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Chemical nutrient some essential minerals and sensory evaluation of chin-chi produced from wheat-fluted pumpkin flour blends

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Abstract
Chi-chi was made from wheat and fluted pumpkin (*Telfairia Occidentalis*) seed flour blends at different level of substitution and analyzed for proximate composition mineral composition and sensory properties. The most acceptable sample (15%) was used to determine, mineral and antinutrient levels. The protein levels (0%-20%) in the chin-chin made from composite flour showed considerable increase (6.13% -11.38%) blends with fluted pumpkin flour; whereas carbohydrate contents reduced chin-chin (8.56-4.72%) with increase in supplementation from 0% - 20%, The chin-chin was also acceptable up to 15% level of substitution with fluted pumpkin flour. All the minerals showed increase, (0.28-4.50mg), Ca (0.10-74.9mg) and P(1.25-1.27mg). There was a significant reduction in phytate content (4.40 – 2.64%). Tannic acid did not show any significant increase. In conclusion, addition of fluted pumpkin to wheat flour improved the nutrient content of chin-chin, protein, and mineral content increased while carbohydrate content decreased in the composite.

Keywords: pumpkin proximate composite, phytate, protein

Introduction
Childhood and adolescence are important periods in human life span with varied nutritional challenges. Adequate nutrients intake during these period is an important long-term strategy for good nutritional status and prevention of non-communicably chromic disease in later life. School children spend 6-8 hours in school and some skipping of breakfast is common among them (Geoge, 2011). The need to eat in other to fight hunger and remain focused during this period is important. Foods most often consumed during this period are snacks whose choice is based on taste rather than nutritional value. An increasing proportion of the house hold food budget in Nigeria is spent on snack food items (Laseken and Akintola, 2002) [12]. Snacks play a major and growing roles in the diets of children and adolescents. The most popular snacks among this group are kin-kin (biscuits) because they are handy and have longer shelf life.

The problem of protein malnutrition among children and adolescents can be controlled if foods that are high in protein are incorporated into chin-chin. Plant protein have limiting amino acids and the need to combine plant proteins in proportions that will improve the protein profile of foods is emphasized. To ensure adequate of nutrient intake among the snacks consuming population (children and adolescents), who are the most vulnerable to nutritional inadequacies, use of blends of cereals and pulses is appropriate in the production of many baked snack foods because of their low cost and keeping qualities. The use of composite flours from cereals and fluid pumpkin for the production of kin-kin is therefore expected to enhance the utilization of local crops as raw materially, improve the nutritive quality of kin-kin while increase the general food and nutrient intake of consumers.

Fluted pumpkin is one of the locally available under exploited but a potential high protein and mineral food source in Nigeria. In addition to its importance as an oilseed, it is a valuable source of protein (27%) with a high content of micronutrient (Long *et al*, 1983) [13]. However, the usefulness of fluted pumpkin (*Telfairia Occidentalis* Hook) seed as a protein source for human food is limited by the presence of anti-nutrients, particularly phytic (Akwaowo, *et al*, 2000) [3], which has been shown to lower the bioavailability of minerals in human.

Confectionary product such as chin-chin are usually patronized by children and adolescents, therefore are important local snacks which would need to be supplemented with high protein oil seeds, such as the fluted pumpkin seed.

These study therefore, was to blend wheat with fluted pumpkin and determine the proximate, minerals and antinutrient compositions of chin-chin made from them. The data would generate production of nutrient dense chin-chin at household and commercial levels.

Materials and Methods
The fluted pumpkins (*Telfairia occidentalis*) seed was obtained form the mile 3 market in Port Harcourt, Rivers State, for the study. The wheat flour was got from the Port Harcourt flour mills, shorting (margarine), eggs, salt and baking power were also purchased from the mile 3 market.

The fluted pumpkin seed were processed into flour as shown in figure 1. The seeds were washed and boiled in water in a stainless steel kettle for 2 hours. The seeds were allowed to cool at room temperature and seed coats removed manually, and dried in oven for 48 hours in 60^0C in a domestic gas oven. Dried, dehulled seeds were grounded using a commercial mill and sieved through a 425µm mesh size. The flour obtained was partially defatted by solvent extraction for 2 hours using

petroleum ether (40-60^0) and dried in the oven for 24 hours. The flour was then stored in polythene bags at room temperature until used.

Preparation of Fluted Pumpkin seed flour.

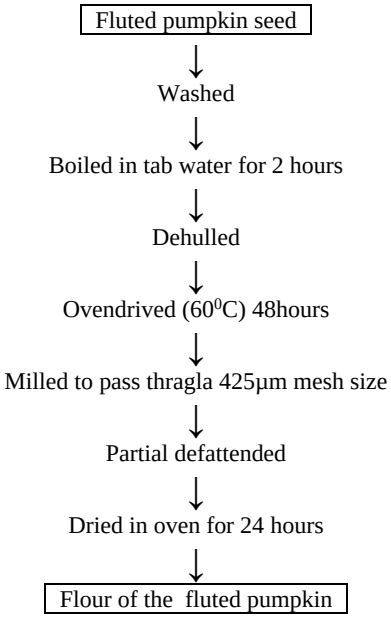

Fig 1: Flow Charts of Flutted pumpkin production

Preparation of chin-chin Formulation

The formulation of chin-chin containing, 0,5,10,15 and 20% fluted pumpkin flour replacing what flour were used as shown in table 1. other ingredients included in the formulation were egg and sugar, which were mixed beaten manually for 2 minutes and mixed by hand milk was then added and the dough thoroughly kneaded by hand on a flat chain stainless metal table. The dough was thinly rolled on a sheeting board to a uniform thickness and cut into cubes of various size and shapes. The dough cubes were deep fried in groundnut oil for 3 minutes at 190^{0}C in an aluminum utensil until brown, drained within 5 minutes, cooled and packed in high density polythene bags.

Table 1: Formulation of chin-chin production

Ingredient	Chin-chin (g)				
	A	B	C	D	E
Wheat flour (%)	100	95	90	85	80
Pumpkin Flour (%)	0	5	10	15	20
Sugar (g)	25	25	25	25	25
Shortening (g)	50	50	50	50	50
Egg (g)	24	24	24	24	24
Salt (g)	-	-	-	-	-
Baking powder	5.6	5.6	5.6	5.6	5.6
Milk	10	10	10	10	10

A = 100% what flour; B = 5% pumpkin added; C= 10% pumpkin added; d = 15% pumpkin added; e = 70% pumpkin added

Analysis of the Samples

The proximate analysis was done to obtained values for the moisture content, dry matter, crude protein, crude fiber, crude fat and ash following the procedures described by AOAC (2005) [5]. The moisture content was determined by air-oven drying as weight difference at 130^{0}C for 1hr, and the crude protein contents by micro Kjeldahl method (% total nitrogen x 6.25) (AOAC, 2005) [5]. The crude fiber content was determined using dilute acid and alkali hydrolysis. Crude fat was extracted by exhaustively extracting 10g of each sample in a soxhlet apparatus using dimethyl either (boiling range, 30-60^{0}C) as the solvent. Ash was also determined by the incineration of 10g of each sample placed in a muffle furnace maintained at 550^{0}C for 4 hrs. The total carbohydrate content (on dry weight basis) was calculated by the difference: 100 – (crude protein crude fats + ash + crude fiber).

Mineral Composition

The content of Fe, Ca and P were determined by the procedure and outlined by Bochringer (1979) [8] and AOAC (2005) [5]. Two grains of each of the dried samples in a crucible were ashed 550^{0}C in a Gallenkamp muffle furnace. The ash was later dissolved in 100ml volumetric flask with de-ionized water. Ten ml of concentrated hydrochloric acid was added and filtered. The filtreate was made up to 50ml with 0.1m HCL. Iron (fe) and calcium (Ca) values were determined using Atomic absorption spectrophotometer. Phosphorus was determined using ammonium vanadate and ammonium molybdate according to Chapman and Praff (1961) [9].

Phytate and tannin Determination

The procedure of Young and graves (1940) [17] as modified by Igbedion, *et al* (1994) [11] and Abunlude (2001) [1] was used for extraction, precipitation and determination of phytate. Quantitative estimate of tannin was carried out using the method described by Makkar and Goodchild (1996) [14] and Hagerman and Lev (1983) [10].

Sensory Evaluation

The sensory evaluation of the chin-chin were carried out using eighteen consumers comprising staff of the Rivers state University, Port Harcourt. Members were trained in the use of sensory evaluation procedures and the meaning of the terms used.

During each assessment, the panelist were several chin-chin in saucers and water was given to them for proper rinsing of their mouth before the next criteria was assessed. Panelists were asked to evaluate colour first and then texture flavour, taste and overall acceptability. A five point hedonic scale with 1 = dislike very much, 2 = dislike slightly, 3 = indifferent, 4 – good and 5 = excellent. This evaluation was done immediately after the production of the chin-chin.

Data Analyses

Data for all determinations were subjected to analysis of variance (ANOVA) using the Genstat Discovery Edition 3 software. Fisher's least significant difference (F-LSD) test was used to identify significant differences among treatment means ($P < 0.05$) as outlined by Obi (2002) [15]. Prior to analysis all percentage data were angular transformed (Steel and Torrie, 1980) [16]. Factor analysis based on principal component analysis and cluster analysis were performed to characterized the accessions in relations to the most discriminating nutrient traits.

Results

The proximate composition (% dry matter) of chin-chin made from wheat and fluted pumpkin flour blend is presented in Table 2. The protein levels (0%, 5%, 10%, 15% and 20% fluted pumpkin flour) of the chin-chin ranged from 6.13% in wheat flour product to 11.38% in the products made from the composite flour. The chin-chin made from wheat flour had higher carbohydrate (8.56%) then the products from the composite flours (7.10%, 6.50%, 5.26% and 4.72%) respectively in reduction of wheat flour in the blends. The chin-chin contain significant quantities of fat (20 -40%).

The ash levels of the chin-chin were of various range as shown on the table 2. The protein, fat and moisture levels of the various blend is shown in table 2.

Table 2: Proximate Composition of Chin-chin made from wheat /fluted pumpkin flour blends (%)

Levels of fluted pumpkin in samples	Carbohydrate	Protein	Fat	Moisture	Ash	Feber
0	8.56	6.13	20	6.0	1.4	1.85
5	7.10	7.88	30	4.0	1.0	1.80
10	6.50	10.33	20	6.0	0.5	1.80
15	5.26	1.94	2.9	8.0	0.2	1.63
20	4.72	11.38	40	8.0	1.0	1.60

Mean of triplicate determination mean values with the same superscript within the some row do not differ significantly (P<0.05).

Mineral and antinutrient content

The levels of P, Fe and Ca, including the antinutrients - phytate and tannic acid are shown on Table 3. The levels of minerals in the chin-chin increased with added fluted pumpkin. The range of wheat to composite were, Fe(0.28-4.50mg), Ca(0.10-74.9mg) and P(1.16-1.27mg). The antinutrients content of the wheat was higher than that of the compositions as shown on the table 3.

Table 3: Mineral and antinutrient content of the chin-chin

Levels of fluted pumpkin in samples	Fe(µg/kg)	Ca(mg/100)	P(µg/kg)	Tannic acid %	Phytic Acid %
0	0.28^{y}	0.10^{b}	1.26^{a}	0.19	4.40
15	4.50^{2}	74.9^{a}	1.27^{b}	0.20	2.64

Mean of triplicate determination

Fe = iron, Ca = calcium and P = phosphorus.

Mean values with the same superscript letters within same row do not differ (P<0.05). Mean of triplicate determinations

Sensory Evaluation

The scores for the sensory evaluation of chin-chin made from wheat flour and fluted pumpkin composite flour are shown in Table 4. Data for chin-chin ranged between 2.22 – 2.56 and 3.72 – 3.0 for texture and taste respectively. The colour for chin-chin at 0 and 5% levels were 4.27 and 4.0% respectively, while 10%, 15% and 20% had 2.94, 2.83 and 2.0 respectively which were not significantly different at (P<0.05).

Table 4: Sensory evaluation of chin-chin made from wheat/fluted pumpkin flour blends

Levels of fluted pumpkin in samples	Colour	Flavour	Texture	Taste	General acceptability
0	4.24^{a}	3.74^{a}	2.24^{a}	3.70^{b}	4.13^{a}
5	4.01^{a}	3.55^{a}	2.24^{a}	3.15^{b}	3.80^{a}
10	2.80^{bc}	2.25^{b}	2.13^{a}	3.31^{b}	3.55^{a}
15	2.80^{bc}	2.25^{b}	2.13^{a}	3.31^{b}	3.55^{a}
20	2.01^{c}	2.21^{b}	2.55^{a}	3.01^{b}	2.69^{b}

Means of triplicate determinations. Mean values with the same superscript letters within the same row do not differ significantly (P < 0.05).

Discussion

The higher protein content observed in the chin-chin made from the composite flours, than those made from the wheat flour was likely due to the supplementation effect of the fluted pumpkin seed flour. Fluted pumpkin is an oil seed with significant quantity of protein (12.56% (Aruah *et al*, 2011) [6]. The high fat and protein contents of fluted pumpkin seeds upgraded the levels of the nutrients in the composite flour and demonstrated the beneficial effect of blending two foods in product development. The products, particularly those made from the wheat-fluted pumpkin composite flours could be valuable in the fight against protein-energy malnutrition (PEM) as well as contribute to the micronutrient intake of the populace, by virtue of their P and Ca contents.

The lower carbohydrates of the products made from composite than the products made from the wheat flour was because of the supplementation effect of the fluted pumpkin flour on the wheat flour mixture. The moisture levels of all the products were due to extent of drying.

The chin-chin made from 100% wheat flour (control) and those produced from the composite flour from 5% to 15% level of substitution with the composite flour were generally acceptable. The variation observed in the colour could be due to the increase in the fluted pumpkin flour on the composite flour which results to darkening, crumble texture and a beany flavor. Colour darkening of the chin-chin is attributed to sugar caramelization and the maillard reactions between sugar and amino acids (Alobo, 2001) [4].

The higher mineral (Ca, Fe and P) levels of composites than the wheat flour products further confirms the beneficial effects

of supplementation. It further supports Achinewhu, (1986) [2] who reported that the fluted pumpkin seeds are good sources of minerals such as iron and phosphorus.

In conclusion, the study revealed that addition of fluted pumpkin to wheat flour increased the protein content of the composite flour, in addition to the mineral content.

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