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Consumer Acceptability of Bread Produced from Alternatives to Wheat Flour for Sale in Hotels and Restaurants

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Abstract: ***The most suitable flour variety and an acceptable maximum substitution level of wheat flour with those of cassava, maize and millet for bread production in terms of baking and organoleptic properties was determined. High quality flour produced from four varieties (cassava, maize, millet and wheat) was used to make bread. Bread samples were baked from the resulting flour and examined. The products were subjected to sensory analysis for appearance, colour, taste, texture, flavour, crumbliness and overall acceptability, for sale in hotels and restaurants by a panel of 15 consumers using a nine-point hedonic scale. ANOVA and sample mean were used to analyze data. Cassava bread consequently has the most acceptable percentage with respect to samples evaluated when used as an alternative to wheat flour for bread production. The study therefore adjudged cassava flour as the best alternative flour for bread production which can be offered to consumers in hotels and restaurants. However, cassava flour should be fortified in order to meet other basic human nutritional needs.***

Keywords: Consumer acceptability, bread, hotels, physical properties, restaurants

1. Introduction

Bread is a universally accepted form of convenient food that is important to all population. It is a good source of macro nutrients (carbohydrate, protein and fat) and micro nutrient (minerals and vitamins) which are essentials for human health. In Nigeria, bread has become the second most widely consumed non-indigenous food product after rice, as it is consumed extensively in most homes, restaurants, fast food outlets and hotels. It has been mainly produced from wheat as its major raw material. In Nigeria, wheat production is limited due to the climate condition hence wheat flour is imported to meet local flour needs for bread production. Thus large amount of foreign exchange is spent yearly to import wheat. While effort has been made by local authorities to promote the use of other flour which can be gotten from locally grown crops and high protein seeds to replace a portion of wheat flour for use in bread production, and in order to reduce the demand for imported wheat and also help in producing protein enriched bread (Ndife and Abbo 2009), most tropical cereals grains and tubers can be used to make alternative flour for bread making, like barley, corn, millet, oats, rye, sorghum, soya beans, maize, potato, and cassava. However, there is a substantial amount of bread made from other alternative flour; but most of these bread still require at least 50% to 70% of wheat flour to be able to rise due to the presence of gluten – the major protein in cereal which is responsible for the elasticity in dough and the structure in bread production (Okaka and Potter, 2012).

The successful use of other alternative flour has been made evident. Many authors have reported the use of composite flour of wheat, protein and soya bean in making cookies (Mohsen, Fadel, Bekhit, Edris, and Ahmed, 2009). Serrem, Kock and Taylor (2011), viewed that good quality and acceptable bread product could be derived from composite flour with a certain level of bread fruit flour substitution in wheat flour, hence this study aimed at producing bread by using cassava flour, maize flour and millet flour in other to increase the fiber, protein and other nutrients of the product, as well as examine the cost effectiveness of producing bread (domestically, for a given hotel or restaurant) using alternative flour. It is noteworthy that the use of white flour derived from processing of whole wheat grain aimed at improving the aesthetic value of white bread has led to the drastic reduction in the nutritional density and fiber content when compared to bread from whole grain cereal (Dewettinck, Van Bockstaele, Kuhne, Van de Walle, Courtens, Gellynck and Cereal, 2008).

1.1 Study Objectives

The main objective of this study is to examine the level of customer acceptability of alternative breads to wheat bread for sale in hotels and restaurants, while the specific objective are to:

a. Prepare and bake bread using different flour from wheat, cassava, maize and millet.
b. Assess the sensory qualities of breads produced from alternatives to wheat flour.

2. Theoretical Framework

The consumption of bread produced from wheat flour is very popular in Nigeria. But the low protein content of the wheat flour which is the most vital ingredient used for the production of bread has been a major concern in its utilization (Young, 2001). As an important staple food with the consumption growing steadily and increasingly in Nigeria, bread has become relatively expensive as wheat is not cultivated in tropical regions of the world due to unfavourable climatic conditions (El Gharras, 2009). At present, the cost of bread has become relatively high in Nigeria thus giving concern to further research into the use of alternative flour for baking.

However, wheat is a good source of calories and other nutrient but its protein is of lower nutritional quality and is deficient in essential amino acid such as lysine and threonine when compared to millet (Bakke and Vickers, 2007). This has led to the promotion of maize flour, cassava flour and millet flour which can be made from locally grown crops and high protein seeds to replace a portion of wheat flour for use in bread production thereby decreasing the demand for imported wheat and producing protein enriched bread (Mohsen et al., 2009). Consumer awareness of the need to eat high quality and healthy bread which contains ingredients that will provide additional health benefits beyond the basic nutritional requirements is rapidly on the increase (Ndife and Abbo, 2009). Therefore, this trend is to produce bread from other flour that will be of great value in terms of cost and nutritional benefit. Legumes can complement cereals when blended at optimum ratio (Okaka and Potter, 2012); hence this study is significant.

3. Methodology

Sensory assessment forms were provided to the taste panelists, who were required to evaluate some of the sensory attributes of the bread produced, including appearance, colour taste, flavour, texture, crumbliness and overall acceptability. A nine-point hedonic Likert rating scale was used. Two-Way ANOVA and sample mean were used to analyze data from respondents.

3.1 Research Population

Sixteen people were randomly selected from among customers of four hotels within Ilaro area (Ogun State, Nigeria), which represent the number of panelist to be used. The sample size for this study was determined using Taro Yamen formula; n=$N/(1+N(e^2)$. Where:

n=Sample size
N =finite population
1 = constant
e = level of significance

$$n = \frac{16}{1+35(o.o5^2)}$$

$$n = \frac{16}{1+16(0.0025)}$$

$$n = \frac{16}{1+0.04}$$

$$n = \frac{16}{1.04}$$

n =15.38
n =15

4. Result and Discussion

The rating of the sample were carried out by the panelist and it was discovered that the bread made from wheat flour was highly rated above other samples and it happens to be the most preferred among the whole samples. However, bread made from cassava flour is the best alternative to wheat flour when used for bread production.

Bread made from wheat flour (WBP) is significantly rated (8.13) above other samples, as CBO sample is the closest rated alternative (7.80) by virtue of the mean scores. MBZ and DBM samples had mean scores of 7.20 and 6.87 respectively, as they are rated lower than CBO sample (Table 1).

Respondents accepted the colour of bread sample from WBP significantly (8.0), followed by CBO sample with a mean score of 7.2 as the best alternative. Samples MBZ and DBM were also accepted in this regard with same mean scores of 6.87 each (Table 2).

The texture of the samples were positively rated. While WBP has a score of 7.47, CBO closely had a mean score of 6.47, MBZ and DBM samples were rated 6.13. CBO sample has the best texture out of the alternative samples to WBP, based on the analysis on Table 3.

Respondents accepted the taste of the samples and rated WBP sample as best out of the other three samples. CBO sample, however, was better than the other samples (6.87) as samples MBZ and DBM scored 6.72 and 6.13 respectively (Table 4).

Samples CBO and MBZ were tied at a mean score of 6.47 for flavour desirability behind WBP sample at 6.93, and DBM has a mean score of 6.33 (Table 5), while in Table 6, sample CDB is the best alternative to wheat bread with a mean score of 7.2 in the crumbliness scale.

Overall acceptability is the major factor that must be considered before a food product can be offered to the consumer in order to determine if the product is worth its development, as well as to determine if profit can be made from such product. So the overall acceptability scale (Table 7) shows that sample WBP was rated above other samples (7.73) followed by sample CBO with the alternatively highest mean score (6.67) to other alternative samples. Bread made from maize flour and millet flour were tied at a mean score of 6.53 each. Hence bread made from cassava flour has the highest ranking in terms of overall acceptability according to the taste panelist and is, therefore, the best alternative to wheat flour for use in bread production.

In the ANOVA tables, data show Fcal summation of ≥ 0.5 in all the distributions for both sample and panel subscales. This represents a positive general and overall acceptability of the bread produced from the different flour alternatives by the respondents, hence the products were ranked accepted for consumption.

5. Result of Sensory Evaluation

Table 1: Appearance of Samples

PANELIST	WBP	MBZ	CBO	DBM	TOTAL
1	7	6	8	6	27
2	8	8	9	8	33
3	9	9	9	9	36
4	7	5	6	5	23
5	8	5	8	5	26
6	8	8	8	7	31
7	8	8	6	7	29
8	8	8	7	8	31
9	9	9	9	9	36

10	9	6	7	6	28
11	9	7	9	7	32
12	8	7	7	6	28
13	9	7	9	7	32
14	8	7	7	6	28
15	7	8	8	7	30
TOTAL	122	108	117	103	450
MEAN	8.13	7.20	7.80	6.87	

Code: *WBP = bread produced from wheat flour; MBZ = bread produced from maize flour; CBO = bread produced from cassava flour; DBM = bread produced from millet flour.*

Source: *Survey, 2017.*

Decision Rule: *If mean score ≤ 5.49, respondents dislike*
If mean ≥ 5.50, respondents like

1. Correction factor CF = $\frac{(\text{grand total})2}{P \times S}$

   Where P = No of panelist
   S = No of samples

   CF = $\frac{(450)2}{15X4}$

   CF = $\frac{202500}{60}$

   CF = 3,375
2. TOTAL SUM OF SQUARES TSS= EX^2- CF

   Where EX = sum of each panelist grade
   CF = correction factor

   TSS = $7^2+8^2+9^2+7^2+8^2+8^2+8^2+8^2+9^2+9^2+9^2+8^2+9^2+8^2+7^2$
   = 1000

   $6^2+8^2+9^2+5^2+5^2+8^2+8^2+8^2+9^2+6^2+7^2+7^2+7^2+7^2+8^2$ = 800

   $8^2+9^2+9^2+6^2+8^2+8^2+6^2+7^2+9^2+7^2+9^2+7^2+9^2+7^2+8^2$
   = 929

   $6^2+8^2+9^2+5^2+5^2+7^2+7^2+8^2+9^2+6^2+7^2+6^2+7^2+6^2+7^2$
   = 729

   TSS = (1000+800+929+729) - 3375
   TSS = 3458-3375
   TSS = 83
3. SUM OF SQUARES OF PANELIST SSP = $\frac{EP^2-CF}{\text{NO OF SAMPLE}}$

   SSP = 27^2
   $+33^2+36^2+23^2+26^2+31^2+29^2+31^2+36^2+28^2+32^2+28^2+$
   $32^2+28^2+30^2$

   SSP
   =729+1089+1296+529+679+961+841+961+1296+78
   4+1024+784+ 1024+784+900

   SSP = $\frac{13681}{4}$

   3420.25-3375
   = 45.25
4. SUM OF SAMPLES SSS = $\frac{EP^2-CF}{\text{NO OF PANEL}}$

   $\frac{122^2+108^2+117^2+103^2}{15}$ - 3375

   = $\frac{14884+11664+13689+10609-3375}{15}$

   = $\frac{50846}{15}$

   = 3389.73- 3375
   = 14.43
5. SSE = TSS – (SSS + SSP)
   = 83 – (14.73 + 45. 25)
   = 83 – (59.98)
   = 23.02

   CF = 3375
   TSS = 83
   SSP = 45.25
   SSS = 14.73
   SSE = 23.02

ANOVA Table (for Table 1)

Variation	DF	SS	MS	Fcal
Sample	3	14.73	4.91	8.93
Panel	14	45.25	3.23	5.87
Error	42	23.02	0.55	
Total		83		

Df of sample = Ns – 1
= 4 – 1
= 3

Df of panel = Np – 1
=15 – 1
= 14

Df of error = (Ns – 1) (Ns - 1)
= (4-1) (15-1)
= (3) (14)
= 42

Ms = $\frac{ss}{df}$

Fcal = $\frac{ms}{ms\ error}$

Table 2: Colour of Samples

PANELIST	WBP	MBZ	CBO	DBM	TOTAL
1	8	8	8	7	31
2	7	7	9	7	30
3	7	7	7	7	28
4	6	5	5	5	21
5	8	4	8	4	24
6	9	8	8	7	32
7	8	7	6	6	27
8	8	7	7	9	31
9	9	8	8	8	33
10	8	5	8	7	28
11	9	8	8	8	33
12	7	7	8	7	29
13	8	8	7	7	30
14	9	8	6	7	30
15	9	6	5	7	27
TOTAL	120	103	108	103	434
MEAN	8	6.87	7.2	6.87	

ANOVA Table (for Table 2)

Variation	DF	SS	MS	Fcal
Sample	3	12.86	4.29	4.47
Panel	14	7.73	0.55	0.57
Error	42	40.14	0.96	
Total		60.73		

Table 3: Texture of Samples

PANELIST	WBP	MBZ	CBO	DBM	TOTAL
1	8	6	7	5	26
2	7	7	8	7	29
3	8	7	8	7	30
4	5	4	4	4	17
5	8	3	8	3	22

6	8	8	8	8	32
7	7	6	5	5	23
8	7	2	1	3	13
9	8	7	7	7	29
10	8	4	3	4	19
11	8	9	9	8	34
12	7	8	7	6	28
13	7	8	8	9	32
14	8	7	7	8	30
15	8	6	7	8	29
TOTAL	112	92	97	92	393
MEAN	7.47	6.13	6.47	6.13	

ANOVA Table (for Table 3)

Variation	DF	SS	MS	Fcal
Sample	3	173.92	57.97	156.68
Panel	14	130.6	9.33	25.22
Error	42	15.33	0.37	
Total		319.85		

Table 4: Taste of Samples

PANELIST	WBP	MBZ	CBO	DBM	TOTAL
1	8	7	8	5	26
2	8	9	7	8	33
3	9	8	7	8	32
4	5	2	5	5	16
5	6	4	4	4	19
6	9	8	8	7	31
7	7	6	7	5	22
8	5	3	7	3	14
9	9	7	8	8	31
10	6	2	5	4	13
11	9	9	8	7	33
12	8	6	7	6	25
13	9	8	8	8	32
14	8	7	8	7	29
15	9	8	6	7	31
TOTAL	115	94	103	92	387
MEAN	7.67	6.27	6.87	6.13	

ANOVA Table (for Table 4)

Variation	DF	SS	MS	Fcal
Sample	3	31.92	10.64	17.73
Panel	14	183.1	13.08	21.8
Error	42	25.83	0.60	
Total		240.85		

Table 5: Flavour of Samples

PANELIST	WBP	MBZ	CBO	DBM	TOTAL
1	7	7	7	7	28
2	8	8	8	8	32
3	7	6	7	7	27
4	7	5	5	5	22
5	6	7	6	7	26
6	8	8	8	8	32
7	7	5	5	6	23
8	5	4	8	4	21
9	7	8	7	8	30
10	6	4	4	4	18
11	7	6	7	6	26
12	7	8	7	6	28
13	7	8	7	7	29
14	8	7	6	6	27
15	7	6	5	6	24
TOTAL	104	97	97	95	393
MEAN	6.93	6.47	6.47	6.33	

ANOVA Table (for Table 5)

Variation	DF	SS	MS	Fcal
Sample	3	3.12	1.04	1.58
Panel	14	56.1	4.01	6.06
Error	42	27.63	0.66	
Total		86.85		

Table 6: Crumbliness of Samples

PANELIST	WBP	MBZ	CBO	DBM	TOTAL
1	9	9	9	9	36
2	8	7	8	8	31
3	8	9	8	9	34
4	5	5	6	5	21
5	6	7	6	7	26
6	8	8	8	8	32
7	7	5	6	7	25
8	7	3	7	6	23
9	8	7	7	8	30
10	8	6	6	3	23
11	8	7	7	5	27
12	8	5	6	4	23
13	8	7	7	6	28
14	7	8	8	7	30
15	8	7	8	8	31
TOTAL	113	100	108	100	420
MEAN	7.53	6.67	7.2	6.67	

ANOVA Table (for Table 6)

Variation	DF	SS	MS	Fcal
Sample	3	22.2	7.4	12.13
Panel	14	70	5	8.20
Error	42	25.8	0.61	
Total		118		

Table 7: Overall Acceptability of Samples

PANELIST	WBP	MBZ	CBO	DBM	TOTAL
1	7	5	9	5	23
2	8	9	8	7	32
3	9	9	9	9	35
4	7	4	5	5	21
5	8	5	7	5	25
6	9	8	8	8	33
7	7	7	7	7	26
8	4	4	6	4	16
9	9	8	8	8	33
10	7	4	3	6	21
11	9	7	5	8	31
12	8	7	4	7	28
13	8	7	6	6	29
14	8	7	7	7	28
15	8	7	8	6	28
TOTAL	116	98	100	98	409
MEAN	7.73	6.53	6.67	6.53	

ANOVA Table (for Table 7)

Variation	DF	SS	MS	Fcal
Sample	3	16.75	5.58	46.5
Panel	14	99.23	7.09	59.08
Error	42	5.09	0.12	
Total		121.98		

Table 8: Summary of Sensory Evaluation Result

Bread	Appearance	Colour	Texture	Taste	Flavour	Crumbliness	Overall acceptability
WBP	8.13[a]	8[a]	7.47[a]	7.67[a]	6.93[a]	7.53[a]	7.73[a]
MBZ	7.20[c]	6.87[c]	6.13[b]	6.27[b]	6.47[b]	6.67[d]	6.53[b]
CBO	7.80[b]	7.2[b]	6.47[d]	6.87[d]	6.47[b]	7.2[b]	6.67[d]
DBM	6.87[d]	6.87[c]	6.13[b]	6.13[c]	6.33[d]	6.67[d]	6.53[b]

Conclusion

From the result of the sensory evaluation, sample CBO produced from cassava flour was more preferred to other samples by the respondents in terms of appearance, colour, texture, taste, flavour, crumbliness and overall acceptability than other samples when used as an alternative to wheat flour; hence bread produced from cassava flour is more preferred for bread making than other alternative flour. However, it should be noted that cassava flour has no gluten, which is present in wheat flours. Wheat flour is, however, deficient in essential amino acids which the body requires. Moreso, nutrient like iron, niacin, and riboflavin are less in wheat flour after milling. Wheat flour is also deficient in sodium, vitamin C and vitamin B due to leaching and heat degradation. However, these nutrients are present in bread made from millet flour.

Based on the overall acceptability of the samples by the respondents, this study has therefore established that bread from alternatives to wheat flour can be developed for sale in local hotels and restaurants, and that these establishments can put machinery in place to produce their own products domestically, for sale to their customers, which will, in turn, assist them in conserving scarce resources and maximizing profit.

5.1 Recommendation

In view of the methodology of this study, and the results of its findings, it is therefore recommended that:

1) Cassava flour should be used as an alternative to wheat flour for bread production in local hotels and restaurants since, in Nigeria, it is cheaper and easier to produce than wheat flour. However, cassava flour should be fortified because of lack of some essential nutrients needed by the body to function properly.
2) Local hotels and restaurants in Nigeria should consider establishing bakery units within their outfits to encourage domestic production of cassava and millet (flour) bread, in order to conserve scarce resources. Especially, this will assist in encouraging or boosting local production of cassava to improve the local economy, provide employment for qualified professionals, and ensure customers are served with fresh and quality products.
3) The hospitality industry should be challenged in carrying out research on how to improve flour from cassava, maize and millet, by introducing additives that can improve the gluten deficiency in these flour.
4) Government should collaborate with the hospitality industry to carry out further research on how cassava, millet and maize flour can be improved to meet the requirement for bread production. If this is done, it will reduce the rate of wheat flour importation, which in turn will increase the local usage of maize flour, millet flour and cassava flour, as well as improve the local economy.
5) Prior to baking, the flours should be measured, as cassava flour tends to weigh less in comparison to all other flour hence it should be weighed before usage.
6) If maize flour should be used, the amount of sugar should be reduced as maize flour does not absorb sugar like every other flour.

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