EVALUATION OF VARIOUS CHARACTERISTICS OF Akara (FRIED BEANS CAKE) MADE FROM COWPEA (vigna unguiculata) AND SOYBEAN (glycine max) BLENDS

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ABSTRACT

Akara (fried bean cake) is one of the most popular local dishes in Nigeria. Proximate composition, functional properties and sensory evaluation of akara prepared from cowpea and soybean blends were carried out in present study. Furthermore, study was also planned to determine the best ratio of cowpea & soybean blend that can give best akara production (fried beans cake). Result of proximate analysis revealed that the combination of cowpea and soybean blends (sample B, C and D) had a higher protein content (15.20, 18.31 and 22.52%) ash content (1.74, 1.80 and 1.88%) crude fat (3.38, 4.06 and 5.28%) and crude fiber (1.03, 1.10 and 1.19%) compare to individual cowpea control (sample A) which have only 4.44% (protein) 1.17% (ash) 1.91% (crude fat) and 0.92% (crude fiber) respectively. The functional properties results showed a reduction in bulk density with an increase in soybean blend with cowpea i.e. sample A > B>C. The same pattern of results were recorded for water absorption and swelling capacity. Sample A having the highest value in all the functional properties determined except in oil absorption capacity. The sensory evaluation results showed a slight difference in all parameters tested for except the overall acceptability which showed no significant difference for all the samples at p≤0.05. This implies that cowpea and soybean blends, up to 30% substitution, can be used to produce akara that will be acceptable thus improving the culinary uses of soybean and improving the nutritional quality of akara.

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1 Introduction

Akara (fried bean cake) is popular food in Nigeria and other West African Countries (Ngoddy et al., 1986; Henshaw & Lawal, 1993; Ekariko, 2005), and form part of diet for most ethnic groups in Nigeria. Nigerians usually eat it as breakfast with ogi, or lunch with gari or even dinner with eko. Akara is a traditional African food made by deep frying cowpea paste that has been whipped and seasoning with salt, pepper, onions and other optional ingredients. The outer crust of akara is crisp and the interior is spongy like bread. It is considered to be the most commonly consumed cowpea based food in West Africa (Henshaw & Lawal, 1993; Asare et al., 2013). Akara is made mainly from cowpea and other sources like maize “Monsa”.

Seeds of cowpea can be cooked in the dried form, sprouted or ground into flour in intermediate product. Being in the class of legumes, they are often referred to as ‘poor man’s meat’ due to their use as primary protein sources (Henshaw & Sobowale, 1996; Odedeji & Oyeleke, 2011). It is an important dietary staple in West African countries because of its high nutritional value, low cost and broad availability in the region. Soybean (Glycine max) is the seed of a leguminous plant. It has high protein content and is not very expensive. It has been proposed as ideal source of protein supplementation of starchy foods (Wang et al., 2008), because its protein quality is superior to that of cowpea and it compares favourably well with animal protein. Soybean proteins have been use widely in foods for their distinctive physico-chemical and functional properties as well as nutritional values (Wang et al., 2008). In Nigeria, not much culinary value has been derived from soybean apart from its utilization in soycheese (Tofu) and soymilk production, which are becoming popular in some parts of the Country. It has not found good domestic use as cowpea despite its nutritional advantage. Preliminary study was carried out on soybean paste in production of akara based on the fact of increasing its culinary uses. Individually, Soybean paste was unable to produce the akara because of its functional properties that is differ from other cowpea, so the paste was found dissolve in hot oil during frying. Based on this finding, this work is aimed at improving the domestic use of soybean by combining it with cowpea for the production of akara. This is expected to increase its domestic utilization and compliment cowpea as a cheap source of protein.

2 Materials and Methods

Cowpea and soybean were combined in the three ratios viz 90:10, 80:20 and 70:30 respectively and labelled sample B, C and D while only cowpea was used as the control (sample A). The proximate composition and functional properties of all the flour blends were carried out before the production of akara. The akara samples were subjected to sensory evaluation using selected sensory attributes to determine their overall acceptability. The study has been conducted in the food processing laboratory of the department of Food Technology, Federal Polytechnic Offa, Kwara State. Cowpea and soybean were purchased at Owode market in Offa, Kwara State, Nigeria.

2.1 Preparation of samples

The cowpea and soybean samples were sorted to remove damage ones and other extraneous materials. Both cowpea seeds and soy bean were soaked for 1 hr separately, dehulled and washed. They were combined in ratios with sample A (100% cowpea), sample B (90:10), sample C (80:20), and sample D (70:30) cowpea to soybean in triplicate. They were all wet milled and dried at 70°C in hot air oven for 48 hrs and the flours were packaged in side polyethylene bag and store at room temperature for further analysis. Cowpea flour was used as control (Sample A).

2.2 Proximate Composition of the Sample (dry basis)

Each sample was evaluated for moisture, protein, fat, ash and crude fiber using standard methods of AOAC (2000). Total carbohydrate content was calculated by subtracting the sum of value of the remaining proximate composition from 100.

2.3 Determination of functional properties of samples

The functional properties (Water absorption capacity, Swelling and Bulk density) of samples were determined based on standard methods of the Association of Official Analytical Chemist (AOAC, 2000).

Table 1: Standard recipe for fried “Akara” from cowpea soybean blend.

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cowpea and Soybean flour (different samples)</td>
<td>800g</td>
</tr>
<tr>
<td>Onion</td>
<td>35g</td>
</tr>
<tr>
<td>Pepper</td>
<td>40g</td>
</tr>
<tr>
<td>Water to mix</td>
<td>500ml</td>
</tr>
<tr>
<td>Salt</td>
<td>1g</td>
</tr>
<tr>
<td>Seasoning</td>
<td>2g</td>
</tr>
<tr>
<td>Vegetable oil</td>
<td>500g</td>
</tr>
</tbody>
</table>

Source: Established base on preliminary study
Evaluation of various characteristics of akara (fried beans cake) made from cowpea (Vigna unguiculata) and soybean (Glycine max) blends.

2.4 Sensory evaluation of akara samples

The akara samples were subjected to sensory analysis by using a 5-point hedonic test (Watts, 1989) with a scaling range of 1-5 (1 = poor, 2 = fair 3 = good, 4 = very good, 5 = excellent). A panel of 50 member was used to evaluate for taste, colour, flavour, texture, and overall acceptability.

2.5 Statistical analysis

The analysis of variance (ANOVA) procedures were used to analyze all data using the statistical package for social package for social sciences (SPSS) version 16 for window. Mean separation was performed by the LSD test (p≤0.05).

3 Results and Discussion

3.1 Proximate Composition

The results of the proximate analysis of the samples are presented on Table 2. It was observed that the moisture content of the paste reduced with increased level of soybean substitution with while the dry matter content increased gradually. The reduction in the moisture content of the paste may be due to the increase in protein content of the paste as a result of the addition of soybean. Protein has been reported to have some functional attributes such as water sorption, viscosity, elasticity, foamability, foam stability and fibre formation (Sunful et al., 2010; Dixit et al., 2011).

A significant difference in the protein contents was reported with increases the quantity of soybean substitution. The protein content range from 15-22 % was reported with the subsequent increasing of the soybean percentage, it was 15.20% for sample A, 18.31% for sample B, 20.43% for sample C and 22.52% for sample D. A significant difference was reported in the sample D and sample containing only cowpea (sample A). Findings of the previous researcher have support the statements that soybean has a higher protein quantity than cowpea (Mateos-Aparicio et al., 2008; Dixit et al., 2011). The fat content of various samples also varied according to the percentages of soybean substitution, sample A was having 1.91% fat while sample B, C and D recorded 3.38%, 4.06%, and 5.28% fat respectively. This is not unexpected, because soybean is an oil seed, it has a higher oil content than cowpea.

It is there expected to contribute to the increases observed in the fat content of sample. This is of nutritional importance because soybean oil contains mainly polyunsaturated fatty acids which are considered healthy to the human body (Mateos-Aparicio et al., 2008; Dixit et al., 2011; Jideani, 2011). Furthermore, it has been observed that soybean fat always has other substances associated with it in natural food, such as fat soluble vitamins A, D, E and K. Fat contribute characteristic flavours to food and a small amount produce a feeling of satiety or loss of hunger.

Ash, which is the inorganic residue remaining after an inorganic matter has been burnt represent the mineral content of food. The ash contents of all the samples increased with sample A having the lowest value of 1.17% and sample D having the highest value of 1.88%. The increase can be attributed to the substitution of soybean. This results are in agreement with the report of Sunful et al., 2010 and Abioye et al., 2011. This is of nutritional importance because soybean is a useful source of calcium and iron. The indigestible component of plant material, which include cellulose, hemicellulose, pectin, lignins, and other plant materials are referred to collectively as fibre or dietary fibre. The fibre content of samples showed a significant increase with increases in the percentages of soybean substitution. Sample A had the lowest value of 0.92% while sample B, C, and D had 1.03%, 1.10% and 1.19% respectively. The carbohydrate content of the entire sample followed the pattern of level of substitution of soybean in to cowpea. The control sample has the highest carbohydrate content (68.60%), and it is followed by sample B, C and D (63.69, 61.45, and 59.65%). This result may be due to present of limited amount of other nutrients apart from moisture in the control sample.

Table 3 showed the results of functional properties of the various composition of soybean and cowpea. The bulk density of all the soybean and cowpea composition (samples) were similar except little difference in value without significant differences at p≤ 0.05. The bulk density is influenced by particle size and density of the flour. It is an important requirement for determining the packaging and material harding (Karuna et al., 1996). Low bulk density is influenced by the loose structure of the starch polymer (Olu et al., 2012). The results obtained for water absorption capacity ranged between 1.56-1.72%.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Moisture</th>
<th>Protein</th>
<th>Ash</th>
<th>Crude Fat</th>
<th>Crude Fiber</th>
<th>Carbohydrate</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>12.20±0.01d</td>
<td>15.20± 0.01ª</td>
<td>1.17± 0.01ª</td>
<td>1.91±0.01ª</td>
<td>0.92± 0.01ª</td>
<td>68.60±0.22d</td>
</tr>
<tr>
<td>B</td>
<td>11.80±0.02ª</td>
<td>18.31± 0.01b</td>
<td>1.74± 0.01b</td>
<td>3.38±0.01b</td>
<td>1.03± 0.02b</td>
<td>63.69±0.14ª</td>
</tr>
<tr>
<td>C</td>
<td>11.10±0.01ª</td>
<td>20.43± 0.01c</td>
<td>1.80± 0.01c</td>
<td>4.06±0.03c</td>
<td>1.10± 0.01c</td>
<td>61.45±0.32b</td>
</tr>
<tr>
<td>D</td>
<td>9.40± 0.01ª</td>
<td>22.52±0.01b</td>
<td>1.88± 0.02b</td>
<td>5.28±0.02b</td>
<td>1.19± 0.01b</td>
<td>59.65±0.17a</td>
</tr>
</tbody>
</table>

Values are means and standard deviation (±) of three determinations (n=3) Means followed by the same letter within the same column are not significantly (p>0.05) different according to LSD test.
Sample A which contained 100% cowpea flour gave the highest water absorption capacity followed by sample B, C and D respectively. This may be due to the percentage soy flour added to each sample. Osundahunsi et al. (2003) reported that higher water absorption capacity is desirable in food system to improve yield and consistency of such food product. The low water absorption capacity of the cowpea-soy flour may be due to loose association of amylose and amylopectin in the samples. This result is supported by the findings of Lorenz & (1990) and Olu et al. (2012). These researchers reported that water absorption capacity will be low if there is loose association between amylose and amylopectin in the native granules of starch and weak associative forces maintaining the granules structure.

The oil absorption capacity of all the samples were also different with significant difference at P≤0.05. Oil absorption capacity is an important property of cowpea flour that could be used as an extender in various culinary uses. The presence of soy flour in the sample increased the rate of oil absorption of all the samples. Low oil absorption is highly desirable as far as flour product is concerned (Odedeji & Oyeleke, 2011). The swelling capacity of the three samples followed the same trend of water absorption capacity with sample C having the lowest swelling capacity (3.10%), followed by sample B (3.25%) and highest in sample A (3.57%). The swelling capacity results of the three samples may be due to the ratio of soy flour to cowpea flour in all the samples. The swelling index or swelling capacity is largely controlled by the strength and character of the micellar network within the starch granules (Asare et al., 2013). The starch granules present in the samples showed a weak strength which resulted in low swelling capacity. This result is in line with the result of Abiye et al. (2011) who reported a decrease in swelling capacity of soy – plantain flour.

Table 4 showed the result of the organoleptic evaluation of the akara samples produced from cowpea and soybean blends. The colour of the samples expressed the level of sensation the product provide on the eye by the rays of light (Sunful et al., 2010). They showed mean scores of 4.68, 4.38, 4.52 and 4.42 for samples A, B, C, and D respectively. Flavour is the expression of the aroma and taste of the product. Based on sensory evaluation, flavour range between 4.28 and 3.70. Sample A had the highest percentage of 4.28 while sample D had the lowest percentage of 3.70, this showed that sample A was most preferred in terms of flavour. The texture of the product refers to the smoothness, feel or appearance of the surface of the product. The mean score of texture attribute of the products range between 4.44 for sample A and 4.08 for sample D. Sample A had the highest mean of 4.44 while sample D had the lowest mean score of 4.08. In terms of general acceptability mean score showed 4.46, 4.20, 4.16 and 3.96 for samples A, B, C and D respectively. There was little or no significant different between the samples at P≤0.05 level. This implied that the samples were all acceptable, but sample D was the least preferred.

Conclusions

The results of proximate analysis of the samples showed that samples produced from cowpea and soybean blends were of better nutritional quality than the control sample, although the functional properties proof that whole cowpea is still better than the mixture. Based on the results of sensory evaluation of akara samples produce with different pastes, it can be concluded that there was no significant difference, in terms of quality and acceptability, between the different samples up to 30% soybean substitution. This is expected to increased the domestic utilization of soybean and possibly an improvement on the nutritional quality of akara.

Table 4 Organoleptic result of “Akara” produced from cowpea soybean blend.

<table>
<thead>
<tr>
<th>Samples</th>
<th>Taste</th>
<th>Colour</th>
<th>Flavour</th>
<th>Texture</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>4.42± 0.50b</td>
<td>4.68± 0.47b</td>
<td>4.28± 0.54b</td>
<td>4.44±0.50b</td>
<td>4.46± 0.50b</td>
</tr>
<tr>
<td>B</td>
<td>4.14± 0.50ab</td>
<td>4.38±0.49a</td>
<td>3.72±0.45a</td>
<td>4.24±0.52ab</td>
<td>4.20± 0.49b</td>
</tr>
<tr>
<td>C</td>
<td>4.28± 0.45ab</td>
<td>4.52±0.50ab</td>
<td>3.90±0.42a</td>
<td>4.40±0.53b</td>
<td>4.16± 0.587</td>
</tr>
<tr>
<td>D</td>
<td>4.06± 0.71a</td>
<td>4.42±0.50a</td>
<td>3.70±0.68a</td>
<td>4.08± 0.07a</td>
<td>3.96± 0.607</td>
</tr>
</tbody>
</table>

Values are means and standard deviation of three determinations (n=3). Means followed by the same letter within the same column are not significantly (p>0.05) different according to LSD test

Table 3 Functional Properties of Cowpea and Soybean Blends.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Bulk density (g/ml)</th>
<th>Water Absorption capacity (%)</th>
<th>Oil Absorbtion capacity (%)</th>
<th>Swelling Capacity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0.89±0.30c</td>
<td>1.98±0.01d</td>
<td>1.42±0.12c</td>
<td>3.77±0.03d</td>
</tr>
<tr>
<td>B</td>
<td>0.85±0.02a</td>
<td>1.72± 0.01c</td>
<td>1.46± 0.02c</td>
<td>3.57± 0.01c</td>
</tr>
<tr>
<td>C</td>
<td>0.84± 0.01a</td>
<td>1.67± 0.01b</td>
<td>1.50± 0.01b</td>
<td>3.25± 0.01b</td>
</tr>
<tr>
<td>D</td>
<td>0.83± 0.01a</td>
<td>1.56± 0.02c</td>
<td>1.58± 0.01c</td>
<td>3.19± 0.01c</td>
</tr>
</tbody>
</table>

Values are means and standard deviation of three determinations (n=3). Means followed by the same letter within the same column are not significantly (p>0.05) different according to LSD test
References


