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Organoleptic Assessment of the Performance of Some Cultivars of *Ipomoea batatas* in the Development of Selected Snack Products

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Abstract: Baking tests were conducted with sweet potato (*Ipomoea batatas*) composite paste at 20% level of substitution with wheat flour to determine their potentials in producing acceptable snack products. Studies conducted shows there was no significant difference ($p>0.05$) in the specific volume of the baked bread samples but there was significant difference ($p<0.05$) in the loaf volume and loaf weight of the sweet potato bread samples. Bread samples from cultivars TIS 87/0087 and TIS 8441 were found to be significantly different ($p<0.05$) from the others in terms of their loaf weight with 357.98 g and 357.03 g respectively. Sensory analysis conducted showed there were significant differences ($p<0.05$) in the sweet potato chips produced in terms of texture. Cultivar Ex-Igbariam was the least preferred in terms of texture compared with the other cultivars with 3.95. There was no significant difference ($p>0.05$) in the taste of the sweet potato cake samples. In terms of texture, cake sample from cultivar TIS 25320P0P - 13 was the least preferred but all the cake samples were generally accepted by the panelist. Most of the cultivars performed well in the food product assessment.

Key words: Sweet potato, paste, snack products, cultivar

INTRODUCTION

Sweet potato (*Ipomoea batatas*) is a dicotyledonous plant which belongs to the family of *convolvulacea*. Among the approximately fifty genera and more than one thousand species of this family, only *Ipomoea batatas* is of major economic importance as a food (Woolfe, 1992). It has been a life saver for centuries in many tropical, subtropical and warmer temperate areas of the world, warding off famine in times of both climatic disaster and war. Sweet potato is the world's seventh most important food crop after wheat, rice, maize, potato, barley and cassava (CIP, 1996). It grows under many different ecological conditions, has a shorter growth period than most crops and shows no marked seasonality (Oke, 1990). Sweet potato plays a major role as a famine reserve for many rural and urban households because of its tolerance to drought, short growth period and high yield with limited inputs on relatively marginal soils (Bashaasha *et al*., 1995; Oduro *et al*., 2000).

Sweet potato is widely grown as a staple food in many parts of the tropical and subtropics, which includes many developing countries where it accounts for about 107 million/tons in production per year. It is exclusively grown in the tropical zone, accounting for about 81% of total world production (Odebode *et al*., 2008). It is a low-input crop and it is used as a vegetable, a dessert, source of starch and animal feed. It is also eaten as a substitute for yam due to its lower cost of production (Odebode, 2004). Sweet potato has also been described as a woman's crop and available all year round (Hagenimana, 1999). The tubers can be boiled, baked, fried or eaten fresh. Sweet potato has the potential of bridging the food gap due to diversified processing and utilization technologies that have been produced but not yet fully exploited (Nungo *et al*., 2007). The colour intensity of sweet potato root flesh differs from one cultivar to another and varies from white to deep orange. The intensity of the colour is attributed to carotenoid content (Ameny and Wilson, 1997). A study on carotenoid content in fresh, dried and processed sweet potato showed that increased consumption of orange flesh sweet potato in either fresh or processed form can contribute in alleviating dietary deficiency of vitamin A (Hagenimana *et al*., 1998). Myriad products can be made using none wheat flours in snack production (Ojinnaka *et al*., 2009). There are many products that can be made from using low priced sweet potato as a major ingredient (Ge *et al*., 1992). Sweet potato processing into products with a taste and appearance similar to other marketable processed items has proven to be cost-effective enough to make them competitive (Omosa, 1997; Hagenimana and Owori, 1997). Sweet potato have also been used in the production of purees and these can be used as an ingredient in various products including baby food, casseroles, puddings, pies, cakes, bread, restructured fries, patties, soups and beverages (Truong *et al*., 1995; Walter *et al*., 2001).

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Sweet potato being a root and tuber crop have two singular traits-perishability and bulkinesss. Sweet potato generally store poorly unlike ginger and cassava. It is inadvisable to leave the tubers in the ground after senescence especially in the dry season because of high incidence of maturity, cracks and pest infestation, particularly *Cylas* sp. (Woolfe, 1992). Limited methods of utilization, lack of industrial or village-level processing of the crop and low levels of commercialization are major constraints to increased production of sweet potatoes. The only major avenue left for preservation of sweet potato is processing into secondary products.

MATERIALS AND METHODS

Source of material: The five cultivars of sweet potato were supplied by the Sweet potato Programme of the National Root Crops Research Institute, Umudike, Abia State, Nigeria. The cultivars supplied were:

- TIS 87/0087
- Ex-Igbariam
- TIS 8441
- TIS 8164
- TIS 25320P-13

The ingredients used for the snack production were purchased from the main market Umuahia Abia State Nigeria. The sweet potato cultivars were washed and peeled after harvesting. The tubers were grated using a grater. 20g of the sweet potato paste was used as substitute for wheat flour in the snack production.

Production of snack products: The five cultivars of sweet potato were used in the production of selected snack products (Bread, Pancake, Buns, Chips, Cake) The Cake samples were prepared using the method of Sanful *et al.* (2010) while the chips were produced using the method of Nungo *et al.* (2007).

Sensory evaluation: The method of Iwe (2002) was used in the sensory analysis. The samples of the sweet potato snack products were organoleptically evaluated using a 20-man panel for taste, appearance, texture, flavor, crispiness and general acceptability. The scoring was based on a 7-point hedonic scale ranging from 1(extremely liked) to 7(extremely disliked) and 4(neither liked nor disliked). The values obtained from the sensory evaluation was statistically analyzed using Analysis of Variance (ANOVA) and mean separation as described by Onuh and Igwemma (1998).

RESULTS AND DISCUSSION

Bread: The results shown in Table 1 shows there was no significant difference ($p>0.05$) detected among the cultivars in terms of their specific volume. Bread from cultivars TIS 87/0087 and TIS 8441 were found to be significantly different ($p<0.05$) from the others in terms of loaf weight with values 357.98 g and 357.03 g respectively. There was significant difference ($p<0.05$) in the loaf volume of the samples. The sample containing 100% wheat flour had the highest loaf volume, 1211.68 cm^3. This was followed by sample from TIS - 25320P-13 with 1139.38 cm^3. The least in the loaf volume, being 1063.11 cm^3 from TIS 87/0087. The sample from 100% wheat performed best because of the visco-elastic property of the gluten it contains which makes it an excellent bakery base.

There was no significant difference ($p>0.05$) in the taste, flavor and texture of the bread samples as can be seen from Table 2. But there was significant difference ($p<0.05$) in the appearance of the samples. The bread sample from 100% wheat flour had value of 2.20 followed closely with that from cultivar Ex-Igbariam with 2.65. There colour were preferred to other samples. However, the poor rating in appearance of the sweet potato sample could be attributed to browning reaction. It was observed that as soon as the peeled sweet potatoes were grated they started darkening due to the browning reaction. This darkening effect is carried into the mixed dough and finally into the bread samples. The more accepted cultivar was that from cultivar Ex-Igbariam for bread making.

Cake: Table 3 shows there was no significant difference ($p>0.05$) in terms of the taste, flavour and general acceptability of the cake samples. In terms of appearance the 100% wheat flour cake was mostly preferred followed by the cake from cultivar TIS 87/0087 and Ex-Igbariam. The least preferred in terms of the texture of the cake samples was that from TIS 25320P-13 with 3.85 value. Sweet potato either fresh, grated, cooked and mashed, or made into flour, could with high potential for success replace the expensive wheat flour in making snack products (Hagenimana *et al.*, 1998).

Table 1: Physical quality characteristics of the loaves baked using raw sweet potato paste at 20% substitution level

	Quality parameters			
Code	Sample	Loaf weight (g)	Loaf volume (cm^3)	Specific volume (cm^3/g)
RSB1	Raw sweet potato paste from TIS 87/0087	357.98c	1063.11f	2.96
RSB2	Raw sweet potato paste from Ex-Igbariam	384.03a	1127.25c	2.93
RSB3	Raw sweet potato paste from TIS 8441	357.03c	1115.35d	3.12
RSB4	Raw sweet potato paste from TIS 8164	349.47e	1086.34e	3.10
RSB5	Raw sweet potato paste from TIS 25320P-13	353.73d	1139.38b	3.22
RSB6	100% Wheat flour	375.13b	1211.68a	3.23

*Values down the columns with different letters are significantly different ($p<0.05$)

Table 2: Effect of 20% level of substitution of sweet potato paste on the quality of baked bread

	Quality parameters					
Code	Sample	Taste	Appearance	Flavor	Texture	Gen. acceptance
RSB1	Raw sweet potato paste from TIS 87/0087	3.35	3.85a	3.60	3.15	3.70a
RSB2	Raw sweet potato paste from Ex-Igbariam	2.95	2.65b	2.55	2.60	2.75e
RSB3	Raw sweet potato paste from TIS 8441	2.95	3.25a	3.50	2.90	3.40c
RSB4	Raw sweet potato paste from TIS 8164	2.95	3.20a	2.95	3.45	3.10d
RSB5	Raw sweet potato paste from TIS 25320P-13	3.50	3.45a	3.30	3.45	3.90a
RSB6	100% Wheat flour	3.60	2.20b	3.20	3.00	2.70e

*Values down the columns with different letters are significantly different ($p<0.05$)

Table 3: Effect of 20% level of substitution of sweet potato paste on the quality of baked cake

	Quality parameters					
Code	Sample	Taste	Appearance	Flavor	Texture	Gen. acceptance
RSB1	Raw sweet potato paste from TIS 87/0087	2.00	2.20b	2.25	2.65b	2.15
RSB2	Raw sweet potato paste from Ex-Igbariam	2.30	2.40b	2.25	2.80b	2.55
RSB3	Raw sweet potato paste from TIS 8441	1.90	2.60b	2.20	2.90b	2.35
RSB4	Raw sweet potato paste from TIS 8164	2.00	2.80b	2.50	2.45b	2.45
RSB5	Raw sweet potato paste from TIS 25320P-13	2.55	3.40a	2.90	3.85a	3.45
RSB6	100% Wheat flour	2.40	1.90b	2.35	2.75b	2.00

*Values down the columns with different letters are significantly different ($p<0.05$)

Table 4: Effect of 20% level of substitution of sweet potato paste on the quality of fried buns

	Quality parameters					
Code	Sample	Taste	Appearance	Flavor	Texture	Gen. acceptance
RSB1	Raw sweet potato paste from TIS 87/0087	3.10	2.20	3.65	2.70	3.50a
RSB2	Raw sweet potato paste from Ex-Igbariam	3.45	2.60	3.45	2.80	3.30a
RSB3	Raw sweet potato paste from TIS 8441	2.85	2.00	2.90	2.55	3.05a
RSB4	Raw sweet potato paste from TIS 8164	3.15	2.25	3.05	2.95	3.30a
RSB5	Raw sweet potato paste from TIS 25320P-13	2.55	2.40	3.15	2.90	3.10a
RSB6	100% Wheat flour	2.60	2.20	2.50	1.95	2.05b

*Values down the columns with different letters are significantly different ($p<0.05$)

Table 5: Effect of 20% level of substitution of sweet potato paste on the quality of fried pancake

	Quality parameters					
Code	Sample	Taste	Appearance	Flavor	Texture	Gen. acceptance
RSB1	Raw sweet potato paste from TIS 87/0087	3.30	2.75b	3.65	2.95b	3.25
RSB2	Raw sweet potato paste from Ex-Igbariam	3.35	3.25a	3.20	3.85a	3.55
RSB3	Raw sweet potato paste from TIS 8441	3.85	2.65b	3.00	3.65a	3.15
RSB4	Raw sweet potato paste from TIS 8164	3.45	2.60b	3.30	3.55a	3.35
RSB5	Raw sweet potato paste from TIS 25320P-13	2.05	2.35b	2.70	2.60b	2.70
RSB6	100% Wheat flour	2.45	2.30b	2.30	2.25b	2.40

*Values down the columns with different letters are significantly different ($p<0.05$)

Buns and pancakes: There were no significant difference ($p>0.05$) in the taste, appearance, flavor and texture of the fried buns samples. All the five sweet potato cultivars showed very high level of acceptance by the panelist with their values ranging from 3.05-3.50. This means that these five cultivars can be used for commercial production of buns for marketing to consumers. Sweet potato based products are of high quality and could compete with existing products in the market (Hagenimana and Owori, 1997).

These five cultivars used for pancake production showed significant differences ($p<0.05$) in the texture and appearance. The texture of pancake samples from the 100% wheat flour, cultivar TIS 87/0087 and TIS 25320P-13 were preferred to the other cultivars with values 2.25, 2.60 and 2.95 respectively. This translates to moderately liked in the hedonic scale used. The least preferred in terms of the texture was that from cultivar Ex-Igbariam with value 3.85.

Chips: Table 6 shows that significant differences could not be detected in the chips in terms of taste, appearance, crispiness and general acceptability. However, there was significant difference ($p<0.05$) in the

Table 6: Mean sensory analysis of sweet potato fried chips

Code	Sample	Quality parameters: Taste	Appearance	Crispiness	Texture	Gen. acceptance
RSB1	Chips from cultivar TIS 87/0087	1.95	1.95	1.85	1.95b	1.90
RSB2	Chips from cultivar Ex-Igbariam	2.30	2.00	2.10	3.95a	2.15
RSB3	Chips from cultivar TIS 8441	1.60	1.80	1.65	1.85b	1.75
RSB4	Chips from cultivar TIS 8164	1.65	1.75	1.85	1.95b	1.75
RSB5	Chips from cultivar TIS 25320P-13	1.45	1.75	2.10	2.10b	1.60
RSB6	Chips unripe plantain	1.75	2.10	1.65	2.15b	1.65

*Values down the columns with different letters are significantly different ($p<0.05$)

texture of the chips from the sweet potato cultivars. Chips from cultivar Ex-Igbariam was stronger in texture that the other cultivars and had the value of 3.95. This could be attributed to the strong nature of the Ex-Igbariam cultivar. Nungo *et al*. (2007) also observed that sweet potato chips were well accepted by consumers during a study carried out in Western Kenya. Sweet potato being a starch commodity whose proximate composition, mineral and vitamin content in vitamin A (Woolfe, 1992) is comparable to various fruits. Its usage in chips production should be highly encouraged especially for children and adult consumption.

Conclusion: Due to the high perishable nature of *Ipomoea batatas*, there is need for encouragement of the use of the paste of this tuber crop for snack production so as to minimize post harvest losses being experienced every year. Also diversified sweet potato utilization has an indication for improving food security and local household incomes of the region.

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