PROXIMATE AND SENSORY EVALUATION OF CAKES FORTIFIED WITH SOYBEAN, PLANTAIN AND SESAME SEED FLOUR FOR FOOD AND NUTRITION SECURITY

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Abstract

Cakes were prepared from six different blends of composite flours formulated using soybeans, plantain sesame seed and wheat flour at the ratio of 5:5:5:85; 5:10:5:80; 10:10:5:75; 5:15:10:70; 15:10:15:60; 15:15:15:55 and 100% wheat flour cake was used as the control. The six blends of, soybeans, plantain and sesame seed / wheat composite and the control were coded (SPSW1); (SPSW2); (SPSW3); (SPSW4); (SPSW5); (SPSW6); and (SPSW7) respectively. Findings revealed that the proximate value of all the composite cake were higher than the control as the addition of fortificants increased and composite samples differed significantly at P ≥ 0.05 with the control. Sample with SPSW6- composite cake made with 15% soybean, 15 % plantain, 15 % sesame seed and 55% wheat flour had the best proximate value. Sensory evaluation showed that all the composite cakes were well accepted and liked by the judges. There was no significant difference at P ≥ 0.05 in the mean (□) ratings in terms of texture, flavour, taste, mouth feel and overall acceptability among the composite cake samples and the control. Composite cake made from 5% soybean, 10% plantain, 5% sesame and 80% wheat flour was rated best by the judges’ among the composite cake samples. All the composite cakes compares favorably with the control in all the attributes measured. The researchers therefore concluded that up to 15% level of each of the fortificants can be used to substitute wheat flour without adversely affecting the sensory properties of cakes. The use of soybean, plantain, and sesame seed in the bakery industry will improve the nutritional value of bakery products and can be used as strategy for addressing malnutrition including micronutrient deficiencies, while also providing food and nutritional security for the nation.

Keywords: Fortification, Soybeans, Plantain, Sesame Seed, Food and Nutrition Security

Introduction

One of the basic needs of man is food. Families all around the world utilize varieties of foods in attempt to meet their nutritional needs. The importance of food as sustenance of lives cannot be overemphasized; as such food is expected to be available for human existence. The rapidly growing of Nigeria’s population has made food supply to be insufficient to feed her populace. Jacob (2013) opined that the first essential component of social and economic justice is adequate food production. Augustin, Riley, Stockmann, Bennett, Kahl, Cobiac
(2016), acknowledged that food and nutrition security is a global challenge, and a prerequisite for a healthy, peaceful and productive society. It is therefore a necessity that families all over the world be nutritionally secured.

According to World Food Summit (1996) “Food security exists when “all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life” (US Agency for International Development, 2019). Nutrition security on the other hand depends on having access to a healthy diet which provides all nutrients required for a healthy life, and being healthy so that the body can make optimal use of these nutrients for its different functions (Augustin et al., 2016). While food security is about access to a certain quantity of food, nutrition security considers food quality (Bresee, 2022). Food and nutrition insecurity translates into greater risk of diet-related diseases such as protein - energy malnutrition and micronutrient deficiency with their related complication. Nutrition security hinged on four pillars, namely: availability; food accessibility; affordability or the stability of supply without shortages or seasonal fluctuations; and utilization (Ibukun & Adebayo, 2021; Bresee, 2022) One of the ways of ensuring food and nutrition security and reducing under-nutrition in Nigeria will require the supply and provision of nutrient dense food

Wheat is among the commonly consume food in Nigeria especially in the form of bakery products. Unfortunately, Nigeria only produces about 2% to the total wheat consumed. The Food and Agriculture Organization (FAO) categorized Nigeria as one of the top ten wheat importers in the world and the third-largest importer in Africa importing about 5.2 million tonnes, and was forecasted to increase to 5.5 million tonnes by 2021/2022 (Tunji. 2021). This is besides the huge amount spent on wheat importation yearly. Nigeria’s complete dependence on imported wheat to meet consumers need is totally unsustainable and has greatly hampered the food security of the nation in the bakery sector. Furthermore, refined wheat flour is considered nutritionally poor, apart from being deficient in threonine, most of the nutrients have been stripped off during processing (Ogbonyomi, 2018), and this makes it a very good carrier for fortification. Fortification as the deliberate “practice of increasing the value of one or more micronutrients (i.e., vitamins and minerals) in a food or condiment to improve the nutritional quality of the food supply and provide the general population health benefit with minimal risk to health” (World Health Organization WHO, 2021). Through Fortification large population can be reach with cheaper essential nutrients in most efficient and effective away. Indigenous nutrient dense food/s can be used as composite flour to fortify wheat flour in the bakery industry to substantially increase the amount of bio-available macro and micronutrient/s. Composite flours made from legumes have the advantage of improving overall nutrition (Feyera, 2020; Banu et al., 2021). According to Alliance (2015) Composite flour can also increase the availability, accessibility and acceptability of nutritious foods especially snacks varieties in the local markets, while increasing opportunities for diverse agricultural production systems to be translated into dietary diversification.

Composite flour is mixture of different flours from cereal, legumes or root crops that are created to satisfy specific functional characteristics and nutrient composition (Ogbonyomi, 2018). Indigenous food crops can be used in the bakery industry for fortification of wheat flour in the production of nutrient dense snacks such as cakes. Oduro-Obeng and Plahar (2017) observed that eating in-between meals can help meet the total nutrient intake and ultimately help an individual in meeting their daily Recommended Dietary Allowance (RDA). Fortification of cake with locally available and accessibility food crops such as soybean, plantain and sesame seeds will help improve the nutritional content of cake and other snacks, thereby ensuring food and nutrition security.

Soybean (Glycine max) is a leguminous plant of the pea family. Soybeans are very rich in protein and good substitute for animal source of protein (Ogbonyomi, 2024). They are good source of a variety of minerals and vitamins (Arnason, 2019) and also contain good source of trace elements copper, zinc and manganese, and can be said to contain all the nutrients needed in food (Etiosa, 2017). Soybean is low in carbohydrate content, an
added advantage for the diabetic (Feinman et al. (2015).

Plantain is rich in anti-oxidant vitamins; vitamin C (ascorbic acid); vitamin A (carotene); vitamin E (Tocopherol), and vitamin B complex (thiamin, niacin riboflavin and B6) which helps maintain good vision, good skin, and build immunity against diseases (Amah et al., 2019; Bhuiyan et al., 2020; Oluwajuyitan & Ijarotimi, 2019). They are excellent sources of calcium (Ca), magnesium (Mg), and potassium (K), as well as iron, and phosphorous (K), potassium, magnesium and phosphate, and Copper (Arubaye & Ogbonyomi, 2019; Elum & Tigiri, 2018).

Sesame (Sesamum indicum L) also called benne is of the family of Pedaliaceae, (Alahira, 2016). Sesame seeds contain a considerable amount of protein, fiber, carbohydrate, and minerals; it’s provides high amount of tryptophan and methionine (amino acids) (McCulloch, 2019). The seed is rich in both unsaturated and polyunsaturated fatty acids and also contain rich amount of antioxidants and bioactive compounds (Pathak at al., 2014). They contain high amount of several B vitamins as well as vitamin E, and dietary minerals, especially calcium, magnesium, iron, phosphorus, zinc, copper, manganese, selenium, molybdenum, and dietary fibre (Iombor et al., 2016; Bilyk et al. 2018; McCulloch, 2019). Fortifying wheat with soybeans, plantain and sesame seeds for the production of cake and other snack foods could have diverse health benefits, while also increasing their nutritive content, which could also aid in improving the nutrient intake of individuals not meeting daily nutritional needs. It will also help in reducing or preventing malnutrition where it is most prevalent.

Considerable efforts have been focused on the use of composite flour in the production of bread and other snack food items in Nigeria for more than three decade but there is limited literature on the use of the combination of soybean, plantain and sesame flour blend in the production of cakes for food and nutrition security. Hence the study is aimed at bridging this knowledge gap by examining the proximate and sensory evaluation of cakes fortified with soybean, plantain and sesame seed flour for food and nutrition security.

**Materials**

Soybeans, Matured unripe plantain (*Musa paradisiaca*), sesame seeds, wheat flour, margarine, eggs, and other ingredients were procured from local market in Warri, Delta State. Reagents for laboratory analysis were provided by the Precision laboratory Analyst, Precision Analytical and Research Laboratory, Ibadan, Oyo State, Nigeria.

**Preparation of Soybean Flour**

The soybean was prepared as described by Ndife et al. (2011). The soybean was cleaned, washed, sun dried, roasted, decorticated / winnowed, milled and sieved into fine flour and packaged into a zipped bags, labeled and stored at room temperature until needed.

![Flow chart for the production of soybean flour](source)

**Preparation of Plantain Flour**

Matured unripe plantain bunch were separated and washed under running tap of clean water. The pulps were with the help of a kitchen knife and kept in a large bowl of clean water until the peeling process was completed (to reduce enzymatic reaction). The Plantain pulps were sliced manually into thin cylindrical pieces of 2 mm thickness for easy drying. The sliced plantain was blanched for 5 minutes with hot water at 80°C. This is to stop enzymatic reaction and to get...
fairly white plantain flour. The blanched plantain pebbles was sun-dried and milled into very fine flour, sieved and packaged in air tight container, labeled and stored until needed.

![Flow chart for the production of plantain flour. Source: Ogbonyomi (2018)](image)

**Preparation of sesame seeds flour**

Sesame seeds was cleaned to remove extraneous materials and washed with water, socked in salted water and dehulled. The seeds were sundry and slightly roasted and milled to obtain the sesame flour and package in a zipped bags labeled and stored at room temperature.

![Flow chart for the production of Sesame flour. Source: Ogbonyomi (2024)](image)

**Preparation of plantain/Soybean/ Sesame seed and wheat composite flour**

The composite flour samples were formulated by substituting wheat flour with soybean, plantain and sesame seed flour at different ratios 5:5:5:85; 5:10:5:80; 10:10:5:75; 15:15:10:70; 15:10:15:60; 15:15:15:55 respectively. (SPSW1); (SPSW2); (SPSW3); (SPSW4); (SPSW5); (SPSW6); and one hundred percent (100%) wheat flour (SPSW7) served as the control. A total of seven different samples were prepared.

<table>
<thead>
<tr>
<th>Table 1.0. Formulation of composite and 100% wheat cakes</th>
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<tbody>
<tr>
<td></td>
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<tr>
<td>Wheat flour</td>
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<tr>
<td>Plantain flour</td>
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<tr>
<td>Soybean</td>
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<td>Sesame seeds</td>
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<tr>
<td>Margarine</td>
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<td>Sugar</td>
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<td>Eggs</td>
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<td>Nutmeg</td>
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<td>Baking powder</td>
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<tr>
<td>Vanilla extract</td>
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<td>Lemon rind</td>
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</tbody>
</table>
Production of cakes samples

Cakes were produced from the quantities of ingredients shown in Table 1 using the creaming method as described by All Nigerian recipe (2022) with slight modification.

Proximate Analysis

Proximate analysis was conducted for all the cake samples in triplicates for replication of the data using Association of Official Analytical Chemists (AOAC, 2015; 2012; AOAC) method. This method was used to determine the nutrients composition, including moisture, protein, fat, fibre, ash and carbohydrate content was estimated by simple difference. The sum of percentages of protein, fat, ash, fibre and moisture was subtracted from 100% to obtain the value of carbohydrate.

Sensory Evaluation of cake samples

Sensory evaluation of the cakes was carried out after baking. Fifteen (15) subjects, comprising of academic members of staff and postgraduate students of the Department of Vocational Education, Delta State University, Abraka, were purposively selected to make up the panel of judges. Criteria for selection were that panelist were familiar with cakes and were neither sick nor allergic to any of the ingredients used. Panelists were trained in the use of sensory evaluation procedures. At each session, properly coded samples were served on white saucers, to prevent bias. The sensory attributes of the cakes including general appearance, texture, colour, taste, mouth feel flavour, and overall acceptability was evaluated using a 9 – point hedonic scale with 1 representing the least score (dislike extremely) and 9 the highest score (like extremely), while the cut-off mark was 5. Panelists were requested to rinse their mouth with clean water after each evaluation to prevent carryover flavour during the tasting.

Statistical analysis

Results were expressed as mean values and standard deviation of three (3) determinations. Data were analyzed using a One-Way Analyses of Variance (ANOVA) using Statistical Package for Social Science (SPSS) version 23.0 to test the level of significance (P ≥ 0.05). Turkey Test was used to separate the means where significant differences existed.

Results and Discussion

Table 2.0: Mean value of proximate analysis of all cake samples

<table>
<thead>
<tr>
<th>Samples</th>
<th>Parameters (%)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Moisture</td>
<td>Crude protein</td>
<td>Crude Fat</td>
<td>Crude Fiber</td>
<td>Total Ash</td>
<td>Carbohydrate</td>
</tr>
<tr>
<td>SPSW1</td>
<td>15.93 ±1.80^c</td>
<td>12.60 ±0.20^c</td>
<td>26.25 ±0.24^d</td>
<td>1.23 ±0.13^d</td>
<td>2.57 ±0.20^b</td>
<td>41.18 ±1.80^a</td>
</tr>
<tr>
<td>SPSW2</td>
<td>19.31 ±1.48^b</td>
<td>13.05 ±0.05^c</td>
<td>26.62 ±0.22^d</td>
<td>2.84 ±0.00^c</td>
<td>2.85 ±0.21^b</td>
<td>40.12 ±0.48^b</td>
</tr>
<tr>
<td>SPSW3</td>
<td>19.91 ±0.84^b</td>
<td>14.67 ±0.83^c</td>
<td>28.47 ±0.83^c</td>
<td>2.91 ±0.01^b</td>
<td>3.17 ±0.02^b</td>
<td>36.65 ±0.46^c</td>
</tr>
<tr>
<td>SPSW4</td>
<td>20.33 ±0.58^b</td>
<td>14.27 ±1.07^b</td>
<td>28.95 ±1.03^c</td>
<td>2.98 ±0.00^b</td>
<td>3.64 ±0.16^a</td>
<td>35.66 ±0.10^c</td>
</tr>
<tr>
<td>SPSW5</td>
<td>20.22 ±0.70^b</td>
<td>15.40 ±0.48^a</td>
<td>30.08 ±0.08^b</td>
<td>3.00 ±0.00^b</td>
<td>3.66 ±0.18^a</td>
<td>34.51 ±1.06^c</td>
</tr>
<tr>
<td>SPSW6</td>
<td>22.33 ±0.58^a</td>
<td>15.91 ±0.36^a</td>
<td>32.07 ±0.07^a</td>
<td>3.27 ±0.00^a</td>
<td>3.92 ±0.20^a</td>
<td>26.04 ±0.04^d</td>
</tr>
<tr>
<td>SPSW7</td>
<td>14.67 ±0.58^b</td>
<td>11.37 ±0.61^d</td>
<td>25.25 ±0.50^d</td>
<td>0.51 ±0.61^e</td>
<td>2.35 ±0.10^b</td>
<td>42.66 ±0.06^a</td>
</tr>
</tbody>
</table>

Mean and standard deviation of proximate analysis result

*Samples with different superscripts within the column are significantly different (P ≥ 0.05).

Key:

SPSW1 (5% plantain, 5% soybean, 5% sesame / 85% wheat flour) cake
SPSW2 (10% plantain, 5% soybean, 5% sesame / 80% wheat flour cake)
SPSW3 (10% plantain, 10% soybean, 5% sesame / 75% wheat flour) cake
SPSW4 (15% plantain, 5% soybean, 10% sesame / 70% wheat flour) cake
SPSW5 (10% plantain, 15% soybean, 15% sesame / 60% wheat flour) cake
SPSW6 (15% plantain, 15% soybean, 15% sesame / 55% wheat flour) cake
SPSW7 (100% wheat flour cake) which serves as the control
**Proximate composition profile**

The moisture content of composite cake samples increases from 14.67 ±0.58 in SPSW7 to 22.33±0.58 in SPSW6 as presented in Table 2.0 as the percentage of fortificants. SPSW7 (control) was significantly different from all the composite cake samples except SPSW1. Loza et al. (2017) and Kiin-Kabari and Banigo (2015) also reported high moisture content in their products with sesame seeds, plantain flour and bambara nut substitution. Adebowale et al. (2012) observed that addition of soy flour to plantain flour confers high water binding capacity of plantain flour which in turn improves the reconstitution and textural ability of plantain flour. The relatively high moisture content of the composite cake could be due to the high fibre content of the fortificant (soybean, plantain and sesame seed flour) as food high in fibre has the ability to trap in more moisture than the less fibrous counterparts.

Increase in the addition of fortificants improves the protein quality of the composite cakes as revealed in Table 2.0 protein content increased from11.37 ±0.61 in SPSW1 to 15.91 ±0.36 in SPSW6. Protein value of all the composite cake samples was significantly higher than the control P≥0.05. This observation was also in agreement with Kiin-Kabari and Banigo (2015), Agu and Okoli (2014) and Ndife et al. (2011) who also recorded increase in protein content of cake, biscuits and bread with the addition of legumes respectively. The increase in the protein content of composite cakes is an added advantage to the consumer as it will help increase their consumption of dietary protein thereby prevent protein energy malnutrition.

The fat value of cake samples also increased from 25.25 ±0.50 in SPSW1 to 32.07 ±0.07 in SPSW6. The increase in fat content could be attributed to the use of oil seeds (soybean and sesame seed) which are very rich in fat content. Fortunately, soybean and sesame fats contain healthy mono and polyunsaturated fat (Tunde-Akintunde et al., 2012) that are beneficial to the body. High oil retention improves the mouth feel and retains the flavour of cakes. In similar observation, Agu and Okoli (2014) who prepares composite biscuits from wheat, beniseed, and plantain flours, Ugwuona et al. (2017) composite bread from sesame seed and wheat flour and Loza et al. (2017) cookies with banana flour, sesame seeds and wheat flour all reported increase in fat content of their products.

There was also increase in dietary fibre from 0.51 ±0.6 in SPSW1 to 3.27 ±0.00 in sample SPSW6. The increase in fibre content could be because unripe plantain flour and the hull of sesame seed are both high in fibre. In similar trend Loza et al. (2017) also observed higher crude fiber in sesame composite bread, Ndife et al., (2011) also reported high fibre in soybean and whole wheat flour composite bread.

The Ash content also improved significantly as substitution increased from 2.35 ±0.10 to 3.92 ±0.20 (SPSW1 to SPSW6). The result was in agreement with Zubair, et al. (2021) who observed high ash content in cake made from bends of wheat and sesame seed flour and also Taghdir et al. (2016) who experimented on bread made with corn flour supplemented with soy flour.

The carbohydrate content decreases in all the composite samples more than the control form 42.66 ±0.06 to 26.04 ±0.04 with increased level of substitution with SPSW1 having the highest and SPSW6 the least. Banigo (2015); Ugwuona et al. (2017), Emmanuel-Ikpeme et al. (2012) and Adegunwa et al. (2019) also recorded decrease in carbohydrate content as substitution increased. This revealed that wheat flour was the main contributor of the carbohydrate in the cake samples.
Table 3.0: Mean Ratings of sensory evaluation of all the Cake Samples

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<tbody>
<tr>
<td>Appearance</td>
<td>7.67±0.72&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.33 ±0.8&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.27 ±0.88&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.60±0.73^b</td>
<td>6.80 ±0.77&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.73 ±0.70&lt;sup&gt;b&lt;/sup&gt;</td>
<td>7.47 ±0.64^b</td>
</tr>
<tr>
<td>Colour</td>
<td>7.53±0.53&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.13±1.30&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.27 ±1.39&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.67±0.72&lt;sup&gt;b&lt;/sup&gt;</td>
<td>6.87 ±0.74&lt;sup&gt;b&lt;/sup&gt;</td>
<td>7.00 ±0.76&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.40±0.72&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Flavour</td>
<td>7.20±0.86&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.07±0.80&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.73±0.96&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.13±1.06&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.00 ±0.93&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.07 ±0.76&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.13±0.74&lt;sup&gt;a&lt;/sup&gt;</td>
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<tr>
<td>Taste</td>
<td>7.33±0.97&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.47±1.69&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.27±0.59&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.87±0.64&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.20 ±0.68&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.13 ±1.06&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.80±1.02&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Texture</td>
<td>7.07±0.80&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.53±0.64&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.13±0.52&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.33±0.90&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.87±0.52&lt;sup&gt;b&lt;/sup&gt;</td>
<td>7.47 ±0.64&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.87±0.35&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Mouth feel</td>
<td>6.93±0.89&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.33±0.82&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.87±0.92&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.87±1.06&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.80 ±0.78&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.13 ±1.06&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.27 ±0.6&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Overall</td>
<td>7.07±0.96&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.20±1.21&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.07±0.83&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.00±1.25&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.73 ±1.28&lt;sup&gt;a&lt;/sup&gt;</td>
<td>6.80 ±1.01&lt;sup&gt;a&lt;/sup&gt;</td>
<td>7.47±0.64&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Mean and standard deviation of sensory evaluation result

*Samples with different superscripts within same roll differ significantly (P ≥0.05).

*Key: 9 - liked extremely, 8 - liked very much, 7- liked moderately, 6 - liked slightly, 5 - neither like nor dislike, 4 - disliked slightly, 3 - disliked moderately, 2 - very much disliked, 1 - disliked extremely

*liked extremely being highest (9) scale and dislike extremely (1) being the lowest scale.

*Cut off mark = 5 (Neither like nor dislike)

Sensory evaluation of cake samples

Sensory evaluation of cake samples as shown in Table 3.0 revealed that all the composite cakes were well accepted and liked by the judges. The judges mean ratings of texture, flavour, taste, mouth feel and overall acceptability among all the cake samples were not significantly different SPSW1, SPSW2 and SPSW3 compares favorably well and did not differ significantly at with the control in the all the attribute measured. SPSW2 (10% plantain, 10% soybean, 5% sesame / 80% wheat flour) was rated best by the judges’ among the composite cake samples.

SPSW1 had the highest mean rating even more than SPSW7 (the control), while SPSW4 was significantly different at P ≥ 0.05 in appearance and the least preferred in appearance. Colour of all the cake samples was liked by the judges. SPSW1 had the highest mean rating in colour preference among all the cake samples while SPSW4 and SPSW5 were slightly darker in colour than the control. The darker crust colour of products has also been observed by several authors (Taghdir et al., 2016; Ibeanu et al., 2015; Oloyede, Ocheme & Nurudeen, 2013) in cake, bread and biscuits. The brownish appearance of some of the composite cake samples could be directly related to the brownish colour of roasted sesame seeds, enzymatic reaction, and ascorbic acid of the plantain pulp before dehydration and the method of dehydration used (Arubayi & Ogbon, 2021). Flavour preference showed no significant difference (P<0.05) among all samples including the control. Composite cake SPSW1 had the highest mean rating than all the cake samples while SPSW3 had the least mean rating in flavor preference all the composite samples were not significantly different with the control. This result was in agreement with Liza et al. (2017), Uguwona Emmanuel-Ikpeme et al. (2012) and Obeta (2016) and who experimented on cakes, cookies and bread using plantain, soybean or sesame seeds substitution at different ratio, they all recorded no significant difference in flavor of their products.

The textural quality of all the composite cake samples was like by the judges. The fortificants (plantain, soybean and sesame seed flour) did not have any negative effects on textural quality of all the composite cake samples as they were judged by panelists as acceptable. Even though the control was preferred, none of the composite sample was disliked in texture quality. SPSW2 had the highest mean rating among the composite samples in texture preference. SPSW5 was slightly harder in texture than all the samples, but not too hard to be disliked. Similar findings in textural of preference was reported by Iombor et al. (2016) and Agu and Okoli (2014) in bread and biscuits using beniseed and unripe plantain. The
slightly hard texture may be due to the high fibre content of plantain and sesame seed flour.

Findings also revealed that, the taste of all the cake were moderately liked by and does not differ at $P \geq 0.05$ with the control. SPSW4 had the best mean taste rating among all the samples. High taste preference was also reported by Loza et al. (2017) and Ugwuona and Obeta (2016) using plantain/ sesame seeds /wheat composite in preparation of composite cake and breads. Ibeanu et al. (2015) also recorded high taste preference in wheat and plantain composite cake.

Mouth feel of cake samples had no significant difference at $P \geq 0.05$ with SPSW7 (control), and none of the composite samples were disliked by judges in mouth feel preference. Oledimma (2021) observed up to 50% acceptability in mouth feel preference in cake prepared with soybean / plantain and wheat composite flour. All the composite cake samples were highly rated in overall acceptability, even though SPSW7 (control) was still preferred. All the samples has no significant difference at $P \geq 0.05$ with the control. This result was in agreement with Ibeanu et al. (2015) who reported up to 50% acceptability with plantain substitution, and up to 25% overall acceptability by Sampson et al. (2018) with wheat-soy composite flour on Rock cakes. Emmanuel-Ikpe et al. (2012) whose bread and cakes from wheat and beniseed composite flour result also shows no significant difference in colour, flavour, texture and overall acceptability up to 10% beniseed substitution for bread and up to 20% beniseed substitution for cake with the control. Full fat and defatted sesame seed flour/ wheat flour bread prepared by Ugwuona and Obeta (2016) were reported to have high rating preference in colour, texture, flavour, mouth feel and overall acceptability.

Conclusion

Composite cake (SPSW6) substituted with 15 % level of each of the fortificant (soybean, plantain and sesame seed flour) had the highest nutrient content even more than the control. The sensory attributes of all the composite cakes compared well with the control and were all acceptable. SPSW2 (cake substituted with 5% soybean, plantain, 10% 5% sesame / 80% wheat flour) was rated best by the judges in sensory attributes.

Thus, it can be concluded that various formulations of soybean-unripe plantain-sesame seeds flours can substitute wheat flour in the production of nutritious cakes of acceptable quality without adversely affecting the sensory characteristics. This will help increase and diversify the overall use of soybean, plantain and sesame seed, greatly improve the nutritional status of vulnerable groups, and also use to foster food and nutrition security in Nigeria and other developing countries.

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