# NUTRIENT AND SENSORY EVALUATION OF BAMBARA GROUNDNUT AND COWPEA BLENDS IN AKARA PRODUCTION.

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**ABSTRACT**

*Akara (fried bean cake) is one of the most popular local dishes in Nigeria. Proximate composition, mineral composition and sensory evaluation of akara prepared from bambara and cowpea blends were investigated .. Furthermore, study was also planned to determine the best ratio of bambara and cowpea blend that can give best akara production (fried bean cake). Result of proximate analysis revealed that the combination of bambara and cowpea blend (sample A,B C and D) had a higher protein content of (22.28%, 20.39%, 18.86%, 17.89%,) compare to bambaracontrol sample (sample E) which have only 15.66% (protein), 1.74% (Ash), 5.45% (Crude fat) and 1.28% (crube fiber). The most abundant mineral in the akara produced from the blend of bambara and cowpea was iron content was 17.87% of sample A and the least minerals was calcium of 12.3% of sample E which is the control sample. . The sensory evaluation results showed a slight significancedifferences in texture, taste, aroma and overall acceptability at P≤0.05. Samples D 90:10 was the most accepted in terms of overall acceptability. This implies that bambara and cowpea blends, up to10% substitution, can be used to produce akara that will be acceptable thus improving the culinary uses of bambara groundnut flour and improving the nutritional quality of akara.*

Key words; Nutrient , Sensory , Bambara, Cowpea, Akara

## 1.0 INTRODUCTION

Bambara groundnut (*Vigna subterranean* (L) Verdi) is a pulse with subterranean, fruit-set and is cultivated by small holders in Africa (Linnenamn and Azam-Ali 1993). The legume species is of Africa origin (Borget1992) and is widespread south of sahara (Ocren*et al*, 1998).

Bambara groundnut belongs to the family of leguminosaeit is indigenous and is grown extensively in Nigeria but it is one of the lesser utilized legumes in Nigeria. In Nigeria the freshly harvested pods are cooked shelled and eaten as a vegetable snacks while dry seeds are roasted and eaten as a snack or milled into flour and used in preparation of moin-moin (Olapade et al, 2005).

The protein of bambara groundnut is of good quality and has surplus lysine which complements cereal in the diets (Ocren*et al.,* 1998). The composition of the seeds from the point of view for human nutrition is very well balanced as they contain 20% soluble carbohydrate and 8% of fat (Messken , 2002). It is high in protein but unlike ordinary groundnut contain very little oil (Twenboah, 2002). Food legumes have a major roles to play in the fight against malnutrition. It is therefore necessary that their levels of consumption which are already too low in a number of developing countries should be increased. Bambara groundnut as one of legume is a complete food due to the presences of high carbohydrate (65%) and relatively high protein of about 18% (Doku, 1995).

Cowpea (*Vigna unguiculate*) is an example of grain legume which has found utilization in various ways in traditional and modern food processing in the world. The seed of cowpea can be cooked in dried form, sprouted, or ground into flour intermediate product and it is being used in diet as it serves as primary sources of protein. They represent one of the dietary staple in many parts of the world. Cowpea, so considerable importance in Nigeria and in many African countries as a nutritious leguminous crop providing an alternative sources to animal protein (Asare *et al.,* 2013).

In Nigeria Cowpea is consumed in the form of bean pudding, bean cake, baked beans, tried beans, bean soup amongst other. The main advantages of cowpea over many other crops apart from being the most practical sources of storable and transportable protein is due to the fact that it is a cheap source of protein. However it is susceptible to

many diseases and pests attack right from its growth stage up to storage (Singht *et al*., 1999) and final consumption. Thus is therefore the quest for means of preservation which include flour production.

Cowpea however has been shown to be rich in mineral elements such as phosphorus (p), potassium (k) calcium (cal, magnesium) (mg), sodium (Na), manganese (Mn) Iron (Fc) etc (Akpapunan and Daribe 1994). Cowpea also contain macro molecules (protein) composed of 20x amino acid residue in the L-configuration.

Akara, a deep fried cowpea batter is the most consumed cowpea product in West Africa. Traditionally, the batter is made from fresh cowpea paste seasoned with bell or hot peppers onion and salt and then deep fried at $193^0$c (Plahar*et al*, 2006). The production of fresh paste from cowpea is the major constraint in the preparation of Akara (Henshaw *et al.*, 2003). This involve soaking decortications and wet milling which is tedious and time consuming (Singh *et al*, 1999).

Akara is also greet street food as sellers can be found frying them at different hours of the day. It is popularly served with Ogi (Pap) or with bread while some take it with fried yam. Akara serves as a sources of protein as it supply the body with much protein. It also contain some macro and micro nutrient as leveled from the onion pepper and other ingredient used in the production.

The aim of the research work is Fortifying bambara groundnut with a more proteinous legumes because of its low protein in order to increase the nutrient content of Akara.Andutilization of bambara legume where cowpea is being expensive

## MATERIALS AND METHOD

### 2.1 SOURCES OF RAW MATERIALS

Bambara groundnut (*Vigna subterranean (L) Verdi*) cowpea (*Vigna unguiculata*), vegetable oil and other ingredient such as pepper, onion, salt etc used in this study were purchased from a local market in Ilaro Ogun State Nigeria, while all the materials and all chemicals used for this study were of analytical grade and it were all supplied by the department of Food Technology, Federal Polytechnic Ilaro Ogun State.

### 2.2 SAMPLE PREPARATION

#### 2.2.1 Preparation of Bambara Groundnut Flour

The bambara groundnut was first thoroughly cleaned by picking all the stones and other foreign particle present in them while something out the good ones. The cleaned bambara groundnut were soaked in water for 12 hours. The seeds were dehulled manually over –dried at $75^0$c for about 24 hours. The dried seed where then dry-milled into flour using a attrition mill and the packaged in high density polyethylene bag and tightly sealed until needed.

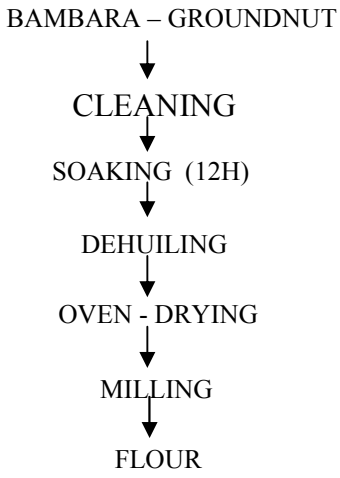


**Figure 1: Flow Chart For The Production Of Bambara Flour**

### 2.2.2 Preparation of Cowpea Flour

The beans which were cleaned to removed dirt, stones, and metals were soaked for 10minutes after which they were dehulled with hands until the seed coat loosened. The loose red coats were floated off in water while the dehulled cotyledons were drained properly and dried in an oven at $60^0$c for about 24 hours. The dried beans were milled in an attrition mill and than packaged in high density polyethylene bag and tightly sealed until seeded.

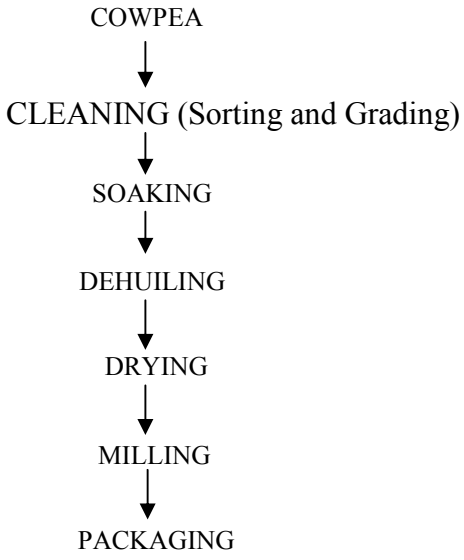


**Figure 2: Flow Chart For The Production Of Bambara Flour**

### 3.3 PRODUCTION OF AKARA

Composite flour of bambara groundnut and cowpea was prepared using the formulation in table 3.1, while akara was prepared using methods described by McWatters (1983). The complete flour was mixed with measured volume of water. This was allowed to form batter. The batter was whipped severally to incorporate air for about 2min. other ingredient like pepper onion, salts, spices were then added. This was then scooped to make ball into already located vegetable oil. The scooped balls were turned frequently until deep fried ($193^0$c) and golden brown colour is obtained.

formulation of flour blend for the production of a akarawas made in ratio 100% Bambara., 90:10. 80:20, 70:30. 50:50.( Bambara :cowpea blend respectively)

**PROXIMATE ANALYSIS:** Proximate analysis was carried out using AOAC (1990) and carbohydrate was determined by difference.

### 2.5 MINERAL ANALYSIS

Five grammes (5 g) of each akara sample were heated gently over a Bunsen burner flame until most of the organic matter was destroyed. This was further heated strongly in a muffle furnace for several hours until white – grey ash was obtained. The ash material was cooled. About 20 ml of distilled water and 10 ml of the dilute hydrochloric and was added to the ashed materials. This mixture was boiled, filtered into a 250 ml volumetric flask, washed thoroughly with hot water cooled and made up to volume. Minerals content of each sample was analyzed using colourimetric or spectrophotometric or titrimetric methods were applicable (AOAC, 1990)

### 2.7 SENSORY ANALYSIS

The Akara produced sample was subjected to organoleptic analysis. A 20 man sensory panelist was invited to access and scores the Akara based on the colour, texture, taste, aroma and overall acceptability of the Akara based on a nine point hedonic scale for preference scores. The panelist was asked to score on the sheet provided using randomization method for sample presentation.

## 3.0 RESULTS AND DISCUSSION

### 3.1 Proximate composition of *akara* made from blends of bambara and cowpea flour

Proximate composition of *akara* made from blends of bambara and cowpea flour. The moisture, protein fat, crude fibre, ash content and carbohydrate are significantly different with values that ranged from 11.18 to 14.62%, 11.66 to 22.28%, 2.67 to 5.45%, 0.8 to 1.28%, 1.78 to 1.89% and 57.99 to 64.56%, respectively. It was observed that as the percentage inclusion of cowpea flour increased there was an increase in the moisture and carbohydrate content in which Sample A had the highest while E had the lowest. As the percentage inclusion of cowpea increased there was a increase in the fat, protein, ash and crude fibre content which Sample A had the highest while sample E the control had the lowest

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 cowpea. 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 protein content of the *akara* can only be supported with the findings of the previous researcher that support the statements that bambara has a higher protein quantity than cowpea (Mateos-Aparicio *et al.,* 2008; Dixit *et al.,* 2011).The decrease in fat content is unexpected, although,bambara is not an oil seed, it has a higher oil content than cowpea. It is therefore expected to contribute to the decreasesd in the fat content of sample.

This is of nutritional importance because bambara 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).

**Table 1: Proximate composition of *akara* made from blends of bambara and cowpea flour**

| Sample | Moisture Content (%) | Protein (%) | Fat Content (%) | Crude fibre (%) | Ash content (%) | Carbohydrate (%) |
|---|---|---|---|---|---|---|
| A | 14.62±0.07$^{e}$ | 22.28±0.07$^{e}$ | 2.67±0.02$^{a}$ | 0.8±0.04$^{a}$ | 1.89±0.02$^{e}$ | 64.56±0.16$^{e}$ |
| B | 14.27±0.05$^{d}$ | 20.39±0.07$^{d}$ | 3.39±0.07$^{b}$ | 0.94±0.04$^{b}$ | 1.82±0.01$^{d}$ | 61.79±0.09$^{d}$ |
| C | 13.35±0.11$^{c}$ | 18.86±0.01$^{c}$ | 3.78±0.15$^{c}$ | 1.06±0.01$^{c}$ | 1.76±0.01$^{c}$ | 61.2±0.29$^{c}$ |
| D | 12.39±0.06$^{b}$ | 17.89±0.01$^{b}$ | 4.36±0.44$^{d}$ | 1.18±0.01$^{d}$ | 1.75±0.01$^{b}$ | 59.87±0.6$^{b}$ |
| E | 11.18±0.08$^{a}$ | 15.66±0.01$^{a}$ | 5.45±0.15$^{e}$ | 1.28±0.01$^{e}$ | 1.74±0.02$^{a}$ | 57.99±0.02$^{a}$ |

Values represent mean and standard deviation, Means with the same superscript with a column are significantly different ($p \leq 0.05$)
A-50% Bambara 50% cowpea flour
B-70% Bambara 30% cowpea flour
C-80% Bambara 20% cowpea flour
D-90% Bambara 10% cowpea flour
E-100% Bambara

Furthermore, it has been observed that bambara 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 producea small amount of loss of hunger.

Ash, which is the inorganic residue remaining after an inorganic matter has been burnt represent the mineral content of food. The increase can be attributed to the substitution of bambara flour with cowpea. This results are in agreement with the report of Sunful*et al.,* (2010) and Abioye*et al.,(*2011). This is of nutritional importance because cowpea 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.

In the case of crude fibre, the decrease in the fibre content could probably be due to the removal of high fibre seed coats especially during the dehuling (Ukachukwu*et al.,* 2002).

### 3.2 Mineral composition of *akara* made from blends of bambara and cowpea flour

The mineral composition of *akara*made from blends of bambara and cowpea flour is presented in Table 2. The calcium, iron and magnesium are significantly different ($p<0.05$) with values that ranged from 12.3 to 12.5 g/100g. 17.07 to 17.87 mg/100g and 15.15 to 15.55 g/100g, respectively, the inclusion of cowpea flour to bambara flour significantly increase the calcium, iron and magnesium content of the *akara*in which sample E had the lowest while A had the highest. This results implies that as the percentage inclusion of cowpea flour increase there were significant impact on the mineral composition of the resulting *akara.*

**Table 2: Mineral composition of *akara* made from blends of bambara and cowpea flour**

| Sample | Ca (g/100g) | Fe (mg/100g) | Mg (g/100g) |
|---|---|---|---|
| A | $12.4\pm0.01^{a}$ | $17.87\pm0.01^{c}$ | $15.55\pm0.21^{a}$ |
| B | $12.4\pm0.02^{a}$ | $17.39\pm0.37^{b}$ | $15.3\pm0.42^{a}$ |
| C | $12.5\pm0.7^{b}$ | $17.34\pm0.15^{b}$ | $15.25\pm0.63^{a}$ |
| D | $12.4\pm0.01^{a}$ | $17.26\pm0.12^{b}$ | $15.2\pm0.14^{a}$ |
| E | $12.3\pm0.01^{a}$ | $17.07\pm0.11^{a}$ | $15.15\pm0.07^{a}$ |

Values represent mean and standard deviation, Means with the same superscript within a column are not significantly different ($p\leq 0.05$

*Akara* from bambara and cowpea flour has the potentials for reducing hunger and malnutrition prevalent in most developing countries. This is evident from the high levels of crude protein and minerals.

### 3.4 The Sensory Analysis of Akara made from Blend of Bambara and Cowpea

Table 3 showed the result of the sensory evaluation of the akara samples produced from blend of bambara and cowpea. The colour of the samples expressed the level of sensation the product provide on the eye by the rays of light (sunfun et al., 2010). There was no significant different in colour ($P<0.05$) .They showed mean scores of 7.40, 7.50, 7.10, 7.60 and 7.60 for sample A, B, C, D and E respectively. Texture of the product refer to the smoothness, feel or appearance of the surface of the product. The mean score of the texture attribute of the product range between 6.90 to 8.00 which is sample E. Sample E has the highest mean of 8.00 while sample c had the lowest mean score of 6.90

In terms of taste, there is significant difference ($P<0.05$) between the sample with the valve ranging from 7.00, to 8.00 with sample E being the most accepted and sample A being the least accepted. Based on sensory evaluation, the Aroma of the akara range between 6.80 to 7.50. sample E had the highest percentage, follow by sample A and sample D which is 7.40 while sample B had the lowest percentage of 6.80, this shows that sample E was most preferred in term of Aroma.

In term of general acceptability mean score showed 7.60, 6.80, 7.60, 8.10 and 7.70 for sample A, B,C,D, and E respectively. There was little significant different between the sample at $P\leq0.05$ level. This implied that the sample were all acceptable . Sample D 90:10 was most preferred while sample B70:30 was the least preferred.

**Table 3: Sensory Analysis of Akara made from Blend of Bambara and Cowpea**

| Sample | Colour | Texture | Taste | Aroma | Overall Acceptability |
|---|---|---|---|---|---|
| A | $7.40^{a}$ | $7.20^{a}$ | $7.00^{a}$ | $7.40^{b}$ | $7.60^{a}$ |
| B | $7.50^{a}$ | $7.00^{a}$ | $7.40^{ab}$ | $6.80^{b}$ | $6.80^{ab}$ |
| C | $7.10^{a}$ | $6.90^{ab}$ | $7.60^{ab}$ | $7.20^{c}$ | $7.60^{a}$ |
| D | $7.60^{a}$ | $7.30^{a}$ | $7.20^{a}$ | $7.40^{a}$ | $8.10^{abc}$ |

| | | | | | |
|---|---|---|---|---|---|
| E | $7.60^{a}$ | $8.00^{ab}$ | $8.00^{abc}$ | $7.50^{a}$ | $7.70^{a}$ |

Values represent mean and standard deviation, Means with the same superscript within a column are not significantly different ($p \leq 0.05$)
A-50% Bambara with 50% cowpea flour
B-70% Bambara with 30% cowpea flour
C-80% Bambara with 20% cowpea flour
D-90% Bambara with 10% cowpea flour
E-100% Bambara

**CONCLUSION**

The results of proximate and mineral analysis of the samples showed that sample produced from bambara and cowpea blends were of better nutritional quality than the control sample, also there is an increase in the mineral content ofthe sample (akara) as the cowpea is being added.
Based on the result of sensory evaluation of akara sample produce with different ratio .sample D was most accepted .Although inclusion of cowpea up to 50% substitution may be encourage . This is expected to increased the domestic utilization of bambara flour, in cooperated into cowpea and possibly an improvement on the nutrition / quality of akara.

This study provide valuable information on the consume acceptance of new akara made form blend of bambara and cowpea flour and it will helps in utilization of bambara groundnut where other legume are at high cost.

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