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PRODUCTION AND PROXIMATE COMPOSITION OF COOKIES FROM COMPOSITE FLOURS OF WHEAT, UNRIPE PLANTAIN AND BREADFRUIT

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Abstract
This study is aimed at producing cookies from the composite flour of wheat flour, unripe plantain flour and breadfruit flour. Cookies was produced from composite flours of wheat, unripe plantain and breadfruit flours with the following formulations; sample WS1 (100% wheat), WPB2 (90% wheat, 5% unripe plantain, 5% breadfruit), WPB3 (80% wheat, 10% unripe plantain, 10% breadfruit), WPB4 (70% wheat, 15% unripe plantain, 15% breadfruit), WPB5 (60% wheat, 20% unripe plantain, 20% breadfruit) and WPB6 (50% wheat, 25% unripe plantain, 25% breadfruit) respectively. The cookies snacks were analyzed for their sensory and proximate qualities. The sensory attributes revealed that samples WS1 and WPB2 showed an average acceptability compared to other cookies samples. In proximate composition, the parameters evaluated were; moisture content, protein content, fibre content, ash content, fats content and carbohydrate content. The result of proximate analysis showed; moisture ranged from (4.66-8.38), protein content (13.53-15.64), fibre content (9.07-9.55), ash content (4.17-4.61), fats content (8.34-10.47) and carbohydrate content (54.57-56.14). It was concluded that the inclusion of unripe plantain flour and breadfruit flour in cookies production could serve as an alternative flour to achieve the desired economic and healthy food.

Keywords: cookies, composite flour, wheat, unripe plantain and breadfruit

Introduction

Cookies are convenient baked products, ready-to-eat and easily available in different shapes and sizes at an affordable cost with high nutritive value (Vijerathna *et al*., 2019). They are the most popular bakery items consumed among all age groups in many countries because they have a very acceptable taste and their low water activity allows a long shelf life (Usman *et al*., 2015). In Nigeria, reliance on wheat flour in the pastry and bakery industries has over the years restricted the use of other cereals and tuber crops available to domestic use. Recently, government has collaborated with the research institutes to encourage the use of composite flours in the production of food products such as cookies, bread etc. Several studies have reported the use of composite flour in cookies production (Akusu *et al*., 2019). All these efforts were aimed at improving the nutritional values of the cookies and also to enhance crop utilization.

Wheat *(Triticum aestivum)* is a common cereal in the world which plays an important role as global commodity due to its gluten forming proteins, which are capable of having extensibility and elasticity required for bakery products and pasta. Wheat contains 78.10% carbohydrate, 14.70% protein, 2.10% fat, 2.10% minerals and considerable proportions of vitamins (thiamine and vitamin-B) and minerals.Plantain *(Musa paradisiaca)* is an important staple food in Central and West Africa (Makanjuola, 2013). Plantains are abundant in Nigeria and other developing countries. Plantain fruit is composed of 75% different elements and 32% of carbohydrates and it also

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contains several vitamins including A, B, C and is very low in protein and fat but rich in minerals particularly iron. Also, it is free from cholesterol, high in fibre and low in sodium (Adewole and Duruji, 2010).

Because plantains have poor amino acid profile, it should be supplemented with protein rich food crops like legumes. The resulting products would be rich in both protein and carbohydrates. African breadfruit (*Treculia africana Dcene*) is a member of the Moracea family. The composition of the seed has been comprehensively reported by several authors where it was reported that the seed contains 17-25% protein and 11% crude fat in addition to essential vitamins and minerals (Akubor, 1997). However, like other legumes, the amino acid profile of the seed is characterized by low concentration of sulphur amino acids and high in lysine, arginine and histidine (Ekpenyong, 1995). The high contents of histidine and lysine are a factor for African breadfruit seeds for food formulations for infants. However, the very low level of sulphur amino acids would impede the optimal utilization of the seeds when consumed as sole food for babies, children and young adults. But when the seeds are consumed with cereals such as wheat as in African breadfruit-wheat bread, the inherent sulphur amino acids deficiency would be diminished (Akubor and Afangiden, 2005).

The Objectives of the study includes:

- To produce flours from unripe plantain and breadfruit.
- To produce composite flours from wheat flour, unripe plantain flour and breadfruit flour.
- To produce cookies from the composite flours.
- To determine the effect of drying and fermentation on the physiochemical properties of the cookies.

Materials and Methods

The unripe plantains and breadfruit were purchased from Eke market in Ekwulobia, Anambra state and were taken to the processing laboratory of Food Science and Technology for further processing.

Production of Unripe plantain Flour

The matured unripe plantain were rinsed with tap water, peeled, washed and sliced into 10mm cubes.

Production of Breadfruit Flour

The breadfruit seeds (4kg) were dehulled and washed with water (500ml) containing 1.5g of sodium metabiosulphate to control colour change. The breadfruit seeds were blanched, oven dried, milled and sieved to obtain flour.

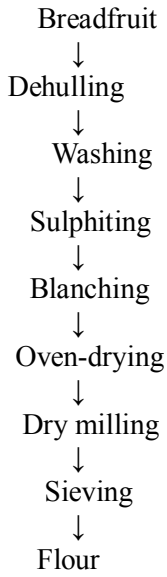

Fig 1: Flow chart for production of breadfruit flour.

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Table 1: Formulation of Blends

Sample	Wheat	Unripe plantain	Breadfruit
WS1	100	0	0
WPB2	90	5	5
WPB3	80	10	10
WPB4	70	15	15
WPB5	60	20	20
WPB6	50	25	25

Production of Cookies

Cookies were prepared using 100% flour, 40% fat, 20% beaten eggs, 35% sugar, 20% milk, 20% salt and 1% baking powder.

Ingredients
↓
Mixing and aeration
↓
Sheeting/rolling (on a wooden board with rolling pin)
↓
Cutting (using cookie cutter)
↓
Panning
↓
Baking (in a hot oven at 200°C for 20mins)
↓
Cooling
↓
Scraps separation
↓
Weighing
↓
Packaging

Fig 2: Flow Chart for Production of Cookies

Sensory Evaluation of Cookies

Sensory evaluation of wheat-breadfruit cookies were carried out after baking. The sensory attributes including colour, taste, mouthfeel and overall acceptability were evaluated using a 9-point hedonic scale with1 representing the least score (dislike extremely) and 9, the highest score (like extremely) as described by Iwe (2010). 9 – Like extremely, 8 – Like very much, 7 – Like moderately, 6 – Like slightly, 5 – Neither like nor Dislike, 4 – Dislike slightly, 3 – Dislike moderately, 2 – Dislike very much, 1 – Dislike extremely

Proximate Analysis

The proximate composition of the cookies samples were determined using the standard methods described by the AOAC (2012).

Statistical Analysis

All analyses were conducted in duplicates. Data were subjected to analysis of variance, and Duncan multiple range test was used to separate the means.

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RESULTS

Table 2: Sensory Evaluation

Sample	Appearance	Taste	Texture	Mouth feel	OA
WS1	7.70^{a}±1.06	8.10^{a}±0.88	7.90^{a}±0.74	7.70^{a}±0.82	7.88^{a}±0.49
WPB2	7.70^{a}±0.95	7.00^{b}±0.82	6.70^{b}±1.42	6.50^{b}±0.85	6.99^{b}±0.62
WPB3	6.70^{b}±0.95	6.50^{ab}±0.85	6.40^{b}±0.52	6.10^{bc}±0.99	6.43^{bc}±1.08
WPB4	6.30^{b}±0.95	6.80^{b}±1.03	6.40^{b}±1.17	6.00^{bc}±1.05	6.39^{c}±0.57
WPB5	5.40^{c}±1.17	5.80^{c}±1.48	5.90^{b}±1.10	5.20^{c}±1.03	5.56^{d}±0.68
WPB6	6.60^{b}±0.84	6.30^{ab}±0.95	6.70^{b}±0.82	6.00^{bc}±1.25	6.46^{bc}±0.78

*Value are means ± standard deviations of triplicate determinations. Means with the same superscript in the same column are not significantly different at p>0.05.

KEYS
WS1: Wheat sample 100%
WPB2: 90% Wheat, 5% Unripe plantain and 5% Breadfruit
WPB3: 80% Wheat, 10% Unripe plantain and 10% Breadfruit
WPB4: 70% Wheat, 15% Unripe plantain and 15% Breadfruit
WPB5: 60% Wheat, 20% Unripe plantain and 20% Breadfruit
WPB6: 50% Wheat, 25% Unripe plantain and 25% Breadfruit

Table 3: Proximate Analysis

Sample	Moisture	Ash	Fibre	Fats	Protein	CHO
WS1	6.9^{b}±0.3	4.28^{a}±0.1	9.19^{ab}±0.1	8.34^{b}±0.6	15.6^{a}±0.3	56.1^{a}±0.1
WPB2	8.4^{a}±0.1	4.17^{a}±0.1	9.07^{b}±0.0	10.3^{a}±0.1	13.5^{b}±0.3	54.6^{c}±0.3
WPB6	4.7^{c}±0.6	4.61^{a}±0.4	9.55^{a}±0.3	10.5^{a}±0.3	15.4^{a}±0.2	55.4^{b}±0.2

*Value are means ± standard deviations of triplicate determinations. Means with the same superscript in the same column are not significantly different at p>0.05.
KEYS
WS1: Wheat sample 100%
WPB2: 90% Wheat, 5% Unripe plantain and 5% Breadfruit
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Discussion

Sensory Evaluation

The mean score for the sensory evaluation of cookies produced with wheat flour, unripe plantain flour and breadfruit flour is presented in Table 2.

The result for appearance ranged from 5.40-7.70 which are significantly different at p>0.05. Sample WPB5 (60% Wheat, 20% Unripe plantain and 20% Breadfruit) had the least score rating while sample WS1 (100% wheat) had the highest score rating. This result is in agreement with the findings of Bello *et al*. (2020).

The result for taste ranged from 5.80-8.10 which are significantly different at p>0.05. Sample WPB5 (60% Wheat, 20% Unripe plantain and 20% Breadfruit) had the least score rating while sample WS1 (100% Wheat sample) had the highest score rating. The result for texture ranged from 5.90-7.90 which are significantly different at p>0.05. Sample WPB5 (60% Wheat, 20% Unripe plantain and 20% Breadfruit) had the least score rating while sample WS1 (100% wheat sample) had the highest score rating. It was observed that sample WS1 (100% wheat sample) had the best texture compared to other cookies sample.

The result for mouth feel ranged from 5.20-7.70 which are significantly different at p>0.05. Sample WPB5 (60% Wheat, 20% Unripe plantain and 20% Breadfruit) had the least score rating while sample WS1 (100% wheat sample) had the highest mean score rating.

The result for overall acceptability ranged from 5.57-7.88 which are significantly different at p>0.05. Sample WPB5 (60% Wheat, 20% Unripe plantain and 20% Breadfruit) had the least score rating while sample WS1 (Wheat sample 100%) had the highest mean score. The high overall acceptability of sample WS1 could be due to the fact that the panelists are familiar with cookies produced with 100% wheat.

Proximate Analysis

The mean score for the proximate analysis of cookies produced with wheat flour, unripe plantain flour and breadfruit flour is presented in Table 3.

The result for moisture content ranged from 4.66-8.38 which are significantly different at p>0.05. Sample WPB6 (50% Wheat, 25% Unripe plantain and 25% Breadfruit) had the least mean score while sample WPB2 (90% Wheat, 5% Unripe plantain and 5% Breadfruit) had the highest mean score. The result for ash content ranged from 4.17-4.61 which are not significantly different at p>0.05. Sample WPB2 (90% Wheat, 5% Unripe plantain and 5% Breadfruit) had the least mean score while sample WPB6 (50% Wheat, 25% Unripe plantain and 25% Breadfruit) had the highest mean score. The ash content of a food material could be used as index of the mineral constituents of the food.

The result for fibre content ranged from 9.07-9.55 which are significantly different at p>0.05. Sample WPB2 (90% Wheat, 5% Unripe plantain and 5% Breadfruit) had the least mean score while sample WPB6 (50% Wheat, 25% Unripe plantain and 25% Breadfruit) had the highest mean score. The consumption of high fibre food products has been reported to reduce the onset of hermorrhoids, diabetes, high blood pressure and obesity in humans (Chukwu *et al*., 2013).

The result for fats ranged from 8.34-10.47 which are significantly different at p>0.05. Sample WS1 (Wheat sample 100%) had the least mean score while sample WPB6 (50% Wheat, 25% Unripe plantain and 25% Breadfruit) had the highest mean score. Cookies are regarded as a rich source of fat; hence they are energy giving food (Kure *et al*., 1998).

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The result for protein content ranged from 13.53-15.64 which are significantly different at p>0.05. Sample WPB2 (90% Wheat, 5% Unripe plantain and 5% Breadfruit) had the least mean score while sample WS1 (Wheat sample 100%) had the highest mean score. Protein is important in the building and maintenance of cells in the body.
The result for carbohydrate ranged from 54.57-56.14 which are significantly different at p>0.05. Sample WPB2 (90% Wheat, 5% Unripe plantain and 5% Breadfruit) had the least mean score while WS1 (Wheat sample 100%) had the highest mean score.

Conclusion and Recommendation

Conclusion

The result of this study shows that addition of unripe plantain and breadfruit can increase the nutritional content of the cookies or any confectionary products because of the high level of the nutritional content.

Recommendation

I recommend that unripe plantain and breadfruit can be used in the production of cookies in other to increase the nutritional value of the product.
Furthermore, extensive study should be done to ascertain if there are anti-nutritional factors in unripe plantain and breadfruit which can inhibit the nutritional value.

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