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CHEMICAL AND ORGANOLEPTIC EVALUATION OF SNACKS DEVELOPED FROM COCOYAM *(COLOCASIS ESCULENTA. XANTHOSOMA MAFAFA)* AND WHEAT *(TRITICUM SPP.)* COMPOSITE FLOURS.

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ABSTRACT

Snacks (cakes and cookies) were developed from cocoyam and wheat composite flours. The products were evaluated by panelists for acceptability based variously on crust/crumb colour, texture and flavour. The developed products were evaluated for their proximate composition. The cakes produced from wheat flour alone XCA2 were better in terms of colour but not in terms of texture and flavour. There was a significant difference ($p \leq 0.05$) in the ratings for general acceptability of the cakes developed. There was also a significant difference among the cookies in terms of texture. The cookie made from wheat flour alone was most acceptable followed by that from 50% xanthosoma flour and 50% wheat flour. The protein content of the cake sample CCA3 was the highest (11.90%) followed by that of XCA2 (9. 45%). While for the cookies, the protein content of XCO3 (12.25%) used as control was the highest. Generally, the snacks were not disliked. These range of snacks could add variety to that available to the consumers and also increase the demand for cocoyam flour.

INTRODUCTION

Cocoyam is one of the major root crops that played an important role in Sociological and nutritional development of the country (Fetuga and Oluyemi, 1976; Steink and Capenter, 1981; Griffin, 1981; Coursey et al, 1984). Cocoyam is called "Ede" in Igbo, "Ikpong" in Efik "Okpon" in Ibibio, "Isukoko" in Yoruba, "Gwasa" and "Makan" in Hausa and "Odika" in Ijaw.s Two varieties, Colocasia (Taro) and xanthosoma (Tannia) are important and mostly cultivated.

The varieties that are widely grown in Nigeria are Colocasia esculenta and xanthosoma mafafa (Ibe and Iwueke, 1984). There has been a declining trend in the production as well as shortage of these crops in our domestic markets. This is attributed to its declining yields, low storability and bulkiness (Coursey et al. 1984). Therefore, the need to process cocoyam into storable, transportable and easily marketable forms become glaringly obvious.

Basically, the corms of cocoyam contains digestible starch as well as substantial amount of protein, vitamin C, thiamin, riboflavin and niacin (Cobley and Steole, 1976). However, the problem of inadequate supply of the type of cocoyam needed by consumers and its associated problem of storage is posing a serious obstacle to the development of improved methods of processing. The forms in which cocoyam are consumed are fairly limited. While xanthosoma mimics yam in its various forms of usage (Onwueme, 1978), Colocasia is manily used as a soup thickener and only occasionally eaten directly after boiling as a main dish with red oil or pounded into "fufu". In all cases, thorough cooking is essential in order to remove the irritants present in the corms and cormels (Tang and Sakai, 1983).

Processing is a useful means of preserving perishable agricultural produce such as cocoyam, and thus obtaining a wider market for commodities which may only be available for a certain season of the year and which may have limited storage properties (Nwana and Onochie, 1979; King, 1980; Coursey et al, 1984).

Storage losses of cocoyam due to physiological and pathological rot which reduces harvest yields could be eliminated if the cormels are converted into more stable processed forms. This work, was therefore aimed at evaluating the acceptability of two snacks (cakes and cookies) produced from cocoyam composite flours.

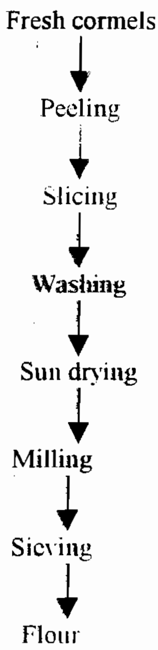
METHODOLOGY

Two white varieties of cocoyam (Colocasia esculenta and xanthosoma mafafa) were purchases from local retailers and the processing method as described by (Akomas et al, 1987) was adopted in producing cocoyam flours used for the study.

Processing of cocoyam into flour:

The fresh cormels were selected, cleaned, peeled, cut into thin slices, washed and sundried outside (30+3°C) for 72 hours. The slices were then milled and sieved for flour. The flour produced had an 11.2% moisture content and was stored in cellophane bags for later use.

Fig 1. Flow diagram of Cocoyam flour Production



Production of Composite Flour:

Cocoyam/wheat composite flours were formulated using various substitution rates. During the pilot study, numerous substitution rates were tried, and finally the study was conducted using these rations (50: 50:, 70: 70). The control flours were 100% wheat flour and 100% cocoyam flour.

Preparation of the Cake and Cookies

The recipes for the cake and cookies are shown in Tables 1 and 2. the control cup cakes and cookies were prepared with standard recipes and procedures.

Table 1: Recipe for Cake

Cocoyam / Wheat flour cake		Wheat flour cake	
Ingredients (Xanthosoma mafafa)	Amount	Ingredients	Amount
cocoyam Flour or "Ede Ocha"	70g	Wheat flour	100g
Wheat flour	30g	Margarine	125g
Margarine	125g	Sugar	125g
Sugar	125g	Eggs	2
Eggs	2	Baking power	1 ½ teaspoon
Baking power	1 ½ teaspoon	Lemon rind	¼ "
Lemon rind	¼ "	Nutmeg	¼ "
Nutmeg	¼ "		

Fig. 2 Flow diagram for preparation of cake.

Weigh out all ingredients

↓

Sift together cocoyam flour, wheat flour and baking powder

↓

Cream sugar and margarine until light and fluffy

↓

Beat eggs and gradually add the beaten eggs

↓

Fold in the dry ingredients alternately with the liquid, ending with dry ingredient

↓

Mix to a soft dropping consistency

↓

Put into well greased muffin tins

↓

Bake for 25 to 30 mins at gas mark 4

↓

Remove from oven and cool on racks

↓

Remove portions for organoleptic and chemical evaluation.

Table 2. Recipe for Cookies

Cocoyam / Wheat flour Cookies		Wheat flour Cookies	
Ingredients (Colocasia esculenta)	Amount	Ingredients	Amount
cocoyam Flour or "coco India"	70g	Wheat flour	100g
Wheat flour	30g	Margarine	125g
Margarine	125g	Sugar	125g
Sugar	125g	Eggs	1
Eggs	1	Baking power	¼ teaspoon
Lemon rind	¼ "	Nutmeg	¼ "
Nutmeg	¼ "		

Fig. 3 Flow diagram for the preparation of cookies

Weigh out all ingredients

↓

Sift together the cocoyam flour and wheat flour with salt into a bowl

↓

Rub in the fat with the fingertips until the mixture resembles breadcrumbs

↓

Stir in the sugar, add the beaten egg to bind the ingredients

↓

Blend the mixture together and knead gently to give a firm smooth dough

↓

Roll out thinly to about 3mm thickness (1/8m) on a floured surface

↓

Cut out into rounds with cookies cutter and place on well greased baking trays, prick with a fork

↓

Bake in moderate hot oven at gas mark 4 for 15 mins until they are pale in colour

↓

Remove from oven and cool on racks

↓

Remove portions for organoleptic and chemical

Sensory Evaluation

Sensory evaluation was done using a 20 –man panel made up of both students and staff in the College of Food Processing and storage Technology, Michael Okpara University of Agriculture, Umudike.

The cakes and cookies were produced by substituting cocoyam flour for wheat flour at different ratios. Products were evaluated by panelists for crust/crumb colour, texture, flavour, taste and overall acceptability.

A nine -point scale (Peryam, 1958) was used for the evaluation and where 1 means "extremely disliked", 9 means "extremely like".

Statistical Analysis

Sensory evaluation data was subjected to analysis of variance (ANOVA). Duncans New multiple Range Test (Steele and Torrie, 1960) was used to identify means with significant differences. Proximate Composition*

The processed cocoyam samples were analysed for crude protein, crude fat, fibre, moisture and ash according to AOAC (1990) methods. Carbohydrate was calculated by difference. All analysis were done in triplicates.

The crude protein content was determined by the Kjedahl method. One half gramme of sample was digested with 50ml of concentrated H2So2. digestion was continuous for two hours until a clear solution was obtained. The digest was diluted to a volume of 40% NaOH solution. The, mixture was distilled by steam. The distillate was collected into 10ml of 10% boric acid solution containing 3 drops of mixed indicator. 50mls of the distillate was collected and titrated against dilute acid (0.02N H2S04). The Nitrogen content was calculated and total protein calculated by amplifying result with a factor of 6.25.

To determine crude fat content, 2g of sample or Whatman No 1 filter paper in a funnel was first extracted with five 20-ml portions of water prior to drying; and ether –extracted and analysed for fat.

Moisture content was determined by drying 2g of each sample contained in a weighed moisture can in a hot air oven at $105^{O}C$ until a constant weight was obtained.

Ash was determined as follows; approximately 4.0g of sample in a weighed shallow wide ashing dish was put in a muffle furnace at $550^{O}C$ until light grey ash resulted. The dish and contents were re-weighed soon after cooling to room temperature in a dessicator containing re-ignited CaO as drying agent.

Carbohydrate content was calculated as the difference in weight between dry sample (after all moisture has been evaporated to constant weight) and the ash. Crude fibre was determined after extracting 2g of sample with petroleum ether, in the presence of asbestos. Crude fibre was taken as the loss in weight on ignition expressed as a percentage of the weight of the initial sample.

RESULTS AND DISCUSSION

The result of the sensory evaluation showed that there was a significant difference ($p \leq 0.05$) in the crumb colour of the cake made from wheat flour alone XCA2 (Table 3).

Table 3: Sensory Characteristics of Cakes Prepared from Different Ratios Cocoyam/Wheat Flours and control Wheat flours.

Products : Cakes	Colour	Texture	Flavour	Taste	Overall Acceptability
XCA1	$5.5^{d} \pm 1.82$	7.05ab ± 1.76	$5.35^{d} \pm 2.18$	5.35c ± 1.46	5.25c ± 1.58
XCA2	$7.8^{a} \pm 0.76$	$7.85^{a} \pm 1.63$	$7.7^{a} \pm 2.15$	7.80a ± 1.67	7.3a ± 1.75
XCA3	$4.25^{e} \pm 1.55$	$6.75^{b} \pm 2.14$	$6.6^{b} \pm 1.93$	6.25b ± 1.91	6.3b ± 1.65
XCA4	$4.15^{e} \pm 1.53$	$7.0^{b} \pm 2.22$	$6.2^{b} \pm 1.98$	6.70b ± 2.13	6.75ab ± 1.51
CCA1	$6.25^{bc} \pm 1.16$	$7.05^{ab} \pm 1.63$	$6.8^{b} \pm 1.98$	6.85b ± 1.63	6.35b ± 1.63
CCA2	$6.35^{b} \pm 1.38$	$5.90^{c} \pm 1.77$	$7.65^{a} \pm 1.98$	7.0ab ± 1.58	6.85ab ± 1.81
CCA3	$5.60^{cd} \pm 1.81$	$6.40^{bc} \pm 2.16$	$4.35^{e} \pm 0.98$	4.7c ± 1.94	4.4d ± 1.27

* Any two means in the same row not followed by the same letters are significantly different at 5% level.

Foot Notes

XCA1 - 50% Xanthosoma flour + 50 wheat flour
XCA2 - 100% Wheat flour +
XCA3 - 70% Xanthosoma flour + 30% wheat flour
XCA4 - 100% Xanthosoma flour +
CCA1 - 50% Colcocasia flour + 50% wheat flour
CCA2 - 70% Colocasia flour + 30% wheat flour
CCA3 - 100% Colocasia flour

Thus, the crumb colour of XCA2 was most accepted. This could be due to the original colour of the flour that was white than the others. Wheat produces a white flour, in addition the unique properties of wheat protein alone can produce flour products of desirable texture and flavour (Ihekoronye and Ngoddy, 1985).

The cakes produced from the flour of the two varieties of cocoyam alone (XCA4 and CCA3) did not rise as much as that produced from wheat flour alon (XCA2). Ideally, the cake feels light, because it has risen will during baking. In terms of the overall acceptability, the cake produced from the flour of (Colocasia) alone CCA3 was rated very low by the panelists. There was no significant difference ($p > 0.05$) in the texture of cakes prepared in the ratios of 50:50xanthosoma and wheat flour, XCAI, 50:50 Colocasia and wheat flour, CCAI and that from wheat flour alone XCA2. this shows that acceptable cakes can be prepared by using cocoyam flour as replacement for part of the wheat flour normally used for preparing cake.

Table 4 shows that the cookies (XCO3 and CCO1) had the highest score for colour, while for texture, XCO3 was most accepted.

Table 4: Sensory Characteristics of Cookles Prepared from Different Ratios Cocoyam/Wheat Flours and control Wheat flours.*

Products: Cookies	Colour	Texture	Flavour	Taste	Overall Acceptability
XCO1	$6.30^{c} \pm 1.80$	$7.30b \pm 1.21$	$6.25a \pm 1.68$	$5.95b \pm 2.13$	$6.45ab \pm 2.37$
XCO2	$5.75^{c} \pm 1.55$	$4.55^{e} \pm 2.39$	$6.85a \pm 1.53$	$6.70ab \pm 1.83$	$5.00c \pm 1.33$
XCO3	$9.00^{a} \pm 1.45$	$8.05^{a} \pm 0.99$	$6.95a \pm 2.18$	$6.95a \pm 1.87$	$7.50a \pm 2.23$
XCO4	$4.65^{d} \pm 1.63$	$7.65a^{b} \pm 1.38$	$5.10b \pm 1.71$	$6.80ab \pm 2.52$	$6.70a \pm 2.29$
CCO1	$8.80^{a} \pm 1.66$	$5.35^{d} \pm 1.98$	6.[illegible]0a ± 1.63	$6.20ab \pm 1.76$	$5.70c \pm 2.00$
CCO2	$7.40^{b} \pm 1.66$	$5.15^{d} \pm 2.10$	$6.95a \pm 2.18$	$6.10ab \pm 1.88$	$6.40ab \pm 1.72$
CCO3	$7.20^{c} \pm 1.82$	$6.50^{c} \pm 0.88$	$6.90a \pm 1.33$	$4.55c \pm 1.31$	$4.55ab \pm 1.93$

* Any two means in the same row not followed by the same letters are significantly different at 5% level.

Foot Notes

XCO1 - 50% Xanthosoma flour + 50 wheat flour
XCO2 - 70% Xanthosoma flour + 30% wheat flour
XCO3 - 100% Wheat +
XCO4 - 100% Xanthosoma flour +
CCO1 - 50% Colcocasia flour + 50% wheat flour
CCO2 - 70% Colocasia flour + 30% wheat flour
CCO3 - 100% Colocasia flour

Xanthosoma flour gave very good baked products especially in the production of cookies. The products were acceptable to the panelists for all the quality attributes evaluated. The colour of the cocoyam flours were not as attractive as that of wheat flour due to its natural brownish colour developed after drying of the chips. According to panel members, this brownish colour did not affect the overall acceptability of the cookies but that of crumb colour of the cake.

The protein content of the cake from "Colocasia" flour (CCA3, 11.90%) table 5, was the highest followed by that in 100% of wheat flour (XCA2, 9.45%). Irvine, (1969) reported that nutritionally, Colocasia is high in protein, minerals and vitamins the calcium content in XCA1, XCA2 and XCA3 were the highest (0.05%) respectively while CCA1 had the lowest (0.03%). Sample XCA1 had the highest magnesium content (0.35%) while XCA4 had the highest (1.8%) while XCA1 had the lowest. In terms of the phosphorus XCA2 and CCA2 had the highest content (0.50%) respectively while XCA4 had the lowest (0.6%). Sample

CCA3 had the highest iron content (0.01%) while XCA1 had the lowest (0.002%).

The nutritional quality of cocoyam compares favourably with other root crops.

Table 5: Proximate Composition of the prepared Cake Samples (g/100)

Products: Cakes	Protein	Fat	Fibre	Ash	Carbohy-drate	Moisture	Energy (Kcals)	Ca (mg)	Mg (mg)	P (mg)	Fe (mg)
XCA1	8.4	2.4	3.6	3.4	82.2	20.2	328.8	0.05	0.35	0.40	0.02
XCA2	9.45	1.8	3.2	5.2	80.35	20.0	321.4	0.05	0.20	0.50	0.03
XCA3	7.35	0.8	5.4	6.2	80.35	23.3	321.0	0.05	0.10	0.40	0.03
XCA4	6.65	0.6	3.6	6.8	82.35	20.3	329.4	0.04	0.06	0.06	0.04
CCA1	8.05	2.0	3.4	3.4	83.15	20.3	332.6	0.03	0.17	0.32	0.04
CCA2	7.00	1.2	5.4	6.0	80.40	20.0	321.6	0.04	0.15	0.50	0.04
CCA3	11.90	1.2	3.8	3.2	79.90	18.3	319.6	0.04	0.08	0.08	0.01

Foot Notes

XCA1 - 50% Xanthosoma flour + 50 wheat flour
XCA2 - 100% Wheat flour +
XCA3 - 70% Xanthosoma flour + 30% wheat flour
XCA4 - 100% Xanthosoma flour +
CCA1 - 50% Colcocasia flour + 50% wheat flour
CCA2 - 70% Colocasia flour + 30% wheat flour
CCA3 - 100% Colocasia flour

Table 6: proximate Composition of the prepared Cookies (g/100)

Products: Cakes	Protein	Fat	Fibre	Ash	Carbohy - drate	Moisture	Energy (Kcals)	Ca (mg)	Mg (mg)	P (mg)	Fe (mg)
XCO1	6.30	2.2	4.2	3.6	83.70	24.6	334.8	0.03	0.15	0.40	0.10
XCO2	5.95	2.0	6.2	5.4	80.45	26.0	321.8	0.03	0.14	0.40	0.04
XCO3	12.25	0.8	4.0	3.6	79.35	20.6	317.4	0.04	0.18	0.40	0.04
XCO4	5.95	1.2	3.0	7.2	82.65	22.3	330.6	0.03	0.08	0.08	0.02
CCO1	6.65	1.8	3.2	4.4	83.95	24.6	335.8	0.03	0.16	0.32	0.03
CCO2	6.65	1.8	6.0	6.2	82.15	26.0	328.6	0.04	0.15	0.40	0.03
CCO3	5.95	0.8	4.0	6.4	8285	328.6	331.4	0.05	0.06	0.10	0.04

Foot Notes

XCO1 - 50% Xanthosoma flour + 50 wheat flour
XCO2 - 70% Xanthosoma flour + 30% wheat flour
XCO3 - 100% Wheat flour +
XCO4 - 100% Xanthosoma flour +
CCO1 - 50% Colcocasia flour + 50% wheat flour
CCO2 - 70% Colocasia flour + 30% wheat flour
CCO3 - 100% Colocasia flour

SUMMARY AND CONCLUSION

Flours of (Colocasia esculenta) and Xanthosoma mafafa) can be utilized as major raw materials for preparing cakes and cookies. Effective processing of cocoyam flour may increase the demand pressure and thereby stimulate production of cocoyam. These developed snacks could add variety to that available to the consumers.

Since a good number of people consume cocoyam by limited methods such as boiling and eating alone coupled with its market value which is too poor, more research should be geared towards the development of more flour products from cocoyam in order to increase its consumption.

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