

*Full Length Research Paper*

# Quality characteristics of biscuits produced from composite flours of wheat and quality protein maize

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**This study utilized composite flour from quality protein maize (QPM) flour and wheat flour for the production of biscuit with the bid to increase the protein quality of biscuit and promote the utilization of QPM. A mixture of wheat and QPM flours were mixed separately with the same quantity of other ingredients (sugar, baking powder, water, baking fat and salt). The biscuits produced were subjected to proximate composition, physical attributes and sensory evaluations using standard methods. The protein and fat contents of the biscuit samples ranged between 10.86-11.56% and 12.96-15.21% respectively. The energy value was between 431.95 and 443.89 Kcal. The spread ratio and break strength of the biscuit ranged from 9.25-12.86 and 119.16-291.35 respectively. The biscuits produced from the composite flour were acceptable and compared favourably with the control. Quality protein maize is of better protein quality than normal maize. Its utilization will afford the consumer to have food of high nutritional value.**

**Key words:** Biscuit, Quality protein maize, Composite flour, Physical attributes, Sensory evaluation.

## INTRODUCTION

The nutritional value of wheat is extremely important as it takes an important place among the few crop species being extensively grown as staple food sources. The importance of wheat is mainly due to the fact that its seed can be ground into flour, semolina etc. which forms the basic ingredients of bread and other bakery products, as well as pasta and thus it presents the main sources of nutrients to the most of the world populations (Sramkova *et al.*, 2009).

Most developing countries including Nigeria rely on importation to get wheat or wheat flour needed for making bread, rolls, biscuits and other pastry products. For this reason, most developing countries were interested in the possibility of replacing the wheat needed for making baked goods, wholly or partly with flour obtained from home grown products. Possible sources are cassava, yam, maize, millet, soy, peanut, sorghum, flours from other sources which substitute wheat forms composite flour. The composite flours from cereals such as maize are known to be rich in protein (Abdel-kader, 2000).

Quality Protein Maize (QPM) was developed through conventional maize breeding methods and has about 10% protein like any Normal Maize (NM) variety. However, its protein has about 70% higher levels of the essential amino acids - lysine and tryptophan. Thus the nutritional quality of its protein is superior to that of normal maize varieties. This is important because non-gastric organisms (including humans, pigs and poultry) are unable to synthesize their own lysine and tryptophan. Hence, they stand to benefit more, nutritionally, from QPM than NM (Akumao-Boateng 2002, Giwa and Ikujenlola 2009, Ikujenlola 2010).

The utilization of QPM in the production of baked goods is not well known in Nigeria and there is scanty information on the utilization of QPM in Nigerian foods. Hence, this study looks into the quality attributes of biscuit produced from composite flour from QPM flour and wheat flour.

## MATERIALS AND METHODS

### MATERIALS

The Quality Protein Maize (QPM)(var. Obamta) and wheat flour used for this study were obtained from Obafemi Awolowo University, Ile-Ile farms and Owo central market respectively.

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### Processing of QPM flour

The QPM was processed into flour by using the method of Aloba (2001). The unit operations included: cleaning, conditioning, dehulling, degerming, washing, drying, milling, sieving and packaging.

### Formulation of Blends

The QPM and wheat flours were blended at varied ratios to give five blends. The ratios were (wheat: QPM) 100:0; 70:30; 50:50; 30:70 and 0:100. The blends were thoroughly mixed using mixer (Kenwood km 201, England).

### Baking Biscuit

The various blends formulated from a mixture of wheat and QPM flours were mixed separately with the same quantity of other ingredients (sugar, baking powder, water, baking fat and salt). The fat was creamed with sugar until fluffy, the other dry ingredients were added, water was added until the desired texture of the batter was obtained. The batter was kneaded on a rolling table to acquire the desired thickness. The batter was later cut to round shape with the aid of biscuit cutter. It was baked in the oven at 200°C for 10 minutes, cooled and packaged.

### Proximate composition determination

The biscuit samples were analyzed for moisture, total ash, crude fibre, fat, crude protein and carbohydrate (by difference) using the standard method of AOAC (1990). Energy value was calculated using Atwater factors by multiplying the portions of protein, fat, and carbohydrate by their physiological fuel value of 4.0, 9.0 and 4.0 Kcal/g respectively and taking the sum of the products.

### Physical analysis of the biscuit

The weight and diameter of the baked biscuit were determined by weighing on a weighing balance and measuring with a calibrated ruler respectively (Ayo *et al.*, 2007).

The spread ratio was determined using the method of Gomez *et al.* (1997). Three rows of five well formed biscuit were made and the height measured. Also the same were arranged horizontally edge to edge and sum diameter measured. The spread ratio is calculated as diameter/ height.

The break strength of the biscuit was determined according to Okaka and Isieh (1990) method. Biscuit of known thickness (0.4cm) was placed between two parallel wooden bars (3.0cm apart). Weights were added on the biscuit until the biscuit snapped. The least weight that caused the breaking of the biscuit was regarded as the break strength of the biscuit.

### Sensory Evaluation

The organoleptic properties of the biscuit including taste, colour, texture, and overall acceptability were assessed by a 10-member panelists who are familiar with the product, five point hedonic scale with 1 representing the least score (dislikes extremely) and 5 the highest score (like extremely) analysis of variance (ANOVA) was performed on the data to determine differences, while the Duncan multiple range test was used to separate means where significant difference existed.

## RESULTS AND DISCUSSION

### Physical Attributes of Biscuit

The weight and diameter of the biscuit samples ranged between 16.49 – 21.99g and 5.38 – 6.43cm respectively. The weight and diameter increased with the level of QPM substitution. The 100% QPM biscuit was heaviest and bulkiest among the samples. The spread ratio followed similar trend as the weight and diameter of the biscuit samples. The QPM flour had high and positive effect on the weight of the biscuit. The increase could be as a result of low fat content and high starch content of QPM. These results were not similar to the observation of Ayo *et al.*, 2007 on biscuit from soybean supplemented wheat flour, also for cowpea-wheat (Okaka and Isieh 1990) and millet-sesame flour (Aloba, 2001). The difference in the observation could be because the other biscuits were produced from wheat flour that was substituted with legume /oil seed as against cereal in this study.

The spread ratio increased with increasing level of substitution with QPM. The QPM flour had a high and positive effect on the spread ratio. The inclusion of QPM flour enhanced the spreadability of the biscuit samples reduced with the level of replacement with QPM. There is a relationship between the spreadability height (thickness) and the breaking strength. The thinner the biscuit the lesser its ability to withstand stress/load. The level of substitution affected the ability of the biscuit to withstand stress. The break strength reduced with increase in the level of QPM flour in the biscuit sample.

The break strength ranged between 291.35g and 119.56g. The highest height was 0.63 cm (100% WF) and the lowest 0.50cm (100% QPM). The use of composite flour for biscuit making has been reported by Okaka and Isieh (1990) and Ayo *et al.*, (2007) to reduce its break strength which aggress with the result of this study. The reduction could be due to carbohydrate/starch of QPM which may not be as hard/strong like that of wheat.

### Proximate Composition

The proximate composition of the biscuit samples showed that the moisture content reduced from 3.55% to 2.50% upon replacing wheat flour with QPM flour Table 2. The level of the crude protein and fat are within similar ranges for all the samples. The biscuit produced from a blend of wheat flour and QPM flour is expected to be better in terms of protein quality since the QPM has adequate quantity of the two limiting amino acids in cereal that is lysine and tryptophan. Although supplementary wheat flour with QPM flour may not necessary increase the level of the crude protein but the protein would be of better quality which is advantageous

**Table 1:** Physical properties of Biscuits

WF: QPMF	Diameter (cm)	Height (cm)	Weight (g)	Spread Ratio	Break Strength
100:00	5.38	0.63	16.49	9.25	291.35
50:50	6.23	0.63	17.18	9.88	191.86
70:30	6.30	0.57	20.67	11.05	172.48
30:70	6.40	0.57	20.82	11.23	130.13
00:100	6.43	0.50	21.99	12.86	119.66

Values are means of triplicate determinations  
WF= Wheat Flour; QPMF =Quality protein maize flour

**Table 2:** Proximate Composition of Biscuit Samples (%)

Sample WF:QPMF	Moisture Content	Fat	Crude Fibre	Crude protein	Ash	Carbohydrate	Energy (keal)
100.0	3.50	12.96	1.26	11.24	3.27	67.77	432.68
70.30	3.10	15.21	1.38	11.56	3.56	65.19	443.89
50.50	2.90	14.02	1.29	11.34	3.06	67.39	441.10
30.70	2.85	14.10	1.42	11.26	3.10	67.27	441.02
0.100	3.45	13.23	1.40	10.86	2.95	68.11	431.95

WF= Wheat Flour; QPMF =Quality protein maize flour

**Table 3:** Mean Scores of Sensory Evaluation WF:QPM

Sensory Parameters	100:00	50:50	70:30	30:70	0:100	Control
Colour	4.0 <sub>ab</sub>	3.6 <sub>ab</sub>	3.70 <sub>b</sub>	3.9 <sub>a</sub>	4.1 <sub>a</sub>	4.5 <sub>a</sub>
Taste	4.0 <sub>ab</sub>	3.3 <sub>ab</sub>	3.9 <sub>ab</sub>	3.7 <sub>ab</sub>	3.5 <sub>ab</sub>	4.4 <sub>a</sub>
Texture	4.3 <sub>ab</sub>	4.2 <sub>ab</sub>	3.5 <sub>b</sub>	3.6 <sub>b</sub>	3.9 <sub>ab</sub>	4.8 <sub>a</sub>
General Acceptability	4.7 <sub>a</sub>	4.1 <sub>a</sub>	3.4 <sub>b</sub>	3.8 <sub>ab</sub>	3.9 <sub>ab</sub>	4.6 <sub>a</sub>

Samples with subscript of different letters along the row are significantly different from each other

to the consumers. The result did not agree with the report of and Ayo *et al.*, (2007) because legume were used in place of QPM flour and the legumes are known to be high in both protein and fat (Dhringa and Jood, 2000).

The carbohydrate content increased with increase in the percentage of QPM. This is expected because QPM has carbohydrate as its highest constituent. The energy value ranged between 431.95 and 443.89kcal. The protein, fat and carbohydrate constituents of the flours contributed calorie content of the biscuit. Biscuit is an

energy food which is taken mostly in between food by both young and old. The addition of QPM should help boost the level of protein quality of biscuit.

### Organoleptic Properties

The organoleptic properties of the biscuit are presented in Table 3. The colours of the biscuit samples were all acceptable to the panelists. However, the control and

100% QPM were most preferred in terms of colour. The texture of the biscuit samples were significantly different ( $P < 0.05$ ) from each other. The increase in the level QPM flour in the supplement reduced the preference for its texture by the panelists. This observation could be due to the grittiness of the flour, this can be improved by proper milling and sieving of flour before use. The tastes of the samples were generally acceptability, but the control and 100% wheat were most preferred.

In all the biscuit samples were all generally acceptable. The 100% wheat was most preferred among the formulated biscuit. There was no significant difference ( $P > 0.05$ ) between the samples fro QPM.

## CONCLUSION

It may be inferred from this study and results that acceptable and good quality biscuits could be produced from wheat flour that is substituted with QPM flour. The resulting biscuit would be expected to have better protein quality because of the protein quality of the QPM flour. The economic implication of this is that biscuit of good quality could be produced at a reduced cost. The biscuit producer can produce at high profit and more foreign exchange can be conserved on the importation of wheat from foreign countries, because QPM can be easily grown in Nigeria with high yield. Nigerians are good consumers of biscuit QPM based biscuit will serve as a means for increasing the quality of protein consumed by Nigerians.

## REFERENCES

- A.O.A.C (1990) Official Methods of Analysis 15<sup>th</sup> Edn Washington D.C. Association of Analytical Chemists 1546.
- Abdel-Kader ZM (2000) Enrichment of Egyptian 'Balady bread Part 1. Baking Studies, Physical and sensory evaluation of enrichment with decorticated cracked broad bean flour (*Vicia Faba L.*) *Nahrung*. 44(6):418-421.
- Akumao-Boateng A (2002) Quality Protein Maize infant feeding Trials in Ghana p 1-5.
- Alobo AP (2001) Effect of Sesame seed flour on Millet Biscuit Characteristics. *Plant for Food Human Nutrition* 56:195-200.
- Ayo JA, Ayo VA, Nkama I, Adeworie R (2007) Physiochemical, Invitro Digestibility and Organoleptic Evaluation of Acha-wheat Biscuit Supplemented with Soybean flour. *Niger. Food J.*
- Dhingra S, Jood, S (2007) Organoleptic and Nutrition Evaluation of wheat a breads supplemented with soybean and barley flour. *Food Chemist*. 77:479-488.
- Eneche EH (1999) Biscuit making potential of millet 1 pigeon pea flour Blends plant foods for Human Nutrition 54:21-27.
- Giwa EO, Ikujenlola AV (2009) Application of Quality Protein Maize in the formulation of broiler's finisher feed. *Journal of Science, Food and Hospitality Vol. 1 No1:47-50.*
- Gomez MI, Obilance AB, Martin DF, Madzvanuse M, Many ES (1997) manual of Laboratory Procedures for quality evaluation of sorghum and Millet. International crop Research Insititute of the Semi Arid and Tropics (ICRSAT), India P.64.
- Ikujenlola AV (2010) Effects of Malting and Fermentation on the Nutritional Qualities of complementary Foods produced from Maize varieties and Soybean grains. Ph. D Thesis Obafemi Awolowo University Ile-Ife Nigerian.
- Okaka JC, Isieh MI (1990) Development and Quality evaluation of Cowpea-wheat biscuit. *Nigerian Food Journal* 8:56-62.
- Sramkova Z, Gregova E, Sturdik E(2009) Chemical Composition and Nutrition Quality of wheat grain *Acta Chemical Sloraca Vol.2 No 1:115-138.*