International Journal of Advance Studies in Engineering and Scientific Inventions
Volume 3 Number 1, JULY 2015. ISSN (Print): 1741-8763 ISSN (Online):1741-8771

ACCEPTABILITY OF BREADFRUIT FLOUR IN CONFECTIONERIES AMONG CONSUMERS IN SOUTH WEST NIGERIA

Tinu Lano-Maduagu PhD
Dept. of Science and Technology Education,
University of Lagos, Nigeria

Abstract
The study investigated the general acceptability, and shelf life of bread fruit flour in confectionaries with particular reference to cake. Wheat flour was supplemented with breadfruit flour at three different levels and used for cake making. The levels were coded alphabetically, A to D representing cake, 50% Wheat flour + 50% bread fruit flour (A), 75% bread fruit flour + 25% Wheat (B), 100% bread fruit flour (C), 100% wheat flour (D) which serves as the control. Organeoleptic evaluation of the cake made was carried out at 3 different periods by 20 randomly selected panelists from Banks, Tertiary institutions, Shopping Malls, and primary / secondary schools using 5 points hedonic scale during each assessment period. The results revealed that the cake made from 50% bread fruit flour + 50% wheat flour was scored highest. Based on these findings, it was concluded that using breadfruit flour to supplement wheat flour at least 50% in cake making will enhance the general acceptability and improve the nutritional value of the confectionaries. Further research on how to extend the shelf life of confectionaries (cake making) containing bread fruit flour should be carried out.

Keywords: *Breadfruit flour, Wheat flour, Confectioneries, Organeoleptic evaluation.*

Website: http://internationalpolicybrief.org/journals/international-scientific-research-consortium-journals/intl-journal-of-engineering-vol3-no1-july-2015

Background to the Study

White flour is used numerously in the production of many pastries consumed by both the rich and the poor in form of fast foods. There are not much health benefit from consuming white flour because processed grains contribute to vitamin B deficiency, diabetes, obesity and other health problems. Fulponi (2005) reported that consumers are becoming more concerned with the process by which food is produced in addition to its content, this is because when food quality is jeopardized, and consumers may not get their worth of money and may suffer in health terms. Breadfruit (Artocarpus Altilis) is specie of flowering tree in mulberry family. The fruit is spherical in shape. It is a remarkable food. The prickly football size of the pod is full of nutrients and energy. It can be further processed into variety of foods and tasty gluten free products. It is traditionally grown in home gardens or integrated mixed agroforestry system Diana Ragone (2006). Breadfruit is a fruit, though it is used more like a vegetable. It can be cooked and eaten at all stages of development. The flower and immature fruit can also be used as vegetable (Bread fruit institution 2006).

Breadfruit is low in saturated fat, cholesterol, sodium and very high in vitamin C, It is highly productive and rich sources of dietary fiber, vitamin C and potassium. A large portion of the calories in breadfruit come from sugar. Lounge (2005) Breadfruit increase immune function, protection against health disease, alleviation of cardiovascular disease and alleviation of hypertension. Haijar (2001) Breadfruit provides high energy; it is a rich source of carbohydrate and energy to all who eat it. It supplies the warmth and vitality needed to be active. It cleans the intestine. The fiber present in breadfruit flushes out the toxins from the intestine and helps in proper functioning of the bowels and intestines. When dried, breadfruit yields a type of rich flour, more productive than wheat flour and different types of important amino acids.

Breadfruit is a rich source of fatty acids like omega 3 and omega 6 which are vital for the proper development of the mind and body. Lounge (2005) Breadfruits do not have any documented side effect.

Statement of the Problem

The effect of breadfruit flour and white flour in confectionaries will make remarkable impact in improving the nutritional status of consumers. The knowledge of healthy food is immensely essential in nutrition to eliminate or reduce the nutritional deficiencies and chronic diseases caused by unhealthy food. The above identified problems gave rise, to the addition of breadfruits flour which has enormous benefits to white flour in confectionaries to enhance the nutritive values and eliminate health hazards created from eating white flour pastries.

Objective of the Study

The objectives of the study include to:

1. Determines the general acceptability of breadfruit flour in confectionaries.
2. Determine the proximate analysis of the products made from
   50% wheat flour plus 50% breadfruit flour
   75% breadfruit flour plus 25% white wheat flour.

100% breadfruit flour
100% wheat flour control

3. To determine the shelf life of the products.

Research Questions

1. What are the organeoleptic differences between cakes made with different percentage of breadfruit flour and cake made with wheat flour?
2. What are the nutrients present in cakes made with;
   a. 50% white wheat flour plus 50% breadfruit flour.
   b. 75% breadfruit flour plus 25% white wheat flour.
   c. 100% breadfruit flour.
   d. 100% white wheat flour.
3. What is the shelf life of cakes made with different quantity of breadfruit flour and white wheat flour?

Research Hypotheses

$H_0$1: There will be no significance differences between cakes made with different percentage of breadfruit flour and cake made with white wheat flour.

$H_0$2: There will be no significance differences in the nutrient present in cakes made with;

1. 50% white wheat flour plus 50% breadfruit flour.
2. 75% breadfruit flour plus 25% white wheat flour.
3. 100% breadfruit flour.
4. 100% white wheat flour.

$H_0$3: There will be no significance differences in the shelf life of cakes made with different quantity of breadfruit flour and white wheat flour.

Methodology

Method of Data Collection

The experiment was carried out thrice and taste panels of ten members were invited to taste the samples. These taste panels evaluated the organeoleptic properties of bread fruits flour and wheat flour in cakes. The 100% wheat flour served as control. Each food samples with different percentages of wheat flour and breadfruit flour were coded, as samples A, B, C, D. Samples A,B,C and D, represents cake with 50% bread fruit flour plus 50% wheat flour, 75% bread fruit flour plus 25% wheat flour, 100% bread fruit flour and 100% wheat flour (control) respectively. The organeoleptic tests carried out were on colour, texture, flavour, taste, appearance and general acceptability, using a 5 points hedonic ranking test. The degree to which a product was liked was expressed as: like a lot 5, like a little 4, neither like nor dislike 3, dislike a little 2, dislike a lot 1.

Note: WF Wheat flour, BFF Breadfruit flour.
Taste panels avoided consuming strong flavored food 30 minutes before tasting.
The temperatures of testing items were the same.

1 Samples had the same quantity
2 Rinsing water was provided for each taster, to prevent carry over taste.
3 Sample container were identical in colour, size and shape.
4 Sample was coded A D.

i.	50% wheat flour plus 50% breadfruit flour cake	A
ii.	75% breadfruit plus 25% wheat flour cake	B
iii.	100% breadfruit cake	C
iv.	100% wheat flour (control)	D

Processing Of Breadfruit Flour

The breadfruit was purchased from the local market; it was prepared as described by Ola (2010). The seeds were collected from the rotten pod, washed and dried in the sun for approximately four days or dried in an oven with temperature of 50oc or 120oF.The seeds were shelled ,particles were removed and grinded into flour and stored in an air tight container.

Equipment/Tools

The equipment and tools that were used in carrying out this experimental research includes: bowls, sample containers, forks, knives, baking pans, trays, mixing bowls, wooden spoon, perforated spoon, colander, sieve, rolling pin, frying pan, oven and measuring scale.

Recipe / Method

100% White Wheat Flour (Control)	100% Breadfruit Flour	50% White Wheat Flour and 50% Breadfruit Flour	75% Breadfruit flour and 25% White wheat Flour
Flour(wheat) 150g Margarine 100g Sugar 65g Egg 4 Rum ½ tsp Butterscotch ½ tsp Bakingpowder ½ level teaspoon Cinnamon ½ level teaspoon	Breadfruit flour 150g Margarine 100g Sugar 65g Egg 4 Rum ½ tsp. Butter Scotch ½ tsp. Baking powder ½ level t/spoon Cinnamon ½ level teaspoon Browning 3 teaspoon	75g wheat flour 75g breadfruit flour 100g margarine 65g sugar 4 eggs ½ teaspoon rum ½ tsp butter scotch ½ level tsp baking powder ½ level tsp cinnamon 3 tsp Browning	Wheat flour 112g Breadfruit flour 38g Margarine 100g Sugar 65g Eggs 4 Rum ½ tsp Butter scotch ½ tsp Baking powder ½ level tsp Cinnamon ½ level tsp Browning 3 teaspoon

Method:

i. Cream fat and sugar till fluffy.
ii. Gradually add the beaten egg, flavour, mix well.
iii. Fold in the sieved flour, cinnamon and baking powder.
iv. Pour in a lightly greased pan.
v. Bake in a moderate oven

Proximate Analysis

This was determined by taking 100grams of the coded food samples to the laboratory in a transparent covered container to determine the carbohydrate, fats and oil, protein, ash and moisture contents of the products using the official method of Association of Analytical Chemist (AOAC 2005) as below;

Determination of Moisture Content

The moisture content of the samples were determined using AOAC 2005 method by weighing 5g of each sample into already weighed clean drying cans. The cans with the samples were placed in an oven drier, maintained at 105degree centigrade. After 16-18 hours, the drying cans were transferred into desiccators to cool, after which the final weight was taken as:

$$\% \text{ Moisture Content (MC)} = \frac{W2-W1}{S} \times 100$$

Where:

W1 = Weight of empty moisture can W2= Weight of dried sample with moisture content can S= Weight of sample

Determination of Ash Content

This was done using AOAC (2005) method which involves weighing 2g of the samples into a crucible, which would have been previously ignited and weighed. The crucible containing the sample was placed on a hot plate inside the fume cupboard to char the organic matter. The remaining residue (inorganic matter) was transferred into the muffle furnace maintained at 600°C for 6 hours to ash the sample completely. The crucibles was transferred into desiccators to cool and weighed.

$$\% \text{ Ash content} = \frac{W3-W1}{W2-W1} \times 100$$

W1 = Weight of crucible

W2= Weight of crucible plus sample before cooling W3= Weight of crucible plus sample after aching.

Determination of Protein Content

The method of AOAC (2005) was used. This was carried out by weighing 0.20-025g of the sample into the digesting tube and adding 4ml each of concentrated Tetraoxosulphate (IV) acid and Hydrogen peroxide. One selenium tablet of kjedhal catalyst -was added. The sample was digestives on the digestion block at 375°C for 3 hours. The tube was made to mark with distilled water, covered with paraffin, and mixed thoroughly. 1ml of digest was pipettes into 25ml volumetric flask;3drops each of polyvinyl / alcohol solution and mineral stabilizer was added to make 25ml marked with distilled water.1ml of Nessler reagent was added for colour development. The mixture was poured into the HACH spectrophotometer 3000 to determine the concentration of nitrogen at 460nm

$$\%\text{Nitrogen} = \frac{\text{Concentration} \& 0.0075}{\text{Sample weighed (g)}}$$

Determination of Fat Content

The method of AOAC (2005) was used. Clean extraction flask has to be oven dried, cooked in desiccators and weighed. The sample (3g) was weighed on the filter paper, folded and transferred into the thimble. The thimble was plugged with cotton wool and placed in the extraction barrel of the sox let apparatus. The barrel was put on pre-weighed flask on the heating mantle of the barrel and the flask. The sample refluxed for 6 hours. After the extraction, the thimble was removed and the solvent was distilled off until the flask was almost dried. The flask was detached, dried in the oven at 500c overnight, cooled in the desiccators and weighed. Fat content=Wt of flask plus fat Wt of empty flask / Wt of sample x 100. The carbohydrate content was determined by the difference between 100 and the total sum of the percentage of fat, moisture, ash, crude fiber and protein content.

Determination of Shelf Life

Shelf life was determined in two ways:

i. Samples without preservative
ii. Samples with preservative

Samples without Preservatives

These samples were collected in a transparent air tight covered container and stored in a ventilated room.

Sample with Preservatives

Were also collected in a transparent air tight covered container and stored in 2 ways (i) ventilated room and (ii) in the refrigerator.

Findings /Discussion

Table 1: Colour Score for Cake

	Experimental			Control
Variable	50% wheat flour + 50% breadfruit flour A	75% breadfruit flour + 25% wheat flour B	100% breadfruit flour C	100% wheat flour D
Golden brown	9 (90%)	6 (60%)	5 (50%)	8 (80%)
Dark brown	1(10%)	4 (40%)	5 (50%)	1 (10%)
Butter brown	0	0	0	0
Brown	0	0	0	0

From Table 1 above 90% of the panelists chose 50% wheat flour plus 50% bread fruit flour (sample A) highest as golden brown while 80% chose 100% wheat flour as golden brown. Sample D (control) 60% of the panelists also chose 75% bread fruit flour plus 25% wheat flour as golden brown (sample B) while 50% chose 100% bread fruit flour as golden brown (sample

C) 10% chose 100% wheat flour sample D (control) as dark brown and another 10% chose it as brown. This shows that the number of panelists that accepted golden brown as the colour of samples were highest for all samples. However, most of the panelists (90%) agreed that sample A and the control (sample D) are golden brown in colour.

Table 2: Taste score for cake

	Experimental			Control
Variable	50% wheat flour + 50% breadfruit flour A	75% breadfruit flour + 25% wheat flour B	100% breadfruit flour C	100% wheat flour D
Very pleasing	7 (70%)	5 (50%)	4 (40%)	8 (80%)
Slightly pleasing	0 (0%)	3 (30%)	5 (50%)	0 (0%)
Pleasing	2 (20%)	1 (10%)	1 (10%)	1 (10%)
Tasteless	1 (10%)	1 (10%)	0	1 (10%)
Sour	0	0	0	0

From the above table, it can be seen that 80% of panelists were of the choice that 100% wheat flour (control) taste was very pleasing, while 50% of the panelist chose sample B as very pleasing and C as slightly pleasing. No panelist chose sour for any sample. The taste of sample A was highly comparable with the taste of the control (sample D). That is 70% of the panelist, accepted that sample A and D are very pleasing in terms of taste. This indicates that the taste of the samples were acceptable to the panelists.

Table 3: Texture Score for Cake

	Experimental			Control
Variable	50% wheat flour + 50% breadfruit flour A	75% breadfruit flour + 25% wheat flour B	100% breadfruit flour C	100% wheat flour D
Tender	9 (90%)	4 (40%)	4 (40%)	6 (60%)
Hard	0	2 (20%)	2 (20%)	0
Soft	1 (10%)	4 (40%)	4 (40%)	4 (40%)
Tough	0	0	0	0
Sticky	0	0	0	0

From the above table, 90% of panelist were of the choice that sample A is tender, 40% believed that sample B and C were also tender while 60% were of the opinion that sample D was tender

also. Also 40% of the panelists chose samples B, C and D as soft, while no panelist rated any sample as tough or sticky. This showed that the texture of the samples comparing the experimental to the control, sample A was rated by 90% of panelists as being tender and 10% rated it soft while 60% rated the control (sample D) as being tender and 40% rated it soft.

Table.4: Flavour score for cake

	Experimental			Control
Variable	50% wheat flour + 50% breadfruit flour A	75% breadfruit flour + 25% wheat flour B	100% breadfruit flour C	100% wheat flour D
Very pleasing	7 (70%)	2 (20%)	1 (10%)	5 (50%)
Pleasing	3 (30%)	7 (70%)	4 (40%)	4 (40%)
Tasteless	0	0	1 (10%)	1 (10%)
Slightly pleasing	0	1 (10%)	4 (40%)	0
Sour	0	0	0	0

From the above table, 70% of the panelists viewed the flavour of sample A as very pleasing while 50% viewed sample D as very pleasing as well. 70% of panelists were of the opinion that sample B flavour was pleasing, 40% rated sample C as pleasing. No panelist viewed any sample flavour as sour. Since all the samples were freshly prepared. This implies that sample with 50% bread fruit flour (sample A) seems to be most pleasing in terms of flavour while sample C is the least. Also the control (sample D) was regarded by 10% of the panelists as being tasteless.

Table 5: Appearance Score for Cake

	Experimental			Control
Variable	50% wheat flour + 50% breadfruit flour A	75% breadfruit flour + 25% wheat flour B	100% breadfruit flour C	100% wheat flour D
Fresh	6 (60%)	4 (40%)	4 (40%)	8 (80%)
Smooth	4 (40%)	6 (60%)	5 (50%)	2 (20%)
Powdery	0	0	1 (10%)	0
Greasy	0	0	0	0

From the above table, 80% of the panelist rated the appearance of the sample D as fresh. 60% were of the opinion that appearance of sample A was fresh while 40% also viewed samples B and C appearance as fresh. 60% of the panelists were of the opinion that sample B appearance was smooth, 50% viewed sample C as smooth, 40% also viewed sample C as smooth while 20% were of the opinion that sample D is smooth. 10% of the panelists viewed sample c as

powdery. No taster was of the opinion that any sample was greasy. In comparison, sample A and B (experimental) were highly comparable with the control (sample D). That is samples A and D were rated similarly in terms of freshness while samples A and B are rated higher than sample D in terms of smoothness.

Table.6: Acceptability Score for cake

	Experimental			Control
Variable	50% wheat flour + 50% breadfruit flour A	75% breadfruit flour + 25% wheat flour B	100% breadfruit flour C	100% wheat flour D
Very Acceptable	6 (60%)	2 (20%)	3 (30%)	5 (50%)
Acceptable	4 (40%)	6 (60%)	5 (50%)	5 (50%)
Slightly acceptable	0	2 (20%)	2 (20%)	0
Very unacceptable	0	0	0	0

From the table above, 60% of the panelists were of the opinion that sample A (control) was very acceptable. Also, 60% of the panelists were of the opinion that sample B was acceptable while 50% viewed sample D (control) as acceptable. No panelist chose any sample as very unacceptable. Therefore, all the panelists, found the experimental (samples A,B and C as acceptable comparable to the control (sample D).

Discussion

Cakes

For colour score, sample A (50% wheat flour plus 50% bread fruit flour) has the highest score, 90% of the panelists chose golden brown, followed by sample D (100% wheat flour). 80% of the panelist went for golden brown while 50% rated sample C (100% bread fruit flour), dark brown, and 60% chose sample B as golden brown. No panelist was of the opinion of chosen butter brown. Based on the findings of this study, it can be deduced that it is acceptable because majority of the panelist went for golden brown and dark brown. The findings correspond with Peckan (2000) that baked confectionery should have golden brown colour. Taste score (Table.2) from the table, it can be seen that 80% of panelists were of the choice that 100% wheat flour (control) taste was very pleasing, while 50% of the panelist chose both sample B and C as lightly pleasing. No panelist chose sour for any sample. This result corresponds with the results of Olaoye (2007) that confectionaries such as biscuits with some percentages of breadfruit flour have similar taste as those made from 100% wheat flour but the former is better nutrition wise.

Texture score (Table 3) sample A (50% wheat flour plus 50% bread fruit flour) has the highest rank (90% as tender, followed by sample D 100% wheat flour (control) which was rated by 60% of the panelists as tender while 40% of panelist were of the opinion that sample B (75% bread fruit flour plus 25% wheat flour) and sample C (100% bread fruit flour) as soft. Since,

according to Peckan (2000) baked confectionaries such as cake with tender texture are better and most acceptable, it follows that sample A (50% bread fruit flour plus 50% wheat flour) is preferred to sample D (control) in terms of texture. This result is in agreement with the statement made by Marck (2010) that breadfruit increases the tenderness of pounded yam and may do the same for baked confectionaries if it is supplemented with wheat flour to some extent.

Flavour

70% of the panelists rated sample A (50% wheat flour plus 50% bread fruit flour) as very pleasing, the same percentage of panelists rated sample B (75% bread fruit flour plus 25% wheat flour) as pleasing. 50% of panelists were of the opinion that sample D (100% wheat flour) was very pleasing, while 40% of panelist chose sample C (100% bread fruit) as slightly pleasing. No panelist chose sour. This implies that sample with 50% bread fruit flour + 50% wheat flour (sample A) seem to be most pleasing in terms of flavour while sample C (100% bread fruit) is the least. Also the control (100% wheat flour) sample D, was regarded by 10% of the panelists as being tasteless. This finding is in contrast with the result given by Olaoye (2007) that the flavour of confectionaries made from 100% wheat flour is virtually similar to those made from wheat flour supplemented with 25% bread fruit flour.

Appearance

Based on the panelist, 60% went for sample a (50% wheat flour plus 50% bread fruit flour) as fresh, while 80% chose sample D (100% wheat flour) control as also fresh. 60% of panelists were of the opinion that sample B (75% bread fruit flour) + (25% wheat flour) was smooth, while 50% chose sample C (100% bread fruit flour) as smooth. No panelist chose greasy. In comparison, sample A (50% wheat flour + 50% bread fruit flour) and B (75% bread fruit flour + 25% wheat flour (experimental) were highly comparable with the control 100% wheat flour (sample D) that is, samples A and D are rated similarly in terms of freshness while samples A and B are rated higher than sample D (control) in terms of smoothness. Peckan (2000), said in his research that appearance of baked confectionaries depends on period of preparation, ingredients or recipe used and texture of the flour used. But a good baked confectionary should be fresh and smooth. Based on these findings, it can be deduced that the appearance was acceptable because it was highly rated for freshness and smoothness.

General Acceptability

60% of the panelist rated sample A (50% wheat flour + 50% breadfruit flour) highest (very acceptable) while 60% chose sample B (75% bread fruit flour plus 25% wheat flour) as acceptable. Also 50% of the panelists were of the opinion that sample D 100% of wheat flour (control) and sample C (100% bread fruit flour) were acceptable. No panelist chose very unacceptable. This result corresponds with the results of Olushola (2011) that cake that contains 50% cassava flour are more acceptable than the ones that contain 100% wheat flour. However, the general acceptability of confectionaries according to Peckan (2010) should be rated based on other organoleptic tests and nutrients composition.

Table 13: Proximate composition of breadfruit flour in confectionaries (cake)

Samples	Carbohydrate %	Protein %	Ash %	Fat and oil %	Moisture %
A (50% wheat flour plus 50% bread fruit flour	79.37%	2.98%	0.49%	4.80%	6.50%
B (75% bread fruit flour plus 25% wheat flour	77.96	3.80	0.69	5.20	6.25
C (100% bread fruit flour)	76.67	3.50	0.83	7.10	5.50
D (100% wheat flour)	78.88	3.0	0.62	4.50	7.0

The nutrients composition of cake made from different percentages of wheat flour and breadfruit flour 50% wheat flour plus 50% bread fruit flour (sample A) 75% bread fruit flour plus 25% wheat flour(sample B) 100% bread fruit flour (sample C) and 100% wheat flour (sample D) showed from the Table 13 above for cake, carbohydrate % ranged from 76.67% to 79.37%, samples made with 50% wheat flour plus 50% bread fruit flour has the highest carbohydrate content that is 79.37% while that of 100% bread fruit flour has the lowest (76.67%). The percentage of carbohydrate content decreased as breadfruit level increased. Also, the carbohydrate content of one of the experimental (sample A) 50% bread fruit flour + 50% wheat flour was higher than that of the control (sample D) (100% wheat flour). However, the carbohydrate content of the control sample is relatively higher and this corresponds with the results of Marcola (2011) that white flour essentially becomes a form of sugar considering what gets lost in the refining. Protein % ranged from 2.98% - 3.80% sample with 75% bread fruit flour plus 25% wheat flour was highest (3.80%) next was sample with 100% bread fruit flour (3.5%) and the lowest was sample made from 50% wheat flour plus 50% bread fruit flour. The experimental sample A was higher in protein (3.80%) than the control (3.0%). This is a plus considering the amount of carbohydrate and other nutrients contained in sample B.

This corresponds with the findings of Nwaojigwa (2007) on bread made from wheat flour and plantain flour that the protein content of composite flour increases as the amount of plantain flour increases. Ash content also ranged from 0.49% to 0.83%. sample made from 100% breadfruit has highest ash content (0.83%) followed by sample made from 75% bread fruit flour plus 25% wheat flour (0.69%) lowest were samples made from 50% wheat flour plus 50% bread fruit flour (0.49). This showed an increase of ash content as breadfruit flour increased. Ash content was highest in 100% breadfruit. This shows that breadfruit has higher ash content than wheat flour which is in agreement with the result of Marcola (2011) that 50% calcium, 70% phosphorus, 80% iron, 90% magnesium, 50-80% B vitamins and many other nutrient are destroyed in the refining process of white flour leaving nearly all starch flour. Moisture contents of the samples were also ranged from 5.50% - 7.0%, samples made from 100% wheat flour was highest (7.0%) while samples made from 100% breadfruit flour was lowest (5.50%). The moisture content decreases as % level of breadfruit increases. This result corresponds with the analysis of N.N.D.B. (2001) that breadfruit contain relatively low

amount of moisture and this accounts for the high amount of other nutrients present in breadfruit. Fats and oil also ranged from 4.50% to 7.10%, samples made from 100% breadfruit flour was highest 7.10%, while sample made from 100% wheat flour was lowest (4.50%) shows an increase in fat content with an increase in breadfruit level. In comparison, the lipid content of cake made from breadfruit flour is higher than the lipid content of cake made from wheat flour by 2.6%. This result agrees with the findings of Marcola (2011) that half of the beneficial unsaturated fatty acids in wheat flour are lost during the refining process, leaving saturated fatty acids which cause obesity and other weight issues. Generally cake made from the composite flour contains more nutrient except moisture and carbohydrate than cake made from wheat flour alone. This result corresponds with the findings of Anderea R. (2010) that unrefined wheat flour will naturally contain 22 essential nutrients all of which are lost during the refining process.

Shelf Life of Breadfruit Flour in Confectionaries (Cake)

Samples without preservatives: It was observed that cake with 100% and 75% breadfruit flour spoilt before 24 hours while the cake with 50% breadfruit managed to stay for 30 hours before spoilage. This could be attributed to the higher lipid content of breadfruit seed from which the flour was made. Seeds generally have more oil content than any other part of the plant. Lounge (2005).

Sample with preservatives: It was observed that the ones in a ventilated room lasted for 10 days. At 10 days it was still acceptable but very soft. Spoilage started earlier with cakes made with 100% breadfruit flour. The refrigerated ones were seen to last for about 2 weeks before spoilage. This again may be attributed to higher oil content of breadfruit flour. Fat and oil plays vital role in the determination of shelf life of foods. High amount of fat and oil is usually undesirable because it accelerates spoilage by promoting rancidity but when used with preservative and chilled stays longer (Olaoye, 2007).

Conclusion

This finding revealed that there is little or no difference between the organoleptic properties of cake made from the composite flour and those made from 100% wheat flour. However, cake made from 50% bread fruit flour plus 50% wheat flour is more acceptable in terms of colour, texture, flavour, taste and appearance than cake made from 100% wheat flour.

Also proximate composition of cake made from bread fruit flour is richer in protein, fat and oil than those made from 100% wheat flour. Bread fruit flour is also lower in carbohydrate and moisture content. The shelf life of cake made from composite flour is shorter (less than 30 hours than the shelf life of cake made from 100% wheat because of the high fat content of breadfruit flour. But, the shelf life can be extended using preservatives as it is mostly done for confectionaries. Therefore, using bread fruit flour to supplement wheat flour in confectionaries will enhance the general acceptability and improve the nutritional status of confectionaries. It will also reduce the amount spent on importation of wheat and increase the income of indigenous farmer and the country's income as a whole.

Recommendations

Based on the findings of this study, the following recommendations are made:

1. Wheat flour should be supplemented with bread fruit flour up to at least 50% as this will enhance acceptability and nutrient content.
2. Further research should be done on how to extend the shelf life of confectionaries containing bread fruit flour.

References

Afolabi, B. & Anthonia O. (2006), "Rheology & banking, Potential of Wheat / Plantain composite flour." Online Library Wiley. com / pdf.

Anderea, R. (2010), "The danger of white flour." www.helum.coHome Health & Fitness

Andrews (2009), "Planting & Harvesting of Breadfruit." Y work wood.com

Angus (2008), "Kennedy's Confectionery Magazine"

Ascherio, A. (1998), "Breadfruit Health." Alliciousness.co

Bank (2002), "West African Breadfruit Revolution." htm cached

Breadfruit Institution (2006), "Tropical botanical garden." ntbg org / breadfruit

Chioma, O. & Busola, L. (2012), "Nigeria Breadfruit." htm / cached

Diana, R. (2003), "National tropical Botanical garden." nt.org.breadfruit

Diana, R. (2006), "breadfruit tree." on wikipedia.org.wiki

Enid, O. & Reilly, W. (1980,) "The student's cookery book" 2nd Edition Britain: Oxford University Press

Evangeline, D. (2008), "The danger of white flour." www.helium.com Home Health and Fitness FAO (1983) Leaflet No. 9 www.fao.org. x 5425e.htm-cached.

Fulponi (2005). Multidisciplinary journal of research development by national association of development. volume 10 No. 6

Haijar, I. M. & Grim C. E. (2001), "Breadfruit Health Aliciousness." www.heatlh, Aliciousness com. fruit / breadfruit php cached

Haiti, S. (2011), "Breadfruit Nutrition facts & health benefits fitness republic." www.fitness republic.com / nutrition / breadfruit

Idosi (2010), "Planting of breadfruit." www.idosi org / mejsr / mejsr 6 (5) pdf

Jackie, L. (2010), "Effect of removing sugar and white flour from the diet." www.how food drink com.archives / 2030

Jeff, M. (2010), "West African breadfruit Revolution."

Jeff, M. (2010), net / breadfruit revolution, htm cached.

Justus (2012), "African recipe Nigeria breadfruit."

Kinton & Ceserani (1981,). 4th edition "the theory of catering"

Kinton & Ceserani (1984), 5th edition practical cookery

Likolo (2012), "African Nigeria breadfruit." www.JustushealthyeatingNigeriadiets. com / Nigeria breadfruit html cached.

Lounge (2005) "Nutritional facts and analysis for breadfruit." Nutritional dats. Self com / facts.

Mercola (2011) "How bread with refined white flour affects your health." Articles mercola com / site / articles.

Mirkins (2004), "Chemical analysis of Breadfruit." Western Nigeria food Techno

N.N.D.B (2001)' "National Nutrient data base breadfruit nutrition." Fats and Health Benefits Nutrition and you com. breadfruit html coached

Nwaojigwa (2007), African Journal of food Agriculture, Nutrition & Development. Volume 7, No.1

Nwachukwu (2012), "African recipe, Nigeria breadfruit."

Ola, O.A. (2010), "Processing of breadfruit." (Breadfruit cubes, serve)

Olaoye (2007), "Breadfruit flour in biscuit making effects in product science stage."

Olaoye, (2007), "Breadfruit flour in biscuit making." African journal of food volume 8, No. 2

Olaoye (2007), "Chemical composition, Rheological properties & bread making." www academic journals org / aifs / pd / p

Olaoye (2007), "Microbiological proximate analysis& sensory evaluation of baked products from blends of wheat breadfruit flours."

Olusola (2011), "download complete issue." (2640kb) academic journals

Peckan (2000,) “Thanksgiving Desserts & Baking Recipes and Videos.” joy of Baking com. www. Joy of baking com

Peckan (2000), “The food time lime Cake history notes.” www foodlime line org / food cakes. htm /

Peckan (2010), “Food lipids chemistry, nutrition and Biotechnology.”

Peters (2008) “Kitchen myths Facts & fiction about food and cooking.”

Peter, L. (2001), “Analyst Kitchen myths com / of breadfruit nutrition facts & health benefits.” www nutrition and you.com

Ragone (2005), “Breadfruit institution.” www breadfruit org. Kausi, Hawali

Shoummojit (1999), “Growing of breadfruit tree.” (Artocarpus Altillis) www. Only foods net / breadfruit tree

Tribune (2012), “African breadfruit Nature's antidote.” www.Naturalstandard.com / dat abases / herb supplements / b / fruit.

Uchenna (2010), “Processing of breadfruit flour.” www. fao.org / wairdocs / X5425

Umesh, R. (2009), “Breadfruit Nutrition fact and health benefits.” (www nutrition and you, com. breadfruit htm / -cached)

World Health Organization (WHO) (2001), “Health Promotion for working Population.” Report of a WHO Expert Committee Series 765