SENSORY EVALUATION OF USE OF MAIZE AND YAM FLOUR IN COMPOSITION WITH WHEAT FLOUR FOR THE PRODUCTION OF SELECTED SNACKS

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Abstract

This research was designed to process corn and yam into flour and to ascertain their performance and suitability in the production of snacks like cake and chin-chin. Three research questions guided the study. Maize and yam flour were used for the experiment and wheat flour served as a control. These flours were used in their various proportions for the experiments. The sensory evaluation scoring was based on a 5-point rating scale with 20 panel of judges that judged and scored the products in relation to colour, texture, shape, taste and overall appearance. Descriptive statistics (mean) was used to analyze the data. The finding showed that it was possible to produce cake and chin-chin using 100% corn flour, 100% yam flour and combination of wheat and corn flour and also wheat and yam flour. Most of the products 0were rated acceptable while some were rated unacceptable by the judges. Therefore, the study concluded that corn flour and yam flour should be used in snacks production to reduce the over-dependence on wheat flour.

Introduction

Nigeria is a nation blessed with fertile land for the production of many cereal and tuber crops. The global emphasis is shifting from over dependence on importation of goods to locally made goods. The prospects of blending tubers, roots and plantain with cereals and legumes for the production of household food products is receiving considerable attention worldwide (Nnam, 2002). These products would be relatively cheap, nutritious and affordable to the rural poor to stem-off protein-energy-malnutrition (PEM) and micronutrient deficiencies. Some of the food crops include yam, maize, plantain, beans, wheat, and sorghum among others.

Maize (*Zeamays*) also known as maize is a cereal crop that grows across a range of agro-ecological zones in Nigeria, though it is grown slightly in the northern part of the country. Two types of maize are grown in Nigeria, the yellow and white variety. All parts of the crop can be used for food and non-food products. It is on record that more than 60% of Nigeria's production of maize is consumed by the industrial sector for the production of flour, beer, malt drink, maizeflakes, starch, syrup, dextrose and animal feeds (http://foramfera.com/index608-maizecultivation-in-nigeriaApril2014.php/human-development-programmes-and-adtraining-opportunities-innigeria.)

Maize is a major source of energy. In a 100g serving, maize kernels provide 86kcal and are a good source of B vitamins, thiamine, pathothenic acid (BS) and folate. They supply dietary fibre, the essential minerals and phosphorus (Rooney & Serna-Saldvar, 2000). Maize flour is one of the common types of flour obtained from maize. It can be used in the production of chin-chin, cake, bread, biscuit, doughnut, pudding among others. According to Onyemaobi, Ihekoronye and Okoro (2005), maize grain contains 65-84% starch, 9-10% protein, 12-15% moisture, 3-5% fat, 2-3% fibre, 3% ash and 410 calories. Maize has a lower nutritive values than wheat and it is deficient in niacin.

Yam (*discorea rotundata)* is a common name for some plant species in the genus *discorea* that form edible tubers. FAO (2011) stated that Nigeria is the world largest producer of yams, accounting for over 70-76% of the world production. Yam is in the class of roots and tubers that is a staple of the Nigerian and West African diet, it provides some 200kcal of energy per capita daily. Tuber is the main part of the yam plant which has high CHO content (low in fat and protein) and provides a good source of energy. It is processed into flour for use in the production of paste. Its medicinal use as a heart stimulant is attributed to its chemical composition which consist of alkaloids of saponin and sapogenin (IITA, 2009).

Yam flour is yam that has been peeled, sliced, cleaned, dried and processed into flour. It is white in colour. It is used in the production of yam dough (foofoo), biscuit, scones, cakes and pie dishes. Yam has a large percentage of moisture content about 70% depending on the type of yam. It is high in vitamin C, dietary fibre, vitamin B6, potassium and manganese. Yam is low in saturated fat and sodium. Yam products generally have a low glycemic index than other foods like potato products which means that they can provide a more sustained form of energy and give better protection against obesity and diabetes. They also protect the body against osteoporosis and heart disease (Davidson, 1999).

Nutritionally, yam contains 80-90% carbohydrates, 5-8% protein, 3.5% minerals. They are source of steroids and alkaloids-chemicals that are extremely active physiologically in vertebrate animals. There is increase in urbanization in Nigeria leading to changes in food habits from the traditional foods to confectionary and snacks particularly among teenagers and young children.

A snack is any food or drink consumed between main meals example interval between breakfast and lunch. Many factors contribute to snacking, these include to prevent the individual from becoming ravenously hungry; it is used to socialize and have fun with others; it helps workers to gain a few hours of focus and attention before the main meal thereby encouraging high productivity. Most importantly the main factor in snacking is the tasty taste of the snack. For a healthy snacking, every individual should ensure that the snack contains protein, fat, fiber and water. Snacking should be enjoyable and mentally satisfying as well.

The snacks commonly consumed include cake, chin-chin, doughnut, buns, meat pie, among others. These snacks are usually produced from wheat flour which is low in

protein content like yam and maize. Moreover, the cost of importation of wheat flour continues to increase with increasing demand from these snacks.

It is upon this background that the study is aimed at producing snacks using yam and maize as an alternative source of snacks production and also as a composite to reduce the high cost of wheat importation over-dependence on wheat. It will also encourage the use of locally available cereals and tubers for they are relatively cheap they have many nutritional and health benefits.

Objectives of the Study: To produce snack (cake and chin-chin). Using maize and yam flour in composition with wheat flour specifically the study aimed at:

i. Producing cake and chin-chin with maize, yam and wheat flour
ii. Evaluate the sensory evaluation of the snacks.
iii. Compare the wheat, maize and wheat/yam compositions with 100% wheat flour product.
iv.

MATERIALS AND METHODS

Materials:

Maize (*zeamays*) (white seeds) and yam (*discorea rotundata*) was purchased from Owerri main market (Ekeonunwa/Ekeukwu) Owerri, Imo State.

Preparation of samples

Maize and wheat seeds were cleaned, separated/sorted, washed and soaked overnight. The soaked cereals were rewashed and sundried for two days before milling. The seeds were hammer milled into flour (40mm mesh screen) and put in polyethylene bag. Yam tubers were first peeled, sliced, washed sundried and milled into flour (40mm mesh screen) and also put in polythene bag until used for the production of snacks.

Formulation of blends

Wheat flour, maize flour and yam flour were mixed in the ratio of 50:50 (wheat 50%, yam 50%) (wheat 50%, maize 50%) for the cake, and chin-chin production and 100% wheat, yam and maize were also used in the snacks production.

Production of snacks: (Cake, and chin-chin). The development and standardization of recipe were carried out based on original recipe made from wheat flour for cake and chin-chin production. These recipes were modified to reflect the flour combinations.

Table 1: Original recipe of the different snacks from wheat flour

Product	Wheat Flour	Sugar	Fat	Baking Powder	Yeast	Salt	Vanilla essence	Egg	Milk	Oil	Dried fruit
Cake	200g	125g	125g	1tsp	-	Pinch	1/2tsp	2	75mls	-	50g
Chin-chin	225g	1tsp	50g	1tsp	-	-	1/2tsp	1	75mls	1bottle	-

Table 2: Modification of recipe of the different snacks using maize flour

Product	Maize Flour	Sugar	Fat	Baking Powder	Yeast	Salt	Vanilla essence	Egg	Milk	Oil	Dried fruit
Cake	200g	125g	125g	1tsp	-	Pinch	1/2tsp	2	75mls	-	50g
Chin-chin	225g	1tsp	50g	1tsp	-	-	1/2tsp	1	75mls	1bottle	-

Table 3: Modification of recipe of the different snacks using yam flour

Product	Yam Flour	Sugar	Fat	Baking Powder	Yeast	Salt	Vanilla essence	Egg	Milk	Oil	Dried fruit	Water
Cake	200g	125g	125g	1tsp	-	Pinch	1/2tsp	2	75mls	-	50g	-
Chin-chin	225g	1tsp	50g	1tsp	-	-	1/2tsp	1	75mls	1bottle	-	1 ½ tsp

Table 4: Modification of recipe of the different snacks using 50:50 wheat and Maize flour

Product	Wheat flour/ Maize flour	Sugar	Fat	Baking Powder	Salt	Vanilla essence	Yeast	Egg	Milk	Oil	Dried fruit	Water
Cake	100+100g = 200g	125g	125g	1tsp	Pinch	1/2tsp	-	2	75mls	50g	-	-
Chin-chin	112.5+112.5g = 225	1tsp	50g	1tsp	Pinch	1/2tsp	-	1	75mls	-	1bottle	1 ½ tsp

Table 5: Modification of recipe of the different snacks using 50:50 wheat and yam flour

Product	Wheat flour/ Yam flour	Sugar	Fat	Baking Powder	Salt	Vanilla essence	Yeast	Egg	Milk	Oil	Dried fruit	Water
Cake	100+100g = 200g	125g	125g	1tsp	Pinch	1/2tsp	-	2	75mls	50g	-	-
Chin-chin	112.5+112.5g = 225	1tsp	50g	1tsp	Pinch	1/2tsp	-	1	75mls	-	1bottle	1 ½ tsp
Doughnut	125+125g =250g	50g	50g	-	Pinch	-	1/2tsp	2	-	1bottle	-	75mls

METHOD OF PREPARATION

Chin-Chin

- Sieve flour
- Add up all dry ingredients, salt, nutmeg, baking powder, sugar etc
- Rub margarine into the flour
- Make a well in the centre, pour in the beaten egg
- Add milk and water to bind to a stiff dough, knead until smooth
- Lightly roll to 1cm thickness on a floured board, then cut into cubes
- Fry in hot oil until golden brown, drain

Cake

- Cream sugar and fat together until soft, white and creamy
- Add the beaten eggs by degrees, continuing the creaming between each addition. If mixture begins to curdle, add a little flour to make it smooth again.
- Add a little milk
- Add baking powder into the flour and then dried fruits
- Mix well to keep the mixture in a soft dropping consistency
- Rub the baking pan with fat and pour in the mixture
- Bake in a moderate oven for 30minutes

Sensory Evaluation

Cake and chin-chin samples including 100% wheat (control) yam and maize flour were evaluated by a panel of 25 judges for the sensory attributes of colour, taste, texture, aroma and overall acceptability using a 5point structured hedonic scale. Key for the scoring was; 5-very good, 4 = good, 3 = undecided, 2 = fairly good, 1 = not good at all.

The judges consisted of students and staff of the Department of Home Economics AIFCE, Owerri, familiar with these snacks quality characteristics. The assessments were conducted in well lit room designed for sensory evaluation. Drinking water was provided for the judges to rinse their mouth between evaluations.

Data and Statistical Analysis

Data from the study were statistically analyzed using ANOVA. Means were separated and judged at $P<0.05$

Results

Table 6: Respondents mean rating on the colour of 100% wheat flour cake, 100% maize flour cake, 100% yam flour cake, combination of 50:50 wheat flour and maize flour cake and also a 50:50 wheat flour and yam flour cake (n=20)

Product	FX	N	X	Remark
100% wheat flour cake	89	20	4.45	Accepted
100% maize flour cake	92	20	4.6	Accepted
100% yam flour cake	82	20	4.1	Accepted
50:50 wheat flour and maize flour cake	66	20	3.3	Unaccepted
50:50 wheat flour and yam flour cake	91	20	4.55	Accepted

The above table shows that the colour of cake 100% wheat flour, 100% maize flour, 100% yam flour and combination of wheat and yam flour were rated accepted, but the 50:50 wheat and maize flour cake colour was unacceptable.

Table 7: Respondents mean rating on the texture of 100% wheat flour cake, 100% maize flour cake, 100% yam flour cake, 50:50 wheat flour and maize flour cake and 50:50 wheat flour and yam flour cake (n=20).

Product	FX	N	X	Remark
100% wheat flour cake	89	20	4.0	Accepted
100% maize flour cake	83	20	4.6	Accepted
100% yam flour cake	78	20	3.9	Accepted
50:50 wheat flour and maize flour cake	70	20	3.9	Accepted
50:50 wheat flour and yam flour cake	70	20	4.3	Accepted

The above table shows that the texture of cake was acceptable in all the cake products.

Table 8: Respondents mean rating on the shape of 100% wheat flour cake, 100% maize flour cake, 100% yam flour cake, combination of 50:50 wheat and maize flour cake and combination of 50:50 wheat and yam flour cake (n=20).

Product	FX	N	X	Remark
100% wheat flour cake	89	20	4.5	Accepted
100% maize flour cake	87	20	4.15	Accepted
100% yam flour cake	78	20	3.9	Accepted
50:50 wheat flour and maize flour cake	73	20	3.65	Accepted
50:50 wheat flour and yam flour cake	88	20	4.4	Accepted

The above table shows that the shape of cake were acceptable, although the 100% wheat flour cake were the most acceptable to the respondents.

Table 9: Respondents mean rating on the taste of 100% wheat flour cake, 100% maize flour cake, 100% yam flour cake, combination of 50:50 wheat and maize flour cake and 50:50 combination of wheat and yam flour cake (n=20).

Product	FX	N	X	Remark
100% wheat flour cake	85	20	4.25	Accepted
100% maize flour cake	82	20	4.1	Accepted
100% yam flour cake	69	20	3.45	Unaccepted
50:50 wheat flour and maize flour cake	65	20	3.25	Unaccepted
50:50 wheat flour and yam flour cake	83	20	4.15	Accepted

The above table shows that the taste of cake were acceptable, for 100% wheat flour, 100% maize flour and 50:50% wheat/yam flour. The taste of the 100% yam flour and 50/50 wheat and maize flour cake were unacceptable.

Table 10: Respondents mean rating on the overall appearance of 100% wheat flour cake, 100% maize flour cake, 100% yam flour cake, combination of 50:50 wheat flour and maize flour cake and combination of 50:50 wheat and yam flour cake (n=20).

Product	FX	N	X	Remark
100% wheat flour cake	82	20	4.1	Accepted
100% maize flour cake	77	20	3.85	Accepted
100% yam flour cake	68	20	3.4	Unaccepted
50:50 wheat flour and maize flour cake	63	20	3.15	Unaccepted
50:50 wheat flour and yam flour cake	73	20	3.65	Accepted

The above table shows that the overall appearance of cake for 100% wheat/yam flour, 100% maize flour and 50:50 wheat/yam flour were acceptable, 100% yam flour cake and 50:50 wheat and maize flour cake were unacceptable to the respondents.

Table 11: Respondents mean rating on the colour of 100% wheat flour chin-chin, 100% maize flour chin-chin, 100% yam flour chin-chin, combination of 50:50 wheat flour and maize flour chin-chin and combination of 50:50 wheat and yam flour chin-chin (n=20).

Product	FX	N	X	Remark
100% wheat flour chin-chin	8	20	4.25	Accepted
100% maize flour chin-chin	81	20	4.05	Accepted
100% yam flour chin-chin	80	20	4.0	Accepted
50:50 wheat flour and maize flour chin-chin	79	20	3.95	Accepted
50:50 wheat flour and yam flour chin-chin	73	20	3.65	Accepted

The table above shows that the colour of chin-chin was all acceptable to the respondents despite the composition of the flour.

Table 12: Respondents mean rating on the texture of 100% wheat flour chin-chin, 100% maize flour chin-chin, 100% yam flour chin-chin, 50:50 wheat flour and maize flour chin-chin and 50:50 wheat and yam flour chin-chin (n=20).

Product	FX	N	X	Remark
100% wheat flour chin-chin	85	20	4.25	Accepted
100% maize flour chin-chin	67	20	3.35	Unaccepted
100% yam flour chin-chin	67	20	3.35	Unaccepted
50:50 wheat flour and maize flour chin-chin	73	20	3.65	Accepted
50:50 wheat flour and yam flour chin-chin	81	20	4.05	Accepted

The table above shows that the texture of chin-chin were all acceptable except 100% maize flour chin-chin, 100% yam flour chin-chin which was unacceptable to the respondents.

Table 13: Respondents mean rating on the shape of 100% wheat flour chin-chin, 100% maize flour chin-chin, 100% yam flour chin-chin, 50:50 wheat flour and maize flour chin-chin and 50:50 wheat and yam flour chin-chin (n=20).

Product	FX	N	X	Remark
100% wheat flour chin-chin	85	20	4.25	Accepted
100% maize flour chin-chin	75	20	3.75	Accepted
100% yam flour chin-chin	78	20	3.9	Accepted
50:50 wheat flour and maize flour chin-chin	80	20	4.0	Accepted
50:50 wheat flour and yam flour chin-chin	80	20	4.0	Accepted

The table above shows that the shape of chin-chin was all acceptable to the respondents, despite the flour composition.

Table 14: Respondents mean rating on the taste of 100% wheat flour chin-chin, 100% maize flour chin-chin, 100% yam flour chin-chin, 50:50 wheat flour and maize flour chin-chin and 50:50 wheat and yam flour chin-chin (n=20).

Product	FX	N	X	Remark
100% wheat flour chin-chin	83	20	4.15	Accepted
100% maize flour chin-chin	79	20	3.95	Accepted
100% yam flour chin-chin	71	20	3.55	Accepted
50:50 wheat flour and maize flour chin-chin	75	20	3.75	Accepted
50:50 wheat flour and yam flour chin-chin	80	20	4.0	Accepted

The table above shows that the taste of chin-chin was all acceptable to the respondents, despite the flour composition.

Table 15: Respondents mean rating on the overall appearance of 100% wheat flour chin-chin, 100% maize flour chin-chin, 100% yam flour chin-chin, 50:50 wheat flour and maize flour chin-chin and 50:50 wheat and yam flour chin-chin (n=20).

Product	FX	N	X	Remark
100% wheat flour chin-chin	80	20	4.0	Accepted
100% maize flour chin-chin	70	20	3.5	Accepted
100% yam flour chin-chin	65	20	3.25	Unaccepted
50:50 wheat flour and maize flour chin-chin	67	20	3.35	Unaccepted
50:50 wheat flour and yam flour chin-chin	74	20	4.7	Accepted

The table above shows that the overall appearance of chin-chin was acceptable, except 100% yam flour and 50:50 wheat and maize flour which were unacceptable by the respondents.

Discussion of Findings

The study focused on the use of maize and yam flour in the production of snacks. The result revealed that maize flour and yam flour were, successful in the production of snacks like cake and chin-chin. This finding is in agreement with Okoro (1992) that maize flour and yam flour could be used in making of snacks and pastries.

The result of the experiential cookery revealed that the colour and texture evaluation of the different cake showed that colour and texture evaluation of the different cake showed that maize flour caked were acceptable to the respondents. This finding agrees with Nwokoma (2003) that maize flour can be used in so many ways such as maize starch used in thickening of sauces and puddings. Also 50:50 combination of wheat flour and maize flour cake were unacceptable. However, the taste and overall appearance of maize flour and yam flour were also acceptable except in 50:50 combination of wheat flour and maize flour cake, 100% yam flour cake were not accepted is that yam is less in gluten. Also why 50:50 wheat and maize flour cake combination were not accepted is that the gluten found in wheat flour will not be enough to do the work it suppose to do when only wheat flour is used for baking.

The colour of the 100% wheat flour chin-chin was more attractive and accepted than 100% yam flour chin-chin. The shape and taste of maize flour chin-chin were acceptable to the respondents. This fining is in agreement with Onyemoabi, Ihekoronye and Okoro (2005) that maize can be turned into maize starch which is made into pap for human consumption. But the texture and overall appearance of maize flour chin-chin, yam flour chin-chin, and 50:50 wheat and maize flour chin-chin were rated unacceptable.

Summary

This research aimed at ascertaining the performance and suitability of maize and yam flour in the production of snacks like cake and chin-chin. Specifically the study determined how cakes and chin-chin made from maize and yam flour compared with cake and chin-chin made from wheat flour and those made from the 50:50 combination of

wheat and maize flour and 50:50 combination of wheat and yam flour in terms of colour, texture, shape, taste and overall appearance.

The snacks (cake) from wheat flour were produced using original recipe of cake production using wheat flour, cake and chin-chin produced from maize and yam flour and the combinations with wheat flour were made through the modification of wheat flour recip. Cakes were made using baking method while the chin-chin were made using frying method.

The study used 20 panel of judges for the sensory evaluation using 5point hedonic scale. The cut off mark for the mean was 3.5 and anyone below the cut off mark was regarded as unacceptable.

The study highlighted the importance of maize and yam flour in the nutritional, social and economic development of the nation. It revealed that maize and yam flour can be effectively used in the production of snacks especially with the combination of wheat flour thereby encouraging indegemaise maize and yam farming and reducing the cost of wheat importation.

Conclusion

This study revealed that maize and yam processed into flour and can be used for snacks production. These findings will help Nigeria and its citizens realized that there are alternative raw materials in snacks production which can be harnessed locally. This will reduce over dependence on wheat and its flour.

The findings from the sensory evaluation of the products (cake and chin-chin) made from wheat/maize and wheat/yam combination showed that the attributes of cake (made from). However, the colour, taste and overall appearance of the 50:50 wheat/maize blend were not acceptable to the judges and also the overall appearance of the 50:50 wheat/maize chin-chin was not acceptable to the judges. This implies that for a better acceptability, the quantity of the wheat should be increases for example 60:40 and 70:30 ratios of wheat/maize and wheat/yam combinations.

Recommendations

Awareness should be created to the public on the effectiveness of the one of local cereals and tubers like maize and yam in the production of snacks and pastries with wheat combinations.

Government should encourage farmers to produce these local cereals and tubers and ensure that pastry industries use these local raw materials thus enhance patronage.

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