Consumer acceptability of wheat/cassava composite bread.

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Abstract: Bread is traditionally made from common wheat (*Triticum aestivum*) flour dough that is cultured with yeast, allowed to rise, and finally baked in an oven, but in some cuisines breads are steamed and fried. The possibility of using flours derived from roots and other food resources for producing bread has not been extensively explored, although there are a number of root crops that are of economic importance all the world over from which flours are made for various uses. Producing composite bread from flours from such root crops such as cassava will boost its uptake since the consumption of bread is rising in Ghana and other sub-Saharan African countries where large volumes of cassava are cultivated. In this study, composite bread was prepared with High Quality Cassava Flour (HQCF) and wheat flour in the ratio of 1:4 (20% HQCF) and served with either tea, cocoa drink, *koko* (local porridge) or Tom Brown (brown porridge) to 1,497 senior high school students from 8 senior high schools in the Volta and Greater Accra regions of Ghana to test their acceptability. The results showed that the students rated the bread high on the nine point Hedonic scale, particularly those in single sex schools. The bread was generally accepted by the students and the students were ready to take the composite bread as part of their breakfast menu. The result is good for the cassava industry in Ghana since stakeholders of the industry in Ghana and the nation on the whole has a lot to gain if the composite bread is consumed by Ghanaians.
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1. Introduction

Bread is food prepared by cooking dough made of flour, water and other ingredients. Bread is the staple food in Europe, European-derived cultures such as the Americas, and the Middle East and North Africa, as opposed to East Asia whose staple is rice (http://en.wikipedia.org/wiki/bread#). Though Bread is a staple in the above mentioned geographical regions, it is now one of the most consumed foods in the whole world including Ghana. Bread has become a major food item that compliments *koko* (traditional porridge) or Tea/Milo/Coffee beverage for a breakfast menu in Ghana. Bread is usually made from wheat-flour dough that is cultured with yeast, allowed to rise, and finally baked in an oven but in some cuisines breads are steamed and fried. Owing to its high levels of gluten (which gives the dough sponginess and elasticity), common wheat, *Triticum aestivum* (also known as bread wheat) is the most common grain used for the preparation of bread, but bread is also made from the flour of other wheat species (including *T. durum*, *T. spelta* and *T. dicoccum*), rye, barley, maize (corn), and oats, usually, but not always, in combination with wheat flour. Salt, fat and leavening agents such as yeast and baking soda are common ingredients, though bread may contain other ingredients, such as milk, egg, sugar, spice, fruit (such as raisins), vegetables (such as onion), nuts (such as walnut) or seeds (such as poppy). All the flours mentioned above are derived from grains. The possibility of using flours derived from roots and other food resources for producing bread has not been extensively explored. However, there are a number of root crops that are of economic importance all the world over. These include cassava that is extensively used in Africa, South America and the Caribbean. Others are potatoes, sweet potatoes and yam. Flours have been developed from these roots and used for various purposes. Cassava flour is used to make composite pastries and even 100% cassava flour products (Eddy *et al*, 2007). However, production and adoption of composite cassava bread will boost the uptake of cassava tremendously along the value chain, because the volume of bread consumed in Africa is becoming increasingly large and this will increase the income of farmers, cassava processors and bakers.

As mentioned earlier, cassava is one of the most important root crops in Africa whose flour could be exploited in combination with wheat flour for baking bread. Sixty percent of the population of sub-Saharan Africa (SSA) depends on cassava as a staple food crop (Dziedzoave *et al*, 2006). Through its production, marketing and processing, cassava provides a major source of household income, often for women and the very poor. Cassava is currently utilized in Africa for two main purposes: human food and industrial usage (Oduro *et al*, 2000). Estimates for the percentage of cassava used for industrial utilization range from 5 to 16%; one of such industrial products is High Quality Cassava Flour (HQCF) which has gained popularity in the West African sub region over the past few years,

while the rest is used directly for human consumption. Most of cassava's industrial utilization is for animal feed (RTIMP, 2004). About 10% of its industrial demand consists of high quality cassava flour used in biscuits and other confectioneries, dextrin, pre-gelled starch for adhesives, and starch for pharmaceuticals and seasonings (RTIMP, 2004). However, for effective, uptake of HQCF in bread production, the product (bread) should be acceptable to the consumers. It is only then the adoption rate will be fast and high. The main aim of this work was to test the consumer acceptability of composite bread prepared from HQCF and wheat flour which was served to students in senior high schools in two regions of Ghana.

1.1 Objective of the study

The broad objective of the study is to promote the use of HQCF as an alternate industrial raw material for the bakery and pastry industries in Ghana so as to ensure food security and also to enhance the income levels of cassava farmers, processors and other stakeholders in the cassava industry in Ghana. The specific objective is to test the acceptability levels of consumers of wheat/cassava composite bread in Ghana starting with senior high schools students in selected senior high schools in Volta and Greater Accra regions of Ghana.

2. Methodology

HQCF for baking the bread was obtained from Caltech Ventures, Ho, Ghana. The HQCF was prepared using the standard methods specified in the training manual (Vowotor *et al,* 2009) provided by CSIR-Food Research Institute, Accra, Ghana. The Wheat flour was obtained from Takoradi Flour Mills Ltd, Ghana.

2.1 Selection of Senior High Schools.

Visits were made to senior high schools in the Volta and Greater Accra regions of Ghana to discuss the research work/project with management of potential schools. The criteria for selection of potential schools included (a) number of students in the boarding house (b) whether the school kitchen had facilities for baking bread and (c) the willingness of the head of the school to permit the team to carry out the work. Ten schools were selected at the end of the tour but the research was done in eight schools due to the late decision of two schools to opt out.

2.2 Training of Kitchen staff and mass baking of composite bread for consumer assessment.

The research team provided a day's training session on composite bread baking with HQCF and wheat flour for the kitchen staff of the selected schools. This was followed up by production of composite bread together with the research team from CSIR-FRI for the entire boarding population of the selected schools for a breakfast menu.

2.3 Formulation of composite bread

HQCF and wheat flour were used in the proportion of 1:4 to obtain 20% HQCF and 80% wheat flour composite bread. Other ingredients like milk, sugar, egg, margarine, salt, nutmeg, baking powder etc were added as in normal wheat bread preparation. The yeast added was more (100% more) than the normal yeast which is added to wheat bread of the same quantity. This was to allow early proofing of the dough for baking (Dziedzoave *et al*, eds., 2003)

2.4 Sensory Methodology

The students were provided with ballot sheets asking them to rate how much they liked each sample in terms of the following attributes: appearance, colour, taste, texture and mouthfeel. Rating was done on a 9-point hedonic scale with anchors; 1-dislike extremely and 9-like extremely. Also, provision was made on the ballot sheets for further comments from the students for liking and disliking the samples. The students were made to eat the bread with their breakfast menu according to the schools' meal plan in a day. The students were briefed about the bread and given a short training on answering the questionnaire just before the consumption of the breakfast menu after which they answered the simple questionnaire.

2.5 Statistical analysis

All data obtained from the students on the rating of the sensory attributes of the cassava bread were analysed using SPSS version 16.

3. Results and discussion

3.1 Consumer sample size

The students who participated in the consumer acceptability test were selected at random after they were briefed about the bread and given a short training on answering the questionnaire just before the consumption of the breakfast menu. About 20% of the boarding student population who ate the breakfast menu were selected for the test in each school. The total number of students selected in each school was as follows; School A – 167, School B – 168, School C – 277, School D – 202, School E – 147, School F – 209, School G – 161 and School H – 166.

3.2 Appearance

The appearance of the composite bread was liked by the students, however the students' responses to the appearance of the bread was significantly ($p<0.05$) different among the schools. Students in School H, Ho and School E, Accra, both of which are single sex (girls) schools liked the appearance of the bread very

much (7.8 and 7.11) compared to the other schools who liked the appearance of the bread slightly (5.4, 5.8 and 6.7) (Table 1).

3.3 Colour

Students in all the schools liked the colour of the composite bread especially students in the single sex schools E, F and H (7.4, 7.3 and 8.0) respectively. School F is a single sex (boys) school. Responses to the colour of the bread of students in the single sex schools were therefore significantly ($p<0.05$) different from that of students in the mixed sex schools (Table 1).

3.4 Taste

On the whole, the taste of the composite bread was acceptable as is evident by the fact that the taste was not rated below 6 (like slightly) on the hedonic scale. According to the analysis of variance, there was a statistically significant difference in panelists' liking of the taste of the bread. Students in Schools A, B and C liked the taste slightly (6.0) compared to students in Schools D, E, F and G who liked the bread moderately (6.8 and 7.2) and OLA who liked it very much (7.8)

3.5 Mouthfeel

Students in most of the schools rated the composite bread equally based on how the bread feels in the mouth at above 6.0 which indicates that they liked how the bread feels in the mouth. Students in schools G and H rated at a high score of 7.2 and 7.7 for mouthfeel of the bread.

3.6 Texture

The texture of the composite bread was rated on the positive side of the hedonic scale by the students in all the schools. However, analysis of variance shows that there was a statistically significant difference in panelists' liking of the texture of the bread with students in school H liking the texture of the bread very much compared to students in the other schools (8.0) (Table 1).

3.7 Overall acceptability

Panelists on the whole rated all the attributes of the cassava/wheat composite bread on the positive side of the Hedonic scale as shown in Table 1. The overall mean of acceptability all the 1497 students (consumers) was 6.44 as shown in Table 2. This was also on the positive side of the Hedonic scale. According to the analysis of variance, overall, the cassava bread was best accepted by students in the single sex schools compared to students in the mixed sex schools. This could be due to the fact that the opposite sex peer teenage factor that normally influence the general habits of students and in particular eating habits was non existence in the single sex schools. The students in the single sex schools therefore felt at ease to consume the bread and rated it as it was without pretending. Most of the students in the mixed sex schools may want to impress the opposite sex students by exhibiting that the bread was not good. This may have had influence on the comments of other students which could have led to the relatively low rating of the bread in the mixed sex schools. The authorities of most schools however testified that the attributes of the composite bread were good and that they would start the production of the bread to feed the children in order to cut down cost of feeding the students. This is because the market price of a 50Kg bag of the HQCF at the time of this work was half the price of 50Kg of Wheat flour.

Table 1. Means (±SD) and significance[1] for consumer acceptance testing of wheat/cassava composite bread.

	Sensory Attributes					
Schools	**Appearance**	**Colour**	**Taste**	**Mouthfeel**	**Texture**	**Overall acceptability**
A	5.44 ± 2.7^{a}	6.0 ± 2.3^{a}	6.0 ± 2.3^{a}	6.0 ± 2.4^{a}	5.0 ± 2.5^{a}	5.68 ± 2.6^{a}
B	5.45 ± 2.7^{a}	6.0 ± 2.3^{a}	6.0 ± 2.3^{a}	6.0 ± 2.4^{a}	5.3 ± 2.5^{a}	5.75 ± 2.6^{b}
C	5.4 ± 2.6^{a}	6.4 ± 2.1^{a}	6.0 ± 2.2^{a}	6.0 ± 2.3^{a}	5.1 ± 2.5^{a}	5.78 ± 2.7^{b}
D	5.8 ± 2.6^{a}	6.4 ± 2.1^{a}	6.8 ± 1.9^{b}	6.4 ± 2.2^{b}	6.0 ± 2.3^{b}	6.28 ± 2.6^{c}
E	7.1 ± 2.8^{cd}	7.4 ± 1.6^{c}	6.8 ± 1.9^{b}	6.8 ± 1.8^{bc}	6.8 ± 2.0^{c}	6.98 ± 2.0^{d}
F	6.7 ± 2.2^{bc}	7.3 ± 1.5^{c}	6.8 ± 1.4^{b}	6.4 ± 1.8^{b}	6.7 ± 2.0^{c}	6.78 ± 2.6^{c}
G	6.1 ± 2.6^{ab}	6.8 ± 2.0^{c}	7.2 ± 1.8^{b}	7.2 ± 1.7^{cd}	7.0 ± 2.1^{c}	6.86 ± 1.9^{d}
H	7.8 ± 1.7^{d}	8.0 ± 1.1^{d}	8.0 ± 1.5^{c}	7.4 ± 1.6^{d}	8.1 ± 1.2^{d}	7.86 ± 1.8^{d}

[1] values in the same column with different superscripts are significantly different at $p<0.05$.

[2] sensory attributes were evaluated on a 9-point hedonic scale as follows: 1-dislike extremely and 9-like extremely.

Table 2. Overall consumer acceptability means for wheat/cassava composite bread

Sensory Attribute	N	Minimum	Maximum	Mean
Appearance	1497	1	9	6.17 ± 2.6
Colour	1497	1	9	6.75 ± 2.0
Taste	1497	1	9	6.6 ± 2.1
Mouthfeel	1494	1	9	6.26 ± 2.3
Texture	1497	1	9	6.05 ± 2.5
Overall acceptability	1497	5.68	7.86	6.44 ± 0.7

4. Conclusion

The results showed that 20% wheat/cassava composite flour bread was acceptable to most students in senior high schools in the Volta and Greater Accra regions of Ghana. The recipe could be a viable alternative to 100% wheat bread which is consumed in large quantities in these schools. On the average, most of the schools eat bread four times as breakfast menu in a week. The number of times the bread is eaten in a week coupled with student population size in most of the schools is a major boost for the cassava industry if the composite bread is adopted by schools in Ghana. This will go a long way to promote food security and improve the income levels of stakeholders and create more jobs for the people of Ghana. This intervention through the schools may catch up with the entire populace of Ghana and in no time, the nation could cut down the cost on importation of wheat into Ghana thus saving substantial amounts on foreign exchange earnings.

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