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Nutrient Composition and Sensory Properties of Cakes Made from Wheat and African Yam Bean Flour Blends

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Abstract: Wheat Flour (WF) was supplemented with African Yam Bean Flour (AYBF) and used to bake queen cakes at various ratios (WF/AYBF 100:0, 80:20, 75:25, 50:50, 0:100). The 100% WF cake served as control. Proximate analysis showed significant increase ($p<0.05$) in protein content (9.2-17.4%), ash (3.7-5.5%) and crude fiber (0.14-1.80%) in AYBF supplemented cakes. There was a significant decrease ($p<0.05$) in carbohydrate (70.26-63.1%) and fat (16.7-13.2%) contents. There was no significant difference ($p>0.05$) in moisture contents (14.4-14%) of test samples. Sensory evaluation results showed that all cake samples had high rating for all evaluated attributes. The 20 and 25% AYBF supplementation compared favorably with control (100% WF). Cakes from other supplementation levels were generally acceptable as they were neither liked nor disliked.

Key words: *Sphenostylis stenocarpa*, flour, cakes, sensory attributes, blends, proximate constituents

INTRODUCTION

Legumes are still relatively minor crops despite their role as sources of protein and oil in the diet of people of the developing world. Legumes rank next to cereals as source of human food and provide much of the needed protein to the vegetarian population.

African yam bean (*Sphenostylis stenocarpa*), an important legume in Africa is a lesser-known legume of the tropical and sub-tropical areas of the world which has attracted research in recent times (Azeke *et al*., 2005). It is a climbing legume with exceptional ability for adaptation to lowlands and takes about 5-7 months to grow and produce mature seeds (Apata and Ologhoba, 1990). In Nigeria, it is grown mostly in the Northern parts of the country where it is grown mainly for its seeds. Nutritional composition of African yam bean has been addressed by Ene-Obong (1993), Oshodi *et al.* (1995), Nwinuka *et al.* (1997), Adeyeye *et al.* (1999) and Agunbiade and Longe (1999). A protein content ranging between 20.2 and 21.2% has reported for African yam bean by Eneche (2003) and Ene-Obong (1993). Its protein concentrate has been reported to be used in fortification of starchy foods like maize, cassava and Akamu flours (Eneche, 2005). The proportion of lysine in African yam bean is reported to be equal to or higher than that of soybean while most of the other essential amino acids corresponds to the WHO/FAO recommendation (Evans and Boutler, 1974). This legume has also been reported to be of importance in the management of chromic diseases like diabetes, hypertension and cardiovascular diseases because of its high dietary fibre content (Enwere, 1998). Despite this, African yam bean is underutilized and rarely consumed in urban areas whish is attributed to its elaborate preparation method. Diets eaten in Nigeria urban centers are increasing more westernized especially in the area of consumption of wheat and wheat-based products. Parts of wheat flour used for production of various confectioneries can be substituted or supplemented with flours from other cereals, oil seeds, higher and lesser known legumes. These composite flours with reduced gluten content are still suitable for breads, cakes and biscuits where weaker flours are desirable.

Cake is a conventional snack produced from wheat flour with other ingredients. In a country, like Nigeria where malnutrition due to deficiencies in protein and calories contributes to more than half a million deaths of newborn (Onyezili, 1999). African yam bean though deficient in sulphur containing amino acids methionine and cystine and high in lysine can be utilized as a complementary protein in carbohydrate-based foods to improve their nutritional quality. Incorporation of African yam bean flour into wheat-based products make the foods useful protein and energy sources with good nutritive value.

This study thus, seeks to prepare and evaluate the nutrient composition as well as the acceptability of cakes produced from wheat and African yam bean blends with the aim of promoting utilization of African yam bean.

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MATERIALS AND METHODS

The wheat flour and African yam bean seeds (*Sphenostylis stenocarpa*) were purchased from a local market (Ika-Ika Qua) in Cross River State, Nigeria. The African yam bean seeds were sorted, washed, sun dried and weighed. The seeds were roasted for 10 min and milled using a laboratory hammer mill (model ED-5, Thomas Wiley, England) and sieved into fine flour with a 1 mm mesh sieve. The purchased wheat flour was sieved using the same mesh screen to obtain the same particle size with African yam flour.

Parts of Wheat Flour (WF) were substituted with 20, 25 and 50% African Yam Bean Flour (AYBF) by weights. Each blend was separately mixed in a Philip blender (HR 2811 model) for three minutes at high speed. The various blends were packed separately in airtight plastic containers till needed.

Preparation of cakes: Table 1 shows the recipe used for making the wheat-African yam bean cakes samples. Cakes were prepared according to the method described by Ceserani *et al.* (1995). The fat and sugar were creamed together until fluffy (doubled its size) using a wooden spoon in a stainless steel bowl followed by addition of the liquids (beaten eggs and milk). The sieved flour with salt and baking powder was folded into the mixture gradually with a metal spoon and poured into greased queen cake baking tins. The cake mixtures were baked in a pre-heated oven at 220°C for 20 min.

Proximate analysis: Proximate analysis of cake samples were carried out in triplicates. Moisture, crude protein, crude fat, crude fibre and ash contents were determined using methods of Association of Analytical Chemists (AOAC, 2000). Carbohydrate content was estimated by simple difference. The caloric value was calculated by multiplying values obtained for carbohydrate, fat and protein by the Atwater factors of 4, 9 and 4 kilocalories, respectively and taking the sum of the products.

Sensory evaluation: A 15 member panel randomly selected amongst the member of staff and students of the Department of Home-Economics, Cross River College of Education, Akamkpa, Cross River State was used for the sensory evaluation. The study was carried out under white light in the food laboratory within the Department in the mid morning hours (10:00 am). The laboratory was quiet without noise and/or interruption. The panelists were separately seated, each provided with a glass of clean tap water to rinse their mouths between the five evaluation sessions of 3 min interval. The 100% wheat flour cake served as control. The five cake samples were presented in two digit coded white plastic plates and were evaluated for colour, texture, flavor, taste and general acceptability using a 9 point hedonic scale in which one represents the least score (disliked extremely) and 9 the most desirable score (liked extremely) for any attribute (Iwe, 2002).

Table 1: Recipe used for preparation of cake samples

Ingredients	Quantity
Wheat-African yam flour blend (g)	200
Margarine (g)	120
Sugar (g)	80
Eggs (beaten)	4
Milk (mL)	60
Baking powder (g)	5
Salt (g)	2

Statistical analysis: Data generated from the study was subjected to Analysis of Variance and means were separated using Fischer LSD and judged significantly different at 95% confidence level ($p<0.05$).

RESULTS AND DISCUSSION

Results of nutrient composition of cakes produced from wheat and African yam bean flour blend (Table 2) show protein, crude fiber and ash contents to increase significantly ($p<0.05$) from the control cake AW_0 (100% WF) to AW_4 (100% AYBF). The observed increase in these parameters increased with increasing level of supplementation of the wheat flour with African yam bean flour. Wheat flour like other cereals is limiting in lysine and tryptophan and rich in sulphur containing amino acids, methionine and cystine while the reverse is the case for African yam bean flour (Ene-Obong and Carnovale, 1992). The proteins of wheat flour and African yam bean flour thus complement each other's limiting amino acids, thus, producing cakes of better nutritional quality. The utilization of lesser known legumes that are cheaply available and equally rich in protein cannot be overemphasized in reduction of protein energy malnutrition resulting from high cost of animal protein and commonly accepted legumes like cowpeas.

The higher fibre and ash content of cakes produced from WF/AYBF blend further justifies the nutritional importance of African yam bean. The utilization of fiber rich leguminous plant food in developing countries to combat the high incidence of diabetes has been of considerable interest in recent years (Onyechi *et al.*,

Table 2: Nutrient composition of cakes made from WF, AYBF and WF/AYBF blends

Parameters	Samples				
	AW_0 (WF:AYBF 100:0)	AW_1 (WF:AYBF 80:20)	AW_2 (WF:AYBF 75:25)	AW_3 (WF:AYBF 50:50)	AW_4 (WF:AYBF 0:100)
Moisture	14.40[a]	14.21[a]	14.19[a]	14.08[a]	14.00[a]
Crude protein	9.20[a]	11.41[b]	11.52[b]	16.11[c]	17.40[d]
Crude fat	16.70[a]	16.30[b]	16.00[b]	14.90[c]	13.20[d]
Crude fiber	0.14[a]	0.52[b]	0.68[b]	1.10[c]	1.80[d]
Ash	3.70[a]	4.12[b]	4.51[b]	4.95[b]	5.50[c]
Carbohydrates	70.26[a]	67.65[a]	67.29[a]	62.94[b]	62.10[b]
Caloric value	468.14[a]	462.94[b]	459.24[b]	450.30[c]	436.80[d]

WF: Wheat Flour; AYBF: African Yam Bean Flour; [a-d]Values on the same row with different letters are significantly different at $p<0.05$

Table 3: Sensory evaluation scores for cakes samples

Samples	Parameters				
colour	Texture	Taste	Flavor	General	Acceptability
AW_0	8.0[a]	8.3[a]	7.9[a]	8.1[a]	7.9[a]
AW_1	7.8[a]	8.1[a]	7.5[a]	8.0[a]	7.8[a]
AW_2	7.6[a]	7.8[b]	7.0[b]	7.5[b]	7.5[a]
AW_3	7.0[b]	6.8[c]	6.6[c]	6.8[c]	6.2[b]
AW_4	6.8[b]	6.3[d]	6.3[c]	6.0[d]	5.8b

AW_0: 100%WF cake; AW_1-80:20; AW_2-75: 25; AW_3-50:50 WF: AYBF respectively; AW_4-100% AYBF where WF: Wheat Flour; AYBF = African Yam Bean Flour; [a-d]Values on the same row with different letters are significantly different at $p<0.05$

1998). The resultant effect of the utilization of WF/AYBF blend will increase intake of dietary fiber and subsequent reduction in the prevalence of chronic diseases.

The results of the study also show a significant decline ($p<0.05$) in carbohydrate and fat contents hence, lower caloric values of cakes from WF/AYBF blends. The most significant decrease was observed in the cakes made from 50% AYBF supplementation.

Results of sensory evaluation (Table 3) indicated that all cake samples were generally acceptable for all evaluated parameters as none scored below the minimum acceptable rating of five on a 9 point hedonic scale. The cake sample from 20% AYBF supplementation show no significant difference ($p>0.05$) with the control cake (100% WF) in all attributes evaluated.

CONCLUSION

Cakes of acceptable qualities can be produced from wheat flour supplemented with up to 25% of African yam bean flour as cake samples made from 20 and 25% AYBF supplementation compared favorably with control cake (100% WF). At other levels of supplementation, there were significant differences ($p<0.05$) although scores were above minimum in all parameters. Cake production from WF/AYBF blends may be an answer to increase in consumption and utilization of this lesser known legume with the resultant effect of increase intake of quality protein, minerals and dietary fibre.

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