

CHEMICAL COMPOSITION OF AFRICAN YAM BEAN (*Sphenostylis stenocarpa*) PUDDING VENDED IN ENUGU STATE, NIGERIA

Ngwu, E. K., Nwachi, I. C., Ani, P. N., Ozioko, F. A.

Department of Home Science, Nutrition and Dietetics, University of Nigeria, Nsukka.

Corresponding author e-mail: kanayolizzy@yahoo.com

ABSTRACT

Objective: This study investigated the chemical composition of African Yam Bean (AYB) pudding vended in Enugu state, Nigeria.

Materials and methods: AYB puddings as consumed were purchased from local markets in three communities (Umulumgbe, Ukehe and Opi) of Enugu State. The recipes for preparing the puddings were obtained from the vendors through focus group discussions. Proximate analysis and some mineral and vitamin determinations of the samples were done using standard methods. The percentage contributions of the puddings to daily nutrient requirements of adult male and female (30 – 50 years) were compared with the recommended nutrient intake (RNI). Analysis of variance (ANOVA) was used to separate means.

Results: The pudding purchased from Opi had significantly higher protein (31.22%) than that from Umulumgbe (25.69%) and Ukehe (29.79%). AYB pudding purchased from Umulumgbe was significantly higher in fat, crude fibre and moisture and lower in ash, carbohydrate and protein. There was significantly higher vitamin A value in the pudding purchased from Opi (19.35RE) than that purchased from the other two communities. Vitamin E content of the pudding from Opi was also higher (7.50µg) than that from Ukehe (5.27µg) and Umulumgbe (6.94µg). The pudding purchased from Umulumgbe had significantly higher phosphorus (95.33mg/100g) and calcium (0.96mg/100g) than puddings purchased from Ukehe (35.67mg/100g and 0.35mg/100g, respectively) and Opi (67.33mg/100g and 0.67mg/100g, respectively). One wrap of the AYB pudding from Opi, Umulumgbe and Ukehe contributed 21%, 22% and 19% of the daily energy requirements for adults male (30 – 50 years), respectively.

Conclusion: AYB pudding has high nutrient potentials and adds to the food composition list of local dishes.

Keywords: African yam bean, Chemical composition, Enugu state, Pudding.

INTRODUCTION

Large segments of the population in developing countries suffer from protein, energy and micronutrient malnutrition. Projections based on current trends indicate a widening gap between human population and food supply; hence intense research efforts are currently directed towards identification and evaluation of under-exploited food sources such as alternative protein crops for the World of Tomorrow [1]; especially for those who cannot supplement their diets with meat. The need for sustainable development and economic recovery in developing regions of the world is crucial, particularly in the area of access to quality

proteinous foods and food security in general. Conversely, the commonly relied source of quality protein which is animal protein is grossly expensive and scarce [2]. Thus rich sources of plant protein such as legumes present a substitute for the scarce animal protein. Legumes rank next to cereals as source of human food and provide much of the needed protein to the vegetarian population. They represent a major direct source of nitrogen rich edible seeds providing a wide variety of high protein products which contribute 33% of the dietary protein in nitrogen needs of humans [3] and are also useful sources of minerals like; magnesium, calcium and potassium.

African yam bean (AYB) is a climbing legume crop with an exceptional ability for adaptation to low land tropical conditions [4]. It is often cited among the lesser known and under exploited species. In Enugu State, puddings such as *okpa* (bambara groundnut pudding), *moi-moi* (cowpea pudding) and *igbangwu-oka* (maize pudding) are popular and vended in many markets and public squares. *igba- azam* or *igba- ozak* (AYB pudding) is unpopular, prepared and vended in very few markets in Enugu State. Individuals who consume AYB products claim that AYB has medicinal and health attributes (Personal Communication). In Ghana, AYB paste is used for treating stomach aches and when the paste is mixed with water, it is traditionally used for the treatment of acute drunkenness [5]. There is little or no information on the nutritional composition of *igba- azam* or *igba- ozak*; hence this study on the chemical composition of AYB pudding vended in Enugu State.

MATERIALS AND METHODS

Area of study

The study was carried out in three purposively selected rural communities of Enugu state (Umulumbe, Ukehe and Opi). Umulumbe is in Enugu West Senatorial Zone, Opi and Ukehe are in Enugu North Senatorial Zones. The three communities share similar cultural and agricultural characteristics. They equally lay on the geographical plane coming after each other along old Enugu – Nsukka Trunk A road. Inhabitants are mainly subsistence farmers, few civil servants, traders and politicians. Staple foods popularly grown in the areas include yam, cassava,

cocoyam, water-yam and aerial yam. Assorted fruits and vegetables are available. The major cash crop is palm oil trees. Livestock grown include; sheep, goat, chicken and cows. The three communities have important market days that hold every native week (every 4 days). The market days in the communities are known for fruits and vegetable sales. Traders from surrounding urban centers travel to the places for commercial purchase of fruits and vegetables on market days.

Methods

Market survey of AYB pudding sold in various markets in Enugu State was carried out. Enugu West and Enugu North Senatorial Zones of Enugu State were purposively selected for the market survey and collection of AYB pudding samples. The markets where the pudding was sold were purposively selected for sample collection. The vendors were interviewed and the processing methods and recipes for the pudding were collected during focus group discussion. A wrap of AYB pudding from each vendor in a particular market were collected and pulverised. A portion of the pulverised sample was collected for each market and analyzed for nutrient composition using standard methods.

Method of processing AYB flour

AYB seeds were sorted to remove stones and debris, then washed twice in clean water and drained with sieve. The seeds were roasted (until cracking) and cooled in open air; after which the seeds were milled whole for 3 times to get fine flour.

Recipes for the preparation of the AYB pudding

Ingredients	Quantities
AYB flour	1500g
Palm oil	1800ml
Pepper (ground)	400g
Water (luke-warm)	3 litres
Salt	To taste.

Procedure:

- Into a medium size bowl add the AYB flour, palm oil, ground pepper and salt.
- Gradually add luke warm water to the mixed ingredients in the bowl.
- Mix with wooden spoon to get paste of dropping consistency.
- Wrap a cup (250 mls) full of the mixture in dried banana leaves or cellophane bags and drop into boiling water pot.
- Cook for one (1) hour and serve.

Chemical Analysis

Proximate composition of the pulverized AYB pudding sample was determined using the official method of AOAC, [8]. Total moisture was done by the air oven method, protein by the microkjedahl method. Total carbohydrate (%) was calculated by difference as 100% minus % moisture + % crude protein + % fat + % ash + % fibre. The mineral content of the samples (magnesium, calcium and phosphorus) were determined by AOAC, [8]. Mineral estimation was done using wet digestion with nitric and perchloric acids. Calcium (Ca) and magnesium (Mg) were determined by atomic absorption spectrophotometer. Phosphorus (P) was calorimetrically determined with spectrophotometer using phospho-vanadomolybdate method. Pro-vitamin A (β -carotene) was determined using the method of IVACG [9]. The samples were washed with volatile organic solvent (chloroform). The

absorbances of the filtrates were measured with UV – spectrophotometer at 328nm.

Statistical Analysis

Descriptive statistics such as mean and standard deviation of the nutrients in the AYB pudding samples from different markets in the communities were calculated. Analysis of variance (ANOVA) was used to separate the means from different source. The caloric contribution of the AYB pudding to the caloric requirement of adult (30 – 50years) was compared with the standard (2800kcal – males and 2525kcal – females) [10].

RESULTS**Proximate composition of AYB puddings**

Table 1 shows that the moisture content of AYB from the various communities ranged from 4.23% - 5.46% with Umulumgbe having significantly ($P<0.05$) higher value (5.46%) than Opi (4.23%) and Ukehe (4.94%). The ash content ranged from 3.89% – 4.61% with Opi having the highest value (4.61%) and Umulumgbe the least (3.89%). The crude fibre content ranged from 20.01% - 23.28% with Umulumgbe having the highest mean value (23.28%) and Ukehe the least (20.01%).

The fat content of the AYB pudding varied significantly ($P<0.05$) between 24.79% in Umulumgbe to 15.26% in Ukehe. The carbohydrate contents also varied significantly between the communities, 26.10% in Ukehe, 20.59% in Opi and 16.96% in Umulumgbe.

The protein content of the AYB pudding ranged significantly ($P<0.05$) from 25.61% in Umulumgbe to 31.22% in Opi.

Table 1: Proximate composition (%) of AYB puddings from the three communities

Nutrients	Opi	Ukehe	Umulumgbe
Moisture	4.23±0.88 ^a	4.94±0.87 ^b	5.46 ±0.76 ^c
Ash	4.61±0.19 ^c	4.51±0.47 ^b	3.89±0.06 ^a
Crude fibre	21.06±0.21 ^b	20.01±0.9 ^a	23.28±0.21 ^c
Fat	18.29±0.27 ^b	15.26±.08 ^a	24.79±0.17 ^c
Carbohydrate	20.59±2.16 ^b	26.10±4.13 ^c	16.96±0.09 ^a
Protein	31.22±1.47 ^c	29.18±3.02 ^b	25.61±0.04 ^a

abc values with different superscripts in a row are significantly different

Mineral and Vitamin composition of AYB pudding

Table 2 shows that vitamin A content of the AYB puddings ranged from 14.83mg to 19.35RE with Opi having the highest mean value (19.35) and Umulumgbe having the least (14.83). Vitamin E content ranged from 5.27 μ g in Ukehe to 7.50 μ g in Opi. Magnesium varied from 5.47mg to 1.79mg with Ukehe having the highest value (5.47mg/100g) and Umulumgbe the least

(1.79mg/100g). There was a significant difference in their magnesium contents ($P < 0.05$). Calcium in Umulumgbe (0.96 ± 0.05 mg/100g) was significantly ($P > 0.05$) higher than in Opi (0.67mg/100g) and Ukehe (0.35 ± 0.04 mg/100g).

Pudding in Umulumgbe had significantly ($P < 0.05$) higher calcium (0.96mg/100g) and phosphorus (95.33mg/100g) than in Ukehe (0.35mg/100g, 35.67mg/100g) and Opi (0.67mg/100g, 67.33/100g), respectively as shown in Table 2.

Table 2: Mineral and vitamin composition of the puddings from the three communities.

Nutrients	Opi	Ukehe	Umulumgbe
Vitamin A (RE/100g)	19.35 \pm 0.08 ^c	16.12 \pm 0.20 ^b	14.83 \pm 2.88 ^a
Vitamin E(μ g/100g)	7.50 \pm 0.09 ^c	5.27 \pm 0.02 ^a	6.94 \pm 0.02 ^c
Calcium (mg/100g)	0.67 \pm 0.04 ^b	0.35 \pm 0.04 ^a	0.96 \pm 0.05 ^c
Magnesium (mg/100g)	4.20 \pm 0.05 ^b	5.47 \pm 0.005 ^c	1.79 \pm 0.01 ^a
Phosphorous (mg/100g)	67.33 \pm 240 ^b	35.67 \pm 2.33 ^a	95.33 \pm 6.67 ^c

Mean values with different alphabets superscripts are significantly different ($P > 0.05$)

Caloric composition of the puddings

The caloric composition of the puddings (per 100g) from the three communities ranged from 362.05 Kcal-393.27Kcal as shown in Table 3. Pudding from Umulumgbe had higher caloric value (393.27Kcal) compared with Opi (369.87Kcal) and Ukehe (362.06Kcal).

Table 3. Caloric content of the puddings (per 100g) from the three

Communities	Energy(Kcal)	Carbohydrate (Kcal)	Protein(Kcal)	Fat(Kcal)
Umulumgbe	393.27	67.76	102.4	223.11
Opi	369.87	82.36	124.88	162.63
Ukehe	362.06	104.40	116.72	140.94

The energy value of the pudding from the different communities as consumed varied between 526.44Kcal – 609.57Kcal; with pudding from Ukehe having the least value (526.44Kcal) and that from Umulumgbe the highest value of 609.57Kcal (Table 3).

Table 4: Percentage daily caloric contribution of the pudding to the adult male and female (30-50 years) energy requirements

Communities	One wrap wt. (g)	Energy (Kcal)	Female RNI (Kcal)	% of RNI met	Male RNI (Kcal)	% of RNI met
Umulumgbe	155	609.57	2200	28	2800	22
Opi	160	591.79	2200	27	2800	21
Ukehe	145	526.44	2200	24	2800	19

% = percentage

RNI = Recommended nutrient intake

DISCUSSION

Protein malnutrition is persistent in Africa partly because animal protein is unaffordable to the majority of the population. Interest is therefore rising in low cost protein-rich plant foods as supplements. Studies show that legumes are plant foods which are high in protein and incorporation of the legume protein into diets can provide a completely adequate and balance mixture of essential amino acid. The consumption of African yam bean pudding in Enugu State is not popular probably because most people are not informed of the nutritional composition of the pudding; other legume products like *okpa* (bambara groundnut pudding) and *moi-moi* (cowpea pudding) are consumed in almost every part of the State either as a meal or as a component of a meal or a snack. These legume products have been accepted by large segment of the country's population.

Proximate analysis of puddings purchased from Umulumgbe showed a higher moisture (5%), fat (24.79%) and crude fibre (23%) contents than the puddings from Ukehe which had moisture (4%), fat (15.66%) and crude fibre (20%) and Opi which contained moisture (4%), fat (18.07) and crude fibre (21%). This disagrees with Achinewhu and Akah [11] who reported that dry samples of cowpea processed into *moi-moi* (cowpea pudding) contained 11.85% moisture, 2.83% fat and 2.85% crude fibre. The lower crude fibre reported in the study [11] could be attributed to the processing method used in which the hulls were removed. In the present study, the hulls were not excluded hence the high fibre content of >20% observed. The high moisture and fat contents of the pudding as reported in this study could be attributed to the recipe used in the preparation.

Puddings from Opi and Ukehe had a protein value

higher than the pudding from Umulumgbe, this may be due to their low moisture content; this protein value which ranged between 25 – 31g can be compared with the protein content (24.8g) of cowpea pudding (*moi-moi*) as reported by Ihekoronye and Ngoddy [12]. Ene-Obong and Carnovale [13] reported a protein value of 21.6g for AYB flour. The increase in the protein value of the AYB pudding could be attributed to treatments like roasting and cooking which reduce the antinutrients level thereby increasing the availability of protein. Pudding from Opi and Ukehe were relatively high and differed by 1.0g, this can be attributed to the processing method. This fibre contents which ranged from 20 – 23% agrees with the report by Ene-Obong and Carnovale [13] on AYB flour which contained 19.12% fibre. The ash contents of the puddings from the various communities were at low levels and this can be attributed to the degree of minerals contained in the product. The vitamin and mineral contents of the puddings were high but their values were low compared to their requirement for a meal; this could be attributed to the different locations where the grains were purchased. This agreed with the report by Adeye and Agesin, [14] that legumes contain low levels of calcium, copper and phosphorous.

The caloric contents of the puddings varied though they were comparable. Pudding from Umulumgbe had the highest caloric value of 393.27Kcal. The difference in the energy value can be attributed to the recipe used for its preparation; though it was high in calorie, it was less nutrient dense. This recipe also resulted to different weights of the puddings as consumed by different communities. The caloric content of the pudding was inadequate when consumed as purchased for a meal. Yetunde and Ime [15] reported increased energy value of

cake prepared with a composite of AYB flour and wheat flour which recorded 439.34Kcal a higher energy value than that prepared with AYB flour alone. This energy value is also low when compared with FAO and WHO [10] one-third daily caloric requirement for adult males or females which is 933.3Kcal and 733.3Kcal, respectively.

5.2 Conclusion

Vended AYB pudding was rich in protein and could be used to supplement the scarce animal protein. The puddings assessed contained antioxidants, vitamin A and E which are necessary in the body for elimination of free radicals. Their high crude fibre content could slow down the release of their carbohydrate into the body system thereby regulating blood sugar levels and therefore useful in the management of Type II diabetes. The pudding as prepared by the three different communities had varying composition of various nutrients; the processing method and recipe used by Opi community should be adopted and made known to other communities in Enugu state.

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