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Sensory Evaluation of Toasted Bread Fortified with Banana Flour: A Preliminary Study

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Abstract

The use of whole wheat and banana flour blends in the production of toasted breads was studied, essentially, to determine the effect of banana flour on the sensory qualities of toasted bread. The flour blends of whole wheat and banana were composites at varying inclusion levels of 10, 20 and 30% as samples B, C and D respectively, while the whole wheat flour toasted bread (sample A) served as control. The bread loaves were produced using the straight-dough procedure and were subsequently evaluated for their sensory attributes. The sensory analysis showed that there was no significant difference between the whole wheat toasted bread and the banana fortified samples in the sensory attributes of taste, aroma, appearance and texture. While significant difference ($p < 0.05$) was observed in the overall acceptability. Our conclusion is that a substitution of up to 30% banana flour into wheat flour would give the toasted bread a high acceptability.

1. Introduction

Bread may be described as a fermented confectionary product produced mainly from wheat flour, water, yeast and salt by a series of process involving mixing, kneading, proofing, shaping and baking (Dewettinck *et al.*, 2008). The consumption of bread and other baked goods such as biscuits, doughnuts and cakes produced from wheat flour is very popular, but the low protein content of wheat flour, which is the most vital ingredient used for the production of different kinds of baked goods has been major concern in its utilization (Young, 2001).

However, wheat is a good source of calories and other nutrients but its protein is of lower nutritional quality when compared to milk, soya bean, pea and lupin proteins as its protein is deficient in essential amino acids such as lysine and threonine (Bakke and Vickers, 2007; Dewettinck *et al.*, 2008; Jideani and Onwubali, 2009). The use of white flour derived from the processing of whole wheat grain, which is aimed at improving the aesthetic value of white bread, has also led to the drastic reduction in the nutritional density and fibre content when compared to bread made from whole grain cereals (Maneju *et al.*, 2011). Recently, consumers' awareness of the need to eat high quality and healthy foods – known as functional foods, that is, foods which contain ingredients that provide additional health benefits beyond the basic nutritional requirements, is increasing (Ndife and Abbo, 2009). Therefore, the trend is to produce specialty breads

made from whole grain flour and other functional ingredients known as health breads or functional foods (Dewettinck *et al.*, 2008).

The banana fruit is a healthy, nutritious commodity which contains 74%, 23% carbohydrates, 1% protein and 0.5% fat. Without its peel, it is a good source of Vitamin B6, potassium and fiber. Moreover, it has no sodium and cholesterol and is a great source of Vitamin C and magnesium and contains three natural sugars – sucrose, fructose and glucose giving an instant, sustained and substantial boost of energy (<http://www.ffc.agnet.org/library>). Potentially, it can be processed and preserved to expand its market value, such as, puree from ripe fruits for use in ice cream, yogurt, cake, baby foods and nectar; sliced and canned in syrup for use in fruit salads and as toppings; sun dried banana crispy; and, fermented to produce vinegar and alcoholic beverage. A new product with commercial value is the banana flour which can be used as a mixture for various cakes and breads. But since it does not contain gluten, it could not be used as the main ingredient but rather mixed with wheat flour in the production of quality baked products (<http://www.ffc.agnet.org/library>).

Most Nigerians are consuming bread as a traditional food item. Wheat flour is the major component of bread. Since wheat is not a tropical crop, it is imported at high cost to meet the rising trend in demand (Udofia *et al.*, 2013). Efforts of government to embark on local production of wheat have been failing; the situation is not likely to improve on account of unfavorable agronomic conditions of the crop in Nigeria. The presence of gluten and glutenin confers wheat with unique baking properties. Wheat may contain some anti-nutritional factors like phytate and tannins especially if not properly processed (Zharfi *et al.*, 2012).

Bread as a daily food is of high interest, therefore its production and distribution deserves improvement. Based on available data, food fibers are considered useful substances for human consumption (Ndife *et al.*, 2011); therefore nutritional expert try to find appropriate methods of adding fiber to food preparations, especially bread. For instance, in Ghana bakery products are prepared with food fibers, and breads enriched with soluble fibers are very valuable. Banana is a high fiber fruit and its consumption decrease blood cholesterol. Addition of about 300 – 500g/kg freeze dried banana to diet had a reducing effect on cholesterol (www.dietaryfiber.food.com/fiber-rda.php). In general, the more soluble fiber and protein in a bread formulation, the tendered and more nutritious the bread will be. Mohammed and Jingyuan (2010) opined that plantain flour is rich in some vitamins, minerals, antioxidants, proteins and fibers which can decrease heart disease, blood cholesterol, cancer, diabetes and renal calculus. Fortification of bread with banana flour has been reported to improve other useful properties in bread. This was confirmed by Chong and Noor-Aziah (2008) who reported that addition of fiber such as banana powder (10%) to bread formation enhanced water absorption and lengthened dough mixing time. Zhu *et al.*

(2005) reported that banana starch had high resistance to enzyme activity as well as high viscosity. Aparicio-saquilan *et al.* (2007) produced cookies containing 15% banana powder and found that these cookies had more digestibility and shelf life than control cookies.

Good bread can be made from dough to which adequate amount of yeast is added. The dough is allowed to ferment and kept at desirable temperature for an appropriate period of time. Unfortunately, in most bakeries recovery defects due to under – fermented dough as well as poor flour quality, leaves no choice than to use chemicals such as soda, blanket (sodium hydrosulfite), extra salt for the reduction of gluten fluidity and increase dough elasticity. This practice has health implications such as and is a cause of stomach trouble, malnutrition, increased blood pressure and allergies (www.dietaryfiber.food.com/fiber-rda.php). This generally affects sensory qualities and overall acceptability of bread (Eddy *et al.*, 2007). The major or mandatory ingredients in bread making are flour, water and yeast (Akobudu, 2006; Osuji, 2006). The flour should have good amylase activity, the moisture content should be less than 14% and the colour or appearance should be satisfactory (Giami *et al.*, 2004). Due to the high cost, geographical scarcity and high demand of wheat flour, efforts are being directed towards the provision of alternative source of flour. For example, Eduardo *et al.* (2013) reported that composite bread can be made by substituting 5, 10, 15, 20 and 30% plantain flour for wheat flour. Sensory evaluation evokes measures, analysis and interpretation of consumers' responses to products as perceived by senses of sight, smell, touch, taste and hearing. The consumer buys nutrition, convenience, image and functionality in food. Therefore, new products must provide all the responses like or near the older product (Udofia *et al.*, 2013).

The objective of this study, was to formulate and develop functional bread from whole wheat flour composited with banana flour and to evaluate the sensory qualities and consumer overall acceptability of toasted bread.

2. Materials and Methods

2.1. Experimental Procedure

2.1.1. Preparation of Banana Flour

Banana was bought from the market and bad ones were sorted out. The sorted banana was peeled, sliced and sun dried. The dried Banana was later milled using attrition mill and sieved into fine flour of uniform particle size, by passing them through a 2 mm mesh sieve as shown in Figure 1.

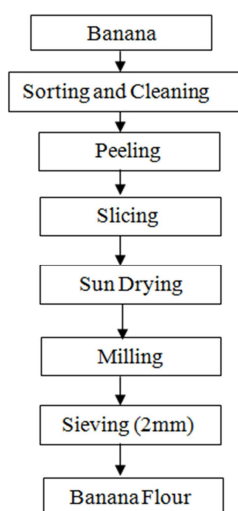


Figure 1. Flow Chart of Banana Flour Production

2.1.2. Baking and Toasting of Bread

The whole wheat flour was mixed, with varying inclusions of 0, 10, 20 and 30% of the banana flour. The composite flours were blended with other baking ingredients (Table 1) in a mixer, kneaded for 12 minutes into consistent dough and the resulting dough was egg washed, molded and placed in a pre-oiled baking container. The dough was proofed for 45 to 60 minutes at 34°C and 82% relative humidity and baked in a reel oven for 35 minutes at 216°C. The bread was later toasted using a toasting machine at 134°C.

Table 1. Formulation of Whole-wheat and Banana composite Doughs

Parameter	Samples			
	A	B	C	D
Whole-wheat flour (g)	100	90	80	70
Banana Flour (g)	0	10	20	30
Salt	2	2	2	2
Sugar (g)	6	6	6	6
Margarine (g)	4	4	4	4
Yeast powder (g)	2	2	2	2
Egg (1 piece)	1	1	1	1
Warm Water (cl)	65	65	65	65

2.2. Data Collection

The experiment was carried out in the Home and Rural Economics Department of College of Agriculture Zuru, Kebbi State, Nigeria. The sensory attributes including taste, aroma, appearance, texture and overall acceptability of the samples were evaluated by twenty (20) trained member panelist, using a 5 point hedonic scale (Jones *et al.*, 1955). The scale ranges from 1 – 5 with 1 representing the least score (dislike extremely) and 5 highest score (like extremely). The twenty member panelists were drawn from both staff and students of College of Agriculture Zuru.

2.3. Data Analysis

Data were subjected to analysis of variance (ANOVA). Mean values were compared at $P < 0.05$ level of significance using Least Significant Difference (LSD). Statistical package

for social science (SPSS) version 16.0 was used in analyzing the data.

3. Results and Discussion

Result of sensory analysis of toasted bread samples containing different levels of Banana flour substitution as compared to the control is shown in Table 2. The statistical analysis (ANOVA) revealed that there is no significant difference ($p > 0.05$) among all the toasted bread samples in the sensory attributes observed. This implied that sample A = B = C = D across the sensory parameters (taste, aroma, appearance and texture) tested by the panelists. However, significant difference ($p < 0.05$) was observed in the overall acceptability of the toasted bread samples. Sample D with 30% inclusion of banana flour had the highest mean value of 4.75. Zharfiet *al.* (2012) carried out a study in Malaysia on Evaluation of Sensory Properties of Toast Bread Containing Banana Powder with 10, 15 and 20% banana flour inclusion. They observed that, there was no significant difference ($p > 0.05$) between the treatments in relation to taste and aroma, while significant ($p < 0.05$) exist between the treatments in terms of their texture. The difference in result between the two experiments could be attributed to variation in inclusion levels of Banana flour of 10, 15 and 20% as against 10, 20 and 30%. However, Chong and Noor (2008) also conducted a research on Influence of Partial Substitution of Wheat Flour with Banana (*Musa paradisiaca var. Awak*) Flour on the Physico-chemical and Sensory Characteristics of Doughnuts and revealed that doughnut with 20% Banana flour was found to be the most acceptable. This is contrary to the findings of this research as 30% inclusion of Banana flour is most acceptable in toasted bread. The reason could be due to difference in preparation of the two products, as doughnut is fried while toasted bread is baked and toasted.

Table 2. Sensory Mean Scores of Toasted Bread Samples

Parameter	Samples			
	A	B	C	D
Taste	4.25 ^a	4.0 ^a	4.25 ^a	4.25 ^a
Aroma	3.5 ^a	4.0 ^a	4.5 ^a	4.5 ^a
Appearance	4.25 ^a	4.5 ^a	4.0 ^a	4.5 ^a
Texture	4.5 ^a	4.25 ^a	3.75 ^a	4.5 ^a
Overall Acceptability	4.0 ^b	4.25 ^b	4.25 ^b	4.75 ^a

Note: Means in the same row with different superscripts are significantly different at $p < 0.05$.

4. Conclusion and Recommendations

This study revealed that toasted bread with 30% banana flour was more acceptable to consumers compared to the 10% and 20% banana flour substitution. Therefore, acceptable toasted bread can be prepared by including wheat flour with 30% Banana flour.

We recommend here that, further research work should be focused on the proximate analysis and physico-chemical properties of banana enriched toasted breads. There is also a

need to investigate the impact of adjusting ingredients composition and baking techniques on the quality of the composite toasted bread.

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