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ORGANOLEPTIC PROPERTIES AND PROXIMATE COMPOSITION OF SOME ORANGE-FLESHED SWEET POTATO GENOTYPES

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ABSTRACT

Melon The outstanding features of Orange-fleshed sweet potatoes (OFSP) are the nutritional and sensory versatility in terms of its micronutrient contents and wide range of colours, taste and mouth feel. This study was carried out to evaluate the organoleptic properties and proximate composition of some Orange-fleshed sweet potato genotypes viz: Umuspo1, Umuspo3 and Ex-Igbariam. Estimation of moisture, ash, crude fibre, fat, protein and energy value was conducted using standard AOAC procedures. Twenty-eight sensory assessors were used to evaluate some sensory (organoleptic) attributes such as colour, aroma, taste, mouth feel and general acceptability of chips and shake made from the OFSP genotypes. Proximate analysis result showed that moisture content varied from 68.137 - 61.235%, 4.23 - 5.54% for protein, 0.542 - 1.265% for fat, 1.22 -2.25% for crude fibre, and 1.189 - 1.677 % for ash. The energy value ranged from 392.906 %- Umuspo1 to 390.74%-Ex-Igbariam. % moisture content and dry matter differed significantly with varieties ($P < 0.05$). The highest values of vitamin C, B3 and B2 were 24.03 mg/g (Umuspo3), 0.324 mg/g (Umuspo3) and 0.028 mg/g (Ex-Igbariam), respectively. The experimental OFSP genotypes had higher value of calcium than the other mineral content. Chips and shake prepared from the experimental OFSP genotypes were generally accepted for consumption and could serve for use as chips and shake.

KEYWORDS: Orange-fleshed Sweetpotato, Proximate Composition, Energy Value, Organoleptic Properties

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Introduction

Sweet potato (*Ipomea batatas Lam*) is largely tropical root crop that has started playing an important role in food security, nutrition and economy of Nigeria and many other tropical Sub-Saharan African (SSA) countries (Woolfe 1992; Horton 1998). Sweet potato is highly nutritious in terms of calcium and potassium (Woolfe, 1992) than other root crops particularly the dark orange and yellow fleshed varieties. Root and tubers produce large quantities of energy per day in comparison with cereals (Padmaja, 2000). The orange-fleshed variety of sweet potato is high in beta-carotene which can be converted into vitamin A in the intestines and liver when consumed. Research scientists working on this root crop have developed β-carotene rich Orange-Fleshed Sweet potato (OFSP) genotypes that are adaptable to the tropical agro-ecosystems in SSA countries (Woolfe 1992; Anderson *et al.,* 2003; Degras 2003).

Orange-Fleshed Sweet potato is one of the most promising plant sources of β-carotene which is believed to represent the least expensive, year-round source of dietary vitamin A available to rural families (Roots, 2003). According to Woolfe (1992), the outstanding features of OFSP are the nutritional, compositional and sensory versatility in terms of its micronutrient contents and wide range of colours, taste and textures. The β-carotene in OFSP is more readily released than that in dark-green leafy vegetables during cooking thereby enhancing bio-availability (De pee and West, 1996; Castenmiller and West, 1998). Also β–carotene availability in sweet potato is significantly higher than that in other leafy vegetables and this could be due to lack of chlorophylls and other caroteniods which are found to be inhibitors of pro-vitamin A absorption (Tsou and Kan, 1985).

In the tropics, sweet potatoes are consumed if marketed soon after harvesting because of their shelf-life that can be as short as one week. (Ravindran *et al.,* 1995; Yeoh *et al*., 2000). The development of processed products from sweet potato presents one of the most important keys to the expanded utilization of the crop. Just like white potatoes, sweet potatoes are multipurpose vegetables. The development in sweet potato research and development (R&D), has transformed the crop from a simple staple food to an important commercial crop with multiple uses such as a snack, ingredient in various foods and complementary vegetable. The objectives of this study are to determine the proximate composition of three varieties of OFSP and evaluate the sensory (organoleptic) properties of chips and shake prepared from the OFSP.

Materials and Methods

Sample collection

Three varieties of Orange-Fleshed Sweetpotato were obtained from the National Root Crops Research Institute (NRCRI), Umudike, Abia State. The three varieties included Umuspo1, Umuspo3 and Ex-Igbariam as shown in Figure 1. The roots were harvested at 16 weeks (120 days) after planting and used for the experiments.

Experimental analysis

Representative samples were obtained from each freshly harvested sample, properly labeled, bagged and transported to the laboratory for analyses. The proximate analysis viz., estimation of moisture, ash, protein, fat, carbohydrate, fibre, energy value (EV) along with total soluble sugars, vitamins and mineral composition were carried out using Standard methods of the Official Methods of Analytical Chemist (AOAC, 2010).

Sensory (organoleptic) evaluation

Twenty-eight sensory assessors, who were regular consumers of chips and shake were randomly selected from National Root Crops Research Institute (NRCRI) Umudike and Michael Okpara University of Agriculture Umudike, were used for the sensory evaluation of the four experimental samples of the chips and shake. Promise sweet potato chips (sample 850) made in Aba was used as the control for the chips while Five Alive pure orange juice made by the coca-cola company (sample 950) was used as the control for the shake. For the sweet potato chips, Umuspo1 was denoted as 221, Umuspo3 as 393, Ex-Igbariam as 274 and the control as 850 while Umuspo1 was denoted as 221, Umuspo3 as 393, Ex-Igbariam as 274 and the control as 950 for the sweet potato shake. A 9-point Hedonic scale was used for the organoleptic evaluation.

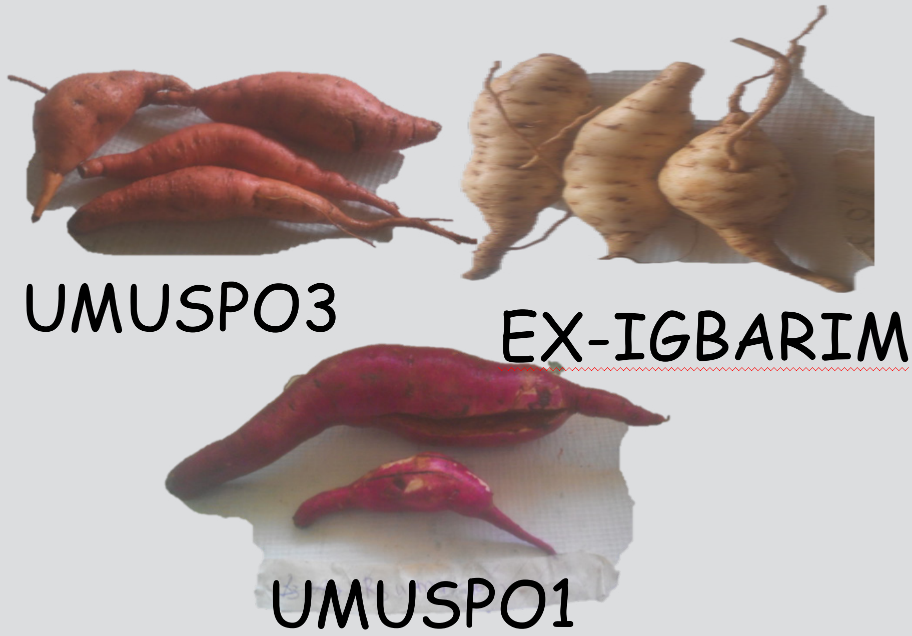

Figure 1: Orange-fleshed sweet potato varieties at 16 weeks.

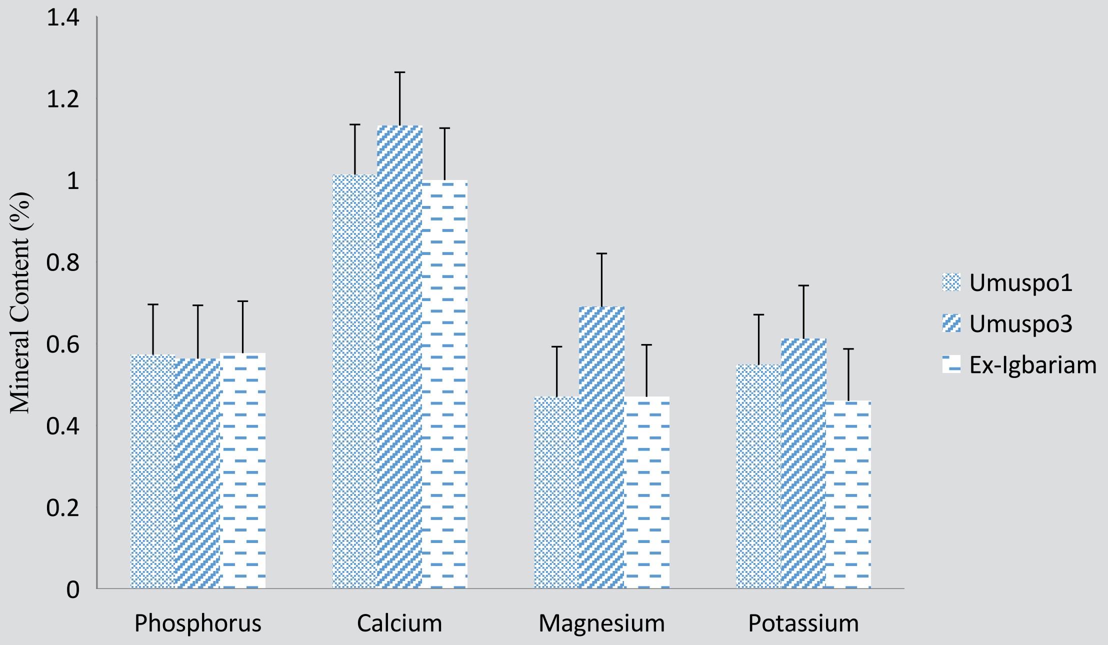

Figure 2: Mineral composition of orange-fleshed sweetpotato at 16 weeks Data points are means (SE) of the three replicates

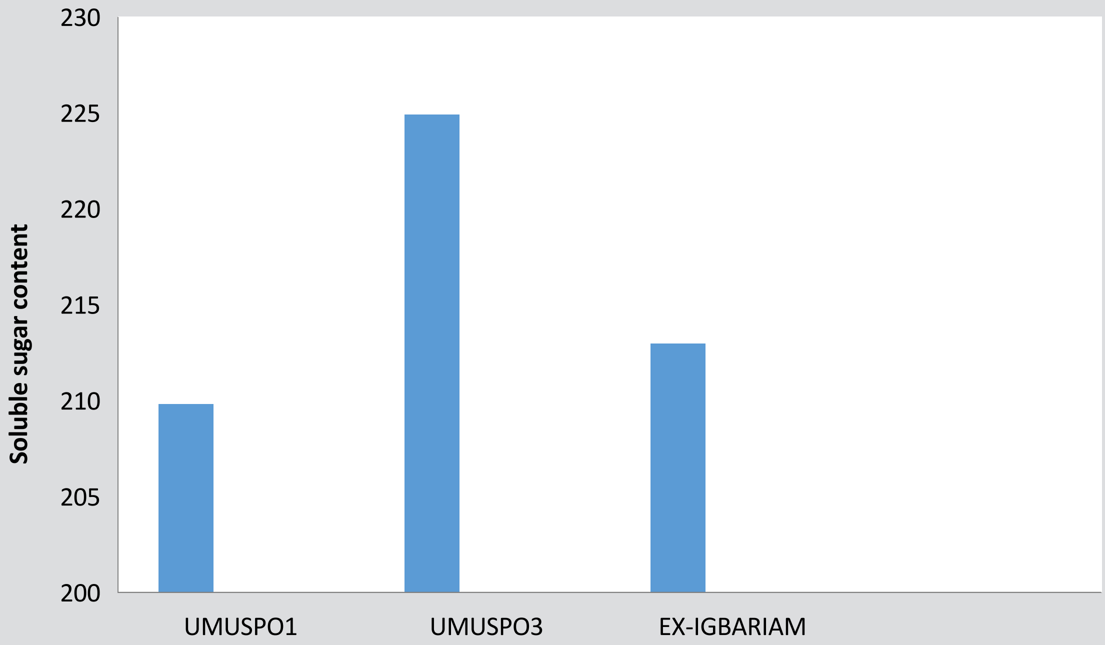

Figure 3: Soluble sugar content of orange-fleshed sweet Potato harvested at 16 weeks

Table 1: Proximate composition of the orange-fleshed sweetpotato harvested at 16 weeks

SAMPLE	%DM	%MC	%ASH	%CF	%FAT	%PRO-TEIN	%CHO	%N	%EV
Umuspo1	33.419	66.581	1.406	1.946	1.265	5.54	89.836	0.886	392.906
Umuspo3	31.863	68.137	1.677	1.22	0.542	4.23	92.346	0.66	391.19
Ex-Igbar-iam	38.764	61.235	1.189	2.25	0.898	5.25	90.413	0.84	390.74

DM= Dry matter, MC= Moisture content, CF=Crude fibre, CHO=Carbohydrate, EV=Energy value, N=nitrogen

In the scoring of the relevant sensory parameters (appearance, taste, aroma, mouth feel, and general acceptability), 9 = like extremely, 8 = like very much, 7 = like moderately, 6 = like slightly, 5= neither like nor dislike, 4 = dislike slightly, 3= dislike moderately, 2 = dislike very much, and 1 = dislike extremely. The sensory assessors were also required to comment freely.

Statistical analysis

The mean, standard deviation and Analysis of Variance (ANOVA) of the data obtained from the study were computed using Statistical Package for Social Sciences (SPSS). Means were separated using Fisher's Least Significance Difference (FLSD) test at $p < 0.05$. Analysis of Variance (ANOVA) was specifically performed to check for significant difference between means.

Results and Discussions

The proximate analysis and vitamin composition were analyzed in the three different sweet potato genotypes, the results of which are indicated in Tables 1 and 2. Percentage protein content ranged from 4.23% (UMUSPO3) to 5.54 % (Umuspo1) and % crude fibre had a range of 1.22 – 2.25%. Umuspo3 genotype has the highest value (1.677) of % ash and the least value (0.542) of % fat content. The total carbohydrate content ranged from 89.836% (Umuspo1) to 92.346 % (Umuspo3) and they were not significantly different on the varieties at $P < 0.05$. % moisture content and dry matter differed significantly with varieties ($P < 0.05$) and varied from 61.235 (Ex-Igbariam) – 68.137% (Umuspo3) and 31.863 (Umuspo3) – 38.76% (Ex-Igbariam), respectively. % energy value had no significant different on the varieties ($P < 0.05$) and has highest and least values of 392.906 % and 390.74 % in Umuspo1 and Ex-Igbariam respectively. The highest values, 24.03 mg/g and 0.324 mg/g of vitamin C and vitamin B_3 were recorded in Umuspo3. Ex-Igbariam genotype had the least values, 14.08 mg/g and 0.103 mg/g of vitamin C and Vitamin B_3 respectively, with the highest value (0.028 mg/g) of vitamin B_2. Omodamiro *et al.*(2013) recorded a significant different ($P < 0.05$) of moisture content with varieties on the proximate composition of some sweet potato genotypes, with % moisture content of 61.27%, 1.87% of crude fibre, 1.02 % fat and 5.06% protein for Ex-Igbariam. This agrees with the result recorded in this study.

The mineral composition and soluble sugar content of the different orange-fleshed sweet potato genotypes are presented in Figures 2 and 3. No significant variation ($p < 0.05$) was observed in the mineral composition of the OFSP genotypes. The phosphorus and potassium content of the three genotypes were similar, with values ranging from 0.56% (Umuspo3) to 0.58% (Ex-Igbariam) and 0.460% (Ex-Igbariam) to 0.612% (Umuspo1), respectively. Calcium content ranged from 1.00% (Ex-Igbariam) to1.13% (Umuspo3). Magnesium content of the OFSP genotypes was similar except for Umuspo3 with higher value of 0.69%. The highest and least values of soluble sugar content were 224.9% and 209.8% in Umuspo3 and Umuspo1 respectively. Figure 2 showed that OFSP roots contain more calcium than potassium, phosphorus and magnesium. This is in line with the findings of Nandutu (2004).

. The organoleptic evaluation result of the chips and shake (Table 3) produced from the fresh OFSP roots showed that the three experimental genotypes could serve as replacement sweet potato in the preparation of chips for Nigerian local consumers. However, at 95% confidence interval, it was observed that the appearance, taste, aroma and mouth feel of Umuspo3 was significantly different from the commercial chips (control), that is, the consumers preferred the commercial chips to Umuspo3 chips. This could be linked to the cooking method (frying) used in the preparation of Umuspo3 which affected its appearance, taste, aroma and mouth feel.

Conclusion

Orange –fleshed sweet potato is rich in the minerals evaluated which included calcium, magnesium, potassium, phosphorus. The experimental OFSP genotypes contained more calcium than the other three minerals. Also, OFSP is a rich source of vitamins B_2, B_3 and C. The OFSP genotypes can be used in the preparation of chips and shake by food processors in Nigeria. However, the observed dislike for Umuspo3 chips to the commercial sweet potato chips suggests that frying alters its sensory qualities, hence should be processed using other methods.

Table 2: Vitamin composition of the orange-fleshed sweetpotato harvested at 16 weeks

Varieties	Vitamins (mg/g)		
	B2	B3	C
Umuspo1	0.0264	0.216	19.36
Umuspo3	0.0221	0.324	24.03
Ex-Igbariam	0.028	0.103	14.08

Table 3: Sensory characteristics of orange-fleshed sweetpotato chips and shake

Sweetpotato Varieties	Parameters				
CHIPS	Appearance	Taste	Aroma	Mouth Feel	General Acceptability
Umuspo1 (221)	6.64[a]	6.86[a], [b]	6.50[a]	6.18[a]	6.68[a]
Umuspo3 (393)	5.85	4.96	5.46	4.89	5.57
Ex-Igbariam (274)	6.61[a]	6.14[a]	6.68[a]	5.96[a]	6.57[a]
Control (850)	8.11	7.61[b]	7.00[a]	7.68	7.86
$L.S.D_{0.05}$					
SHAKE					
Umuspo1 (221)	7.11[a]	5.81[a]	6.15[a]	6.67[a]	6.48[a]
Umuspo3 (393)	7.37	6.19[a]	6.07[a]	6.78[a]	6.67[a]
Ex-Igbariam (274)	7.04[a]	6.52[a]	6.44[a]	6.59[a]	6.81[a]
Control (950)	8.22	8.26	8.37	8.33	8.07
$L.S.D_{0.05}$					

Values with the same letter in a column do not differ significantly ($p<0.05$).

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