IOSR Journal of Environmental Science, Toxicology and Food Technology (IOSR-JESTFT)
e-ISSN: 2319-2402,p- ISSN: 2319-2399.Volume 10, Issue 12 Ver. II (Dec. 2016), PP 26-30
www.iosrjournals.org

Effects of Addition of Cocoyam Leaf Shoot (Colocasia Esculenta) on Some Properties of Local Maize Snack (Kokoro)

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Abstract: *'Koroko' a local maize snack was prepared from maize-cocoyam leaf shoot flour mixture in ratio of 100:0, 99:1 97:3 95:5 93:7 & 91:9. The blends were made into a thick paste, manually shaped into a ring shape and deep fried in hot vegetable oil (170^{0}C) for 5min. The products obtained were analyzed for proximate, textural and sensory qualities. Results obtained indicated substantial increase in the level of protein, fat and fibre with an increase in the level of substitution with cocoyam leaf shoot. The carbohydrate content decreases as the proportion of cocoyam leaf shoot flour increases ranging from 65.6% to 46.88%. In the texture analysis the hardness attributes of the samples 2K1 decrease in line with the level of cocoyam leaf shoot addition. In terms of sensorial attributes 2KC (100%maize) has the greatest value in terms of all attributes while samples 2k5 (91:9) had the highest value for the overall acceptability*

Keywords: *'Koroko', cocoyam leaf shoot flour, Maize Flour.*

I. Introduction

Snacks contribute an important part of many consumers` daily nutrient and calorie intake in Nigeria and it is therefore necessary to produce highly acceptable snack with high nutritional quality that are affordable by potential consumers.

'Koroko' a popular traditional snack made from maize paste is consumed by all categories of people of South- Western State of Nigeria. [1]. It is made from maize flour which contains primarily carbohydrate. The production of 'koroko' involves mixing of maize flour with water to form a paste. The paste is seasoned with or without sugar and heated with continuous stirring to form a dough, the dough is rolled with finger palms into a finger- like shape and deep fried in hot vegetable oil until it is golden brown.

According to [2], Maize is not a complete food and a diet based on white maize may be deficient in Calcium, Vitamins A, C, B12, E, and K Folate, Riboflavin, Pantothenic Acid Niacin, Potassium and Iron. Maize is also limiting in lysine and low in tryptophan amino acid. Maize had been complemented with legume such as groundnut, soya bean, cowpea and pigeon pea which are better sources of sulphur containing amino acids in order to improve balance of amino acid in the product made from such combinations, [3], [4], [5]. As 'kokoro' is widely consumed, 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.

Root and tubers crops are well known for their high nutrition contents. Quite many of them offer high nutritional benefit that can help bridge the gaps and balance certain dietary requirements, among these beneficial root and tuber crops is cocoyam. Cocoyams possess high nutritional value when compared with others like cassava and yam with substantial vitamins and proteinous content. Cocoyam corms are rich in carbohydrate while the leaves are a good source of vitamins A and C and contain more protein than the corms. [6]

The possibility of producing acceptable 'kokoro' with better nutritional content and sensory quality from maize flour fortified with cocoyam leaf shoot was investigated. The objective of this study was to increase the nutritional content of the snack (kokoro) as well as increase the use of cocoyam leaf shoot which is readily available.

II. Materials and Methods

Dry maize (white variety) grains, vegetable oil, salt, onion were purchased from a local market in Ilaro, Ogun State, Nigeria. The cocoyam leaf shoot were harvested from location around Federal Polytechnic Ilaro.

2.1 Methods – Preparation of Maize Flour

Maize flour was produced as described by [7]. Dried maize grain were cleaned and sorted to remove stones, dirt, debris and foreign matter. It was winnowed, washed with water and then decorticated in a decorcating machine. The shaft was blown away and decorticated maize milled and passes through a 100µm mesh sieve using a laboratory hammer mill and stored in an air tight plastic container prior to use.

2.2 Preparation of Cocoyam Leaf Shoot Flour

The succulent immature leaves of the cocoyam were harvested from the stalk, washed in running water to remove sand and stone, chopped into smaller piece and blanched in water. It was then sundried and milled into

fine powdered form/flour using electric blender. The sample powdered were placed in an air-tight container and stored in a dry place.

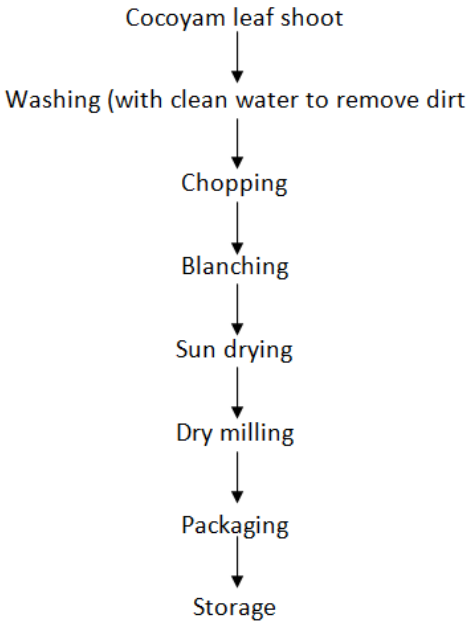

Fig1: Flow Chart for Dried Cocoyam leaf Shoot Flour

Table 1: Maize and Cocoyam Leaf Shoot Flour Blends

Samples	Maize (%)	Cocoyam leaf shoot flour %
2KC	100	0
2K1	99	1
2K2	97	3
2K3	95	5
2K4	93	7
2K5	91	9

2.3 Preparation of Kokoro

This was done essentially by a modification of the traditional method of koroko preparation. Blends of maize flour and dried cocoyam leaf shoot flour were prepared ranging from 1%, 3%, 5%, 7%, 9% cocoyam leaf shoot flour. Equal amount 5g of salt, 5g and blended onion (2.0g) were added to each of the blend as taste and flavor additives and then mixed thoroughly to a smooth texture and even distribution. The control was made from maize(100%) flour alone. 100ml of water was boiled and the mixtures were poured and mixed to form a dough in each case.

The dough was then kneaded and cut into pieces, and the pieces were rolled into a ring-like shape of 5mm diameter. The rolled out pieces were then fried in hot refined vegetable oil at 170^0C for 5min. The fried pieces were drained and left to cool and then transferred into a basket lined with paper. It was refried the next day to achieve a whitish colour. They were then packed into polyethylene bags and sealed [8].

2.4 Determination of Proximate Composition of Kokoro

The method of [9] was used to determine the moisture, protein, ash, fat and crude fiber content, while carbohydrates was obtained by difference.

2.5 Texture Profile Analysis

It was determined using a texture Analyzer (model TA – XT2i stable micro systems, Surrey England) filled with a 5kg load cell.

Test Set Up

The two adjustable support of the rig base plate are placed in a suitable distance apart so as to support the sample e.g. 40mm. For comparison purposes, this gap distance should be noted and kept constant. The base plate is then secured into the heavy duty platform. The heavy duty Platform is maneuvered and locked in a position that enables the upper blade to be equidistant from the two lower supports. The sample is removed from its place of storage and is placed centrally over the support just prior to measurement. Once the trigger force is

attained the force is seen to increase until such time as the snack fracture and falls into two pieces. This is observed as the maximum force and can be referred to as the "hardness" of the sample. The distance at the point of break is the resistance of the sample to bend and so relates to the fracturability of the sample i.e. a sample that breaks at a very short distance has a high fracturability.

2.6 Sensory Evaluation

Sensory evaluation was carried out on the freshly prepared samples using a panel of 16 members who were familiar with the sensory properties of koroko. The panelists were each given six samples at a time to evaluate the effect different substitution ratio will have on the appearance, aroma, taste, crispness and overall acceptability. Each panelist was asked to score each attribute on a 9-point hedonic scale, where 1 and 9 represent dislike extremely and like extremely respectively

The results were subjected to statistical analysis using SPSS. 15. The scores were ranked and analyses of variance. (ANOVA) were computed, where significant difference between the treatment were separated using Duncan`s multiple range: tests [10]

III. Results and Discussion

Table 2: Proximate Composition of Maize Snacks (Kokoro) Fortified With Cocoyam Leaf Shoot Flour

PARAMETERS				**SAMPLES**		
%	**2KC**	**2K1**	**2K2**	**2K3**	**2K4**	**2K5**
Moisture	5.96±0.06	6.07±0.07	5.30±0.10	4.74±0.00	4.68±0.02	4.26±0.03
Ash	2.47±0.01	2.48±0.01	2.5±0.01	2.53±0.00	2.96±0.01	3.29±0.01
Fibre	3.50±0.03	3.88±0.04	3.99±0.02	5.16±0.02	5.46±0.01	6.31±0.31
Fat	15.32±0.01	23.02±0.01	25.09±0.01	26.87±0.01	29.91±0.01	30.32±0.01
Protein	7.15±0.08	7.69±0.06	7.92±0.00	8.22±0.00	8.64±0.05	8.94±0.03
CHO	65.6±0.08	56.86±0.19	55.2±0.04	52.48±0.04	48.35±0.16	46.88±0.04

NB: Values are means ±standard deviation of triplicate determinations

NB: 2KC (100:0) =100% Maize flour + 0% cocoyam leaf shoot, 2KI (99:1) = 99% maize flour + 1% cocoyam leaf shoot, 2K2 (97:7) = 97% maize flour + 3% cocoyam leaf shoot, 2K3 (95:5) = 95% maize flour + 5% cocoyam leaf shoot, 2K4 (93:7) = 93% maize flour + 7% cocoyam leaf shoot and 2K5 (91:9%) = 91% maize flour + 9% cocoyam leaf shoot.

Table 3: Texture Analysis on Maize Snack (Kokoro) Fortified With Cocoyam Leaf Shoot Flour

SAMPLE	**Force (g) HARDNESS**	**Distance (mm) FRACTURABILITY**
2KC	5994.74±659.35	2.79±0.67
2K1	6250.17±524.37	6.11±0.71
2K2	5900.02±586.74	6.52±0.31
2K3	4665.91±330.33	6.63±0.72
2K4	4299.49±1991.06	6.88±1.61
2K5	2834.81±290.99	6.92±0.70

N.B: Values are mean ± standard deviation of triplicate determinations

NB: 2KC (100:0) = 100% maize flour + 0% cocoyam leaf shoot, 2K1 (99:1) = 99% maize flour + 1% cocoyam leaf shoot, 2K2 (97:3) = 97% maize flour + 3% cocoyam leaf shoot, 2K3 (95:5) = 95% maize flour + 5% cocoyam leaf shoot, 2K4 (93:7) = 93% maize flour + 7% cocoyam leaf shoot and 2K5 (91:9%) = 91% maize flour + 9% cocoyam leaf shoot.

Table 4: Mean*Scores of Sensory Evaluation of Maize Snack (Kokoro) Fortified With Cocoyam Leaf Shoot Flour

PARAMETERS	**SAMPLES (KOKORO CODE)**					
	2KC	**2K1**	**2K2**	**2K3**	**2K4**	**2K5**
Appearances	7.7^{a}	7.6^{a}	7.1^{a}	4.8^{b}	3.8^{bc}	3.5^{bc}
Taste	7.7^{a}	7.1^{a}	6.7^{a}	6.8^{a}	4.8^{b}	7.0^{a}
Aroma	7.7^{a}	6.4^{b}	7.1^{ab}	6.6^{b}	5.3^{c}	6.4^{b}
Texture	6.9^{a}	7.1^{a}	6.6^{a}	5.8^{ab}	4.9^{b}	5.7^{b}
Overall Acceptability	7.0^{a}	6.8^{a}	6.6^{a}	6.5^{a}	5.9^{a}	7.1^{a}

*Means within the same column not followed by the same superscripts are significantly ($p<0.05$) different.

NB: 2KC (100:0) = 100% Maize flour + 0% cocoyam leaf shoot, 2Kl (99:1) =99% maize flour =1% cocoyam leaf shoot, 2K2 (97:3) = 97% maize + 3% cocoyam leaf shoot, 2K3 (95:5) =95% maize flour + 5% cocoyam leaf shoot, 2K4 (93:7) = 93% maize flour + 7% cocoyam leaf shoot and 2K5 (91:9%) = 91% maize flour + 90% cocoyam leaf shoot.

3.1 Discussion

The results of the proximate composition are as shown in Table .2. The moisture content of the snack samples ranged from 4.26% to 6.07% and samples 2k1 having the highest 6.07%. The low moisture content (4.26 - 6.07 %) was indicative of its high dry matter content which confers that it would have a good keeping quality. According to [11] low moisture foods have less tendency of spoilage. Sample 2k5 (91:9) had the highest protein content of 8.94% while sample 2KC (100% maize) had the least crude protein of 7.15%. This is however obviously due to increase in the proportion of cocoyam leaf shoot added. The value obtained for the ash content also indicated that 2k5 (91:9) had the highest value of 3.29% while 2kC (100%) had the least 2.47%. The percentage ash content falls within the range reported in the literature of chemical and nutritional value of maize and maize products obtained from selected market [12]. The result also indicates that incorporation of cocoyam leaf shoot flour may enhance the mineral intake of the amount of minerals in food products [13]. The crude fiber is known to aid the digestive system of human. The crude fiber content of the sample increases as the proportion of the cocoyam shoot flour increases. Sample 2kC (100% maize) had the least value of crude fiber of 3.50% and sample 2k5 (91:9) had the highest crude fiber content of 6.31%. This agrees with the literature review that cocoyam leaf shoot include great quality of fiber which contains 15% dietary fiber of 4g [14]. The fat content of the sample ranged from 15.32% to 30.32%. The values of fat contents were similar to the fat content obtained by [7] and[5] in whole maize 'kokoro'.

The carbohydrate content decreases from 65.69% to 46.88% as the percentage of the cocoyam shoot flour is increased from 0 to 9%. This was due to relatively low carbohydrate content of cocoyam shoot flour. Similar findings have been reported with the inclusion of pigeon pea flour soybeans, defatted groundnut paste or beniseed flour. [7]; [15], and [16].

3.1.1 Textural properties of 'kokoro' produced from Maize-Cocoyam leaf shoot flour mixture

The texture analysis of maize snack (kokoro) made from maize and cocoyam leaf shoot flour blends was determined by measuring the force required to break the 'kokoro' samples. Breaking strength measure the maximum force applied by the instrument to snap the snack into two pieces, thereby indicating the hardness of the snack. Hence, higher value indicates that the snack is harder. Meanwhile fracturability is the measurement of snack resistance to bending. Distance at which the snack breaks was noted as fracturability. Snack that breaks at shorter distance has higher fracturability.

The hardness of the samples ranged from 2834.81g to 6250.17g. Samples 2k1 (99.1), had the highest value of 6250.17g, while sample 2K5 (93.7) had the least value of 2834.81g. The fracturability of the samples increases with variations as the proportion of cocoyam shoot flour increases. The fracturability ranged from 2.79mm to 6.92mm. Sample 2kC (100% maize), had the least value of 2.794mm and sample 2k4 had the highest value of 6.92mm.

Increase in fat content may possibly cause the decrease in hardness [17].

Table 4 shows the results of sensory evaluation of all the Kokoro

3.3 Sensory Evaluation

Differences in the appearance and texture may be due to the proportion of cocoyam leaf shoot added to the product. Samples 2KC (100:0), 2K1 (99:1) and 2K2 (97:3) were the most preferred and significantly different from samples 2K3 (95:5), 2K4 (93:7), 2K5 (97:3).

The results for taste showed that samples 2kc, 2k1, 2k2 and 2k5 were not significantly different from each other while sample 2k4 was least preferred. With respect to Aroma sample 2K4 (93:7) was least preferred while sample 2KC (100:0) is most preferred.

In terms of overall acceptability all the samples were not significantly different from each other. However, samples 2K4 (93.7) was the least acceptable, while samples 2K5 (91.9) was the most acceptable. The results indicated that increase in cocoyam leaf shoot flour cause decreased appearance, taste aroma and texture.

IV. Conclusion

This study has revealed that 'kokoro' with a higher nutritional value can be produced from the addition of cocoyam leaf shoot flour. The proximate analysis conducted on the blends revealed an increase in the quality of nutrient such as protein fat and fibre compared to whole maize flour 'Kokoro'. However, the study showed that maize-cocoyam leaf shoot flour 'kokoro' may have a short shelf life due to its high fat content.

Sensory evaluation showed that in terms of overall acceptability all the samples were not significantly different from each other but sample 2kC (100%) has the highest value in terms of all sensory attributes, this is attributed to the fact that people that consume 'kokoro' are not used to the flavored taste of the blend.

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