of Onwuka (2005) was adopted. 1 g of sample was weighed into a conical graduated centrifuge tube and thoroughly mixed with 10ml of oil for 30 seconds using a warring whirl mixer. The sample was allowed to stand for 30 minutes at room temperature after which it was centrifuged at 5000 rpm for 30 minutes. The volume of free oil (supernatant0 was read directly from the graduated centrifuge tube. Oil absorption capacity was expressed as grams of oil absorbed (or retained) per gram sample.

$$\text{OAC (\%)} = \frac{\text{Amount of oil absorbed (total – free)} \times \text{density of oil} \times 100}{\text{Weight of sample (g)}}$$

Determination of Swelling Index

The method of Onwuka (2005) was used. 10 g of each sample was weighed into a 100 ml graduated cylinder with the dry bulk volume noted. 100 ml of hot water at 70ºC was mixed. The volume after 10 minutes was recorded and the swelling index was calculated.

$$\text{Swelling Index} = \frac{\text{Change in volume of sample (ml)}}{\text{Original weight of sample}}$$

Physical Properties of Bread Samples

The loaf height, loaf weight, loaf length and oven spring were the physical parameters measured.

The loaf height was determined with the aid of a ruler according to the method of Ayo *et al.,* (2007). The loaf weight was determined with the aid of a weighing scale according to the method of Ayo *et al.,* (2007). The lengths of the bread samples were determined according to the method of AACC (2000). Four loaves were placed edge to edge and their total lengths were measured with the aid of a ruler. The loaves were then rotated at angles of 90º for duplicate reading.

The standardized measurement of bread oven spring involves three main steps using the modified AACC (2000) method. First, the initial height (HI) of proofed dough was measured at three points (center and 2cm from each edge) under controlled conditions (30±1ºC, 75% RH). Second, the bread was baked at 215 ± 2ºC and cooled for two hours at room temperature (21±1 ºC). Finally, the final height (H2) at the same points was measured. The oven spring was calculated as H2 minus H1, averaged across the three measurement points and reported to 0.1 mm precision. The procedure requires three replications for statistical validity.

Sensory Evaluation

Fifteen semi-trained panelists made up of males and females were selected from the department of Food Science and Technology, Joseph Sarwuan Tarka University, Makurdi. Panelists were provided with product information and requested to evaluate the various breads for appearance, taste, texture, flavour and overall acceptability using a nine-point Hedonic scale as described by Iwe (2002).

Statistical Analysis

Statistical analysis was performed using the SPSS (version 20). Difference in proximate and sensory score was detected using Duncan's multiple tests. A significant level of ($p<0.05$) in all data were determined by the General Linear Model procedure (GLM) while the least significant difference (LSD) was used to separate the means.

Results and Discussion

Functional Properties of Wheat and Plantain Peel Composite Flour

Table 1 presents the functional properties of the composite flour blend samples. Water absorption capacity (WAC) were significantly different ($p<0.05$)

and varied among samples peaking at 1.37g/ml for sample D (85:15) and lowest at 1.29g/ml (sample C). The high fibre content in plantain peel flour enhanced WAC due to the hydrophilic properties of the fibres. This property is advantageous as it results in softer dough due to improved moisture retention. The WAC of the bread samples obtained in this study were slightly lower than the value reported by Ajala *et al.,* (2018) which ranged from 1.35 to 1.85±0.07g/cm^3. These authors noted that WAC and swelling index are directly related because swelling of flour results from water absorption by the samples.

The bulk densities of the bread samples were not significantly (p>0.05) different among four of the samples. Only sample E was significantly (p<0.05) different with the highest value of 1.51g/ml. The bulk density obtained in this study (1.40 – 1.51g/ml) were slightly higher than those obtained by Ogunlakin *et al.,* (2014) which ranged from 0.48 to 0.88 g/cm^3. According to these authors, the bulk density is generally affected by particle size and the density of the flour. Bulk density is very important in determining the packaging requirement material handling and application in wet processing in the food industry.

The swelling index of the bread samples ranged from 6.88 to 7.78g/ml. Sample C (90:10) had the highest swelling index while sample B (95:5) had the lowest value. This moderate levels of PPF optimize water retention and dough expansion. Swelling capacity is essential for achieving a desirable crumb structure, as it allows the dough to expand while retaining a soft texture. Adeola and Ohizua (2018) found similar swelling behaviour with moderate fibre additions in baked goods, where fibre at optimal levels enhanced the dough's volume and softness. However, excessive PPF might cause the dough to over-expand and collapse as observed in sample E. Maintaining swelling index at moderate levels is ideal for structural integrity. The oil absorption capacity (OAC) increased progressively with PPF inclusion and ranged from 1.63g/ml to 2.03g/ml. The PPF fibrous content allows it to retain oils contributing to a richer, softer texture, which is a desirable trait in bread products. High OAC is beneficial for mouth feel, as it enhances crumb softness and gives a moist texture. This trend is consistent with Uzoukwu *et al.,* (2015) who reported values which ranged from 1.47 to 1.83% in their study on the functional properties of wheat/plantain flour as influenced by blanching treatments. According to these authors, the water/ fat binding capacity of protein is an index of its ability to absorb and retain oil, which in turn influences the texture and mouth feel of baked products like bread, cakes and so on.

Proximate Analysis of Bread from Wheat and Plantain Peel Flour

The proximate composition of the bread samples from wheat and plantain peel flour (PPF) is as shown in Table 2. The moisture content decreased significantly (p<0.05) from 29.64% in sample A to 26.65% and 26.66% in sample D and E respectively. This reduction suggested that although plantain peel flour initially absorbed water, it did not retain it as effectively during baking. Lower moisture contributes to a firmer crumb but may reduce bread's shelf life by making it prone to staling. The protein content decreased significantly (p<0.05) with increasing PPF levels with sample A (Control) having the highest value of 19.66% and sample C, the lowest at 15.29%. The reduction in protein is a direct consequence of substituting wheat flour, which is rich in gluten and glutenin, with PPF which contains lower protein levels. Protein is essential for bread's nutritional and structural quality. Igbabul *et al.,* (2014) reported slightly lower protein content values which ranged from 10.05 to 17.11% in their bread samples. The fat content reported in this study decreased significantly from 2.47 to 2.12%. Ajala *et al.,* (2018) reported similar fat content which ranged from 1.21 to 2.50%. Crude fibre and ash increased in this study from 0.01 to 0.25% and 0.08 to 0.77% respectively with higher PPF substitution. This reflects the mineral rich nature of PPF while the crude fibre can aid digestion, reduce cholesterol and lower blood sugar levels. Ibrahim *et al.,* (2022) reported higher values of 1.80 to 2.05% and 1.15 to 1.48% for crude fibre and ash respectively.

Physical Analysis of Bread from Wheat and Plantain Peel Flour

The physical characteristics of bread samples produced from wheat-plantain peel flour blends are presented in Table 3. The loaf length remained relatively consistent at 12.98cm for samples A, B and E, with slight reductions in samples C (11.98 cm) and D (12.48 cm).

Height measurements revealed a progressive decline from 8.99cm in the control to 5.99cm in sample E, indicating that increased plantain peel flour negatively impacted loaf height. Loaf weight similarly decreased from 232.99g (samples A and B) to 223.98g (sample E). Igbabul *et al.,* (2014) reported lower weight values of 199.50 to 213.00g for their bread samples.

Table.1 Functional Properties of Bread from Wheat and Plantain Peel Flour

Sample	Water Absorption Capacity (g/ml)	Bulk Density (g/ml)	Swelling Index (g/ml)	Oil Absorption Capacity
A	$1.33^{b}\pm0.04$	$1.40^{b}\pm0.04$	$7.48^{b}\pm0.04$	$1.93^{b}\pm0.04$
B	$1.32^{c}\pm0.04$	$1.40^{b}\pm0.04$	$6.88^{d}\pm0.04$	$1.63^{c}\pm0.04$
C	$1.29^{d}\pm0.04$	$1.40^{b}\pm0.04$	$7.78^{a}\pm0.04$	$1.93^{b}\pm0.04$
D	$1.37^{a}\pm0.04$	$1.40^{b}\pm0.04$	$7.35^{c}\pm0.04$	$2.03^{a}\pm0.04$
E	$1.32^{c}\pm0.04$	$1.51^{a}\pm0.04$	$7.48^{b}\pm0.04$	$1.93^{b}\pm0.04$

Values are means ± standard deviations of triplicate determinations. Means in the same column with different superscripts are significantly different at $p<0.05$.
A= 100% Wheat Flour and 0% Plantain Peel Flour (Control); B = 95% Wheat Flour and 5% Plantain Peel Flour
C = 90% Wheat Flour and 10% Plantain Peel Flour; D = 85% Wheat Flour and 15% Plantain Peel Flour
E = 80% Wheat Flour and 20% Plantain Peel Flour

Table.2 Proximate Composition of Bread from Wheat and Plantain Peel Flour (%)

Sample	Crude Protein	Moisture	Fat	Crude Fibre	Ash	Carbohydrate
A	$19.66^{c}\pm0.04$	$29.64^{a}\pm0.01$	$2.47^{a}\pm0.04$	$0.01^{d}\pm0.00$	$0.80^{a}\pm0.04$	$48.11^{c}\pm0.14$
B	$24.04^{a}\pm0.04$	$28.56^{b}\pm0.04$	$2.41^{a}\pm0.04$	$0.19^{c}\pm0.04$	$0.10^{c}\pm0.04$	$44.76^{f}\pm0.18$
C	$15.29^{d}\pm0.04$	$28.72^{b}\pm0.04$	$2.32^{b}\pm0.04$	$0.21^{c}\pm0.04$	$0.14^{c}\pm0.04$	$53.68^{a}\pm0.18$
D	$24.04^{a}\pm0.04$	$26.65^{c}\pm0.29$	$2.18^{c}\pm0.04$	$0.24^{b}\pm0.04$	$0.21^{b}\pm0.02$	$46.53^{e}\pm0.18$
E	$21.85^{b}\pm0.04$	$26.66^{c}\pm0.04$	$2.12^{d}\pm0.04$	$0.25^{b}\pm0.04$	$0.77^{b}\pm0.04$	$48.35^{d}\pm0.18$

Values are means ± standard deviations of triplicate determinations. Means in the same column with different superscripts are significantly different at $p<0.05$.
A= 100% Wheat Flour and 0% Plantain Peel Flour; B = 95% Wheat Flour and 5% Plantain Peel Flour
C = 90% Wheat Flour and 10% Plantain Peel Flour; D = 85% Wheat Flour and 15% Plantain Peel Flour
E = 80% Wheat Flour and 20% Plantain Peel Flour

Table.3 Physical Analysis of Bread from Wheat and Plantain Peel Flour

Sample	Length of Loaf (cm)	Height of Loaf (cm)	Weight of Loaf (g)	Oven spring (cm)
A	$12.98^{a} \pm 0.04$	$8.99^{a} \pm 0.01$	$232.99^{a} \pm 0.01$	$16.98^{d} \pm 0.04$
B	$12.98^{a} \pm 0.04$	$7.99^{a} \pm 0.01$	$232.99^{a} \pm 0.01$	$16.98^{d} \pm 0.03$
C	$11.98^{b} \pm 0.04$	$6.99^{c} \pm 0.01$	$231.98^{b} \pm 0.04$	$17.98^{c} \pm 0.04$
D	$12.48^{b} \pm 0.04$	$6.99^{c} \pm 0.01$	$226.96^{c} \pm 0.04$	$22.98^{b} \pm 0.04$
E	$12.98^{a} \pm 0.04$	$5.99^{d} \pm 0.01$	$223.98^{d} \pm 0.04$	$25.98^{a} \pm 0.04$

Values are means ±standard deviations of triplicate determinations. Means in the same column with different superscripts are significantly different at $p<0.05$
A= 100% Wheat flour and 0% Plantain peel flour (Control); B= 95% Wheat Flour and 5% Plantain peel flour
C= 90% Wheat Flour and 10% Plantain peel flour; D= 85% Wheat Flour and 15% Plantain peel flour
E= 80% Wheat Flour and 20% Plantain peel flour

Table.4 Sensory Evaluation of Bread from Wheat and Plantain Peel Flour

Sample	Appearance	Taste	Aroma	Texture	Mouth feel	Sweetness	Overall acceptability
A	$8.60^{a} \pm 0.64$	$8.33^{b} \pm 0.82$	$8.53^{a} \pm 0.74$	$8.53^{a} \pm 0.74$	$8.53^{a} \pm 0.74$	$8.60^{a} \pm 0.63$	$8.93^{a} \pm 0.26$
B	$8.53^{b} \pm 0.64$	$8.40^{a} \pm 0.64$	$8.33^{b} \pm 0.72$	$8.33^{b} \pm 0.72$	$8.40^{a} \pm 0.63$	$8.07^{a} \pm 0.88$	$8.20^{b} \pm 0.74$
C	$8.13^{c} \pm 0.83$	$8.00^{c} \pm 0.85$	$8.00^{c} \pm 0.85$	$8.00^{c} \pm 0.85$	$7.73^{b} \pm 0.70$	$7.60^{b} \pm 0.83$	$7.67^{c} \pm 0.62$
D	$7.93^{d} \pm 1.10$	$7.73^{d} \pm 0.88$	$7.53^{d} \pm 1.06$	$7.53^{d} \pm 1.06$	$7.67^{b} \pm 0.82$	$7.27^{b} \pm 0.96$	$7.67^{c} \pm 0.90$
E	$7.60^{e} \pm 1.18$	$6.93^{e} \pm 1.16$	$7.00^{e} \pm 1.20$	$7.00^{e} \pm 1.20$	$6.93^{c} \pm 1.10$	$6.67^{c} \pm 1.23$	$6.73^{d} \pm 1.10$

Values are means ±standard deviations of triplicate determinations. Means in the same column with different superscripts are significantly different at $p<0.05$

A= 100% Wheat flour and 0% Plantain peel flour (Control); B= 95% Wheat Flour and 5% Plantain peel flour

C= 90% Wheat Flour and 10% Plantain peel flour; D= 85% Wheat Flour and 15% Plantain peel flour

E= 80% Wheat Flour and 20% Plantain peel flour

Ovenspring, or the final expansion of the dough during baking was higher in bread with PPF, increasing from 16.98cm in the control sample to 25.98cm in sample E. Uzoukwu *et al.,* (2015) reported lower values of Ovenspring which ranged from 2.70 to 4.00cm in their wheat-plantain bread samples. The high fibre content of PPF had created a network that trapped gases within the dough matrix, allowing for initial expansion despite the gluten deficit (Olapade and Ogunade, 2014).

Sensory Evaluation of Bread from Wheat and Plantain Peel Flour

Table 4 presents the sensory evaluation data revealing a gradual decline in acceptance with increased PPF substitution. Sensory attributes showed consisted patterns across all parameters. Sample A (control) had the highest scores with ratings declining as PPF content increased. Appearance and aroma scores declined from 8.60 to 7.60 and 8.53 to 7.00 respectively. Similarly, texture, mouthfeel, taste, sweetness and overall acceptability declined with increased substitution with PPF (Table 4). Ajala *et al.,* (2018) reported lower values for colour (8.17 to 6.23); aroma (7.99 to 6.05); taste (7.84 to 5.67) and overall acceptability (8.00 to 6.05).

Conclusion and Recommendation

Supplementing wheat flour with plantain peel flour positively impacted the fibre content and reducing carbohydrate levels thereby offering a more nutritionally balanced product. Bread samples with up to 10-15 % PPF substitution maintained acceptable physical properties such as loaf height, volume and loaf weight, which are crucial for consumer acceptance. Moderate PPF inclusion (up to 10%) did not significantly compromise bread taste, texture or overall acceptability. The integration of PPF in bread formulations represents a promising avenue for the bakery industry to produce innovative, nutritious and sustainable products.

Based on this result, it is recommended to use PPF at maximum substitution level of 10 % as seen in sample C. This provided an enhanced nutritional profile with increased fibre and mineral content without significantly compromising loaf volume, texture or consumer acceptability.

References

AACC (2000): Approved Methods of the American Association of Cereal Chemists. 10th Edition, American Association of Cereal Chemists Press, St. Paul, MN.

Adeola, A. A. and Ohizua, E. R. (2018): Physical and functional properties of cassava, sweet potato and unripe protein starches. *African Journal of Biotechnology,*17(1): 9-15

Ajala, A. S., Ajagbe, O. A., Abioye, A. O. and Bolarinwa, I. F. (2018): Investigating the effect of drying factors on the quality assessment of plantain flour and wheat-plantain bread. *International Food Research Journal* 25 (4): 1566-1573

Anyasi, T. A., Jideani, A. I. O. and Mchau, G. R. A. (2018): Functional properties and postharvest utilization of commercial and noncommercial banana cultivars. *Comprehensive Reviews in Food Science and Food Safety,* 17 (5): 1294-1319.

AOAC (2012): Official Methods of Analysis, Association of Analytical Chemists. 19th Edition, Washington DC.

Aurore, G., Parfait, B. and Fahrasmane, L. (2009): Bananas, raw materials for making processed food products. *Trends in Food Science and Technology,* 20 (2): 78-91 https://doi.org/10.1016/j.tifs.2008.10.003

Ayo, J. A., Ayo, V. A., Nkama, I. and Adewori, R. (2007): Physicochemical, in-vitro digestibility and organoleptic evaluation of "Acha" wheat biscuit supplemented with soybean flour. Nigerian Food Journal 25(1):77-89.

Ibrahim, N. I., Abena, S. and Ayamba, D. (2022): Quality Characteristics of Bread made with wheat, plantain and pigeon peas. Natural Volatiles and Essential Oils 9(2): 755-762.

Igbabul, B. D., Amove, J. and Okoh, A. (2014): Quality Evaluation of composite bread produced from wheat, defatted soy and banana flours. *International Journal of Nutrition and Food Sciences* 3 (5): 471-476. https://doi.org/10.11648/j.ijnfs.20140305.26

Iwe, M. O. (2002): Handbook of Sensory Methods and Analysis. Enugu, Nigeria: Rejoint Communications Ltd.

Ktenioudaki, A. and Gallagher, E. (2012): Recent advances in the development of high-fibre baked products. *Trends in Food Science and Technology,* 28(1): 4-14 http://dx.doi.org/10.1016/j.tifs.2012.06.004

Ogunlakin, G. O., Abioye, V. F. and Olewepo, M. O. (2014): Evaluation of the Quality attribute of wheat composite (wheat-cassava, wheat-plantain and wheat-rice) flours in bread making. *African Journal of Biotechnology* 13 (38): 3907-3911. https://doi.org/10.5897/AJB2013.13169

Olapade, A. A. and Ogunade, O. A. (2014): Production and evaluation of flours and crunchy snacks from sweet potato (*Ipomea batatas*) and maize flours. *International Food Research Journal,* 21 (2): 203-208.

Onwuka, G. I. (2005): Food Analysis and Instrumentation: Theory and Practice. Naphtali Prints, Lagos. 133-137.

Rosell C. M., Santos, E. and Collar, C. (2010): Physical characterization of fiber-enriched bread doughs by dual mixing and temperature constraint using the Mixolab. *European Food Research and Technology*, 231(1): 535-544. http://dx.doi.org/10.1007/s00217-010-1310-y

Sapone, A., Bai, J. C. Ciacci, C., Dolinsek, J. Green, P. H., Hadjivassilou, M. and Fasano, A. (2012): Spectrum of Gluten-related disorders: consensus on new nomenclature and classification. *BMC Medicine*, 10(1):13 https://doi.org/10.1186/1741-7015-10-13

Uzoukwu, A. E., Ubbaonu, C. N., Enwereuzor, R. O., Akajiaku, L. O., Umelo, M. C. and Okereke, S. O. (2015): The Functional Properties of Plantain (*Musa* spp) Flour and Sensory Properties of Bread from Wheat-Plantain Flour as influenced by Blanching Treatments. *Asian Journal of Agriculture and Food Sciences* 3 (1):1-12.

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