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Fortification of Cassava *fufu* flour with African yam bean flour: Implications for improved nutrition in Nigeria

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ABSRACT

Cassava fufu flour samples were blended with African-yam-bean (AYB) flour, as a way of improving the food quality of cassava fufuflour known to be very low in protein content. The samples were A 5% Toasted AYB/95% cassava fufu flour, B 10% Toasted AYB/90% cassava Fufuflour, C 20% Toasted AYB/80% cassava fufuflour, D 5% fermented AYB/95% cassava fufu flour, E 10% fermented AYB/90% cassava Fufuflour, F 20% fermented AYB/80% cassava fufuflour, G 5% untreated AYB/95% cassava fufu flour, H 10% untreated AYB/90% cassava Fufuflour, I was 20% untreated AYB/80% cassava fufuflour and J which was 100% cassava fufu flour which also served as the control. The samples were properly mixed and packaged for determination of their protein compositions and bulk densities. Also, the samples were reconstituted into cassava fufu meals which were subjected to sensory evaluation using a 20-man panel of judges who were conversant with cassava fufumeals. The result of the protein compositions of the samples showed that there were increases in protein contents of the samples with increase in their fortification levels. The highest increases in protein composition were recorded in samples with untreated AYB. Also, samples with the fermented AYB were higher in protein contents than those with toasted AYB. The result of bulk density indicated that the samples were either of the same bulk density or higher bulk density with the cassava fufusamples. This showed that the fortification did not affect their ability to form good cassava fufu meal. The sensory evaluation result of the cassava fufu meal revealed that there were no significant differences among the samples in their over-all acceptability. This shows that AYB is a food item which can be used in fortification of cassava fufu flour for use in preparation of cassava fufu meal. The consumption of fortified cassava fufu meal cassava can help in combating protein mal-nutrition prevalent in most cassava consuming areas of Nigeria.

Key words: cassava *fufu*, fermentation, African-yam-bean, mal-nutrition, protein, fortification

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INTRODUCTION

The poor state of health in our society in Nigeria is as a result of persistent prevalence of malnutrition. Most of the staple foods in Nigeria are root and tuber crops which are known for their high carbohydrate contents that apart from providing energy are usually deficient of protein and other food nutrients. In Nigeria, cassava is an important staple food which is consumed by over 70% of the populace at least once a day. This cassava is shown to be low in protein content. Hence persistent consumption of this food item without proper fortification or enrichment could be said to be contributory to the level of mal-nutrition in this area. However, this study looks at the possibility of improving the food quality of cassava (fortification) with African-yam-beans (AYB) for use in *fufu*food production (*fufu* is a traditional food made from fermented cassava which is staple Nigeria particularly in South-eastern parts).

African Yam bean (Sphenostylisstenocarpa) is an important legume in Africa, known among the *Igbos* in Nigeria as *Odudu* although it is a lesser-known legume of the tropical and sub-tropical areas of the world. The AYB is grown in Nigeria mainly for its seeds but, there are evidences that the tubers are relished in East and Central Africa (Potter 1992). The AYB is usually cultivated mainly for home consumption (with only about 30% of the dry grain produced being sold) and also for soil restoration (Saka et al. 2004). AYB is a good source of protein, fibre, carbohydrate and it is also rich in minerals such as phosphorus, iron and potassium (Ajibade et al. 2005; Fasoyiro et al. 2006).The

protein content in AYB grains is about 30% (Uguru and Madukaife 2001). AYB produces an appreciable yield under diverse environmental conditions (Schippers 2000). Also the high content of dietary fibre of AYB makes it an important crop in managing chronic diseases such as diabetes, hypertension and cardiovascular diseases. However, the quantity and availability of AYB germplasm is decreasing with time. To this effect, Klu et al, (2001) had speculated that the crop was nearing extinction, its inherent ability to adapt to diverse environmental conditions notwithstanding. Hence, every effort should be made to preserve this crop by encouraging its increased cultivation with diversification of its use in order to exploit the high nutritional quality and other important attributes of AYB.

This study however, seeks to optimize the use of AYB in enhancing the food quality of cassava*fufu* meals, by incorporating different levels of the variously treated AYB flour into cassava *fufu* flour with the determination for their suitability as food.

MATERIALS AND METHODS

Procurement of materials

The AYB was procured from Umuahia main market, Abia State, Nigeria while the cassava was harvested from Cassava Programme, National Root Crops Research Institute (NRCRI), Umudike, Abia State, Nigeria.

Preparation of cassava *fufu*Flour

The fresh cassava roots harvested from NRCRI, Umudike farm were sorted and 200kg of the fresh roots was weighed out. The roots were peeled, thoroughly washed and soaked in water to ferment for 3 days. Then the fermented cassava was washed and grated into a mash using locally fabricated motorized grating machine. The mash produced was put in a big plastic container, covered to protect from fries for 2 days. Thereafter, the mash was dewatered after putting it in a clean bag using a locally fabricated dewatering machine. The dewatered caked mash was broken into granules and spread out on a raised platform to sun-dry. The dry cassava granules were milled into powder using Hammer mill to produce cassava *fufu* flour. The flour was packed in high density polyethylene and stored under refrigeration (4^0C) for use later.

Method of Preparation of Cassava *Fufu* Flour

Fresh cassava Roots
↓
Peel
↓
Wash
↓
Ferment for 3 days
↓
Grate
↓
Ferment Mash for a day
↓
Dewater
↓
Dry (on a raised platform to avoid contamination)
↓
Mill into powder
↓
Cassava *fufu* flour

Fig 1: flow Chart for the preparation of Cassava flour

Preparation of African-Yam-bean (AYB) Flour

The seeds of AYB were thoroughly cleaned and sorted to remove extraneous matters. Then 4kg of the clean seeds was toasted at 190^0C for 10min, another 4kg of the clean seeds were fermented for 24 hours and sun-dried. The toasted beans, the fermented beans and yet another 4kg of the cleaned AYB were then dehulled separately using plate mill with clearance of 6mm between the plates. Then the cotyledons of the differently treated Africa-Yam-Bean were milled into powder using hammer mill. Thereafter, the powders were sieved using muslin cloth (0.8mm screen size). The flours were packed separately in high density polyethylene and stored under refrigeration (4^0C) for use later.

Method of Processing Toasted African-Yam-Bean into Flour

AFRICAN YAM BEAN
↓
Sort
↓
Roast
(at 190^{0}C for 10mins)
↓
Dehull
↓
Mill
↓
Sieve
(using muslin cloth 0.8mm screen size)
↓
TOASTED AFRICAN YAM BEAN FLOUR

Method of Processing Fermented African-Yam-Bean into Flour

AFRICAN YAM BEAN
↓
Sort
↓
Ferment for 24 hours
↓
Sun-dry
↓
Dehull
↓
Mill
↓
Sieve
(using muslin cloth 0.8mm screen size)
↓
SOAKED AFRICAN YAM BEAN FLOUR

Method of Processing Untreated African-Yam-Bean into Flour

AFRICAN YAM BEAN
↓
Sort
↓
Dehull
↓
Mill
↓
Sieve
(using muslin cloth 0.8mm screen size)
↓
AFRICAN YAM BEAN FLOUR

Fig 2: flow Chart for the preparation of various samples of African Yam Bean flour

Determination of Protein Composition and Bulk Density Analysis of the Samples

The fortified cassava *fufu*flour samples and their control (100% cassava *fufu*flour) were analysed in triplicates using AOAC (1990) methods to determine the protein composition of the samples. The methods described by Onwuka (2005) were used to determine the bulk density of the fortified cassava *fufu*flour samples.

Sensory Evaluation

The cassava *fufu*flour samples were reconstituted into cassava fufufoods by cooking 100g of each of the samples in 100mls of boiling water while stirring vigorously for 5 minutes. Then the cooked samples were subjected to sensory evaluation using 20-man panel of judges, who were familiar with the products. The panellists evaluated for attributes such as colour, hand-feel, mouldability and over-all acceptability of the products using a seven (7) point hedonic scale where 7 indicated extremely like, 4 indicated neither like nor dislike and 1 indicated extremely dislike.

Statistical Analysis

The data generated from sensory evaluation were subjected to statistical analyses to determine the Least Significant Difference among the samples at 5% significance levels using SAS computer package.

RESULTS AND DISCUSSION

The result in Fig 1 showed that the fortification brought about increase in crude protein content of the samples, as the levels of fortification increased, the protein content of the samples increased irrespective of what treatment given to the AYB. However, the protein increase was higher in the untreated AYB samples.

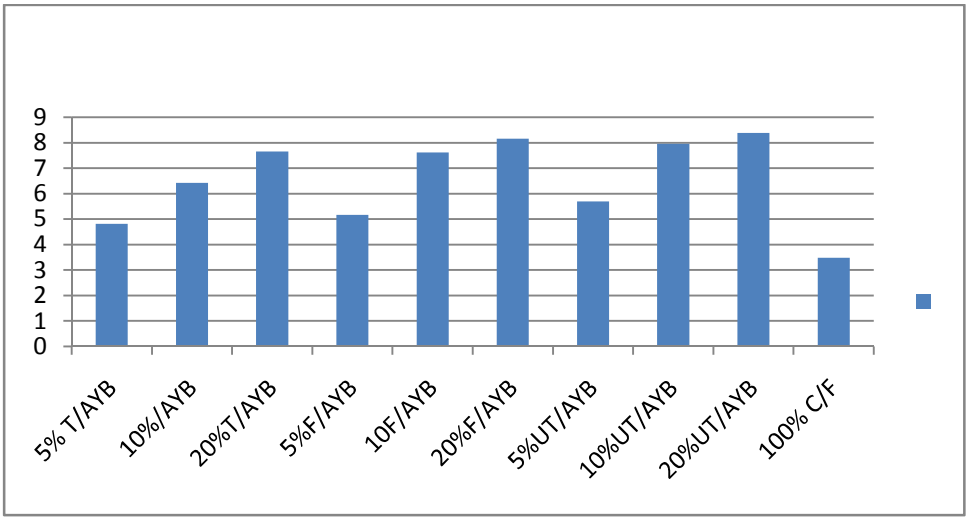

Fig 3: Protein Composition of Fortified Cassava *Fufu* Flour samples

The result in Fig 2 also showed that the fortified samples were either of the same bulk density or higher in bulk density than the control (100% cassava fufu flour), indicating that they will form good quality fufu meals that can compare favourably with the control. This is in line with the report of Brenan *et al* (1996) which contended that the higher the bulk density, the better the quality fufu meals when reconstituted in boiling water. This is because high density determines the ability of the flour to disperse easily when reconstituted in hot water.

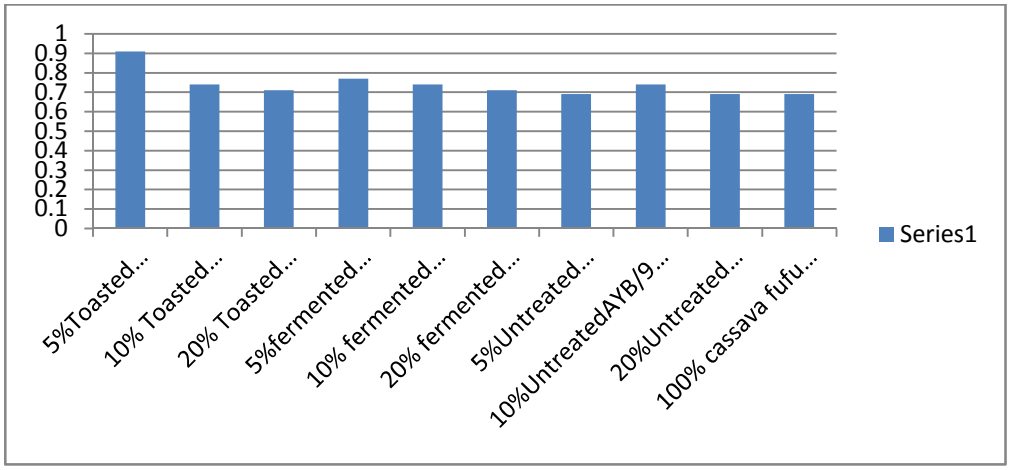

Fig 4: Bulk Density (g/ml) of the Fortified Cassava *Fufu* Flour Samples

The result of sensory evaluation in Table 1 showed that there were no significant (P>0.05) differences among the samples, indicating that all the samples were good quality fufu meals.

Table 1: Sensory Evaluation of Cassava *Fufu* Food Samples

S/N	SAMPLES	Colour	Hand-feel	Mouldability	Over-all Acceptability
A	5%Toasted AYB/95% Cassava. *fufu* Flour	6.0	5.6	5.6	5.3
B	10% Toasted AYB/90% Cassava *Fufu*Flour	5.0	5.7	5.4	5.2
C	20%Toasted AYB/80% Cassava *fufu* Flour	5.1	4.8	3.9	5.1
D	5%Fermented AYB/95% Cassava *fufu* Flour	4.6	5.1	5.3	5.2
E	10%Fermented AYB/90% Cassava *Fufu*Flour	4.2	5.0	4.7	5.1
F	20%Fermented AYB/80% Cassava *fufu* Flour	3.7	5.0	4.8	4.5
G	5%Untreated AYB/95% Cassava *fufu* Flour	3.8	5.6	5.4	5.3
H	10%UntreatedAYB/90%cass. *Fufu*Flour	6.3	4.8	5.0	4.5
I	20%Untreated AYB/80%Cassava *fufu* Flour	5.1	5.5	5.1	5.2
J	100% Cassava *fufu*Flour	5.1	4.7	4.1	5.2
	LSD	**0.6**	**0.3**	**NSD**	**NSD**

**7-Point Hedonic Scale: 1=dislike extremely, 4=neither like nor dislike, 7= like extremely*

CONCLUSION

Cassava fufu flour fortified with AYB flour (toasted, fermented or untreated) gave good quality fufu meals. Hence, enrichment or fortification of cassava fufu flour with AYB flour at the levels of 5%, 10% and 20% is recommended for increased protein intake to combate protein mal-nutrition prevalent in most cassava consuming areas of Nigeria.

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