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Proximate Characteristics and Complementary assesment of Five Organic Sweet Potatoes Cultivars and Cowpea Varieties

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ABSTRACT

Flours from five (5) organic sweet potato and cowpea varieties were analyzed for their proximate composition and functional properties at the Federal University of Agriculture, Abeokuta, Nigeria with the purpose of utilizing them for preparation of complementary food. Sweet potato tubers NG/SP/034 (yellow-flesh), NG/SP/083 (white-flesh), NG/SP/109 (yellow-flesh), NG/SP/277 (yellow-flesh), slipot 3 (orange flesh) and cowpea varieties Black- eye, Hundea, Kpotowai, Ellane and batami processed into flour were obtained from the organic skill demonstration farm at the Federal University of Agriculture, Abeokuta Nigeria and Njala Agricultural Research Centre, Njala, Sierra Leone in 2012 and 2013, respectively. Results showed proximate composition and functional properties of legume varieties Black eye beans, and batami met the average values and can be used to formulate composite flour for complementary food. Organic sweet potato cultivars (SLIPOT / 003, NGB/SP/083 also falls within average protein content with suitable functional properties thus have the potential to ensure nutrient security if composited to formulate a complementary diet.

***Key words**: organic sweet potato, cowpea, proximate composition, functional properties*

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I. INTRODUCTION

Nutrition's importance as a foundation for healthy development is often underestimated. Sweet potatoes (*Ipomoea batatas L.*) and cowpea (*Vigna unguiculata*) are important staples in the diets of Sub-Saharan Africans. While the former is relished for its calories outranking most other carbohydrates in vitamins, minerals and protein

(Onuh *et al*, 2004), the latter provides a good secondary source of dietary proteins with a relatively high level of amino acids. Sweet potato roots despite its nutritional roles in diets and economic values as a good source of income to the farmers, who cultivates it on a large scale, are still underutilized in Sub-Saharan Africa particularly Sierra Leone. Its supplementary role to rice, the most-popular staple can be linked to poor agricultural technologies and insufficient resources available for rice production on a large scale coupled with low yields recently obtained owing to such factors as pest, diseases, non-availability of improved varieties among others (Rachie, 2010) leaving the population of the country insecured.

According to a report by Otegbayo, *et al*., (2000), low-protein staples notably roots, tubers and starchy fruits such as plantains do not provide adequate protein for human requirement even when consumption exceeds caloric requirement (Badrie and Mellowes, 1992) and youths particularly infants and children are most vulnerable to malnutrition in extreme cases of protein insufficiency and deficiency (Weinstocks, 1989; Tettweiler, 1991).

Therefore, the quickest way to improve protein intake of people as suggested by Nelson et al., (1987) is to evolve the methods of preparing protein foods at home level as protein-rich foods tends to be commercially too expensive for low-income earners who are often the target of protein intake improvement (Omueti, 1999).

As continued efforts are being made globally towards improving home-level utilization of pulses such as soybeans through its incorporation into existing diets at home level, it becomes important to evaluate nutritional properties of some cowpea and fortifiability potentials they have with low-protein sources like sweet potatoes; a common staple in Sierra Leone.

II. MATERIALS AND METHODS

Location of the experiment

The experiment was carried out at the Food Science and Technology laboratory of the Federal University of Agriculture, Abeokuta, Ogun State, Nigeria from February till November, 2013.

Cowpea flour preparation

The acquired samples were cleaned of foreign matter (unhealthy insect infested seeds and chaff) before processing. The whole beans were soaked for eighteen (18) hours. It was later de-husked, blanched for 5 minutes and sun-dried for sixteen (16) hours. The dried seeds were milled with an attrition mill and sieved through a net with mesh size of 1.5 µm. Flour samples were packaged in sealed low density polyethylene bags and stored in refrigerators prior to analysis.

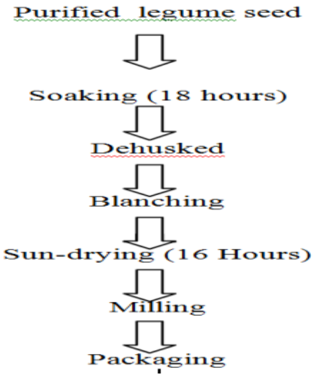

Fig. 1: Flow chart for processing of cowpea into flour

Sweet potato flour preparation

Freshly harvested organic sweet potato (yellow and white) roots were peeled manually using a stainless steel knife and washed thoroughly with clean water. Then sliced into think pieces, the slice pieces were sun dried for 16 hours. The dried sweet potato roots were milled with an attrition mill and sieved through a net with mesh size of 1.5 µm. Flour samples were packaged in sealed low density polyethylene bags and stored in refrigerators prior to analysis.

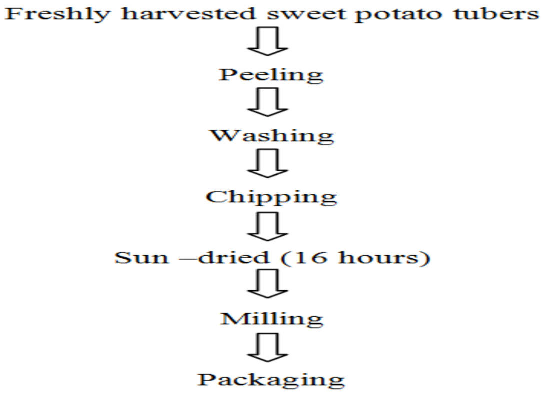

Fig.2: Flow chart for processing of organic sweet potatoes in to flour

Proximate analyses and functional property determination

Moisture content, Ash, crude fibre, crude protein, and fat, Water binding capacity, water absorption capacity, bulk density, dispersibility and PH were determined by AOAC (2005) methods

III. RESULTS

Tables 1 and 2 shows the proximate composition of organic sweet potato and cowpea flour respectively. Moisture of the flours ranged from 63.38 to 65.48%, protein 3.98 to5.02%, ash 2.27 to 3.10%, crude fibre, 2.50 to 4.70% and from fat 1.41 to 2.92%. The cowpea flours had moisture contents ranging between 5.7 and 6.9%, protein 19.5 and 28.0%, ash 2.1 and 3.3%, crude fibre, 2.6 and 4.8% and fat varying between10.4 and12.4% (Tables 1 and 2). The functional properties for the organic sweet potato flours varied from 1.85 to 5.77 for water binding capacity, 0.68 to 0.83 for bulk density, 42.00 to 60.00 dispersibility, pH of 6.04 to -6.26, and a swelling power of 0.03 to 0.05. The ranges for the cowpea flours varied from 1.0 to 9.7 for water binding capacity, 0.7 to 0.9 for bulk density, 57.5 to72.0 for dispersibility, pH of 6.2 to 6.7 and swelling power of 261 and 264 (Tables 3 and 4). These results indicate that flours from the organic sweet potato and cowpea varieties have interesting proximate and functional characteristic that makes them great potential agents in complementary food development Proximate composition of organic sweet potato varieties showed that protein content ranged from 5.02 - 4.45, moisture 5.48 - 3.38, crude fibre 4.70-0.60, and ash 3.10 – 2.27.

Table 1: Mean proximate composition of five (5) organic cowpea *(Vigna unguiculata)* **(sample**

Sample (Local Names)	protein	Moist	Crude Fiber	Fat	Ash
black eye beans	28.0^{a}	5.7^{a}	4.3	2.0^{a}	3.3^{a}
Hudea (Mende)	24.7^{b}	6.5^{b}	4.8	11.9^{b}	2.1^{b}
Kpotowai (Mende)	19.5^{c}	5.7^{c}	2.6	10.4^{c}	3.3^{c}
Ellane (Temne)	22.7^{d}	6.1^{d}	4.4	10.9^{c}	3.0^{d}
Batami	20.2^{e}	6.9^{e}	0.8	12.4^{e}	3.2^{e}

Mean in column with the same letter are not significantly different at p> 0.05

Table 2: Mean proximate composition of five organic sweet potato samples

Sample	Protein	Moisture	Crude fibre	Fat	Ash
NGB/SP/034	4.45^{c}	3.38^{e}	0.60e	2.92^{b}	2.87^{a}
NGB/SP/083	4.45^{c}	2.59^{d}	4.70a	1.79^{c}	2.86^{b}
NGB/SP/109	4.91^{b}	3.71^{c}	3.50b	1.50^{e}	3.07^{b}
NGB/SP/277	3.98^{d}	3.91^{b}	2.50d	1.77^{d}	3.10^{c}
SLIPOT/003	5.02^{a}	5.48^{a}	2.80c	1.41^{a}	2.27^{d}

Mean in column with the same letter are not significantly different at p> 0.05

Table 3: Mean functional properties of five organic cowpea (*Vigna unguiculata*) **samples**

Sample (Local Names)	Water Binding Capacity	Bulk Density	Dispersibility	PH	Swelling Power
black eye beans	2.3^{a}	0.7^{a}	72.0^{a}	6.5^{a}	2.1^{a}
Hudea	1.0^{a}	0.9^{a}	57.5^{b}	6.7^{b}	2.3^{a}
Kpotowai	9.7^{b}	0.8^{b}	66.0^{c}	6.2^{c}	2.0^{a}
Ellane	1.0^{c}	0.9^{c}	70.5^{d}	6.5^{d}	2.4^{a}
Batami	2.2^{d}	0.7^{c}	68.5^{e}	6.7^{e}	2.7^{a}

Mean in column with the same letter are not significantly different at p> 0.05

Table 4: Mean functional properties of five organic sweet potato samples

Sample	Water Binding Capacity	Bulk Density	Dispersibility	PH	Swelling Power
NGB/SP/034	3.13^{a}	0.83^{a}	60.00^{a}	6.04^{b}	0.03^{a}
NGB/SP/083	5.77^{b}	0.77^{b}	58.00^{b}	6.10^{b}	0.04^{a}
NGB/SP/109	1.85^{c}	0.77^{b}	56.50^{c}	6.05^{b}	0.05^{a}
NGB/SP/277	1.87^{d}	0.79^{b}	54.00^{d}	6.06^{b}	0.04^{a}
SLIPOT/003	2.77^{e}	0.68^{c}	42.00^{e}	6.26^{a}	0.04^{a}

Mean in column with the same letter are not significantly different at p> 0.05

IV. DISCUSSION

Compatibility among food substances is a function of physical and chemical properties there in the samples to be combined. Suitability therefore would be based on the capability each posses towards fulfilment of deficiencies of the other. Various crop grown either of legume or other background needs be evaluated as cheaper and readily-available options to the synthetic materials commonly found in West Africa. According to Appiah *et al*. (2011), compositional differences in cowpea could be attributable to soil type, cultural practices, environmental condition and genetic factors. However, since the cowpea varieties were grown under similar conditions, their differences could be mainly genetic. Generally, higher protein content in cowpea is desirable for improved nutrition. The higher protein content of black eye beans, therefore, suggests it could be a superior source of protein compared to the other four varieties.

The high protein content of the varieties is indicative that its use could help reduce protein-deficiency conditions such as Kwashiorkor. As regards crude fibre content, hudea would be a better source than other four samples since it had significantly higher crude fibre content and could be useful in providing bulk to foods to relieve constipation. Black eye beans, being richer in fat, could be useful in improving palatability of foods in which it is incorporated. The high ash contents of black eye beans indicate that the cowpea variety could be important sources of minerals and energy for consumers (Brown, 1991)

Higher crude fiber value observed for the organic sweet potato samples confirms the report of Igbokwe et al. (2005) that non-synthetic input cropping system enhanced crude fiber more than the conventional (chemical intensive) cropping system. The mean fat values for the different varieties ranged from 1.41-2.92%. These are similar to the values of 1.2-2.7% reported by Okum et al. (2009). Bulk density of cowpea flour (0.9) was higher than that reported by Masood Sadiq.(2010) *Canavalia eusiformis*). High bulk densities observed in the cowpea varieties used in this study indicate that their flours are heavy. This being heavier would occupy less space per unit weight compared to other legumes. The high bulk densities of the flours suggest their suitability for use in various food preparations.

The water absorption capacity was highest for cowpea flour. The water absorption capacities values were in agreement with that (1.60 and 1.94) reported by Chinma et al. (2008). According to Butt and Batool (2010), protein has both hydrophilic and hydrophobic properties, and so can interact with water in foods. Carbohydrates have also been reported to influence water absorption capacity of foods (Adejuyitan, 2009). The ability of protein to bind water is indicative of its water absorption capacity. The observed variation in water absorption among the legume samples may be due to different protein concentration, their degree of interaction with water and their conformational characteristics (Butt and Batool, 2010).

In conclusion results indicate that flours from the organic sweet potato and cowpea varieties have interesting proximate and functional characteristic that makes then great potential agents in complementary food development.

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