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NUTRIENT AND SENSORY EVALUATION OF CASSAVA CAKE (*kpo-kpogarri*) ENRICHED WITH COCONUT AND PALM WEEVIL LARVAE (*Rhyncophorous ferrugineus*)

[1]AHIAKWO, Rosemary O. Ph.D & [2]OKWECHIME, U. J.

[1]Department of Home Economics, School of Vocational Education,
Federal College of Education (Technical) Omoku, Rivers State
[2]Department of Food science and Technology,
Rivers State University ,Port Harcourt, Rivers State
Corresponding Email: rosemary.ahiakwo@fcetomoku.edu.ng

Abstract
The Nutrient composition and sensory evaluation of cassava cake commonly called kpo-kpo garri enriched with palm weevil larvae (Rhyncophorous ferrugineus) and coconut was investigated. Using standard analytical methods, the cake sample was subjected to proximate and sensory analysis. There were differences in the nutrient composition of the enriched cassava cake and the non-enriched (control) cake. Values varied from 0.31-3.87%, 1.07-18.14%, 2.47-6.14%, and 0.15-10.30% for Ash, protein, fibre and fat respectively. Carbohydrate content decreased with enrichment, 88.08 to 53.26% whereas moisture decreased with enrichment 4.78% as against 6.72% in the control. The enriched cassava cake was liked extremely over the control in terms of taste and overall acceptability from the organoleptic test. Results from the study, shows that the enriched cassava cake has better nutritional qualities than the control sample hence will be capable of reducing the level of protein-energy malnutrition. The need to improve nutritive quality of local foods using nutrient rich ingredients has been promoted. Palm weevil larvae and coconut are rich in Protein, Lipid, Carbohydrate, Fibre, minerals and vitamins. Development of this type of product could be a source of livelihood to the local people and create job for the unemployed youths.
Keywords: *cassava cake, Nutrient composition, organoleptic test, Palm weevil larvae, sensory evaluation.*

Introduction

Snacks are small amount of foods eaten in-between meals. They are in different forms and relatively inexpensive due to their comparative low cost of production. They are widely consumed by both children and adults. Snacks can be eaten as meal or as in-between meals (Olaleye *et al*., 2017). The types of snack foods found in different localities are usually related to the food raw material availability and culture of the people, such as roasted breadfruit and palm kernel (Aki na Ukwa) and Bambaranut pudding (*okpa*) in eastern Nigeria, plantain chips and beans pudding *(moi-moi)* in the west and cassava cake (*kpo-kpogarri* and Palm weevil larvae) commonly called *bayelsa suya* in southern part of Delta and Bayelsa state. Most snack foods eaten in Nigeria are cereal or tuber-based with high starch content (Wordu & Akusu, 2016), these types of snack foods are

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nutritionally deficient. The world nutrition bodies have campaigned for the eating of functional foods and low carbohydrate diets or slowly digested starchy foods (WHO/FAO, 2003). Dietary approval and guidelines shows that healthfulness of any snacks is on the based on the nutrient they contain. Cassava (*Manihot esculenta Crantz*), the base ingredient for cassava cake (*kpo-kpogarri)* is a major and an important staple food in most countries of the world. Nigeria is among the largest producer of cassava in the world. Cassava when compared with nutrient composition of other cereal grains is low in protein and of poor quality with very low essential amino acid (Olugbemi *et al.*, 2010). As a result, cassava-based diets must be enriched with protein sources that provide wellbeing. Coconut is rich in several important minerals, especially manganese and copper which support various body functions (Suzirtha & Mahendran, 2015). Coconut meat can be prepared into coconut chips and used in confectionaries due to their ability to produce desired texture and flavor (Emelike *et al*., 2015). Palm Tree Weevils (*Rhyncophorous ferrugineus*) are very popular in Southern Cameroun and Nigeria. The larvae of the palm weevil (*Rhynchophorus pheonicis*) are available from the wild but can also be cultured (Opara et al., 2012). In Nigeria (Bayelsa state) it is nicknamed Bayelsa suya: a delicious meat toast (Omotoso & Adedire, 2007). It is rich in Protein, Lipid and Carbohydrate with considerable amount of Potassium, Magnesium, Iron, Phosphorus, Calcium, Zinc, and others (Arnal *et al.*, 2013). Fakayode & Ugwumba, (2013) stated that the nutritive value of *Rhyncophorous ferrugineus* makes it suitable as replacement for fishmeal in compounding fish feeds. Locally available snacks today are lacking in protein minerals and vitamins. Nutrient rich ingredients can be combined into them to comfort malnutrition at the family level. In Nigeria, the need to develop cheap but nutritious and easy to prepare locally available complementary foods cannot be over-stressed. Hence, this study is aimed at examining the nutrient composition and sensory quality of cassava cake (*kpo-kpogarri*) enriched with palm weevil larvae (*Rhyncophorousferrugineus*).

Research design

This study employed research and development (R&D), According to Sugiyono, (2014) research and development method is a method used to produce a certain product, and test the effectiveness of the product.

Materials and methods

Cassava tubers free of contaminants was collected from ADP Rumudumaya Port Harcourt, while matured coconut, was purchased from Mile 3 Market Port Harcourt, Rivers State, palm weevil larvae (*Rhyncophorousferrugineus*) was harvested from a fallen palm tree at Omoku (Onelga) Rivers state. All reagents used for the chemical analysis were of analytical grading supplied by Joechem chemicals Choba, Port Harcourt.

Methodology

Two (2 kg) kilograms of freshly harvested cassava roots were sorted to remove damaged or rotten roots; they were then peeled, washed and soaked in water allowing the cassava mash to ferment for a period of 24 hours, thereafter it was de-watered. Coconut endosperm was shredded and milled using Panasonic blender (Model MX-105 India). The residue was oven dried for 24 h at 60℃. The dried crush was stored at room temperature in an air- tight low density polyethylene bag (LDPE) and kept until required for use. Palm weevil larvae (*Rhyncophorousferrugineus*) was harvested, washed in warm water and fried on a frying pan without oil until a golden colour Palm weevil larva was obtained.

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Table 1. Analysis of Cassava Cake Blend

Sample	Cassava mash (g)	Coconut (g)	Palm weevil larvae (g)	Salt (g)
Cassava cake Without enrichment	99.5	-	-	0.5
Cassava cake (Enriched)	49.5	30	20	0.5

Source: Emelike *et al*., 2015(with slight modification)

Preparation of Enriched cassava Cake

Traditional method of cassava snacks preparation described by Emelike *et al*., (2015) with slight adjustment was adopted. De-watered cassava mash, was roasted for 15 min and then coconut chips was added, followed by addition of required quantity of the palm weevil larvae. The ingredient mix was then milled together and processed into cassava cake (*kpo-kpogarri)* by roasting for 40-50 min in a hot air oven at constant temperature of 60-80℃. Roasting was completed when crispy whitish cake (*kpo-kpogarri*) was obtained. The cakes were removed and allowed cooling before packaging in an air-tight polyethylene bag until analysis.

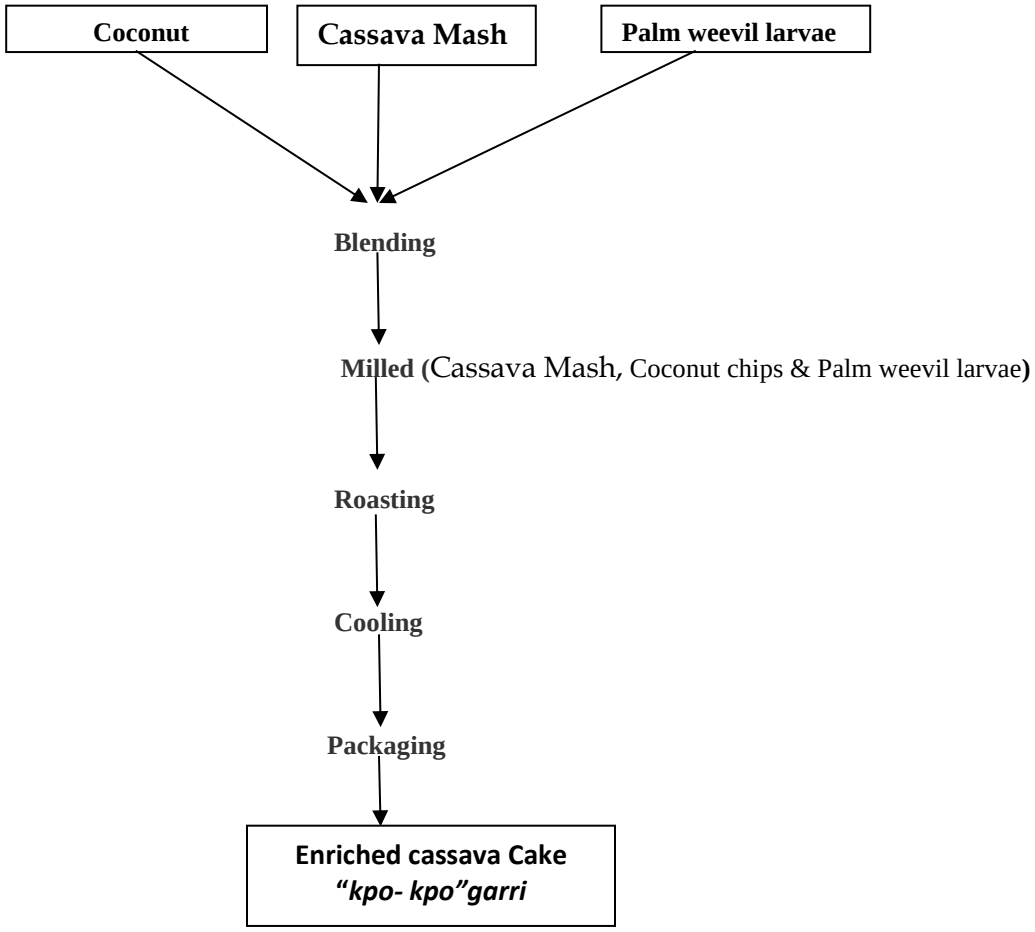

Figure 1 Illustrating Steps in Production of Enriched Cassava Cake
Source: Emelike *et al*., (2015)

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Analysis

Proximate composition was determined using AOAC, (2019), total carbohydrates was determined by difference while Sensory attributes was by 9-point hedonic scale,

Results

Moisture content of enriched cassava cake and control varied between 4.78and 6.72 %, respectively. Enriched cassava cake had the highest values for Ash, protein, fibre and fat content, values varied from 0.31-3.87%, 1.07-18.14%, 2.47-6.14% and 0.15-10.3%, respectively. Carbohydrate was highest (88.08%) in the control sample and lowest (53.26%) in the enriched sample. Sensory evaluation presented in table 3 shows scores from panellist on the attributes of enriched and non-enriched *kpo-kpogarri*. Scores for appearance, aroma, taste and overall acceptability was highest in the enriched sample whereas score for texture was highest in sample without enrichment, 6.88and 8.48 correspondingly.

Table 2.Proximate Composition of Cassava Cake "*Kpo-Kpo* Garri''

Sample	Moisture (%)	Ash (%)	Protein (%)	Fibre (%)	Fat (%)	Carbohydrate (%)
Enriched cassava snacks	$4.78^{d} \pm 0.45$	$3.87^{f} \pm 0.04$	$18.14^{b} \pm 0.17$	$6.14^{e} \pm 0.01$	$10.30^{c} \pm 0.72$	$53.26^{a} \pm 0.02$
Cassava snacks (without enrichment) Control sample	$6.72^{b} \pm 0.21$	$0.31^{e} \pm 0.06$	$1.07^{d} \pm 0.05$	$2.47^{c} \pm 0.03$	$0.15^{f} \pm 0.05$	$88.08^{a} \pm 0.24$

Means not followed by same superscript are significantly different (P<0.05)

Table3. Sensory Evaluation of Cassava Cake "*Kpo-Kpo* Garri''

Parameter	Appearance	Aroma	Taste	Texture	Overall acceptance
Enriched cassava snacks	$7.44^{a} \pm 0.53$	$8.30^{a} \pm 0.12$	$8.12^{a} \pm 0.76$	$6.88^{b} \pm 0.10$	$8.36^{a} \pm 0.15$
Cassava snacks (without enrichment) Control sample	$5.06^{b} \pm 0.11$	$4.74^{b} \pm 0.20$	$4.74^{b} \pm 0.22$	$8.48^{a} \pm 0.55$	$4.32^{b} \pm 0.10$

Means not followed by same superscript are significantly different (P<0.05)

Discussion of findings

Value of moisture content in enriched cassava snacks (Table 2) was lower (4.78%) significantly (p<0.05) when compared with moisture value 6.72 % in the control. Low moisture of enriched *kpo-kpogarri* could be as a result of the enrichment. The lower the moisture contents of a product, the higher the shelf life (Sanni *et al*., 2006). The low moisture content of the enriched "kpo-kpo" garri could reduce the growth of microorganisms thus increase its shelf life. Ash content of the enriched *kpo-kpogarri* snacks was higher than the control sample; this could be as a result of added ingredients (coconut and larva of oil palm weevil). Values (Table 2) were 3.87% and 0.31 % respectively for enriched and control. Ash content shows presence of mineral content of the samples. Ash content means that the enriched *kpo-kpogarri* is rich in some minerals and nutrients. Protein was highest (18.14%) in enriched *kpo-kpogarri* snacks whereas control sample had value of 1.07%.High protein content of enriched *"kpo-kpo"garri* samples could be attributed to the addition of coconut and larva of oil palm weevil during the preparation. The results obtained were

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higher than that reported by Emelike & Akusu, (2018) with protein content of 1.38-8.78 %. High protein content in *kpo-kpogarri* is desirable to supplement low protein in *kpo-kpogarri* hence will be capable of reducing the level of protein-energy malnutrition. Fibre and fat content were highest in the enriched *kpokpogarri* snacks. Values presented in table 2 shows fibre content of 6.14 % and 2.47% respectively for enriched and the control snacks. Value is higher than that reported by Wordu and Akusu (2016) in snacks from similar ingredients. High fiber content of the enriched snack will stop constipation.

Fat content varied between 10.30 % and 0.15 %. Fat was more in the enriched sample because coconut and larva of oil palm weevil are high in oil content. The larvae are great sources of essential amino acids such as lysine, methionine and cysteine, threonine, tryptophan, leucine, isoleucine, valine (Ogbuagu, 2010). Van Huis (2013) reported 66.61 % lipids content of larva of oil palm weevil. Coconut oil is 100% fat rich source of medium-chain fatty acids **(**Hossain & Salehuddin, 2012). Carbohydrate content in enriched cassava cake samples decreased with inclusion of palm weevil larvae and coconut meat. The enrichment will be suitable for the obese and health conscious people. Enriched *kpo-kpogarri* had carbohydrate content of 53.26 % whereas the control sample was 88.08 %. Sensory evaluation presented in table 3 showed that the panellist scored all the attributes including overall acceptability highest in the enriched *kpo-kpogarri* snacks except for texture. Scores for texture was highest 8.48 for the control whereas the enriched sample had 6.88 indicating higher shelf life for the prepared sample

Conclusion

Cassava cake (*kpo-kpogarri*) is one of the cheapest source of calories for people of south-south Nigeria especially Bayelsans and southern part of Delta state (Adebowale & Sanni, 2013). However, it is deficient in protein, fat and other essential nutrients. These deficiencies were improved by addition of coconut and the Palm weevil larvae. The final product was accepted by the sensory evaluation panel over the cassava cake without enrichment. The enrichment added value to the cassava cake (*kpo-kpogarri*) making it a functional food.

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