



Quality Assessment of Cookies Produced from Composite Flour of Wheat, unripe Plantain and Moringa Leaf

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Abstract: *The composite flour produced from blends of wheat, unripe plantain and moringa leaf were processed into cookies in the following ratios:100:0:0,50:45:5,35:55:10 and 45:50:5 respectively designated as W, WP₄₅M, WP₅₅M and WP₅₀M. The chemical composition and sensory properties of cookies samples from the blends were determined. The cookies produced from the resultant blends were significantly ($p < 0.05$) higher in protein (12.26%), ash (3.00%) and fibre (3.30%) than the control in protein (10.29%), ash (2.00%) and fibre (0.50%). Carbohydrate contents decreased with the addition of unripe plantain and moringa leaf. The cookies prepared using 35:55:10 blends had the higher vitamin A (6.90mg/100g) and vitamin C (7.89mg/100g) compared with the control. The sensory acceptability score showed the most accepted substitution level for making cookies was sample WP₅₀M (45% wheat,50% unripe plantain and 5% moringa leaf). The study revealed importance of promoting the processing and utilization of lesser known local crops in baked product enrichment.*

Keywords: *composite flour, plantain, moringa leaf, cookies, chemical composition, sensory evaluation*

INTRODUCTION

The health problems such as diabetes and coronary heart disease associated with consumption of functional foods. This has prone a challenge to food scientists and industrialist to produce food products containing functional ingredients in order to meet the nutritional requirements of these individuals with health challenges. Ibeanu *et al.* (2016) reported that this might be the effect of added sugar and lipids in the industrial products. Alternative source of tackle these challenges has led to prospect of blending indigenous foods like tuber, moringa leaf, plantain among others with cereals and legumes for production of household food products. This might increase nutritional quality of the developed products, make it relatively cheap and affordable to the rural poor people to alleviate hunger and malnutrition.

Cookies are one of most popular bakery products made from the cereals that are consumed by school children and nearly all people. This is due to its ready-to-eat nature, convenience and availability in different varieties and affordability. Wheat as the major raw material for the production of cookies also lacks some nutrients such as amino acids especially lysine (Ihekoronye & Ngoddy, 1985).

The potential use of composite flours for the production of bakery products to increase and improve the protein content has been evaluated by several workers. Composite flours are thus advantageous in the sense

that inherent deficiencies of essential amino acids in wheat flour (lysine, tryptophan and threonine) are supplemented from other sources (Elochukwu & Onyekwelu, 2015).

Plantain *Musa paradisiaca* is a staple food with great economic value. It is a basic food crop and cheap sources of energy in Nigeria. According to FAO (2005), over 2.11 million metric tons of plantains are produced in Nigeria annually. However, about 35-60% post-harvest losses had been reported and attributed to lack of storage facilities and inappropriate technologies for food processing (Olorunda & Adelusola, 1997). It can be dried and milled into flour which can be used as composite in baking and complementary foods. USDA (2009) reported that plantain provides a better source of vitamin A than other staple food. Plantain has about 220 calories and is a good source of potassium and dietary fiber (Randy et al., 2007). It is rich in carbohydrate, dietary fiber, and also potent source of micronutrients especially irons, vitamins, and minerals. This nutritious food is ideal for diabetics, children, and pregnant women. It can also be a good supplement for marasmus patients. Its regular consumption helps cure anemia (low blood level) and maintain a healthy heart (USDA Nutrient Database, 2010). A diet of unripe plantain is filling and can also be a good inclusion in a weight loss diet plan (Oke et al., 1998).

Moringa oleifera lam belongs to single genus family *moringaceae* which has fourteen species (Morton, 1991). It is native to the Indian sub-continent and naturalized in many other parts of the world including Nigeria. The plant is a small fast growing tree found in the tropical regions, easy to cultivate, resistant to drought and all parts of the plant are edible. Anhwange *et al.* (2004) reported that *M. oleifera* seeds contained all the essential amino acid in appreciable quantities.

Moringa plant contains more vitamin C than orange, more calcium than milk, more iron than spinach and more potassium than bananas and the protein found in the moringa leaves rivals that found in egg and milk (Fahey, 2005). It is an important nutritional supplement. Moringa seed has been used to combat malnutrition in infant and nursing mother (Fugile, 2001). In developing countries, moringa plant has potential to improve nutrition, boost food security, foster rural development and support sustainable land care (National Research council, 2006). In 1996, the Church World Service Office in Danker in collaboration with the Senegalese organization AGADA (Alternative Action for African Development) studied the potential of *Moringa oleifera* to combat the problem of malnutrition and reported that moringa was successful in the treatment of malnourished children (Fugile, 2001). (Abiodiun *et al.* 2012) reported that flour from moringa leaf could be employed in fortifying other foods such as sauce, juice, bread and instant noodles.

Therefore, utilization of these indigenous plants (unripe plantain and moringa leaf) that can supplement a part of wheat flour, will increase the overall nutrient, increase cookies variety, reduce dependence on wheat flour for production of cookies and also prevent nutritional deficiency among the children. This research work seeks to evaluate the chemical composition and acceptability of cookies produced from composite flour of wheat, unripe plantain and moringa leaf.

Materials and methods

Unripe plantain, wheat flour and other bakery materials were procured from Eke market Ekwulobia and fresh moringa leaves were obtained from a farmyard in Ekwulobia.

Preparation of plantain flour

The methods described by (Enwere, 1998) were used to prepare the plantain flour. Firm unripe plantain fruit were washed to remove soil particles, peeled, sliced, soaked in 2.0g sodium metabisulphite for 20min and dried in the cabinet dryer at 50°C for 24h. The dried plantain slices were milled into flour using a hammer mill and sieved through 250µm sieve. The flour was packed and sealed in polyethylene bags.

Preparation of moringa flour

The leaflet was stripped, washed thoroughly, drained and spread in well ventilated room to dry. The dried leaves were ground and sieved (63 μ mesh) using kitchen sieve to get moringa leaf flour. The flour was packed and sealed in polyethylene bags.

Preparation of composite flour from blends of wheat, unripe plantain – moringa leaf

The composite flour was produced from blends of wheat, unripe plantain and moringa leaf. The wheat, unripe plantain and moringa leaf flour were blended in the following ratios: 100:0:0, 50:45:5, 35:55:10 and 45:50:5 respectively designated as W, WP₄₅M, WP₅₅M and WP₅₀M. The composite flour was packed and sealed in air tight polyethylene.

Production of cookies

The method used for the preparation of dough was the creaming method where fat and sugar were creamed together using the Kenwood mixer (United Kingdom) at medium speed for two min. After creaming flour, baking powder and milk were added and mixed until dough was well mixed. The dough was manually kneaded to ensure uniformity. The dough was then transferred to a clean tray and gently rolled using a roller. The dough sheath was cut into round shapes using a cutter. Shaped dough pieces were placed into a greased pan and baked in the oven at 180°C for 40min. The baked biscuits were placed on a cooling rack for 30min to cool before packaging. The production process is shown on Figure 1.

Chemical Analysis

The moisture, protein, fat, ash and crude fibre content of the cookies was carried out according to the methods of AOAC (2010), while carbohydrate was calculated by differences (Ihekoronye and Ngoddy, 1985). Vitamin C content of the sample was determined by titrimetric method of AOAC (2010). Provitamin A was determined by the method of the Association of Vitamin Chemists (Kirk and Sawyer, 1998).

Sensory evaluation

A ten-member panel was trained on sensory attributes for the evaluation of cookies on a 9-point Hedonic scale (where 9= extremely like and 1= dislike extremely). The samples were scored for colour, flavor, taste, crispness and overall acceptability.

Statistical analysis

The data were subjected to Analysis of Variance (ANOVA) using the statistical package for Social Sciences (SPSS) Version 17.0. Duncan's Multiple Range Test (DMRT) was used to compare the treatment mean. Statistical significance was accepted at ($p < 0.05$).

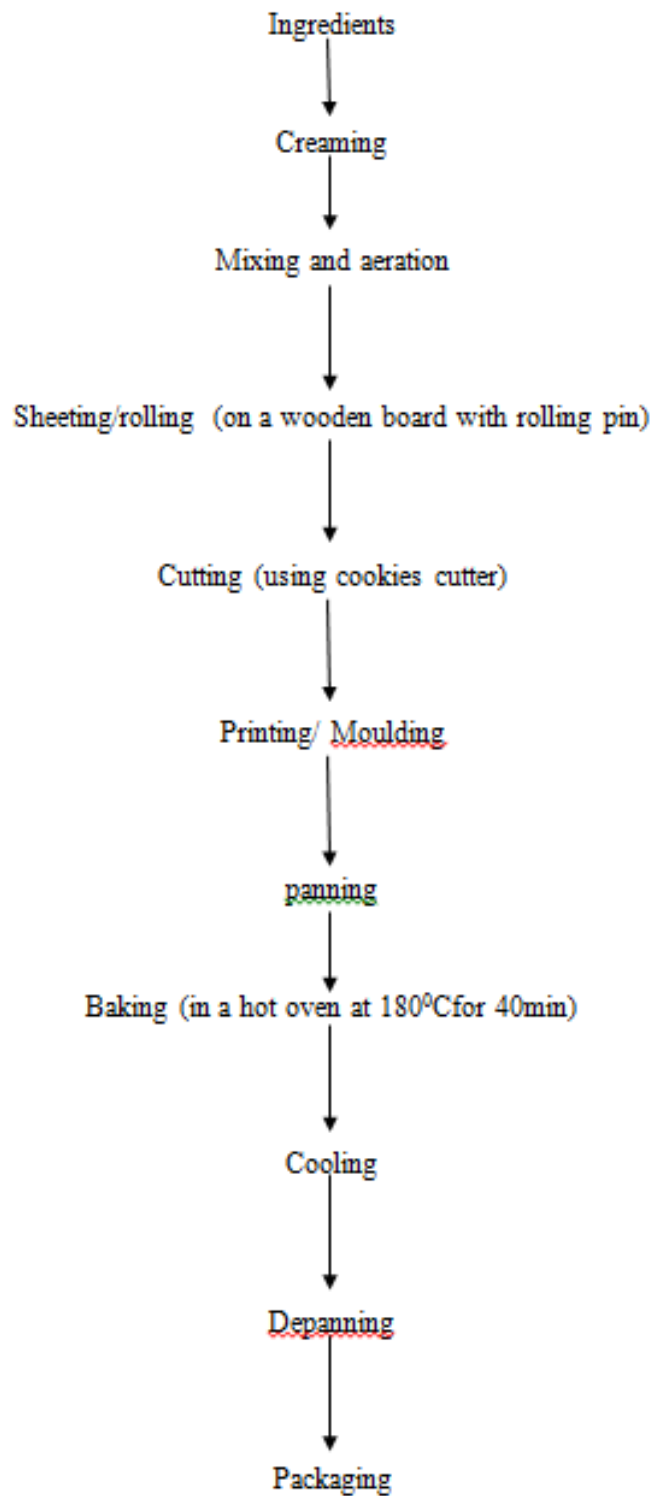


Fig 1: Flow chart for the Production of Cookies

Results and Discussion**Table 1: chemical composition of cookies**

samples	Moisture (%)	Protein (%)	Fat (%)	Ash (%)	Fibre (%)	Carbohydrate (%)	Provitamin A(mg/100g)_	Vitamin C(mg/100g)_
W	11.00 ^a	10.29 ^a	12.50 ^c	2.00 ^a	0.50 ^c	63.49 ^a	2.10 ^c	1.90 ^c
WP ₄₅ M	9.50 ^b	11.60 ^b	13.00 ^c	2.50 ^a	1.50 ^{bc}	61.90 ^b	4.70 ^b	4.00 ^b
WP ₅₅ M	7.50 ^c	12.26 ^a	16.50 ^a	3.00 ^a	3.50 ^a	58.23 ^c	6.90 ^a	7.90 ^a
WP ₅₀ M	9.00 ^b	10.51 ^c	15.00 ^b	2.50 ^a	2.00 ^b	61.20 ^b	3.90 ^b	3.00 ^{bc}

Means with the same superscripts within the column are not significantly different ($p < 0.05$)

Key

W = 100% wheat

WP₄₅M = 50% wheat, 45% unripe plantain and 5% moringa leaf

WP₅₅M = 35% wheat, 55% unripe plantain and 10% moringa leaf

WP₅₀M = 45% wheat, 50% unripe plantain and 5% moringa leaf

The chemical composition of cookies was presented in table 1. There was a significant ($p < 0.05$) difference in moisture content of the samples. Sample WP₅₅M (35% wheat, 55% unripe plantain and 10% moringa leaf) had the lowest value (7.50%) of moisture content while sample W (100% wheat) had the highest value of moisture. This result was with result of Omeire *et al.* (2014) who reported that noodle produced from 100% wheat had the highest moisture content value from other samples blended with Acha and soybean flour. Samples WP₄₅M, WP₅₅M and WP₅₀M were below the 10% moisture level recommended for safe keeping flour samples (SON, 2007). According to Nnam (2002) the lower the moisture content of a product, the longer the shelf life, this implies that sample WP₅₅M can keep longer than other samples.

Protein and fat contents of samples were significantly ($P < 0.05$) different from other samples. The samples that contain unripe plantain and moringa flour were significantly higher in protein and fat content than control. Sample WP₅₅M had the highest values of fat (16.50%) and protein contents (12.26%). This is may be as a result of addition of unripe plantain and moringa leaf flour. The percentage of fat and protein content increased as the percentage level of moringa leaf flour decreased. This result was in agreement with the

report of other workers (Fugile, 2001; Gernah and sengev,2011.). The ash content of the blended samples ranged from 2.50 to 3.00%. Sample WP₅₅M had higher ash content than other samples. This may due to addition effect of unripe plantain and moringa leaf.

The crude fibre content of the samples were significantly (P<0.05) difference from each other. The samples added unripe plantain and moringa leaf flour had the higher fibre content than that of control. This is may be as a result of high fibre content of unripe plantain and moringa leaf flour (Gernah and sengev, 2011). The carbohydrate content decreased with increase in the percentage of unripe plantain and moringa leaf flour (Onyekwelu, 2016). There were significant (P<0.05) difference in provitamin A and vitamin C among the samples. The Sample WP₅₅M (35% wheat, 55% unripe plantain and 10% moringa leaf) had the highest mean score values in provitamin A (6.90mg/100g) and vitamin C (7.90mg/100g) compared with the control. The high value of vitamin C and provitaminA may be attributed to high level of unripe plantain and moringa leaf flour. Unripe plantain and moringa leaf flour are potent sources of micronutrient (Fugile, 2001; USDA, 2009).

Table 2: Sensory evaluation of cookies

samples	Colour	Flavor	Taste	Crispness	Overall acceptability
W	7.50 ^a	7.70 ^a	8.00 ^a	7.60 ^a	8.30 ^a
WP ₄₅ M	5.80 ^d	6.50 ^b	6.00 ^c	6.40 ^c	6.40 ^c
WP ₅₅ M	6.10 ^c	5.80 ^c	6.10 ^c	6.10 ^d	6.70 ^c
WP ₅₀ M	6.90 ^b	6.40 ^b	6.60 ^b	6.60 ^b	7.30 ^a

Means with the same superscripts within the column are not significantly different (p<0.05)

Key

W = 100% wheat

WP₄₅M = 50% wheat, 45% unripe plantain and 5% moringa leaf

WP₅₅M = 35% wheat,55% unripe plantain and 10% moringa leaf

WP₅₀M = 45% wheat, 50% unripe plantain and 5% moringa leaf

Sensory evaluation

Table 2 shows the sensory evaluation of cookies. There were significant ($P < 0.05$) difference in all the sensory attributes among the samples. Sample WP₅₀M (45% wheat, 50% unripe plantain and 5% moringa leaf) was most accepted among the blended samples in all the sensory attributes.

Conclusion

Cookies can be produced from blends of unripe plantain, moringa leaf and wheat. The result revealed that samples WP₄₅M, WP₅₅M and WP₅₀M moisture content within the recommended standard for safe keeping of the product which showed that the samples will have long shelf life. The protein and ash contents results showed that the blended samples had the higher protein and ash content than the control (100% wheat) which signified that incorporation of unripe plantain and moringa leaf increased the protein and ash content. Addition of unripe plantain up to 55% and moringa leaf 5% had highest value of provitamin A and vitamin C and also was most preferred due to high improved nutritional content. Sample substitute with 50% unripe plantain and 5% moringa leaf was most accepted among blended samples. This implies that wheat can be supplemented with unripe plantain and moringa leaf flour. The use of unripe plantain and moringa leaf flour in cookies production will greatly increase variety, boost their nutritional content and enhance the utilization of these crops in Nigeria

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