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Full Length Research Paper

Effect of partially defatted soybeans or groundnut cake flours on proximate and sensory characteristics of kokoro

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Kokoro a local maize snack was made from substitution of maize flour with either defatted soybean or groundnut cake flour (9:1, 7:3, 5:5, 3:7 and 1:9 substitution ratios) were evaluated for proximate and sensory qualities. Increase in substitution ratio produced kokoro with higher nutritional content (28.46 and 35.10 percent protein for those made from 1:9 substitution ratio respectively). Increase in substitution with the two substitutes progressively increased protein and fat content but reduced the ash, crude fibre and carbohydrate contents. More over the crispiness and over all acceptability of the kokoro decreased with increasing substitution. Products made from 9:1 substitution were well accepted and compared favourably with whole maize product.

Key words: Maize, soybeans, groundnuts, defatted, substitution, nutrition,

INTRODUCTION

Cereal grains are used for production of different classes of foods; these include breakfast cereals such as corn flakes, breads, and pastries brewing of both alcoholic and non-alcoholic drinks. In different cultures and societies staple foods are also produced for use as accompaniments for soups, gravies and stews and they supply the basic energy requirement of the consumers. . They are also used for the production of different snack foods which are eaten to prevent hunger before main meals or just (as relish) for the fun of eating them, but they are deficient in some essential amino acids like lysine. These amino acids can be supplied to the food by complimenting the maize with legumes such as groundnuts and soybeans which are better sources of the sulphur amino acids (Okaka, 2005). There is usually improved balance of amino acids in the products made from such combinations (Ameida-Dominguez *et al.,* 1990).

Most often snack foods do not provide nutrients in adequate quantities needed by the body (Omueti and Morton, 1996). This may be due to their composition or due to the production process they went through. What ever is responsible for their poor nutritional content, it is necessary to ensure that every food consumed by an individual contains required nutrients in adequate amounts. This is especially important due to the fact that many people now work outside their homes and are becoming more dependent on snacks for the supply of part of their daily nutritional requirements. It is therefore necessary to produce a highly acceptable snack with high nutritional quality that could be useful in nutritional programmes to combat malnutrition and nutrient deficiencies (Rosa *et al*, 2003).

Kokoro is a popular local snack made and consumed during the day, alone or with roasted groundnuts, and 'washed down' with soft drinks or just water by the people of South Western Nigeria. It is made from maize flour which contains primarily carbohydrates. As a product that is consumed on such a wide scale it would be important to enhance its nutritional value. Addition of vegetable protein such as textured vegetable protein could be one way of raising the nutritional value of the product by introducing more protein into it (Rosa et al, 2003). The possibility of producing acceptable Kokoro, with better nutritional content and sensory quality from maize flour mixed with either defatted groundnuts or soybeans flour was therefore investigated. This was hoped, will increase the nutritional content of the snack as well as increase the use to which the defatted products (soybean and groundnuts cakes) can be put to, in addition to their use as animal feed.

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Table 1. Proximate Composition of Kokoro

Treatment	Subst Ratio	Moisture Content (%)	Protein Content (%)	Fat Content (%)	Ash Content (%)	CF Content (%)	CHO Content (%)
Whole Mazie	1	7.58±0.376	7.03±0.473	1.43±0.441	1.55±0.318	1.26±0.441	76.19±0.408

Means of triplicate determinations and standard deviations
Note:
CHO, Carbohydrates
CF, Crude fibre

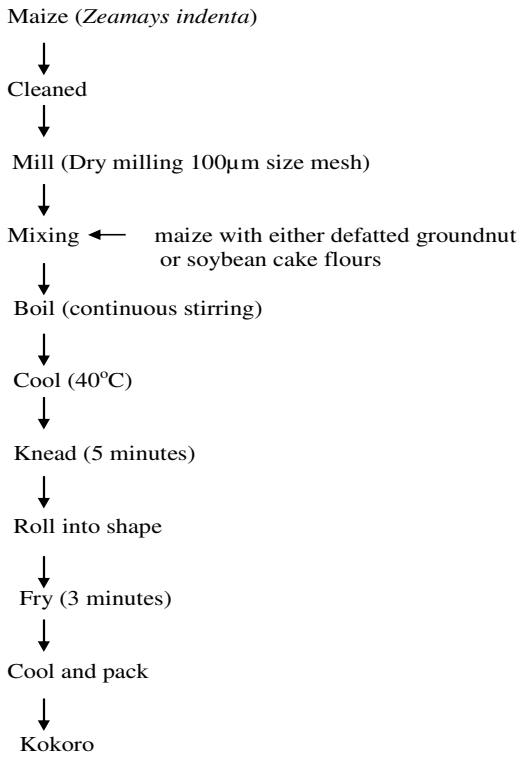


Figure 1. Flow Chart of Kokoro Production

MATERIALS AND METHODS

Maize (*Zea mays indentata*) was obtained from Bodija market Ibadan, Oyo State, Nigeria. Partially defatted soybeans and groundnut cakes were sourced from Adom Feed Mills Limited and Sudit Oil and Chemical Limited Ibadan, Nigeria, respectively. Cleaned maize was dry milled using a hammer mill and sieved with a 100µm sieve and stored for use in polyethylene bags at room temperature (28°C). The partially defatted soybeans and ground-nut cakes were separately milled with a hammer mill, and classified using a 100 µm sieve and then stored in polyethylene bags at room temperature (28°C) for 1 week within which they were used for kokoro production.

Kokoro production

Composite flours of the maize flour and legume flour (partially defatted soybean or groundnut flour) were produced using different levels of the legume flours in the following ratios: 9:1, 7:3, 5:5, 3:7 different composites flours A control kokoro sample was also and 1:9 (Figure 1). The kokoro snacks were made from the produced from 100% maize flour.

Kokoro production was as follows: The 250 g of composites flour, 30 g of sugar and 10 g of salt were gently stirred into 500 cm^3 boiling water in a stainless steel pot. The mixture was cooked with continuous stirring until stiff dough was formed. The dough was cooled to a temperature (40°C) at which it could be kneaded by hand for 5 min. The kneaded dough was cut into pieces, rolled into cylindrical shapes and fried in 1000cm^3 of hot refined vegetable oil for 3 min and then cooled and packed in sealed polyethylene bags.

Proximate analysis

Moisture and protein content analysis were determined using the procedure described by AOAC (1990). The ash content was determined using the procedure described by Pearson (1976). The sample (5g) was dried in an oven at 100°C for 2 h. The dried sample was placed in a furnace and ignited at 550°C for 2.5 h, cooled and weighed. The soxhlet extraction method was used for the fat content determination. Oil in 5 g sample was extracted using hexane in soxhlet extraction equipment for 2.5 h under reflux. The crude fibre content was determined using the procedure described by Kirk and Sawyer (1991). Carbohydrate content was determined using the method described by Pearson, (1976).

Sensory evaluation

A nine point hedonic scale and multiple comparison preference test described by Larmond (1977) was used to test the acceptability of the kokoro made from maize and defatted soybean or groundnut cake flour against a whole maize kokoro.. A panel of 10 judges who were conversant with the sensory qualities of kokoro was chosen. The panelists were each given six samples at a time to evaluate the effect the different substitution ratios will have on the appearance, aroma, taste, crispiness, and over all acceptability of the kokoro at 5% confidence level.

RESULTS AND DISCUSSIONS

The proximate composition of kokoro made with whole maize flour is shown in Table 1. The production of kokoro with 1:9 ratio flours (maize to either defatted soybean or groundnut cake flour) resulted in products with 14% or 11% (Tables 2 and 3) protein contents respectively. This showed an increase in the level of protein in the products .Percentage protein in the products increased as the level of flour substitution increased table (35.10 and 28.46% protein respectively for 90% substitution with defatted soybean and groundnut cake flours). Similar trend was shown by the fat content. Increased protein and fat con-

Table 2. Effect of Partially Defatted Groundnut Cake flours on the Proximate Composition of Kokoro

Treatment	Subst Ratio Content (%)	Moisture Content (%)	Protein Content (%)	Fat Content (%)	Ash Content (%)	CF Content (%)	CHO Content (%)
Maize /DGCF	9:1	5.79±0.334	11.82±0.425	13.00±0.163	0.98±0.358	0.90±0.358	67.51±0.425
	7:3	7.52±0.237	15.32±0.245	16.58±0.367	0.95±0.261	0.63±0.089	59.00±0.628
	1:1	9.64±0.318	15.32±0.245	18.74±0.278	0.92±0.141	0.52±0.089	49.05±0.249
	3 :7	11.24±0.327	26.71±0.412	29.97±0.278	0.94±0.384	0.22±0.171	30.92±0.396
	1 :9	8.82±0.335	28.46±0.327	34.06±0.325	0.90±0.365	0.16±0.065	27.06±0.433

Means of triplicate determinations and standard deviations
Note: DGCF, Defatted groundnut cake flour
CHO, Carbohydrates
CF, Crude fibre

Table 3. Effect of Partially Defatted Soybeans on the Proximate Composition of Kokoro

Treatment	Subst Ratio Content (%)	Moisture Content (%)	Protein Content (%)	Fat Content (%)	Ash Content (%)	CF Content (%)	CHO Content (%)
Maize /DGCF	9:1	7.80±0.335	14.00±0.140	12.70±0.466	1.80±0..310	1.12±0.279	62.68±0.335
	7:3	7.60±0.190	22,30±0.272	18.40±0.360	1.00±0.197	0.88±0.141	49.82±0.358
	1:1	5.20±0.180	26.20±0.082	21.90±0.114	0.84±0.253	0.82±0.256	45.00±0.274
	3 :7	4.90±0.220	31.07±0.348	23.20±0.237	0.84±0.253	0.54±0.171	39.50+0.204
	1 :9	3.40±0.290	35.10±0.224	26.8±0.343	0.72±0.188	0.49±0.139	33.49±0.269

Means of triplicate determinations and standard deviations
Note:
DSCF, Defatted soybean cake flour
CHO, Carbohydrates
CF, Crude fibre

contents were due to the incorporation of either the defatted soybean or groundnut cake flours in the in the formulation. Also this inclusion may have also increased the oil absorption capacity of the dough thereby resulting in the product's higher fat content of 26.80 % and 34.06 for 9:1 ratio flours (maize to either defatted soybean or groundnut cake flour) respectively. However, the higher level of substitution resulted in lower ash, crude fibre and carbohydrate contents of the resultant kokoro. The reduction in the carbohydrates was due to the increasing level of flour with higher protein and fat contents and the tendency of the dough mixture to absorb more oil than that made solely from maize flour (Table 2 and 3). The reduced crude fibre and oil content in the products may have made the products to have reduced level of crispiness.

Sensory evaluation

Increase in the level of substitution of the maize flour with either defatted soybean or groundnut cake flour resulted in decrease in the acceptability of the aroma rating of the kokoro especially for that made with defatted soybean cake flour (Table 4 and 5). There was no significant difference between the products made from 1:9, 3:7 and 5:7 ratios of maize to defatted soybean cake flour in terms of taste and aroma. The level of crispiness decreased with increase in substitution for both treatments (defatted soybean or groundnut cake flour). There was significant difference in the crispiness of products made from 1:9, 3:7 and 5:5 substitutions ratios. The taste of the products made from 1:9 ratios of maize to either defatted soybean or groundnut cake flours was preferred. In terms of overall acceptability of the products, those made from 1:9 ratios of maize to either defatted soybean or groundnut cake flours were well accepted in terms of all the sensory characteristics studied. However, products made from 3:7 ratio of maize to defatted groundnut cake flour received good aroma ratings (Table 5). The acceptability of the kokoro made from 1:9 and 3:7 substitution could have been due to the fact that at this level of substitution the taste of legumes did mask the taste of the maize but just complimented it, giving it a slightly more desirable different taste compared to kokoro made with whole maize flour this is in line with the findings of Onweluzo and Morakinyo (1997) who said that Flour prepared from seeds of *Afzelia africana* dehulled by different treatments used to replace 10, 20, 30, 40 and 50% wheat flour in biscuits and doughnuts had Sensory scores of high overall acceptability for products made from 10–30% level of substitution. In terms of the crispiness and the general appearance of the kokoro at that level (1:9 and 3:7) of substitution ratio they still resembled those of whole

Table 4. Effect of Partially Defatted Soybean Cake Flour on the Sensory Characteristics of Kokoro

Treatment	Subs.Ratio	Appearance	Aroma	Taste	Crispiness	OAA
Maize/DSCF	9:1	5.10[a]	5.10[a]	5.10[a]	4.60[a]	5.20[a]
	7:3	4.30[a]	4.30[a]	4.50[a]	3.80[b]	4.40[a]
	1:1	3.00[b]	3.70[b]	3.80[b]	3.20[b]	3.90[b]
	3 :7	2.40[c]	2.60[b]	2.40[c]	1.50[d]	2.10[c]
	1 :9	1.30[d]	1.80[c]	1.80[c]	1.26[d]	1.40[d]

Note: DSCF: Defatted soybean cake flour
Subs. Substitution
OAA, Over all acceptability

Table 5. Effect of Partially Defatted Groundnut Cake Flour on the Sensory Characteristics of Kokoro

Treatment	Subs. Ratio	Appearance	Aroma	Taste	Crispiness	OAA
Maize /DGCF	9:1	5.00[a]	4.93[a]	5.40[a]	4.80[a]	4.90[a]
	7:3	3.37[b]	4.43[a]	3.62[b]	3.10[b]	3.50[b]
	1:1	2.25[c]	3.31[b]	2.93[b]	2.00[c]	2.40[c]
	3:7	1.50[d]	2.37[b]	1.93[c]	1.40[d]	1.50[d]
	1:9	1.18[d]	2.06[b]	1.37[d]	1.10[d]	1.10[d]

DGCF: Defatted groundnut cake flour
Subs. Substitution
OAA , Over all acceptability

maize products. However as the substitution level increased the flovour, aroma, taste, crispiness and general appearance of the products became different from the standard whole maize kokoro. This difference could have been as a result of; the higher oil content which would have affected the taste, flavour, crispiness and appearance of the products, the increase would have also resulted in increased masking of the taste, aroma and flavour of the kokoro especially those made from substitution with defatted soybeans which would have become increasingly more beany in flavour, aroma and taste.

Conclusion

Kokoro with higher nutritional content can be made with composite flours from defatted soybean or groundnut cake flour, but the maximum level of substitution which is sensorially acceptable is a ratio of to 3 maize:7 either defatted soybeans or groundnut cake flours.

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