

Production and Sensory Evaluation of Rock Cake Produced from Partially Ripe Plantain and Wheat Flour

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Abstract

Pastries are generally produced from wheat. Wheat is not cultivated in Ghana, but imported, hence it is relatively expensive. This research was therefore conducted using partially ripe plantain flour to produce composite rock cake. Three kinds of composite rock cake were produced with the percentage of wheat flour to that of partially ripe plantain flour as 50%:50% (II), 70%:30% (III), and 30%:70% (IV). The rock cake produced from only wheat flour was used as the control, I and its sensory qualities were compared with those produced from wheat and plantain flour. A 30-member semi-trained panel was used for the sensory evaluation using a 7-point hedonic scale where seven indicated like extremely and (1) dislike extremely. The sensory qualities assessed were appearance, texture, taste, aroma, and overall acceptability. The results indicated that the scores of the appearance, taste, aroma and the overall acceptability of the control was not different from II and III ($P>0.05$). The results show that 50% and 70% replacement of wheat flour with partially ripe plantain flour could produce composite rock cake of acceptable qualities.

Keywords: *composite rock cake, wheat flour, partially ripe plantain flour, sensory qualities, overall acceptability, appearance*

Introduction

Rock cake is made from wheat flour. Wheat flour is mainly imported so it is relatively expensive. This increases the cost of pastries, especially rock cakes made from wheat flour. It is therefore important to find other sources of cheap flour which can be added to the wheat flour to reduce the cost of rock cake. One of these relatively cheap sources of flour is plantain. Comparatively, plantain is cheap and even cheaper when in season. Plantain cannot be stored for long. The mature but unripe plantain ripens in two to seven days (Robinson, 1996), and when it is in season a lot of them go waste.

The high cost of wheat, the need for variety, and the need to reduce postharvest losses of fruits, vegetables and cereals have motivated many authors to assess the possibility of using composite

flours in pastries production. Eke-Ejiofor (2013) produced composite cakes and biscuits with African breadfruit and sweet potato-wheat composite flour. The study concluded that 20% replacement of wheat flour with African breadfruit and 30% replacement with sweet potato produced cake and biscuit respectively of improved nutritional and sensory properties. Another study used three varieties of cassava and wheat composite flours to produce composite bread. It was found out that 10% and 20% substitution of wheat flour with two different varieties of cassava flour produced composite bread of similar overall acceptability as the bread made from 100% wheat (Eriksson et al., 2014). Wheat-sweet potato composite bread production has been reported (Trejo-González et al., 2014). That study concluded that acceptable dough and composite sweet potato bread can be produced from 5-10% replaced wheat flours. Composite wheat and fermented durian flours was used for composite bread production and the results indicated that the use of up to 10% of the fermented durian could produce bread of acceptable quality (Ariffin et al., 2015). Composite cookies were made from wheat and full fat soya. The best overall acceptability score in this study was obtained from cookies with 30% and 50% wheat flour replacement (Ndife et al., 2014). It was concluded in a study by Chioma and Chizoba (2015) that 10% replacement of wheat flour with the flour of African yam bean produced a composite biscuit of acceptable quality. Another study recorded a high acceptance level for composite chips made from wheat and ackee composite flour (Essuman et al., 2016).

Against this background, the research was done to assess how different levels of wheat flour replacement with partially ripe plantain flour influence the sensory qualities of rock cake and its overall acceptability.

Methodology

Ingredients

The ingredients used for the rock cake were wheat flour, partially ripe plantain flour, margarine, castor sugar, egg, milk, baking powder and salt.

Source of ingredients

Partially ripe plantain was purchased from *Brodee dwamu* but all other ingredients were bought from Koforidua Central Market. Both locations are in Koforidua in the New Juaben Municipality of the Eastern Region of Ghana.

Preparation of ingredients

Partially ripe plantain was washed two times in different basins of water, peeled, and immersed into boiled water at a temperature of 70°C for 5 min (Fig. 1). They were cut into pieces (Plate 1) and dried at a temperature of 180°C in an oven for 1 h. The dried plantain was milled and sieved to achieve the required smoothness texture (Plate 2).

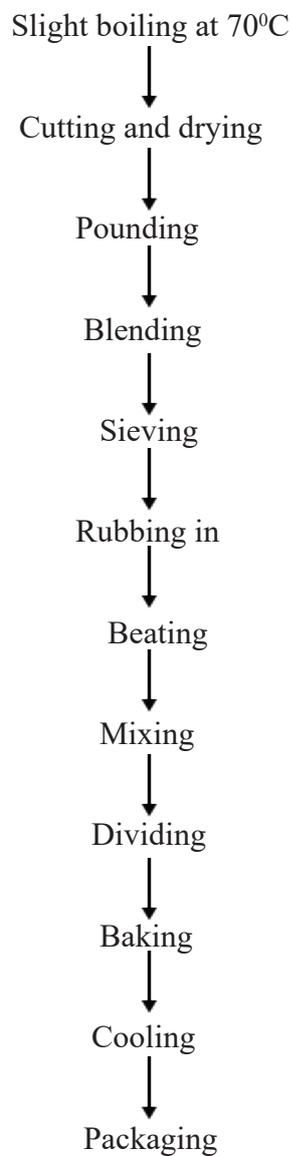


Plate 1: Plantain slices to be dried



Plate 2: 100% Plantain flour

Fig 1: Flow diagram for the preparation of partially ripe plantain rock cake
Wheat flour washing and peeling



Flour composition of partially ripe plantain rock cake

Four (4) kinds of partially ripe plantain rock cake were produced based on the proportion of the wheat and plantain flour used and were labeled as I (control), II, III and IV (Table 1).

Table 1: Flour composition of partially ripe plantain rock cake

Product	Wheat flour (%)	Plantain flour (%)
I (Control)	100	0
II	50	50
III	30	70
IV	70	30

Recipe for partially ripe plantain rock cake

The recipes for the four (4) kinds of partially ripe plantain rock cake are shown in Table 2.

Table 2: Recipe for partially ripe plantain rock cake

Ingredient	Product			
	I	II	III	IV
Wheat flour (g)	200	100	60	140
Plantain flour (g)	---	100	140	60
Salt (tsp.)	¼	¼	¼	¼
Baking powder (g)	1	1	1	1
Castor sugar (g)	75	75	75	75
Margarine (g)	75	75	75	75
Egg (Jumbo size)	1	1	1	1
Milk (ml)	100	100	100	100
Dried fruits (g)	50	50	50	50

Preparation of rock cake

The rock cake was prepared as described by Ceserani and Kinton (2008). In brief, the flour, salt and baking powder were sieved. The margarine was rubbed into the flour to achieve a sandy texture, and sugar was then added to the mixture. A well-beaten egg was gradually added and mixed as lightly as possible until combined. Dried fruits (currants and sultanas) were added to the mixture. a fork was used to shape the mixture on a greased baking sheet and milk wash. The mixture was then baked in a fairly hot oven at 220oC for about 20 min.



Plate 3: 100% wheat flour



Plate 4: 70% wheat flour, 30% plantain flour



Plate 5: 30% wheat flour, 70% plantain flour

Plate 6: 50% wheat flour, 50% plantain flour

Sensory evaluation of partially ripe plantain rock cake

A 30-member semi-trained panel was used to assess the appearance, texture, taste, flavour, and overall acceptability of the ripe plantain rock on a 7-point hedonic scale, where 7-Like extremely, 6-Like very much, 5-Like much, 4-Neither like nor dislike, 3-Dislike much, 2-Dislike very much, and 1-Dislike extremely.

Statistical analysis

The data on sensory evaluation was subjected to analysis of variances (ANOVA) using the Statistical product for service solutions (SPSS). The differences in mean scores were separated using the Duncan Multiple Range Test.

Results and discussion

Appearance scores of partially ripe plantain rock cake

The partially ripe plantain rock cakes produced are shown in Plates 7-11. The mean scores for appearance of the rock cake are shown in Fig. 2.

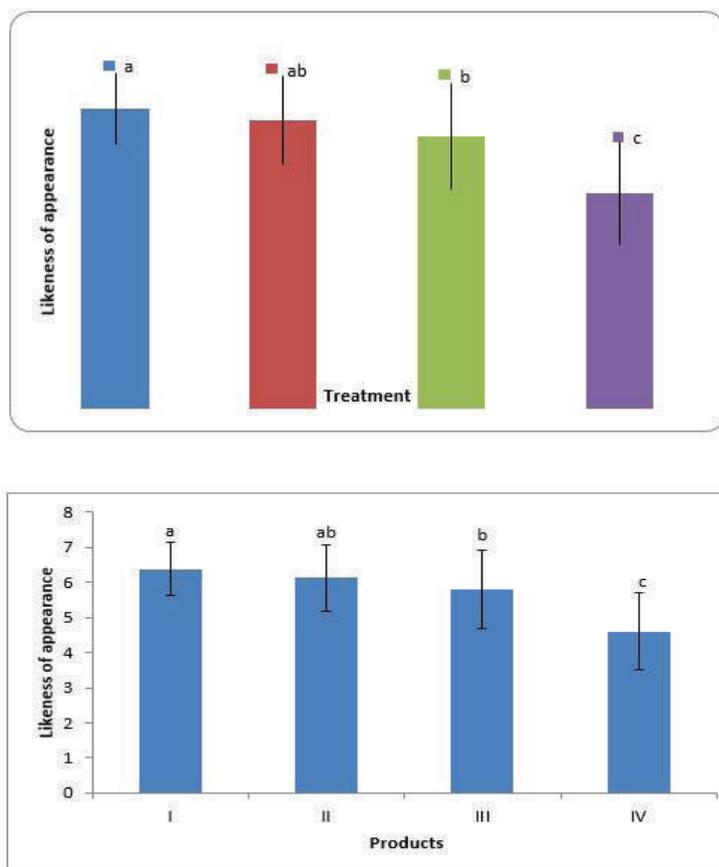


Fig. 2: Appearance scores of partially ripe plantain rock cake

Means with different alphabets are significant at $p < 0.05$. I (100% Wheat flour), II (50% Wheat flour, 50% Plantain flour), III (30% Wheat flour, 70% Plantain flour), IV (70% Wheat flour, 30% Plantain flour)

The results indicate that the appearance scores were in the range 4.60-6.37 on a 7-point hedonic scale in which like extremely is 7 and dislike extremely is 1. The appearance of the rock cake produced by only wheat flour (control) was not statistically different ($P>0.05$) from product II (50% wheat flour, 50% plantain flour). A previous study reported that 50% substitution of wheat flour could produce acceptable composite cake (Ogazi, 1996). However, product III (30% wheat flour, 70% plantain flour) and IV (70% wheat flour 30% plantain flour) were significantly different ($P<0.05$) from product I (control) in terms of appearance. Generally, as the amount of plantain flour in the plantain rock cake increased, the likeness for appearance decreased. Similar results were reported for cocoyam-cassava composite rock cake (Sanful and Darko, 2010). Enzymatic browning took place in the partially ripe plantain during drying, and increased proportion of plantain flour in the composite cake might have led to a more brown product which was less desirable by panel members. The greater preference for the appearance of the control may be due to its lighter colour.



Plate 7: Rock cake produced with different proportions of wheat flour and plantain flour



Plate 8



Plate 9



Plate 10



Plate 11

Plate 8: Rock cake produced with 100% Wheat flour

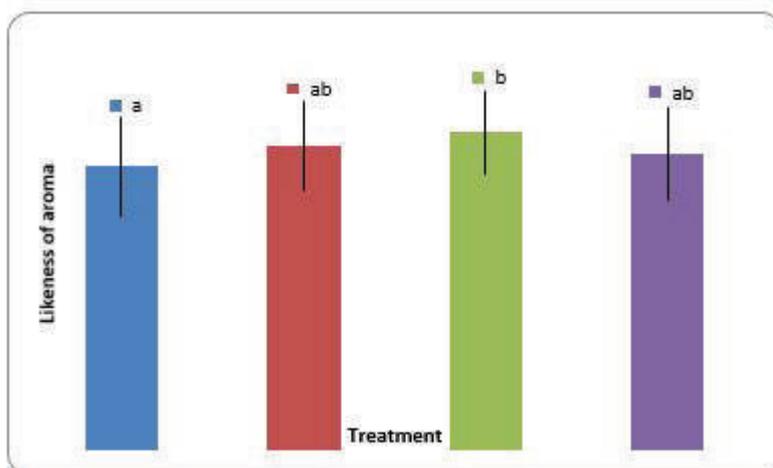
Plate 9: Rock cake produced with 70% Wheat flour and 30% plantain flour

Plate 10: Rock cake produced with 50% Wheat flour and 50% plantain flour

Plate 11: Rock cake produced with 30% Wheat flour and 70% plantain flour

Aroma scores of ripe plantain rock cake

The results of the mean scores of the rock cake in terms of aroma are shown in Fig. 3. The aroma scores for II, III and IV were all higher than that of I (control) even though II and IV were not significantly different ($P>0.05$) from the control. The highest score for III might be due it having



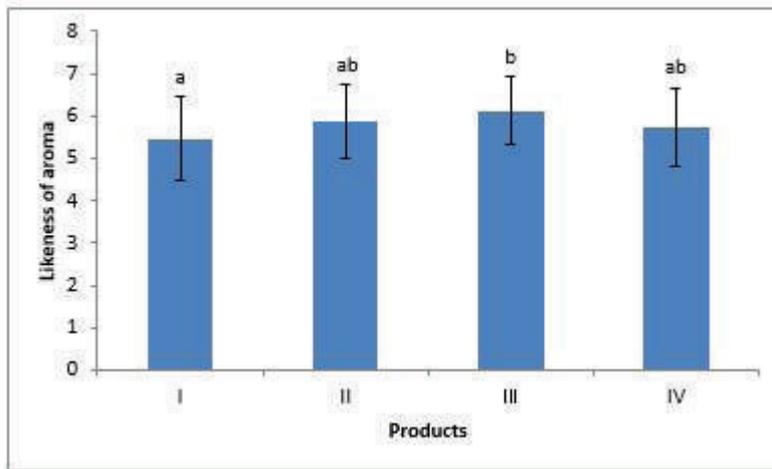
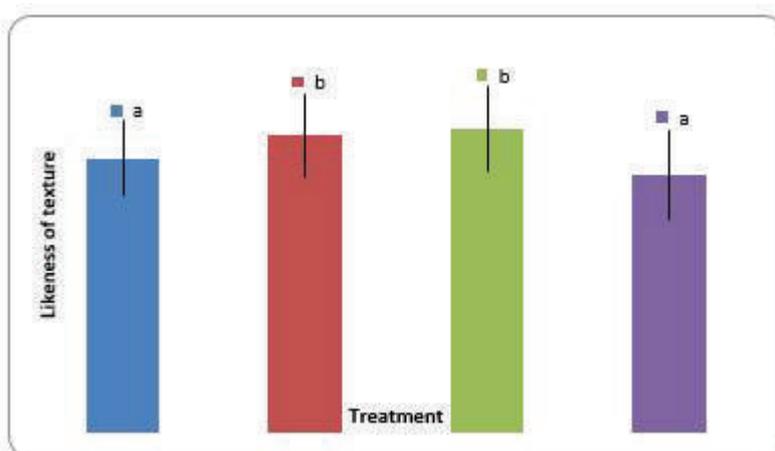


Fig. 3: Aroma scores of ripe plantain rock cake.

Means with different alphabet are significant at $p < 0.05$. I (100% Wheat flour), II (50% Wheat flour, 50% Plantain flour), III (30% Wheat flour, 70% Plantain flour), IV (70% Wheat flour, 30% Plantain flour) the highest proportion of ripe plantain flour which might have influenced the likeness of the respondents for its aroma. Enzymatic browning took place during the drying of the partially ripe plantain, and increased proportion of plantain flour in the composite cake might have led to the production of more desirable flavours. A similar result where the composite cookie sample with the highest soy-flour recorded the most preferred aroma by the respondent was reported by Ndife et al. (2014).

Texture scores of ripe plantain rock cake

The texture scores evaluated by the respondents are shown in Fig. 4. The mean texture scores varied from 5.23 to 6.17. The Products, II and III, recorded significantly higher scores ($P < 0.05$) than the control. In a related study, some soy-flour composite cookies recorded significantly higher textural scores than the control (Ndife et al., 2014). However, the texture likeness for IV was not different from the control ($P < 0.05$). This agrees with a study where the texture of composite biscuits of 33.3 and 66.7% wheat replacement did not differ from the control (Okaka, and Isieh, 1990).



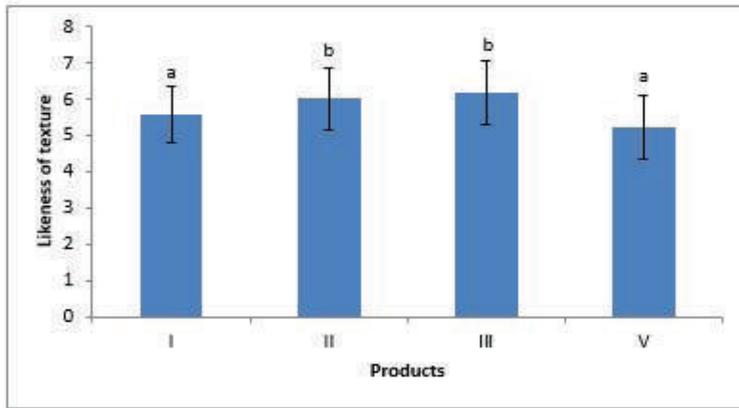


Fig. 4: Texture scores of ripe plantain rock cake

Means with different alphabet are significant at $p < 0.05$. I (100% Wheat flour), II (50% Wheat flour, 50% Plantain flour), III (30% Wheat flour, 70% Plantain flour), IV (70% Wheat flour, 30% Plantain flour)

Taste scores of ripe plantain rock cake

The assessment of the respondents about the taste scores of the ripe plantain rock cake are shown in Fig. 5. The scores ranged between 5.40 and 6.23. Product III which contained the highest proportion of ripe plantain flour had the highest taste score even though it was not significantly

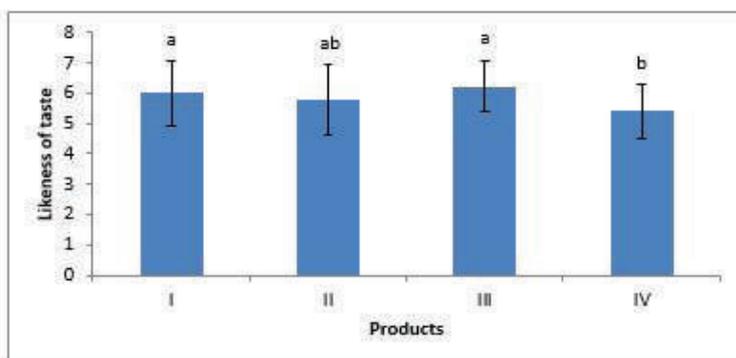
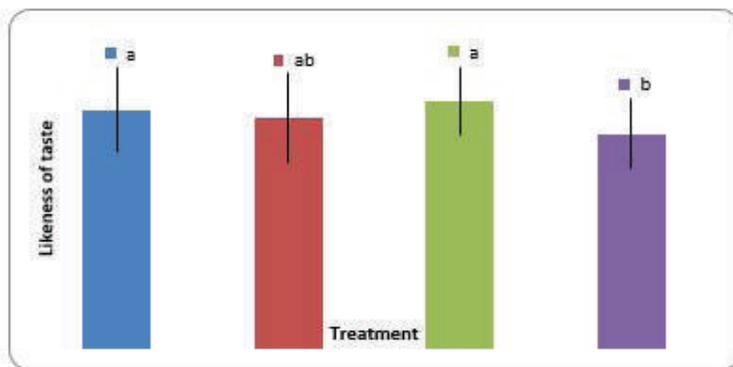


Fig. 5: Taste scores of ripe plantain rock cake

Means with different alphabet are significant at $p < 0.05$. I (100% Wheat flour), II (50% Wheat flour, 50% Plantain flour), III (30% Wheat flour, 70% Plantain flour), IV (70% Wheat flour, 30% Plantain flour) different ($P > 0.05$.) from those of products II and III. Product III contained more sugar than the other products because it had the highest percentage of ripe plantain flour and this might have accounted for its highest mean taste score.

Overall acceptability scores of ripe plantain rock cake

The overall likeness scores of the ripe plantain rock cake are shown in Fig. 6. most of the respondents preferred products II and III to the control in terms of all sensory qualities even though the preferences were not significantly different ($P > 0.05$) from that of the control. Other related studies registered greater overall acceptability scores for some composite baked products than the control (Eke-Ejiofor, 2013; Ndife et al., 2014). It was reported in a previous study that 40% wheat replacement with plantain produced bread and biscuits which were organoleptically acceptable (Mepba et al., 2007).

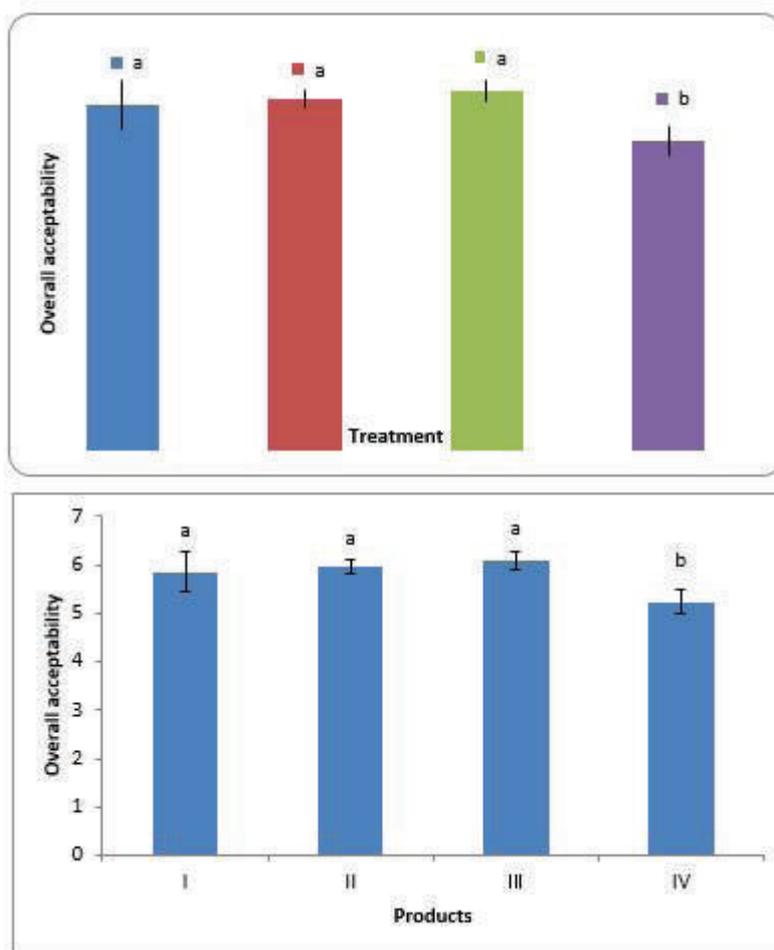


Fig. 6: Overall acceptability scores of ripe plantain rock cake

Means with different alphabet are significant at $p < 0.05$. I (100% Wheat flour), II (50% Wheat flour, 50% Plantain flour), III (30% Wheat flour, 70% Plantain flour), IV (70% Wheat flour, 30% Plantain flour)

Conclusion

In this work, composite rock cake samples made up of different percentages of ripe plantain flour and wheat flour were produced, and the overall acceptability scores indicated that product III (30% wheat flour 70% plantain flour) was the most preferred and this was followed by product II (50% wheat flour 50% plantain flour). The overall preference for products II and III was not significantly different ($P>0.05$) from that of product I (control). Product IV had the least overall preference score and this was significantly lower ($P>0.05$) than those of I, II and III. The results of the study have shown that replacement of wheat flour by 50% and 70% of partially ripe plantain flour could be used to produce rock cake having overall acceptable sensory properties. This could help to reduce importation of wheat and to reduce the cost of rock cake.

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