



COMPOSITION AND SENSORY QUALITY OF WHEAT-BANANA FLOUR BLEND BREAD



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Abstract: The campaign for the substitution of wheat flour with some other flours in order to produce acceptable bakery products has been on the increase in recent years. The study produced composite bread from wheat-banana flours blend, and assess the acceptability of the product. Bread was prepared using varying levels of substitution of wheat flour with banana flour at 10, 20, 30 and 40% (WBA, WBB, WBC, and WBD), respectively and 100% (WBO) wheat flour as control. A 9-point hedonic scale (extremely liked to extremely dislike) was used to evaluate the sensory quality; while the AOAC method of chemical analysis was adopted for the proximate composition determination. The moisture, ash, crude fibre, crude protein, ether extract, carbohydrate and energy content increased from 11.64 to 16.34, 5.00 to 5.32, 0.55 to 0.93, 10.06 to 12.25, 10.97 to 20.23, 44.41 to 55.38 and 365.80 to 426.30 cal./100g, respectively. The proximate composition showed no significant difference ($p > 0.05$) in the moisture content between the control and WBB. The crude protein control was not significantly different from the composite bread except for WBD. The composite bread was acceptable up to 20% added banana flour.

Keywords: Composite bread, wheat, banana flour, proximate composition

Introduction

Bread is an essential staple food prepared from the baking of dough obtained from the mixture of flour, salt, yeast, fat, milk, eggs, anti-oxidant and water (Abdelghafor *et al.*, 2011). Bread consumption is regular and increasing in Nigeria (Abdelghafor *et al.*, 2011). It is relatively expensive because it is made from wheat flour which is imported (Edema *et al.*, 2004). In Nigeria, bread has become the second most widely consumed non-indigenous food after rice (Shittu *et al.*, 2007). It is consumed by people in every socio-economic class and acceptable to both adults and children. In the last few years, there has been need to improve the nutrient content of bread and also increase the use of other locally grown crops that can be partially or totally substituted for wheat (Igbabul *et al.*, 2013). Composite flours present an alternative to the use of the whole wheat flours in bread making; thereby decreasing total dependence on wheat for bread production. The use of local agricultural crops as substitute for part or whole of wheat in bread production would help diversify their use, through value addition and nutrient fortification in bread.

Banana (*Musa sapientum*) is a major staple crop constituting a rich energy source with carbohydrate accounting for 22–32% of the fruit weight. It is also rich in vitamins A, B₆, and C as well as minerals particularly potassium, magnesium, phosphorus, and folate (Honfo *et al.*, 2007). According to Juarez-Garcia *et al.* (2006), green banana is rich in starch and its flour contains 61.3–76.5 g/100g of starch (dry weight) and has high fibre content (6.3–15.5 g/100g) (dry weight). Despite its importance, a lot of postharvest losses have been recorded. The need for diversification of its utilization in order to reduce product wastage becomes necessary. Although the preparation of banana flour from unripe flour has been reported by some researchers (Rodriguez *et al.*, 2008), its application for use in bread baking has not been widely reported suggesting a research gap. The objective of the research was therefore to produce bread from composite flours obtained from wheat and banana; evaluate nutritional quality and consumer acceptance of the product.

Materials and Methods

Banana flour was processed from unripe banana (*Musa acuminata*) purchased from a village farm located at Usen, Edo State Nigeria; while the Dangote all-purpose wheat flour was purchased from Uselu market in Benin City. The Sonia instant yeast, Dangote granulated sugar and iodized table salt,

Niellabaking powder and Sonia butter were obtained from a bakery shop in Benin City. All other materials such as chemicals and reagent were obtained from the Central Laboratory of the Faculty of Agriculture, University of Benin, Edo state, Nigeria.

Banana flour preparation

A fully matured unripe banana (*Musa cavendish*) bunch with hard pulps was washed, peeled and cut into slices. The slices were sundried (35–38°C) under a very hygienic condition for 2 weeks until it was properly dried (12±1%) and then milled using a locally fabricated milling machine (Honda GP 200) into flour. The Composite flour of the wheat and unripe banana flour were formulated using ratio 100:0, 90:10, 80:20, 70:30 and 60:40, respectively to determine the level at which the composite bread will be most acceptable.

Formulation of blends and baking of bread

The blend of wheat and banana composite flour was baked using the straight dough method as adopted by Chauhan (1992). Flours were mixed with butter, sugar, salt, yeast, milk and then water added to the mixture thoroughly mixed manually to form dough. The kneaded dough was placed into greased baking pans and covered with a wet piece of wrapper and allowed to ferment and undergo proofing at room temperature (38±5°C) for about 90 min. It was thereafter baked at 175–180°C for 30 min. The loaves of bread were cooled at room temperature and packed into cellophane bags for analysis.

All bread samples were evaluated for texture, taste, aroma, colour and overall acceptability of the product in compliance with consumer preferences. Assessment was carried out using fifty well-structured consumer preference questionnaires containing a 9-point hedonic scale using 50 semi trained panelist consisting of staff and students of the Faculty of Agriculture, University of Benin, Edo State, Nigeria.

Proximate composition determination

Proximate analysis for moisture, ash, crude fibre, crude protein, ether extract, carbohydrate and energy content of the bread was carried out using the AOAC (2005).

Data analysis

The data obtained from sensory evaluation and proximate analysis were subjected to Analysis of Variance (ANOVA) using GenStat version 12.1 (2016); while the means were separated by Duncan multiple range test (DMRT) where they existed.

Results and Discussion

Proximate composition

Moisture content

The proximate compositions of composite bread from wheat and banana flours at various levels of substitution are presented in Table 1. The results showed that WBA had the highest value (16.34%) and WBC the lowest value (11.64%). There was no significant ($p > 0.05$) difference between the control and WBB, but control was significantly ($p < 0.05$) different from WBA, WBC and WBD. Also there was no significant difference between WBA and WBD.

The values for residual moisture of the bread samples ranged from 2.00 to 6.50% with WBD having the highest value and WBA with the lowest value. The control was not significantly ($p > 0.05$) different from WBB and also, there was no significant ($p > 0.05$) difference between WBC and WBD, but the control was significantly ($P < 0.05$) different from WBA, WBC and WBD. The moisture content observed from the proximate composition of composite bread could be as a result of the banana flour was unripe and it was used in dried ($12 \pm 1\%$ moisture) form and not in slurry form. The value observed in this study was not as high as value (11.20) reported by (Adubofour *et al.*, 2016), but was within range with the lowest value of 11.64. It is important to note that the bread samples had low moisture content compared to the standard ($38 \pm 1\%$) and this could be due to the processing method that was adopted. The moisture content does have influence on the shelf life and keeping quality of the bread, but less of moisture may result in a very tough textured bread which may render it unacceptable to consumers. However optimal moisture content ($38 \pm 1\%$) is important for a better storage quality of bread made from composite flours as reported by Okonkwo (2014).

Ash content

The ash content ranged from 5.00 to 5.32% with WBD having the highest value and WBA having the lowest value. It was observed that there was no significant ($p > 0.05$) difference between WBA, WBB and WBD; but the control was significantly ($p < 0.05$) higher in ash content than the composites bread (Table 1). The result of this study showed that the ash content increased with increase in substitution with banana flour. This could be attributable to the relatively high content of unripe banana flour (40%) with wheat flour. This result corroborates the findings by Ogazi (1988); Aseidu (1989) that banana being high in ash content is capable of increasing the mineral content of composite products that contain it. The ash contents of food material has bearing with or a reflection of the Mineral content; and they are of health benefit to the human body when consumed (Rehinan *et al.*, 2004).

Crude fibre

The crude fibre ranged from 0.55 to 0.93% with WBA having the highest value and WBB, WBC and WBD having the lower values each (Table 1), and the control had the least fibre content of 0.22%. There was significant ($p < 0.05$) difference between control and the composite bread but; no significant ($p > 0.05$) difference was observed amongst the composite products (WBB, WBC and WBD). The samples substituted with unripe banana flour had a higher fibre content of 0.93 and 0.55 % whereas the control had a mean value of 0.22%. This confirms the study by Noor *et al.* (2012) in which the fibre content of bread incorporated with banana flour increased with higher level of substitution.

Crude protein

The Crude Protein values of both the control and WBA were the same. WBA had the highest value of 12.25% and WBD had the lowest value of 10.06%. The control was not significantly ($p > 0.05$) different from WBA, WBB and WBC, but was significantly different from WBD. The protein

contents of the control and the substituted bread samples were not significantly different ($p > 0.05$). This observation agrees with works of Aseidu (1989); in which non-wheat flours were substituted with wheat to produce composite product. The presence of gluten that forms a larger portion of wheat accounts for the relatively high protein content (12.25) observed in the control and WBA.

Ether extract

The ether extract values ranged from 10.97 to 20.23% and WBA had the least value and WBD had the highest value. The results showed the control was significantly ($p < 0.05$) different from WBA and WBB; but was not significantly ($p > 0.05$) different from the control, WBC and WBD. Significant differences ($p < 0.05$) were observed in the fat contents among the samples. Gradual increase was observed in the fat content of the composite bread as the quantity of banana flour substituted (20.23). This confirms earlier study by Olaoye *et al.* (2006).

Energy

The energy values (cal/100g) ranged from 365.80 to 426.30 with WBD having least value (365.80) and WBA having the highest value (426.30). The result showed that there was no significant ($p > 0.05$) difference between the control and the composite bread; except for WBD that was significantly different ($p < 0.05$) from the control and the other composite bread. The energy contents were higher in the whole wheat bread (435.6) than bread substituted with unripe banana flour. The variety of the banana could also be a factor in the level of energy obtained in the product.

Carbohydrate

The carbohydrate values (%) were observed to be least in WBD (48.95) and highest in WBA (55.38). The result showed that there was no significant ($p > 0.05$) difference between control and WBD, but the control and WBA, WBB and WBD. There was significant ($p < 0.05$) difference in carbohydrate with substitution. Olaoye *et al.* (2006) report of carbohydrate content of wheat and plantain flour agrees with the result in this present study. Earlier studies (Orford *et al.*, 1988; Annison *et al.*, 1994; Siljestrom *et al.*, 1989; Muir *et al.*, 1992; Annison *et al.*, 1994) had reported that many carbohydrate rich foods contain variable amount of resistant starch. Several factors that influenced the resistant starch content include the source of dietary starch proportion, granular structure of starch, the degree of processing and presence of other nutrients like protein, fat and fibre.

Table 1: Proximate composition of wheat/banana flour composite bread

Sample g/100g	Control	WBA	WBB	WBC	WBD	SEM
Moisture	14.57 ^b	16.34 ^a	13.40 ^b	13.17 ^a	11.64 ^c	0.52
Residual moisture	4.00 ^b	2.00 ^c	3.75 ^b	5.50 ^a	6.50 ^a	0.37
Ash	5.55 ^a	5.00 ^d	5.05 ^{cd}	5.12 ^c	5.32 ^b	0.04
Crude fibre	0.22 ^c	0.93 ^a	0.55 ^b	0.55 ^b	0.55 ^b	0.05
Protein	12.25 ^a	12.25 ^a	11.81 ^a	11.38 ^{ab}	10.06 ^b	0.51
Ether extract	23.00 ^a	10.97 ^c	17.80 ^b	19.80 ^{ab}	20.23 ^{ab}	1.31
Energy (cal/100g)	435.6 ^a	426.3 ^a	423.2 ^a	420.3 ^a	365.8 ^b	6.81
Carbohydrate	44.41 ^c	55.38 ^a	53.07 ^{ab}	50.67 ^{ab}	48.95 ^{bc}	1.64

Mean values with different alphabets as superscripts in a row are significantly ($P < 0.05$) different

Table 2: Mean sensory score of wheat-banana composite bread

Sample g/100g	Control	WBA	WBB	WBC	WBD	SEM
Appearance	7.96 ^a	7.28 ^b	7.02 ^{bc}	6.54 ^{cd}	6.42 ^d	0.18
Aroma	7.56 ^a	6.78 ^b	6.50 ^b	6.34 ^b	6.20 ^b	0.21
Mouth feel	7.68 ^a	7.30 ^{ab}	6.86 ^{bc}	6.54 ^{cd}	6.16 ^d	0.20
Taste	7.52 ^a	7.48 ^a	6.66 ^b	6.18 ^b	6.36 ^b	0.21
Texture	7.56 ^a	7.32 ^a	7.06 ^a	6.48 ^b	6.22 ^b	0.18
Colour	7.90 ^a	7.20 ^b	6.78 ^b	6.30 ^c	6.24 ^c	0.16
Overall acceptability	7.42 ^a	7.24 ^{ab}	6.72 ^{bc}	6.90 ^{ab}	6.20 ^c	0.20

Mean values with different alphabet as superscripts in a row are significantly (P < 0.05) different

Sensory characteristics

The mean scores of the individual attributes of the composite bread are presented in Table 2.

The product was most preferred by the consumers. A significant difference ($p < 0.05$) was established between the control and all other samples in terms of the colour, aroma, appearance, taste, mouth feel. However, no significant difference ($p > 0.05$) was observed in the texture and the overall acceptability. This shows that the unripe banana flour had an impact on the colour, aroma and texture of the bread samples from the composite flours. Physical examination showed that the unripe banana flour imparted a dark brownish colour on the bread. As the substitution increased from 10 to 40%, the intensity of the brown colour also increased. This influenced the consumer's choice with most of them preferring bread with 100% wheat flour. In terms of colour, the control sample had the highest mean score among the five products. Mohamed *et al.* (2009) had reported that, the brown colour of the bread was as a result of the banana; however, banana flour in bread imparts a pleasant aroma making it appealing to consumers. The mean sensory scores of appearance of composite bread ranged from 6.42 to 7.28 on a scale of 9-points. The result were lower when compared to that for control (7.96), and it showed that there was significant ($p < 0.05$) difference in appearance between control and all other composite bread. The values for aroma ranged from 6.20 to 6.78, with WBA having the highest value (6.78) and WBD having the lowest value (6.20). The control was significantly ($p < 0.05$) different from composite bread; but there was no significant ($p > 0.05$) difference among the composite bread. Also the level of acceptance reduces as the composite flour increases. There was no significant difference ($p > 0.05$) in the aroma among the bread samples with banana. However the bread with the highest banana flour substitution of 40% had the least mean score of 6.20 for aroma indicating that most of the consumers slightly liked this bread sample with high amount of banana flour. This implied that likeness for the aroma of the bread decreased with increasing banana flour content. Banana as a fruit possesses a distinct pleasant aroma when ripened. This aroma is usually imparted into foods as they are incorporated. However, in this study, the aroma of the product decreased as the quantity of banana flour was increased. This could be as a result of the unripe banana that was used; because ripe banana has its own peculiar aroma from that of unripe (Jordan *et al.*, 2001).

Taste

The values for taste ranged from 6.18 to 7.48%, from the result there was significant ($P < 0.05$) difference between control and the other samples except WBA and there was no significant difference among the composite bread except WBA. The values decrease as the composite flour substitution increases. The scores for taste of the bread samples substituted with banana flour had a mean score above average indicating that the consumer slightly liked the sample. The highest

preferred sample was the control with a mean score of 7.52. There was no significant difference ($P > 0.05$) between control and WBA. However, there was significant difference ($P < 0.05$) between the control and WBB, WBC and WBD. This indicated that there was an add-on taste from the unripe banana flour which was liked by the consumers when compared to the control sample. Previous works has shown that unripe banana flour adds sweetness to products due to its high sugar content (Egbebi *et al.*, 2011). The acceptance for the taste attribute by the consumers could be attributed to the sweetness that the banana flour added to the samples.

Texture

The values of texture were highest for WBA (7.32) and were lowest for WBD (6.22). There was no significant ($P > 0.05$) difference between control and WBA, WBB, but there was a significant ($P < 0.05$) difference between control and WBC, WBD. The values decrease as the composite flour substitution increases. The values obtained showed that most of the consumers liked the bread with the lowest banana flour substitution of 10 % with a mean score of 7.32. This was followed by the 20, 30 and 40 % substitutions with mean values of 7.06, 6.48 and 6.22, respectively (Adubofour *et al.*, 2016).

Colour

The values ranged from 6.24 to 7.20 % with WBA having the highest value of 7.32 and WBD having the lowest value of 6.22, the result showed that control was significantly different from the composite bread; it was however not significantly difference between WBA and WBB as well as WBC and WBD. The values decrease as the composite flour substitution increases. Colour is a very important attribute that influences the initial acceptability of a product by a consumer (Zuwariah *et al.*, 2009). The colour differences observed in the bread samples may be attributed to the sugar content in the banana as a result of the different substitution levels of the banana flour. More sugar could results in darker bread because of caramilization of the sugar (Kent *et al.*, 1994). The assessors liked the colour of the control sample which had the highest mean score of 7.90. This was followed by the sample with the 10, 20, 30 and 40% substitution with mean scores of 7.20, 6.78, 6.30 and 6.24, respectively. This shows that as the substitution increased to 40 %, the preference for the sample decreased in that order respectively. Addition of banana flour imparted a dark brown colour to the bread. The brown colour of the bread with banana flour as reported by Kent *et al.* (1994) resulted from a Maillard reaction between reducing sugars and proteins.

Overall acceptability

The average mean score for Overall acceptability ranged from 6.20 to 7.24. The bread with the highest substitution of banana flour was the least preferred with a mean score of 6.20. This was followed by the 10 and 20 and 30% substitution with mean score of 7.24, 6.72 and 6.90, respectively. There was no significant difference ($p > 0.05$) between the control and WBA and WBC. Significant difference ($p < 0.05$) was however observed in the control, WBB and WBD bread. The control sample had the highest mean score of 7.42 which was the most preferred followed by WBA. The sample with the highest substituted banana flour of 40% was the least preferred in terms of overall acceptability (Adubofour *et al.*, 2016).

Conclusion

The present study has shown that wheat and banana composite flours have the potential to produce bread of acceptable quality. Bread of good nutritional and sensory qualities could be produced from up to 20% banana flour substitution. Supplementation of wheat flour with high quality flours from improved banana hybrids could increase levels of

micronutrients. In order to ensure compliance with the consumption of composite bread, consumers of bread and other baked goods need to be educated on the nutritional, economic and social benefits of these composite products.

Conflict of Interest

Authors declare that there is no conflict of interest reported in this work.

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