Development and Evaluation of the acceptability of coconut composite ginger bread on the Ghanaian market

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ABSTRACT
Bread made with wheat flour is an important part of the diet of many in the world. A substantial amount of wheat flour imported from Europe is used in bakeries. However, refined wheat flour is not a good source of dietary fiber. Therefore, partial substitution of wheat by other locally available raw materials in the bakery can be undertaken in order to improve the nutritional value of bread. Coconut flour was used as an alternative to wheat flour because of its unique and excellent flavour, rich in fiber, vitamins, and minerals. The research used coconut flour as a composite in ingredient into wheat flour, in ginger bread making to increase the consumption level of coconut and the varieties of breads in the market in Bolgatanga. A primary source of data collection was used for this research work. Structured questionnaire and simple random sampling techniques were used to obtain 60 respondents from bread sellers and consumers in Bolgatanga Municipality. From the results it was obvious that the consumers were very much satisfied with the taste, texture, colour, aroma and the after taste of the coconut flour bread produced. The study revealed that consumers and sellers were content with the overall product and is ready to buy or recommend it for commercial, retail and domestic consumption. Finally, the sellers and the consumers preferred 70% coconut flour and 30% wheat flour composite ginger bread. Based on the results it was recommended that small improvement to make on the texture and be produced in commercial quantity for mass consumption and people should support and promotion of the usage of coconut since it is nutritionally beneficial to the human.

Key words: Bread, bakery, Coconut flour, ginger bread, consumers, Bolgatanga

Introduction
A possible substitute to the well-known wheat and other grain flours is the coconut flour. It is unique and has an excellent flavour. The botanical name for the coconut plant is cocos nucifer, a large palm growing up to 30m (98 feet) tall with pinnate leaves. Well known locations where the coconut plant is found are around Coastal towns and villages such as Cape Coast, Sekondi-Takoradi, Anloga, Keta, Accra and other inland towns in Ghana (Bawalan, 2000).

The uses of coconut flour for baked goods, tasty snacks or healthy main dishes cannot be underrated, this is so because of its distinctive nutrient and fiber composition that distinguishes it from the more commonly seen soy, nut, rice, corn and potato based flours. It is estimated that about 22% of the total calories of the diet of people across the world is obtained from coconut. It is noteworthy that coconut flour can be incorporated with wheat flour in order to improve the health benefits of bread. Again, numerous
research have been done to assess the possibilities of adding natural ingredients to improve the nutritive value of wheat bread (Becker, 1989) and Klava (2004) for instance studied the possibilities of incorporating apple as a source of dietary fibre in wheat bread.

Other researchers have also recommended the addition of wheat bran, wheat whole grain and mixtures of different seeds, grain of other cereals, (oat, rye and barley), dry fruit or probiotic bacteria to improve the nutritional value of various wheat food products (Bodroza-Solarou, Bojanaetal, 2008). The pivotal consideration in embarking on this present study is being done with the objective of utilizing coconut flour for human consumption as a composite with wheat flour in ginger bread making. Coconut is mostly grown in almost all the regions in Ghana but people have less knowledge about its usage. Apart from eaten it raw and extraction of oil, it can be used as wheat flour substitute or in combination to produce other products to curtail the cost of importing wheat flour in the country.

Coconut is rich in fiber, vitamins and minerals. It is an important multipurpose crop providing essential amenities for human life. It provides a nutritious source of meat, juice, milk and oil that has fed and nourished populations around the globe for years. It is a staple ingredient in the diet of most Island communities. It is estimated that nearly one third of the world’s population depend on coconut to an appreciable degree for their food and their economy.

Coconut flour is soft, flour like product made from the pulp of a coconut. It is actually a by-product made during the coconut milk making process. Coconut flour can be used much like wheat flour to make a multitude of delicacies, cakes, smacks, desserts bread, pies and cookies. Importantly, coconut flour also provides a good source of protein. It contains more protein than enriched flour, cornmeal and also as much as wheat flour.

Coconut is mostly grown in almost all the regions in Ghana but people have less knowledge about its usage. Apart from eaten it raw and extraction of oil, it can be used as wheat flour substitute or in combination to produce other products to curtail the cost of importing wheat flour in the country. It is for these many functional traits of the coconut flour that this research seeks to use coconut flour as a composite ingredient into wheat flour in ginger bread making.

The Nutritional Value of Coconut flour
The composition of Coconut flour depends on the remains of components after the extraction of coconut milk or oil from desiccated coconut. Below is the composition of coconut flour produced by two different methods.

Hagenmaier (1983) reported that coconut flour contains 7.6% protein, 14% oil, approximately 17% Crude fiber and 5% moisture. Arancon (1999), states nutrient composition of coconut flour as, protein 13.41%, moisture 2.80%, crude fat 10.23% and crude fiber 19.3%. Trinidad et al, (2006) reported that the dietary fiber content of coconut flour was 60.0+1.1.0g/100g sample, 56% insoluble and 4% soluble.

The Health Benefits of Coconut Flour
Trinidad (2001), reported that coconut flour is a nutritious and healthy source of dietary fiber. Fife (2005) states that it is free of Trans fatty acids and low in carbohydrates. Coconut flour may play a role in controlling cholesterol and sugar levels in blood and prevention of colon cancer. Studies revealed that high fiber coconut flour content increases fecal bulk (Arancon, 1999).

It is also known to prevent risk of chronic diseases such as cancer, cardiovascular diseases and diabetes mellitus. It enhances water absorption in the colon, thus prevent constipation.

Dietary fiber has the ability to bind with bile acids and prevent its reabsorption in the liver (Brussels, 1994). Butyrate enhances cell differentiation, thus, preventing tumor formation in the colon (Wolever et al., 1992).

Dietary fiber’s viscoce and fibrous structure can control the release of glucose with time in the blood by helping in the proper control and management of diabetes mellitus and obesity (Brussels, 1994).

Coconut Flour-Food Application
Coconut residue represents approximately 25-50% of the weight of the grated kernel in a wet
basis. This is depending on the coconut milk extraction process that is used. Dried coconut milk residue can be used in making fiber-enriched foods, and in the formulation of functional foods because of its high dietary fiber content. The milk residue is used in baking food products such as breads and cookies. It is also used in the dry state for making sweets, chutney powder and as a thickening agent in curries. (Madhavan et al., 2005)

The Food and Nutrition Research Institute of Department of Science and Technology (DOST-FNRI) supports the above application of coconut flour as a potential application. The (DOST-FNRI) believes that this process is on way to lower the cost of bakery products. FNRI also said that coconut flour has a total dietary fiber (TDF) content that is even greater than the popular dietary fiber source like oat bran and flaxseed (Mauro, 2013).

Rodgers (2004), it is apparent that coconut flour can be incorporated with wheat flour in order to improve the health benefits of bread. Similar studies have been conducted to assess the possibilities of adding natural ingredients to improve the nutritive value of what bread (Klava 2004).

Research Design and Methodology

The study was focused on using coconut flour in the production of ginger bread. Research methodology included the use of questionnaires as primary data of the study. Useful information was collected from literature such as academic journals, recipe books, magazines, internet; text books will form the secondary data. Quantitative and qualitative techniques were employed to achieve the above mentioned aims. On the qualitative technique, descriptive statistics in the form of tables and figures were used to give pictorial representative aspect.

Source of Raw material

Uniform and healthy coconut fruits were bought from Bolgatanga market were selected for processing. The nuts were washed with tap water, dried to get rid of the sticky flesh covering. The surface was sterilized with 5% hydrogen peroxide for fifteen minutes.

Population of the study

Bread sellers and consumers especially those in the Sumbrungu community in the Bolgatanga Municipality of the Upper East Region were targeted.

Sampling size and Sample procedure

The researcher adopted the purposive and convenience sampling techniques to get the consumers and sellers in Sumbrungu in order to achieve the objective of the study. A sample size of sixty (60) made up of forty (40) consumers and ten (20) sellers were sampled across the market centre to ascertain their perception about the quality of the bread that was made from coconut flour to bring the total sample size to sixty (60). A sample of the product was presented to the respondents in order for them to taste and rank it by the following characteristics; taste, colour, flavour, and texture.

Data Collection Procedure

For sensory analysis, the research instrument involved the use of questionnaires. Respondents were permitted to taste and code sample of the bread that was provided in answering the research questions. Respondents were provided with water to rinse their mouth before and after tasting each sample.

Recipe For Using Coconut In Ginger Bread Making

Table 1: Product A (70% of wheat flour and 30% of coconut flour)

<table>
<thead>
<tr>
<th>INGREDIENTS</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coconut flour, sifted</td>
<td>60g</td>
</tr>
<tr>
<td>Soft flour</td>
<td>140g</td>
</tr>
<tr>
<td>Eggs</td>
<td>6</td>
</tr>
<tr>
<td>Coconut oil</td>
<td>200ml</td>
</tr>
<tr>
<td>Baking powder</td>
<td>1 teaspoon</td>
</tr>
<tr>
<td>Brown sugar</td>
<td>50g</td>
</tr>
</tbody>
</table>
### Procedure of Making Coconut Ginger Bread

Two tablespoons of honey were measured into a mixing bowl and 400 grams of coconut flour was mixed with the honey together with 170 grams of soft flour and 100 grams of margarine, 5 grams of yeast and 1 teaspoon of bicarbonate of soda. 6 large sizes of eggs were beaten together with ¾ cup full of brown sugar, 2 tablespoons of ground ginger and 2 tablespoons of ground cinnamon, ¼ teaspoon of salt were incorporated into the mixture. The mixture was then mixed to form stiff dough and the dough was kneaded to a smooth texture and allowed to prove in a warm place. The dough was checked and knocked back to allow the yeast mixed completely and also to expel oxygen from the dough. The dough was moulded into the individual loaf tins and allowed to rest for at least 20 minutes for it to reproof again and sent the oven to bake. Checked for the readiness of the bread, removed from the tin and allowed to cool before putting it into small polythene bags for sensory.

#### Process Flow Chart of Coconut Ginger Bread

1. Weighing of ingredients into a mixing bowl
2. Rubbing in margarine
3. Adding beaten eggs mixture
4. Mixed mixture together to stiff dough and knead
5. Allow to prove for at least 30 minutes
6. Check dough and knock back and prove again for 20 mns
7. Knock back again and mould into greased loaf tins
8. Allow to rest for 10 minutes and back in an oven for 30 minutes at a temperature of 200 degrees
9. Remove from oven, cool
10. Package in zip rubber

### Data Collection Instrument

Structured questionnaires were used to ensure the uniformity in the study. The primary data collection was done through self-administered questionnaire. Open and close ended questions, multiple option and rating questions were designed to provide convenience to respondents while obtaining appropriate data. Questionnaires, was used for the collection of data.

### Method of Data Analysis

In this study, non-parametric statistics was the major techniques used in analyzing the data collected. Tables and figures were used to summarize the results obtained from the research with the help of Microsoft Excel and the Statistical Software known as the Statistical Package for Social (SPSS).

### RESULTS AND DISCUSSIONS

#### Respondent Profile

<table>
<thead>
<tr>
<th>Age group</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>21-25</td>
<td>13</td>
<td>22.0</td>
</tr>
<tr>
<td>26-30</td>
<td>29</td>
<td>48.0</td>
</tr>
<tr>
<td>31-35</td>
<td>18</td>
<td>30.0</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
<td>100.0</td>
</tr>
</tbody>
</table>

*Source: field survey, June, 2016*

Out of the 50 people interviewed, 13(22%) fell within the age group of 21-25 years, 29(48%) of

### Table 2: Product B (60% of wheat flour and 40% of coconut flour)

<table>
<thead>
<tr>
<th>INGREDIENTS</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coconut flour, sifted</td>
<td>80g</td>
</tr>
<tr>
<td>Soft flour</td>
<td>120g</td>
</tr>
<tr>
<td>Eggs</td>
<td>6</td>
</tr>
<tr>
<td>Coconut oil</td>
<td>200ml</td>
</tr>
<tr>
<td>Baking powder</td>
<td>1 teaspoon</td>
</tr>
<tr>
<td>brown sugar</td>
<td>50g</td>
</tr>
</tbody>
</table>
the respondents fall under the age group of 26-30 whilst 18(30%) had their age to be within 31-35. Hence the age group of 26-30 constitutes the majority in bread consumption.

**Table 6: Educational Background of the Respondents**

<table>
<thead>
<tr>
<th>Level</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic</td>
<td>6</td>
<td>12.0</td>
</tr>
<tr>
<td>Secondary</td>
<td>2</td>
<td>4.0</td>
</tr>
<tr>
<td>Tertiary</td>
<td>24</td>
<td>48.0</td>
</tr>
<tr>
<td>Others</td>
<td>18</td>
<td>36.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>50</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

*Source: field survey, June, 2016*

Table 6 displays the results of educational level of respondents. From the table greater number of the people who fall under tertiary level 24(48%), 6(12%) respondents fell under basic level and those under senior high level were 2(4%) and another 18(36%) had his education in technical institution. It can be confirmed that majority (48%) of the respondents attained tertiary education whilst senior high education was the least (4%).

While the remaining 12% respondents said no, they do not use them as they indicated the diagram 1. The result implies that majority (88%) of the respondents use coconut for different purposes.

**Figure 1: The consumption level Coconut in the Upper East Region**

*Source: field survey, June, 2016*

As present in figure (1) 88% out of the 50 respondents use or consume coconut when they were contacted to find out whether they use coconut or its other products as they responded yes.

**Figure 2: forms in which coconut is used**

*Source: field survey, June, 2016*

Figure 2 presents the various ways in which yellow corn is used; from the 60 respondents contacted 33.5% of respondents use the seeds of yellow corn while the majorities who are from 62.5% of the respondents use the powder form of the crop to produce finished products for further or final use. This implies that the powder form of the crop is more useful that the seed as indicated by the majority (62.5%) of the respondents.

**Table 3: what respondents use coconut for**

*Source: field survey, June, 2016*

When the respondents were asked what they use coconut for, 30% said they use it to prepare cakes, 15% of the respondents said they use coconut to
cook rice, 10% of consumers use it in biscuits making, 5% respondents use the coconut flour to make bread, and lastly 30% respondents consume the raw nut. The findings indicate that coconut has so many uses and some are yet to be discovered hence more effort is needed to discover the uses of this nitrous nut for human. This findings obtained is in line with the existing literature as the flour is used as coconut flour were prepared as follows: pan de sal, granola bar, cinnamon bread, multigrain loaf, choco chip cookies, hotcake (15%), choco crinkles, carrot cake, macaroons, brownies (Wolever et al, 1992).

Figure 4 the awareness of other products of coconut
Source: field survey, June, 2016
Out of the 60 respondents contacted to find out their awareness of other products of coconut, it was discovered that 92% of the respondents are aware of other products of the nut while 8% responded no, indicating that they do not know other products of coconut. Even though the coconut have certain minerals in their right proportions suitable for the effective and efficient growth and maintenance of the human body not all people know the products of it.

Sensory Evaluations and Acceptability of Coconut Flour Ginger bread

Figure 5: the Taste of the Coconut Ginger Bread
Source: field survey, June, 2016
After tasting and observing the yellow corn cake by 4% of the people contacted like the taste, 36% respondents liked the taste much and the remaining 60% consumers liked the taste of product very much. This shows that consumers were satisfied with the taste of the coconut ginger bread.

Figure 6: Texture of the Coconut Ginger Bread
Source: field survey, June, 2016
In the case of the texture of the product consumers were asked to tick their views or indicate their level of likeness, from the 60 respondents 24% ticked liked much and the rest of the 76% ticked liked very much. This means that consumers were much
pleased with the texture of the product as many of like it very much.

Figure 7: the Colour of the Coconut Ginger Bread
Source: field survey, June, 2016

Figure 7 indicates the level of likeness consumers of cakes have for the yellow corn cake produced. Out of the 60 respondents, 8% of them liked the colour, 36% consumers liked it much and 56% liked the colour very much. These results are opinions of consumers about the colour of the coconut ginger bread product.

Figure 8: Aroma of the Coconut Ginger Bread
Source: field survey, June, 2016

Out of the 60 respondents that were interviewed on the aroma of a coconut ginger bread given to them to taste and comment on it, 50% person liked the aroma, 35% other consumers liked the aroma of the product much and another 15% of the respondent liked the aroma very much. This means that the consumers were gratified with the aroma of the coconut ginger bread produced.

Figure 9: After Taste the Coconut Ginger Bread.
Source: field survey, June, 2016

These are the comments made by the respondents about the after taste of coconut ginger bread after been consumed by them. As indicated in the figure 9 8% of the consumers contacted liked the after taste of the product, 24% of them ticked liked much and the majority representing 68% of the consumers liked the after taste of the product very much. The implication is that the respondents were content with the after taste of the bread.

Table 9: Rating the Products as a Whole

<table>
<thead>
<tr>
<th>Response</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very good</td>
<td>20</td>
<td>33.0</td>
</tr>
<tr>
<td>Good</td>
<td>30</td>
<td>50.0</td>
</tr>
<tr>
<td>Poor</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>Not sure</td>
<td>6</td>
<td>10.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>60</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Source: field survey, June, 2016

From table 9, it was noticed that 20 of the respondents representing 33% rated the product is very good, 30 (50%) of the respondents said the product was good, 4(7%) of the respondents said the product was poor whilst the remaining 6 (10%)
were doubtful. This shows that consumers were satisfied with the overall product.

**Table 10: Buying the Product in Commercial Quantity**

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>20</td>
</tr>
<tr>
<td>Yes</td>
<td>40</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
</tr>
</tbody>
</table>

*Source: field survey, June, 2016*

In an interviewed with respondent as to whether they would agree to buy the cake in commercial quantity for retail. 33% said no whilst the remaining mass of 40 respondents representing 67% responded yes. This shows that there will be ready market for the product if it produced in large quantity.

**Table 11: Recommending the Product to Other Cakes Consumers**

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>9</td>
</tr>
<tr>
<td>Yes</td>
<td>51</td>
</tr>
<tr>
<td>Total</td>
<td>60</td>
</tr>
</tbody>
</table>

*Source: field survey, June, 2016*

From the 60 consumers contacted 51(85%) of them said they will recommend the cake to other consumers whereas the 9(15%) consumers left said they will not recommend it to others which will be a leakage of once secret fine delicacy.

**Table 12: the Final Comment about the Coconut Ginger Bread.**

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Good</td>
<td>20</td>
</tr>
</tbody>
</table>

On the final comment on the cake by the consumers 20 (33%) said the bread is nutritious for domestic and commercial use, 14(23%) recommended that texture should be improve and added to other products by caterers, 8(13%) of the respondents said the bread have attractive appearance. The remaining 12(20%) consumers said the bread taste very good.

**Conclusion**

The conclusion of the study is that coconut can be used to prepare so many dishes and it was not surprise to see nutritious ginger bread being prepared from coconut.

It can be deduced from the finding that the coconut ginger bread has the much needed nutrients for humanity and they were very satisfied with the taste, colour, and aroma and after taste of the bread and recommended that the texture should be improve upon.

**Recommendations**

The researcher would like to make the following recommendations:

i. The food industries (beverage industry like Nestle Ghana Limited and others) should adopt or incorporate the use of coconut in their food processing.

ii. Government should create avenue for small scale business enterprises to encourage people to venture into the processing of Ghana’s raw materials into finished goods to add value to Ghanaian products.

iii. Government should also create organizations that will process and manufacture the coconut ginger bread in larger quantities for people who want to involve themselves in that business since it is a source of business creation.

iv. The Ministry Of Health should also support and promote the usage of coconut products since the nut is nutritionally beneficial to human health.
REFERENCES