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Full Length Research

Effect of fluted pumpkin seeds flour on the proximate and sensory properties of cooking banana flour biscuits and queens cake for household consumption

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ABSTRACT: Biscuits and queens cakes were produced from the blends of cooking banana/fluted pumpkin seeds flour at a substitution levels of 100% wheat flour (control), 90% cooking banana, 10% fluted pumpkin seeds flour, 80% cooking banana, 20% fluted pumpkin seeds flour and 70% cooking banana, 30% fluted pumpkin seeds for households consumption. Proximate and sensory properties of the food products (biscuits and queens cakes) was analyzed. Results for proximate composition showed that samples CPDB 70% cooking banana, 30% fluted pumpkin seeds flour and CPDQ 70% cooking banana, 30% fluted pumpkin seeds flour had the highest value for protein while sample WHAB 100% wheat flour biscuits and WHAQ 100% wheat flour queens cake (control) had the highest value for carbohydrate content. Result for Sensory properties: colour, texture, taste, flavour and general acceptability) revealed that 100% wheat flour products were most preferred compared to all the samples. However, sample CPBB and CPBQ 90% cooking banana with 10% fluted pumpkin seeds flour substitution were comparable to the control in all the attributes evaluated. Sample CPDB and CPDQ had the lowest value and were least preferred. Protein content of biscuits and queen cakes samples improved progressively with increased substitution levels of enrichment with fluted pumpkin seeds flour. This confirms that the developed biscuits and queens cake have a better nutritional value compared to the control sample and could be used to stem the tide of protein energy – malnutrition in the family.

Keywords: Cooking banana, fluted pumpkin, household consumption, proximate, sensory properties.

INTRODUCTION

The demand for snacks and pastry products are on the increase and the cost of the products have become expensive. Wheat flour which is the preferred flour for snacks and pastry production is not successfully grown in most regions of the world (China and Ezem, 2016). Thus, the producers have to rely on importation of wheat flour to sustain the production of such snacks or exclude wheat products from the family's menu. In order to sustain the consumption of these snacks (biscuits and queens cakes) and reduce the importation of wheat flour, there is therefore a need to develop composite flour from locally available food materials particularly, the underutilized crops such as cooking banana and fluted pumpkin seeds. The key focus of this study is that cooking banana (*Musa acuminate*) and fluted pumpkin (*Telifairia occidentalis)* seeds are underutilized at this time of food insufficiency. Its availability is a privilege for households to guide against food scarcity and ensuring food security and peace at the same time reduce insecurity. In utilizing these food crops, the research work will as well expose the households to various ways through which they can effectively and efficiently diversify these food crops to improved household menu. This research is trying to showcase other ways households can transform the underutilized food commodities that are in abundance in this region. Mbah and Azubike (2018) opined that household are group of people living together in a common residence or apartment as consuming units in a physical environment.

Fluted pumpkin (*T. occidentalis*) seeds is one of the nature's food. Giami and Barber (2004) reported that *T. occidentalis* seeds contain sufficient amount of mineral, vitamin and protein that can complement the inadequacies of most foodstuff. *T. occidentalis* seed also contain fat, this according to Mathangi (2018) makes it to be called an oil seed. In the same vein, Achinewhu as cited in Ibaakee (2008) noted that *T. Occidentalis* seeds contain about 27% protein, hence, can be used to supplement a variety of local foods. Inadequate protein consumption is as major cause of poor nutrition among households. According to UNICEF (2016), poor nutrition involving protein remains a major health challenge among young ones under five years of age (UNICEF, 2016). This problem stemmed from inadequate supply induced by high price of animal proteins, which are preferred to those from plant origin. *T. occidentalis* seeds has been recognized as an alternative in alleviating the scourge of protein – energy malnutrition. The flour from the seeds has been recommended as a cheap and good source of plant protein, for enhancing the nutritional quality of other flour such as cooking banana. Cooking banana (*Musa acuminate*) is a banana cultivar in the genus *Musa* and is native to South Asia (IITA, 2014). The fruits contain minerals such as phosphorus, calcium and potassium (Sreejith et al., 2016). Adewole et al. (2012) reported that cooking bananas contain several vitamins including A, B and C, minerals particularly potassium but, low in protein and fat. It is cholesterol and gluten free but high in fiber content. The crop can be used in divers form including processing into flour and used as composite to other flour in snack production.

Snacks according to Anozie et al. (2014) are small meals eaten between meals in order to maintain health, while satisfying appetite. They are often smaller than the regular meals and are made to be portable, quick and satisfying, less perishable. Snacks such as biscuits and queens cakes are forms of confectionery product with a very low water activity and increased shelf life (Okpala and Okoli, 2011). Snack products are consumed extensively by both children and adults and the main ingredients are wheat flour, fat, sugar, butter and water among others (Oyeyinka et al., 2014). Wheat flour which is the flour of choice is expensive and lacks some essential nutrients. However, the application of flour in food product formulation is primarily governed by their functional properties, proximate composition and sensory attributes of the formulated products. The main purpose of this research work was to develop flour from cooking banana and fluted pumpkin seed used in composite flour in snacks production to encourage their utilization.

MATERIALS AND METHODS

Freshly harvested cooking banana and fluted pumpkin fruits were obtained from a local farm in Ahoada-East Local Government Area of Rivers State. Sugar, shortening (Simas margarine), eggs, salt, nutmeg, baking powder, milk, vanilla essence were bought from Mile 3 market in Port Harcourt, Rivers State, Nigeria. The processing of raw materials was done in the Analytical Laboratory, Rivers State University, Nigeria.

Unripe cooking bananas were washed in tap water and peeled using hand pressure to obtain the pulp. The pulp were sliced using a stainless steel knife (5 mm) and dried at 60^{o}C for 24 hours in a hot – air oven (model QUB 305010G, Gallenkamp, UK), ground and sieved through a 500 um British standard sieve (model Bs 410, Endecotts Ltd, London, UK). Flours obtained were stored in an air-tight plastic container at room temperature 37^{o}C until used (China et al., 2019).

Fluted pumpkin fruits were cut open to obtain the seeds. The seeds were separated from the pulp, seeds with intact seed coats were washed and boiled in 200 ml tap water containing 1.2%g sodium meta-bisulphite in a covered stainless steel pot for 1 hour to soften the seed coats and prevent discoloration .The seed coats were removed using hand pressure and the seeds cotyledons were sliced and oven dried at 60^{o}C for 48 hours in a hot – air fan oven (model QUB 305010G, Gallenkamp, UK), grounded using a commercial mills and sieved through a 500 um British standard sieve (model Bs 410, Endecotts Ltd, London, UK).

Flour obtained was defatted using n-hexane. Defatted flour was oven dried at 50^{o}C for 30 minutes to expel residual of n-hexane. The flour was milled and then stored in an air-tight plastic container at room temperature 37^{o}C until used (Giami and Barber, 2004).

Sample formulation

The flour blends were formulated and coded in the following proportion: WTAB and WHAQ = 100% wheat flour, CPBB and CPBQ = 90% cooking banana, 10% fluted pumpkin seeds flour, CPCB and CPCQ = 80% cooking banana, 20% fluted pumpkin seeds flour, CPDB and CPDQ = 70% cooking banana, 30% fluted pumpkin seeds flour.

Proximate composition

Moisture content was determined using the method of AOAC (2012). Five grams (5 g) of each sample was weighed in duplicate into already weighed and dried aluminium dish. The sample was dried to constant weight in an air oven at 105^{o}C for 2 hours. Determination of the crude protein content of the food products was done using the method of the AOAC (2012). One gram (1 g) of the sample was weighed into a 100 ml Kjeldahl flask. One and a half tablet of Kjeldahl catalyst and 10 ml of Nitrogen-free concentrated sulphuric acid added. The mixture was heated slowly for digestion on a digester set at 420^{o}C under a fume cupboard. The sample digest was allowed to cool and then transferred into a 100 ml volumetric flask

and made to volume with distilled water. Ten mililitres (10 ml) of the digest was introduced into 100 ml Kjedahl distillation flask and 10 ml of 45% NaOH was added. The ammonia liberated was steam distilled into a 5 ml of the boric acid indicator in a conical flask using a Nitrogen distillation unit. The distillate was back titrated against O.1NHcl to give the nitrogen content of the sample. A blank determination was also carried out and subtracted from the sample reading and the %N was then calculated.

Crude fat was determined using the Soxhlet extraction method. Five grams (5 g) of dried sample was weighed, wrapped in a Whatman number 1 filter paper and was extracted in the extraction unit for 3 hours using petroleum ether as solvent. At the end of the extraction process, the ether was evaporated and the weight of the extract plus flask taken. The difference in weight of the extraction flask before and after extraction was recorded as the amount of fat or ether extract.

AOAC (2012) method was used in the determination of the ash content. The food product was weighed into a previously ignited and cooled porcelain crucible with the lid. The crucible and sample was heated on a heating mantle in a fume cupboard until smoking ceases. The crucible and the content was then transferred to a muffle furnace and allowed to ash for three hours at 500^{o}C. At the end of ashing, the crucible with its content was removed from the furnace and cooled in a desiccator, and weighed again. The percentage ash content of the sample was calculated.

Two grams (2 g) of the moisture-free sample was extracted for three hours with petroleum ether using a Soxhlet apparatus. The fat-free material was placed in a 200 ml beaker and 50 ml of 1.25% w/v sulphuric acid was added and covered with a watch glass. The content of the beaker was heated gently on a hot plate for 30 minutes (acid hydrolysis). At the end of the acid hydrolysis, the content of the beaker was filtered under vacuum through a Buchner funnel fitted with filter paper (Whatman No. 40) and washed with boiling water. The residue was washed back into the beaker with 1.25% NaOH and boiled for 30 minutes covered with a watch glass. The resulting insoluble material was transferred to dried pre-weighed ash less filter paper and washed thoroughly first with hot water until the washing is no longer alkaline to litmus and then with 15 ml of Ethanol (95%) by volume and was dried at 105^{o}C to a constant weight for one hour. The filter paper and content were incinerated to ash at 500^{o}C for 1 hour. The ash was then cooled and weighed. The weight of the ash was subtracted from the increase of weight on the paper due to the insoluble material and the difference reported as fibre. Total carbohydrate content was determined by difference (100 - %moisture - %ash - %fat - %protein -%crude fibre).

Sensory evaluation

Coded samples of biscuits and queens cake were placed on saucer and presented to a twenty member panelist comprising of staff and students of Department of Food Science and Technology, Rivers State University. The panelist were selected on the basis of age and familiarity with the food products. A nine-point hedonic scale was used for the sensory evaluation of the cooking banana/pumpkin seeds flour biscuits and queens cake, with (1) representing dislike extremely and (9) like extremely (Iwe, 2007). The panelist were asked to evaluate the samples based on their senses of judgment.

Statistical analysis

Data obtained from the study was analyzed statistically using statistical package in MINITAB 16 computer programme. Means were separated using Turkey's Multiple Comparison Test and significance accepted at $p>0.05$ level. Analysis of variance was used on the data while least significant Difference LSD was used to detect significant differences among the means at a level of 0.05.

RESULTS AND DISCUSSION

Proximate composition

The result for moisture content, ash crude fat, crude protein, crude fibre and carbohydrate for all the samples are shown on Table 1 and 2. Tables 1 and 2 revealed that, addition of fluted pumpkin seeds flour to cooking banana flour for production of biscuits and queen's cake, respectively, improved the crude protein content of the samples. The protein content increased with increase in the amount of fluted pumpkin seeds flour with samples CPDB and CPDQ having the highest value for protein content. This result in an accordance with Elegbede et al. (1998) that when legume supplement cereals, tubers, roots or fruits they provide a balance meal. Compositing fluted pumpkin seeds flour to other flour in snack production will help in stemming the tide of protein malnutrition among family members. Snacks are consumed by children and adults. Protein–malnutrition appeared to be the major public health challenge in most developing nation, Nigeria inclusive. Utilization of these two food materials in snack making will also encourage their consumption at the same time reduce protein–malnutrition. The critical interplay is between protein and carbohydrate. Cooking banana is a carbohydrate food with high moisture content hence, compositing it with fluted pumpkin will go a long way in improving the protein content of the food product. Carbohydrate content decreased as the substitution level of pumpkin seeds flour increased. However, there was increase in the fat content with addition of shortening (margarine). The implication is that, when compositing fluted pumpkin seeds flour with other flour, the amount of shortening should be reduced since pumpkin is an oil seed (China and Ezema, 2016). Kiin-

Table 1. Proximate composition of formulated cooking banana/ pumpkin seeds flour blends (biscuits samples) in percentage.

Parameters	Moisture Content	Ash	Fat	Protein	Carbohydrate	Crude fibre
WTAB	5.38^{b}	0.19^{c}	19.30^{b}	5.38^{c}	60.20^{a}	1.32^{a}
CPBB	6.55^{a}	1.68^{a}	22.70^{a}	7.42^{b}	43.20^{b}	0.55^{b}
CPCB	5.20^{b}	1.78^{a}	28.77^{b}	7.49^{b}	43.12^{b}	0.52^{b}
CPDB	5.09^{b}	1.90^{a}	30.28^{a}	8.67^{a}	38.09^{c}	0.48^{b}

WTAB = 100% wheat flour, CPBB = 90% cooking banana 10%pumpkin seeds flour, CPCB = 80% cooking banana 20% pumpkin seeds flour and CPCB = 70% cooking banana, 30%pumpkin seeds flour blends.

Table 2. Proximate composition of formulated cooking banana/pumpkin seeds flour blends (queens cake samples) in percentage.

Parameters	Moisture Content	Ash	Fat	Protein	Carbohydrate	Crude Fibre
WTAQ	7.48^{b}	0.20^{b}	29.27^{a}	5.20^{b}	60.31^{a}	0.40^{b}
CPBQ	10.41^{a}	1.27^{a}	30.11^{b}	7.12^{b}	44.51^{b}	0.32^{a}
CPCQ	10.32^{a}	1.12^{a}	30.46^{a}	8.01^{a}	42.73^{b}	0.32^{a}
CPDQ	10.30^{a}	1.25^{a}	30.52^{a}	8.05^{a}	42.80^{b}	0.35^{c}

WTAQ = 100% wheat flour, CPBQ = 90% cooking banana 10% pumpkin seeds flour, CPCQ = 80% cooking banana 20% pumpkin seeds flour and CPDQ = 70% cooking banana, 30% pumpkin seeds flour blends.

Table 3. Sensory evaluation of cooking banana/pumpkin seeds flour blends biscuits samples.

Parameters	WTAB	CPBB	CPBC	CPBD
Colour	8.20^{a}	6.55^{a}	4.00^{a}	2.65^{a}
Texture	8.15^{a}	5.50^{a}	3.00^{b}	1.55^{b}
Taste	8.16^{a}	4.30^{b}	1.70^{c}	1.20^{b}
Flavour	8.30^{a}	3.95^{b}	1.20^{c}	1.10^{b}
General Acceptability	8.40^{a}	4.15^{b}	1.50^{c}	1.25^{b}

Means with the same superscript on a row are not significantly difference at ($p \leq 0.05$). WTAB = 100% wheat, CPBB = 90% cooking banana, 10% pumpkin seeds flour, CP = 80% cooking banana 20% pumpkin seeds flour and CPCB = 70% cooking banana, 20%pumpkin seeds flour blends.

Table 4. Sensory evaluation of cooking banana/pumpkin seeds flour queens cake samples.

Parameters	WTAQ	CPBQ	CPCQ	CPDQ
Colour	8.04^{a}	5.43^{a}	3.21^{a}	3.23^{a}
Texture	8.00^{a}	5.50^{a}	2.19^{b}	1.20^{b}
Taste	8.07^{a}	5.10^{b}	1.41^{c}	1.20^{b}
Flavour	8.10^{a}	2.19^{c}	1.04^{c}	0.20^{c}
General Acceptability	8.14^{a}	2.00^{c}	1.31^{c}	1.11^{b}

Means with the same superscript on a row are not significantly difference at ($p \leq 0.05$). WTAQ = 100% wheat, CPBQ = 90% cooking banana, 10% pumpkin seeds flour, CPCQ = 80% cooking banana 20% pumpkin seeds flour and CPDQ = 70% cooking banana, 20%pumpkin seeds flour blends.

Kabari and Banigo (2015) reported an increase in protein content of wheat plantain queens cake supplemented with Bambara groundnut.

Sensory evaluation

Tables 3 and 4 showed the mean sensory scores for formulated cooking banana/pumpkin seeds flour blend biscuits and queens cakes. Results for sensory evaluation revealed that there were significantly ($p<0.05$) different in all the attributes evaluated for both biscuits and queens cakes. The result is in accordance with the submission of Taiwo et al. (2018). The 100% wheat flour (control) was most preferred followed by samples with 90:10 substitution level of pumpkin seeds flour to cooking banana. The

original nature of wheat flour influenced the choice made by panelists. Iwe and Egwuekwu (2010) reported that, appearance of food is usually the first sign of edibility. The texture of the (control) sample had higher value and differed significantly ($p>0.05$) from the other samples. Texture of food depends a lot on the starch content (Anozie et al., 2014). This implies that wheat flour contained more carbohydrate than cooking banana. For taste (control) samples were most preferred and was significantly ($p<0.05$) from the other samples. This result is in agreement with the report of Ibaakee (2008) who reported that panelist described cookies and chin chin containing more than 10% pumpkin seed flour as having an after taste. Flavour preference decreased with increase in substitution level of pumpkin seeds. This is in accordance with the result reported by Ibaakee (2008) that, at 30% level of substitution of *T. Occidentialis* seed flour to wheat, panelist described it as having a beany flavour. For general acceptability, the control samples were most acceptable followed by the sample with 10% level of substitution.

Conclusion and recommendations

Quality biscuits and queen cakes were prepared from flour blends of cooking banana/pumpkin seeds. There was improvement in the protein content of the formulated samples. Pumpkin seeds flour can find useful application in food product development with regards to protein enhancement. The proximate composition of the formulated biscuits and queens' cakes showed a significant nutritional influence on the samples. With regards to colour, taste, texture and overall acceptability samples CPBB and CPBQ were comparable to the control 100% wheat flour. It was therefore recommended that, 10% pumpkin seeds flour can be used in composite with other flour in snacks production to achieve quality sensory attribute while 30% of pumpkin seeds flour can be used to improve the nutritional value of snacks.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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