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Development of Plantain and Cocoyam Bread and Assessment of Its Nutritional Value to the Elderly

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Abstract

Cakes were produced from the substitution levels of cocoyam and plantain Nour blends (0-100% and 0-70%), respectively and enriched with 0-30% levels of Bambara groundnut protein concentrate (BGPC) Quality characteristics of the resultant product were analysed to ascertain its sensory. physical and chemical properties Acceptable cakes were produced from 70% wheat flour, 20% plantain flour and 10% BGPC with regards to colour which compared favourably with sample A (100% WF) except F and G samples which differs significantly with other samples The texture of the cakes was also acceptable but F and G samples (6.5 and 6.4), respectively shows significant difference ($p < 0.05$) compared to others. The taste and overall acceptability were not significantly different it all levels of BGPC enrichment compared to sample A. There was no significant difference ($p > 0:05$) in all the samples in terms of the height except sample B with the value of 2.5cm. Highest weight of 194 2g was observed for sample B which was significantly different ($p<0.05$) compared to other samples Increase in BGPC further improved the volume and specific volume of the cake to 524cm3 and 3. 19cm3/100g (sample G), respectively A reduction in the values of carbohydrate, moisture and energy content of the cakes were observed at increased levels of protein concentrate Protein content of the cakes was observed to improve progressively at increasing levels of enrichment and showed significant differences up to sample D (10.4%) while the highest protein value was reported at sample G (13.2%) with 30% protein concentrate. This confirms that the developed cakes have a better nutritional value than the control and could be used to combat protein energy malnutrition.

Keywords: Cocoyam, Bread, Plantain, Floor and Nutrition.

INTRODUCTION

Medicinal plants and their products have been known over the years as effective ingredients for the management of diseases. The essentiality of these plants is due to the bioaccumulation of chemical substances (Pan *et al.*, 2017). Plants are a cheap and reliable source of food and medicine, and compared to animals, certain nutrients like proteins and vitamins, which are important to make a balanced meal or diet, are cheaper to get from plants (Igbe and Okhuarobo, 2018).

Xanthosoma sagitifolium (Cocoyam) is a herbaceous perennial plant belonging to the aracae, and constitutes one of the six most important root and tuber crops worldwide. Cocoyams are grown for their edible roots. However, all its parts are edible (Haimanot *et al.*, 2017). Compared to other root crops like potatoes, cocoyam has more calories as 100g of cocoyam gives 112 calories. The complex carb known as amylose and amylopectin is the source of its calories. Notwithstanding, this root crop contains a very low amount of fat and protein than in other cereals and legumes, and despite its nutritional quality, cocoyam flour has received no deliberate attention, as well as a low research priority (Gizachew *et al.* 2014).

Nutritional or nutritive value is the measure of a well-balanced ratio of the essential nutrients – carbohydrates, fat, protein, minerals, and vitamins in items of food or diet in relation to the nutrient requirements of their consumer (Habtamu, 2014). Wheat flour is one of the major conventional ingredients in

bread making as a function of its gluten fraction, which is responsible for the elasticity of the dough by causing it to extend and trap the carbon dioxide generated by yeast during fermentation. Regardless, in tropical countries, wheat flour is not the only ingredient that can be used for bread making. Cassava, plantain and other tuber crops have been reported to be used alternatively as raw material sources for bread-making for elderly people (Mongi *et al.*, 2011).

Statement of Problem

The major constraints of cocoyam development in Nigeria include lack of funds and limited size of land. Those in the bakery have given several reasons for the slow adoption of this technology, including the ease of deterioration of the cocoyam bread due to its high moisture given that the rate at which Nigerians consume cocoyam is still low when compared to other root tuber crops. Most homes are not also comfortable consuming cocoyam not to talk of its bread.

A substantial number of elderly people in Nigeria have not been educated on the nutritional benefits of consuming cocoyam bread, and this ignorance makes these elderly ones still go for plain flour bread, neglecting the health benefits cocoyam bread offers (Aboubakar *et al.*, 2008).

Justification of Study

Given the slow rate of consumption of cocoyam emanating from ignorance of its nutritional value, effective and efficient management of this constraint will enhance the financial.

Aim of the Study: The aim of this present study is to produce cocoyam bread and assess its nutritional value to the elderly

Objectives of the Study

The specific objectives of this study are limited to;

i. Identifying how to develop cocoyam bread in hospitality industries in Owerri North.
ii. Examining the patronage level of the bread as well as the number of elderly people that prefers it.
iii. Assessing the nutritional and health value of the bread to the elderly consumers.
iv. Determining the constraints faced by bakers who make use of this technology due to set back in cocoyam bread development.

LITERATURE REVIEW

Cocoyam research program is one of the seven crop-based programmes at the National Root Crops Research Institute, Umudike. Cocoyam was recognized as a major crop by the defunct Biafran government in 1969. Effective research on cocoyam started in Nigeria in 1976, when it became one of the mandate crops of the institute charged with the study and holistic improvement of important root and tuber crops in Nigeria. Cocoyam is mainly planted for its corms and cormels (Alcantara *et al.*, 2013). It ranks third in importance after cassava and yam among the roots and tubers in Nigeria. Notwithstanding, it is popularly called the `Nigeria's giant crop' because it is nutritionally superior to other roots and tubers in Nigeria (Ammar *et al.*, 2009).

Bread on the other hand, is s staple food produced from a dough of flour and water, usually by baking. Bread is one of the oldest man-made foods, and has been a prominent food in large parts of the world, having been of significant importance since the dawn of agriculture, and plays significant role in religious rituals and secular culture (Aryee *et al.*, 2006).

Among the ingredients for making bread, is flour; a grain grinded to a powdery consistency, and provides the structure, starch and protein to the final baked bread (Adane *et al.*, 2013). The protein content of the flour is the best indicator of the bread dough and the finished bread. While bread is made from all-purpose wheat flour, a specialty bread flour, containing more protein (12 – 14 %), is recommended for high-quality bread (Afaf *et al.*, 2013). Cocoyam flour is one of the flours used for making bread, giving that its fine granular starch improves binding and reduces breakage of snack products (Huang, 2005).

MATERIALS AND METHODS

3.1 Preparation of Plantain Flour

Plantain fruits (agbagba cultivar), obtained from hand number 2 from the proximal end of the bunch, as recommended by Baiyeri and Ortiz (1996). were peeled manually with the aid of stainless steel kitchen knives and the pulp was cut into uniform slices with thickness of about 1.5mm, soaked in 1.25% sodium metabisulphite for 5min to prevent discolouration and dried in air circulating oven (Gallenkamp S/No 90/02/190, UK) at 650C for 20h according to the method of Adeniji *et al*., (2007) The dried samples were milled to pass a 0.25mm sieve.

3.2 Production of Plantain Cakes

The quantities of ingredients shown in Table 1 were used and the creaming method of blending was adopted. Half the composite flour/blends were mixed with all the fat for about 2 min to obtain creamy dough, before adding the remaining composite flour and other ingredients. The baking powder was dissolved in water and also added to the mixture. Eggs were dispersed in little water and added to the mixture. About % of the estimated water was added and the mixing carried out for another one minute. More water was added gradually and mixing continued until the dough was soft and greasy when touched. The dough was moulded into folls, shaped and baked in the oven at 200oC for 10 min.

3.3 Physical Characteristics of the Cakes

The physical characteristics of the enriched cakes were measures using the method outlined by Zoulias *et al*., (2002) and reported by Giamı and Barber (2004) for fluted pumpkin cookies Physical parameters measured included height, weight, volume and specific volume. The queen's cake volume was calculated using the cone equation below Volume of cake (cm3)= h (d2+db+b2) where d and b are upper and lower diameters of cake.

The specific volume was determined by dividing the cake volume by the weight.

3.3.1 Chemical Analysis

Crude protein (920 87), moisture content (925 10), fat (920.85), ash (923.03) and crude fibre (920.86) content of the cakes were determined according to the AOAC (2012) methods Total available carbohydrate was determined using the Clegg anthrone method as described by Osborne and Voogt (1978) Energy was calculated using the at water factor as reported by Okoye (1992).

3.3.2 Statistical Analysis

Results were expressed as mean values and standard deviation of three (3) determinations Data were analyzed using a one-way analysis of variance (ANOVA) using Statistical Package for Social Science (SPSS) version 200 software 2011 to test the level of significance ($P<0.05$). Duncan New Multiple Range Test was used to separate the means where significant differences existed.

3.4 Production of Cocoyam Flour

The cocoyam was washed, peeled, rewashed and cut into 3-4 cm thick discs they were arranged randomly on the drying trays in single layers and placed in the drying machine (Oven Dryer) at the temperature of 65 oC for 9 h. After that it was milled using attrition milling machine into flour and then sieved. This was done with modification sccording to Sanfull and Darko, 2010.

3.4.1 Production Snacks Made from Plantain, Cocoyam Flour

Cake-like Snacks was produced by the method of Atef *et al*., 2011 with slight modifications 300 g flour, 200 g sugar, 400 g margarine, 4 g baking powder and 6 eggs were used. The dry materials were mixed in a separate bowl while sugar, margarine and egg albumen were thoroughly mixed in another bowl and the mixture was added together the mixture was whipped for 30 min and other ingredients added and mixed. The mixture was poured into baking pans, and baked at 170 o C for 15 min.

3.4.2 Functional Properties of the Flours

The bulk density and swelling capacity were determined using the modified method of Zakpaa *et al*., 2010, while the water and oil absorption capacities were determined by modifying Oyeyinka *et al*., 2014). For packed bulk density 50 g was weighed into 100 ml measuring cylinder. The samples were packed by gently tapping the cylinder on the bench top.

3.4.2 Mineral Analyses

Mineral analyses was performed using the procedure described by the AOAC (1990). The analytical procedures used for sample treatment for Atomic Absorption Spectroscopy analysis were as follows i g of the sample weighed into a Pyrex glass conical flask, 10 ml concentrated nitric acid was introduced into the flask with a straight pipette 5 ml of perchloric acid was also added. The mixture was then heated on an electro-thermal heater for a period of 20 min until a clear digest was obtained. The digest was cooled to room temperature and diluted to 50 ml with distilled water. The diluents were filtered into a plastic vial for AAS analysis of calcium, magnesium, iron and zinc. While sodium and potassium were determined using flame photometer.

3.4.3 Microbial Analyses

Total mesophilic (total viable bacterial counts) and fungi counts (yeast and mould counts) were carried out on the snack to determine the microbial load of the samples as described by Ijah *et al*., 2014. Samples were prepared by mashing the snack and mixing in saline water Subsamples were diluted decimally and I ml aliquots were spread plated on nutrient agar (NA), Mac Conkey agar (MCA), Deoxycholate citrate Agar (DCA) and potato dextrose agar (PDA) for the enumeration of aerobic viable bacteria, coli forms, salmonella and shighella and fungi, respectively. The NA, DCA and MCA plates were incubated at 37 151 °C for 24-48 h while PDA plates were incubated at room temperature (25 °C) for 3-5 days The colonies were then counted and expressed as colony forming units per gram (cfu/g) of samples All counts were done in duplicate using the Stuart scientific colony counter.

3.4.4 Evaluation of Sensory Attributes

After baking, cakes were allowed to cool for about 30 min and organoleptically estimated for the quality attributes by untrained panelists drawn from the Department of Food Science and technology, Federal University of Technology, Akure, Ondo State. Each sample was rated on perceived intensities of standard sensory attributes (Taste, Color, flavor, Texture and General acceptability) using a 9-point hedonic scale (Larmond, 1977).

RESULTS AND DISCUSSION

Proximate Composition of Flours

Table 1 shows the proximate composition of plantain, sweet potato, cocoyam and 169 wheat flour.

The carbohydrate content of cocoyam flour (82.30%) is not unusual as it has long been known as a carbohydrate-giving food (Sanful and Darko, 2010) Plantain flour had higher fat content (12.00%) which was comparable to Adegunwa *et al*., 2014 There was no significant difference in the fiber content of the flours ($p < 0.05$) Cocoyam flour had high moisture (17.37%) and carbohydrate content (82.3%) but low in ash content (2.94 174%) which may due to its anti nutrient present. Sweet potato flour and wheat flour had significant differences in its proximate composition except in fat and fiber ($p < 0.05$) but had higher values than the values reported by Okorie and Onyeneke, 2012, Ugwoan *et al*., 2012, which might be due difference in cultivar and possibly the processing methods used. The moisture and crude fiber contents of sweet potato were 7.27% and 0.86% respectively which are within the values of 8.3% and 1.0% respectively as reported by Adeyeye and Akingbola, 2014, but with low fat content (4.42%) due to an occurrence of oxidative rancidity which might be reduced in non- wheat flours.

Functional Properties of the Flours

The functional properties of the flours used for the cake-like snack is presented in Table 2, the bulk density of the flours were significantly different with values ranging from 0.77-092 g/ml Generally, higher bulk density is desirable for its great ease of dispersibility and reduction of paste thickness which is an important factor in convalescent child feeding (Adegunwa *et al*., 2014) The values of plantain (0.77%) und sweet potato flours (0.78%) is comparable to that obtained by other researchers (Zakpan *et al*., 2010, Fagbeni, 1999, USDA, 2009), but the value of cocoyam flour (0.92%) was higher than the rest because of its smaller particle size due to its smaller starch grains (Oladejı *et al*., 2010) The bulk density is affected by the particle size and the density of the flour which is very important in determining the packaging requirements, material handling and the application in wet processing in food industry (Adegunwa *et al*., 2014). There was significant difference between the flours and the control (wheat flour) in the water and oil absorption capacity which both ranged from 0.95 1.54 g water/g flour and 137-1.62 g oil/g flour respectively which might be due to the difference in the granule size thereby enhancing the ability of the flours to absorb water and oil. Oil absorption in starch relies predominantly on the physical entrapment of oil within the starch structure as starch does not possess nonpolar sites compared to those found in proteins (Oyeyinka *et al*., 2014) Oil absorption capacity of flours is also important for the development of new food products and influences to a great extent their storage stability (Falade and Kolawole, 2011). The swelling capacity of the fleurs (TL-0.50 72-0.60%, and 13-0.50%) was significantly different from the control (wheat flour-0.13%) as it follows the same trend with bulk densities (Table 2). This suggests that particle size of the starch granules and damages done to starch by milling operation had great effect on the swelling capacity of the four.

Proximate Composition of Cake-Like Snacks

Cake-like macks made from both wheat and plantain flour had high protein content (1.70%) as shown in Table 3, which may be due to the high amount of gluten as compare to the rest. The proximate composition of sweet potato was higher than wheat except for protein (1.56%) and ash (1.09%) which indicates a low amount of gluten and minerals as compared to wheat (1.70% and 1.48% for protein and ash respectively), as reported in Okorie and Onyeneke, 2012, only that sweet potato was substituted with wheat in 10-50rutio. Cocoyam had high amount of moisture (17.37 %) and carbohydrate (46.23%) which was expected but low in protein and fat as pared to the control. There was no significant difference in the ash content of the cakes as it was also observed by Kabari and Ejiofor, 2013.

Mineral Analysis of Cake-Like Snacks

Cake-like snack made from plantain flour had relatively higher mineral than those produced from the rest as shown in Figure 1 The calcium, sodrum, magnesium, zinc, iron and potassium contents of the cake-like snacks ranged from (0.99-2.27 mg/100g. 0.06-0.24 mg/100g, 0.53-151 mg/100g, 0.03- 0.05 mg/100g, 0.18-0.24 mg/100g and 0.02-0.06 mg/100g respectively) Calcium and magnesium help reduce the risk to osteoporosis in adults and rickets in children. The increased value of Iron suggests that the cake-like snacks may be used in prevention and control of anemia. Minerals are required for normal growth; cellular activity and oxygen transport (Fe), fluid balance and nerve transmission (K) as well as the regulation of blood pressure and strengthening of bones (Ca and K). Due to the low sodium and protein content, plantain is used in special diets for kidney disease sufferers (Zakpan *et al*., 2010).

Microbial Analysis of Cake-Like Snacks

No microbial growth was observed on the first day till the eight day, but on the ninth day there was significant growth of bacteria and fungi, but coli form and salmonella and shighella growth was not detected as shown on Table 4.

These are within the limit set by the Standard Organization of Nigeria (SON). Which states that the counts of aerobic bacteria must not exceed 100cfu/g and coli form growth must not be detected in cake-like snacks samples.

CONCLUSION

This study has revealed that plantain flour which is available locally can also be used in developing pastry products over the overall dependence on wheat flour The results showed that cake-like snack produced from plantain was comparable in terms of quality and

acceptability to that produced from wheat flour as it has equal amount of protein (1.17 2580 16), and high amount of minerals compared to the others, which is needed for the normal 259growth and development of the body Its high protein content shows that it can be used as an ingredient in functional foods production and also as a food thickener for people of all ages. Plantain cake-like snack is therefore recommended due to its high Calcium content which helps prevent the risk to Osteoporosis in adults and rickets in children and its protein content which is comparable to that of wheat indicates its high leavening ability in contrast to others.

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REFERENCES

- Aboubakar, N. Y. N., Scher, J., & Mbofung, C. M. F. (2008). Physicochemical, thermal properties and microstructure of six varieties of cocoyam (*Colocasia esculenta* L. Schott) flours and starches. *J Food Eng*, *86*(2), 294 – 305.
- Adane, T., Shimelis, A., Negussie, R., Tilahun, B., & Gulilat, D. (2013). Effect of processing method on the proximate composition, mineral content and anti-nutritional factors of cocoyam (*Colocasia esculenta*) grown in Ethiopia. *African Journal of Food, Agriculture, Nutrition and Development*, *13*(2), 7383 – 7398.
- Afaf, O., Ali, M., El-Aziz, Jihan, M. K., & El-Ghany, Z. (2013). Effect of substitution of wheat flour with cocoyam flour on some properties of weaning food formula. *Journal of Applied Science and Research*, *9*(6), 3985 – 3991.
- Alcantara, R. M., Hurtada, W. A., & Dizon, E. I. (2013). The nutritional value and phytochemical composition of cocoyam (*Colocasia esculenta* (L.) Schott)) powder and its selected processed foods. *J Nutr. Food Sci*, *3*, 207.
- Ammar, M. S., Hegazy, A. E., & Bedeir, S. H. (2009). Using cocoyam flour as partial substitute of wheat flour in bread making. *World Journal of Dairy and Food Sciences*, *4*(2), 94 – 99.
- Aryee, F. N. A., Odurol, E. W. O., & Afuakwa, J. J. (2006). The physico-chemical properties of four samples from the roots of 31 varieties of cassava. *Food Control*, *17*, 916 – 922.
- Gizachew, G., Geremew, B., & Solomon, A. (2013). Effect of cassava (*Manihot esculanta* Crantz) variety, drying process and blending ratio on the proximate composition and sensory properties of cassava-wheat composite bread. *Direct Research Journal of Agriculture and Food Science*, *3*(4), 38 – 47.
- Habtamu, F. G. (2014). Nutritional composition, antinutritional factors and effect of boiling on nutritional composition of Anchote (*Coccinia abyssinica*) tubers. *Journal of Science and Innovative Research*, *3*(2), 177 – 188.
- Haimanot, H. A., Tilahun, A., Geremew, B., & Tessema, A. (2017). Nutritional and sensory quality of wheat bread supplemented with cassava and soybean flours. *Journal of Food Science and Technology*, *3*(1), 1331892.
- Igbe, I., & Okhuarobo, A. (2018). Expanding the insights into the usefulness of *Brachystegia eurycoma* Harms: A review of its nutritional and medicinal values. *J Intercult Ethnopharmacol*, *7*(1), 82 – 94.
- Pan, X., Du, L., Tao, J., Jiang, S., Qian, D., & Duan, J. (2017). Dynamic changes of flavonoids in *Abelmoschus manihot* different organs at different growth periods by UPLCMS/MS. *Journal of Chromatogr, B*, *1059*, 21–26.