MICROBIAL QUALITY AND SENSORY EVALUATION OF AKARA PRODUCED FROM BAMBARA AND COWPEA FLOUR BLENDS

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ABSTRACT

The microbial and sensory qualities of akara produced from blends of cowpea flour were investigated. Composite flour was prepared in the ratio 100: 0%90:10% 80:20% 70:30%and 50:50%. The total plate count of akara with 100% Bambara has the highest count $2.55 \pm 1.5\times 10^{3}$ *cfu/g followed by akara with 30% cowpea composite. The Staphylococcus count ranged from 0.95*$\pm 0.5\times 10^{1}$ *to* $1.99 \pm 1.0\times 10^{1}$ *cfu/g, the yeast and mould count range from* $2.15 \pm 1.0\times 10^{2}$ *to* $2.65 \pm 1.5\times 10^{2}$ *cfu/g while there was no growth of Salmonella in all the samples. The microbial analysis shows the values were not more than recommended standard. Sensory evaluation shows that the colour, texture, aroma were not significantly different at p<0.05 but in terms of taste and overall acceptability there was significantly difference in the value at p<0.05. Akara with 10% cowpea composite flour has the highest overall acceptability 8.10 while 30% cowpea flour substitution was more shelf stable for 5 days, hence, inclusion of 30% cowpea should be encouraged. This implies that bambara and cowpea flour blends can be used to produce akara that would be acceptable general populace thus improving the culinary uses of Bambara groundnut flour.*

1.0 INTRODUCTION

Food legumes have a major role to play in the fight against malnutrition. It is therefore necessary that their levels of consumption, which are already too low in most developing countries, and this should be increased (Borget, 2004). Legumes serve as a source of protein to a large proportion of the population in the poor countries of the world by being the least expensive and easily stored and transported non-processed protein source for rural and urban dwellers (Rachie and Silvester, 2000). The high carbohydrate (65%) and relatively highly protein 18% content of

Bambara groundnut make it a complete food (Doku, 2006). Bambara groundnut (*Vigna subterranean* (l.)Verdc.) is a pulse with subterranean fruit-set and is a crop is a legume species of Africa origin (Borget, 2004) and is widespread south of the Sahara (Ocran *et al* 2012).

Bambara groundnut is probably the most drought resistance of the grain legumes. The protein of bambara groundnut is of good quality and has surplus lysine which complements cereals in the diet (Ocran *et al*, 2012). The composition of the seeds from the point of view for human nutrition is very well balance as they contain 20% soluble carbohydrates and 8% fats (Messiaen, 2011). It is high in protein but unlike ordinary groundnuts contains very little oil (Tweneboah, 2000). Cowpea (*Vigna unguiculata*) is a primary food legumes in West Africa, It is used as a fresh vegetable and reconstituted to dry bean.. The paste forms the basis of several popular food such as moin-moin and akara which are prepared by steaming or deep-fat frying respectively. Cowpea is a good source of protein in the tropics with the seed containing appreciable amounts of lysine and tryptophan but is deficient in methionine and cysteine when compared to animal protein. The crop is a major source of dietary protein that nutritionally complements staple cow protein cereal and tuber crops.

Akara is a deep-fat fried ball prepared from whipped cowpea paste, flavoured lwith pepper, onion and salt (Mc Watters, 2010; Olapade *et al*, 2006). Whipping of the paste is usually done prior to the addition of other ingredients to incorporate air and enhance the formation of staple foam (Ngoddy *et al*, 2000; Hung and Mc Watters, 2014). The paste obtained during milling, de-hulled and cleaned cowpea seeds can be processed into moin-moin and akara by steaming or deep-fat frying of the paste respectively (Mc Watters, 2010). The production of fresh paste from cowpea is the major constraint in the preparation of Akara (Henshaw *et al*, 2003). This involves soaking decortications and wet milling which is tedious and time consuming (Singh *et al*., 2005).

Bambara groundnut is a nutritious crop however it is underutilized in Nigeria because of lack of education on the values of the crop, scarcity or in-availability of the crop.

Akara made from cowpea flour is susceptically to various types of spoilage such as staling, rancidity and ropiness, soon after its production with the poor shelf life. Hence, fortifying bambara groundnut with a more proteinous legumes because of its low protein in order to increase the nutrient content of Akara. Objectives of the study is to produce Akara from Bambara and cowpea flour blends, To carry out microbial quality and sensory properties of akara produced from Bambara and cowpea flour blends in order to determine the shelf life and overall acceptability.

2.0 MATERIALS AND METHODS

2.1 Materials

2.1.1 Source of Samples

Bambara groundnut (*Vigna subterranean (L.)Verdc)* cowpea (*Vignaunguiculata*), vegetable oil, table salt, onions and pepper were purchased from Sayedero Market, Ilaro, Ogun State, Nigeria. All other materials were gotten from the Department of Food Technology, The Federal Polytechnic Ilaro, Ogun State.

2.2 Methods

2.2.1 Production of Bambara Flour

Bambara groundnut was sorted to remove dirts, it was soaked in water for 12 hours to soften the testa which were dehulled by rubbing with hands until the seed coat loosened. The loosed coats were floated off in water while the dehulled cotyledons were drained properly and dried in an oven at 60^{o}C for 24 hours. The dried nuts were milled in an attrition mill and then packaged in high density polyethylene bag and tightly sealed until needed.

2.2.2 Production of cowpea flour

Cowpea seeds were manually sorted to remove dirts, stones, and metals. It was soaked in water for 15 mins to soften the testa, which were dehulled by rubbing with hands until the seen coat loosened. The loosed coats were floated off in water while the dehulled cotyledons were drained properly and dried in an oven at 60^{o}c for 24 hours. The dried beans were milled in an attrition mill and then packaged in high density polyethylene bag and tightly sealed until needed.

2.2.3 Production of akara

Composite flour of Bambara and cowpea was prepared using the formulation in Table 1 below while akara was prepared using methods described by (MC Watters, 2010). The composite flour was mixed with measured volume of water. This was allowed to form batter or slurry. The batter was whipped severally to incorporate air for about 2 mins. Other ingredients like pepper, onion, salts, spices were then added. This was then scooped to make ball into already heated oil. The scooped balls (fritters) were turned frequently until deep fried (193^{o}C) and golden brown colour is obtained.

2.3 Microbial Analysis

Microbial isolation and identification was by standard microbiological method. Aliquot 0.1 ml of appropriate dilution was spread inoculated in duplicate plate of Nutrient agar, Baird parkers agar, Bismuth sulphite agar and potato dextrose agar. The inocula where spread with sterile spreader to ensure even distributions before incubating the plate at 28 ^{0}Cfor 3days. Colonies were enumerated at the end of incubation period using digital colony counter .The isolates were characterized on the bases of colonial morphology, microscopic and biochemical characteristics.

2.4 Sensory Evaluation

The sensory evaluation of akara produced from Bambara flour and cowpea blends were carried out on 100% of Bambara flour to 50% carried out by ten panelists using 9 point hedonic scale. Samples were evaluated for their characteristics i.e. colour, aroma, flavor, taste, texture and general acceptability of the product as described by (Ihekoranye and Ngoddy 1985).

3.0 RESULTS

TABLE 1 Microbial Analysis of Akara Samples Produced From Bambara and Cowpea Flour Blends.

Sample code Count (cfu/g)	Total Viable Count (cfu/g)	Staphylococcus Count (cfu/g)	Yeast & mold Count (cfu/g)	Salmonella Count (cfu/g)
A	$2.55\pm1.5\times10^{3}$	$0.95\pm0.5\times10^{1}$	$2.65\pm1.5\times10^{2}$	Nill
B	$1.75\pm2.5\times10^{3}$	$1.11\pm2.5\times10^{1}$	$2.65\pm2.5\times10^{2}$	Nill
C	$2.0\pm1.5x10^{3}$	$1.15\pm2.5\times10^{1}$	$2.15\pm1.0\times10^{2}$	Nill
D	$2.09\pm2.5\times10^{3}$	$1.87\pm1.5\times10^{1}$	$2.62\pm1.5\times10^{2}$	Nill
E	$2.03\pm1.5\times10^{3}$	$1.99\pm1.5\times10^{1}$	$2.35\pm1.5\times x10^{2}$	Nill

Keyword

A - 100% Bambara
B - 90% Bambara 10% Cowpea
C - 80% Bambara 20% Cowpea
D - 70% Bambara 30% Cowpea

E - 50% Bambara 50% Cowpea

TABLE 2. Sensory Evaluation of Akara Samples Produced From Bambara and Cowpea Flour Blends

Samples	Colour	Texture	Taste	Aroma	Overall acceptability
A	7.60^{A}	8.00^{A}	8.00^{A}	7.50^{A}	7.70^{A}
B	7.60^{A}	7.30^{A}	7.20^{A}	7.40^{A}	8.10^{ABC}
C	7.10^{AB}	6.90^{A}	7.60^{AB}	7.20^{A}	7.60^{A}
D	7.50^{A}	7.00^{A}	7.40^{AB}	6.80^{A}	6.80^{AB}
E	7.40^{A}	7.20^{AB}	7.00^{ABC}	7.40^{A}	7.60^{A}

Means in the rows are different significantly ($P \leq 0.05$)

Keywords

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4.0 DISCUSSION

The result of the microbial analysis of the akara samples produced from blends of bambara and cowpea samples presented in Table 1. The highest total count of ($2.55 \pm 1.5 \times 10^{3}$)cfu/g, was recorded for sample A (100% bambara) followed by sample D ($2.09 \pm 2.5 \times 10^{3}$) cfu/×g while C recorded least count of all the sample. Among the samples analyzed for yeast and fungi sample C had the least count $2.15 \pm 1.0 \times 10^{2}$cfu//g while sample A and B had the highest yeast and fungi count. The Staphylococcus count of Sample E has the highest Staphylococcus count with ($1.99 \pm 1.0 \times 10^{2}$cfu/g) while sample had the least count $0.95 \pm 0.5 \times 10^{1}$. In the Akara produced, there was no count recorded for salmonella.Micro-organisms isolated from the Akara samples are; *Micrococcus sp.*, *Streptococcus sp.*, *Bacillus sp.*, *Staphylococcus sp.*, *Enterobacter sp*. Though, all the count does not exceed the standard of x 10^{5} cfu/g of food, which makes the food wholesome. The result of the sensory evaluation of the akara samples produced from bambara and cowpea flour blends are presented in Table 2. The colour of the samples expressed the level of sensation the product provide on the eye by the rays of light. 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. Akara with 100%

Bambara and 10% substitution had the highest colour score while 20% substitution had the lowest score. Sample A 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 value ranging from 7.00 to 8.00 with sample A being the most accepted and sample E being the least accepted. Based on sensory evaluation, the Aroma of the akara range between 6.80 to 7.50. Sample A had the highest percentage, follow by sample B and sample E which is 7.40 while sample D had the lowest percentage of 6.80, this shows that sample A 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 $P\leq 0.05$ level. This implied that the sample were all acceptable but sample B was the Most preferred 10% cowpea composite has the highest overall acceptability.

5.0 CONCLUSION

The research work has shown that Akara can be produced from Bambara and cowpea flour blends. The results of the study shows addition of cowpea flour decrease the total viable count from sample A to E . The microbial analysis shows the values were not more than recommended standard. Sensory evaluation shows that the colour, texture and aroma were not significantly different at $P\leq 0.05$ but in terms of taste, and overall acceptability there was significantly difference in the value at $P\leq 0.05$. Akara with 10% cowpea composite flour has the highest overall acceptability 8.10 while 30% cowpea flour substitution was more shelf stable for 5 days, hence, inclusion up to 30% cowpea should be encouraged. The result has also shown the possibility of increasing the utilization of Bambara nut through traditional pre-processing methods that can be employed and adapted for use on a small scale and at household levels.

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