Journal of Agriculture and Social Research (JASR) VOL. 10, No. 2, 2010

POTENTIALS OF SWEETPOTATO (*Ipomoea batatas*) FOR CONFECTIONARIES: IMPLICATIONS FOR FOOD SECURITY

OTI, E* AND ANIEDU, C.
Post-harvest Technology Programme,
National Root Crops Research Institute (NRCRI),
Umudike, P.M.B. 7006, Umuahia, Abia State, Nigeria.
***Corresponding author. Email: canonaniedu@yahoo.com**

ABSTRACT
Sweetpotato roots were used as base for the preparation of confectioneries namely crisps, doughnuts, strips, chin-chin, bread, cakes biscuits, pancake, crunch and muffins. Sweetpotato starch was used to produce salad cream and the leaves were used to prepare stew and soup. Traditional foods including abacha, ncha, wrap, morn, balls and fufu were produced from the roots. All the products were subjected to sensory evaluation and were acceptable to consumers. The study has revealed the high potential of sweetpotato as base food for preparing confectioneries, salad cream and assorted traditional foods. An aggressive exploitation of the crop is recommended to ensure good nutrition for all and national food security.

Key words: confectioneries, food products, sweet potato

INTRODUCTION
Sweetpotato *(Ipomoea babatas)*is an important staple food crop providing essential minerals, vitamins and carbohydrates in the diets of many people in the tropics (Onwueme, 1978). Sweetpotato is mostly grown for the edible roots but also for the leaves which are a good source of minerals and vitamins (Kay, 1983). Sweetness is an undesirable quality in a staple (Almazan, 1986); however, the sweetness of sweetpotato increases on cooking as a result of starch breakdown into sugar (mainly maltose) and dextrins by amylases at the initial stage of cooking (Kaunagai *et al*., 1990). A great deal of effort is being directed towards improvement and promotion of sweetpotato (Woolfe, 1992) and the nutritional qualities of the crop justify the effort. Sweetpotato is a fair source of lipids and has low fiber content. Its protein content is on the average 1.5% (Bradbury and Holloway, 1988) and the carbohydrate content of the flour derived from it is 83.4% (Woolfe, 1992). The crop contains significant quantities of the antioxidants beta-carotene, vitamin C and Vitamin E which can be preferentially oxidized thus inhibiting the formation of free radicals which have been implicated in the development of coronary diseases and cancer (FAO, 1990).

Sweetpotato contains anti-nutritional factors among which is the flatulence factors raffinose, stachyose and vebascose (FAO, 1990). Lin *et al*. (1985) have established that sweetpotato shows trypsin inhibitor activity ranging from 20% to 90%; however, heating to 90oC for a few minutes inactivates this inhibitor. Sweetpotato is one of the under-exploited root crops in Nigeria. The use of sweetpotato grated roots and flour in bakery products particularly in bread making has been attempted in several countries including the Phillipines, Trinidad and Tobago, Burundi and Peru (Woolfe, 1992). A recipe utilizing 25% sweetpotato flour in making "puff-puff" (a local deep-fried doughnut – like snack) and another utilizing 40-50% sweetpotato flour for fish/meat pie production have been tested and well received in Cameroon (Odaga and Wanzie, 1993). The objectives of this study are to:

- explore the feasibility of using sweetpotato flour as a substitute for wheat flour in bread and other confectioneries production and

- exploit the nutritional potential of sweetpotato leaves.

MATERIALS AND METHODS

The sweetpotato roots and leaves used for the experiments were obtained from the Sweetpotato Programme of National Root Crops Research Institute (NRCRI). Freshly harvested mature roots and leaves were used for the experiments. The wheat flour used for confectionery production were purchase from Umuahia Main Market.

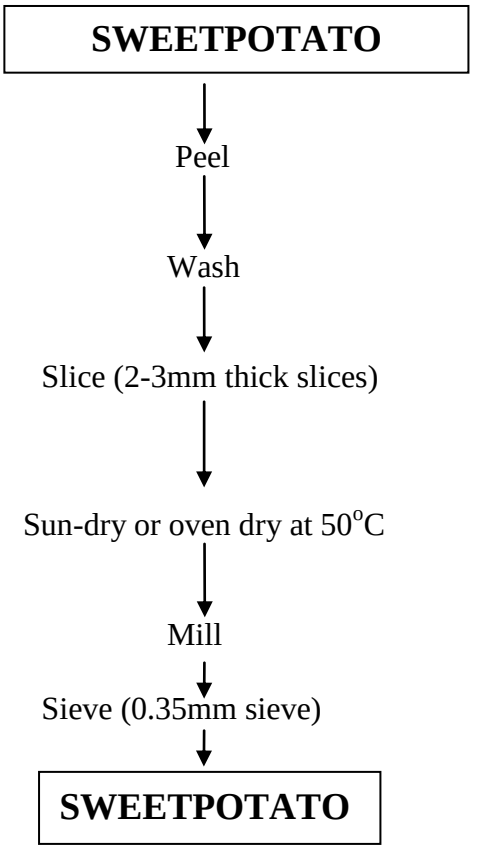

Fig. 1: Flowchart for processing sweet potato roots into flour.

Fig. 1 is a flow chart for processing sweetpotato roots into flour used for the confectionery production. Some of the recipes used in producing the confectioneries were formulated by adapting the recipes for cassava-based confectioneries (Onabolu *et al.*, 1998) and those of Oji (1999) for utilization of root and tuber crops in Nigeria. Novel recipes (recipes developed by the authors *ab initio*) were also employed in making traditional sweetpotato based foods. Golden chips (Irish potato chips) produced by SANKIL NIG. Ltd., Lagos, were used as control for sweetpotato crisps, whereas control samples for the other sweetpotato confectioneries developed were prepared from 100% wheat flour. However, the sweetpotato bread was made from wheat/sweetpotato composite flour (9:1v/v).

Sensory evaluation was carried out to determine the acceptability of the products using a 7-point hedonic (degree of liking) scale. The evaluation was carried out with a 25-man taste panel drawn from staff of NRCRI and student of Michael Okpara University of Agriculture, Umudike.

RESULTS AND DISCUSSION

The sweetpotato based crisps, doughnuts strips,pancake bread, cake, muffins, crunch and biscuits produced were acceptable to the taste panelists (Table 1), although the taste panelists strongly tended to prefer confectioneries from 100% wheat flour. However, the result for *chin-chin* was an exception, in that the panelists found sweetpotato *chin-chin* more acceptable to that of the control (samples produced from 100% wheat flour), although no significant differences ($P<0.05$) existed among the samples.

Table 1: Sensory qualities of sweetpotato based confectioneries and their controls.

***Sensory Attributes**

Confectionery	Colour	Flavour	Texture	General Acceptability	Control food Products
Sweetpotato crisps	5.9±0.1 (5.8±0.2)**	6.1± 0.3 (5.5± 0.3)	6.1± 0.2 (5.5± 0.1)	6.5± 0.2*** (6.0± 0.3)	Cocoyam crisps
Sweetpotato doughnut	5.2± 0.1 (6. 8± 0.4)	6.3± 0.3 (6.3± 0.2)	5.8± 0.1 (5.8± 0.2)	5.8± 0.3*** (6.4±0.2)	Wheat doughnuts
Sweetpotato strips	5.9 ± 0.3 (6.9 ± 0.1)	6.5± 0.0 (6.5± 0.2)	5.7± 0.3 (6.2± 0.4)	5.9± 0.2*** (6.5± 0.1)	Cassava strips
Sweetpotato chin-chin	6.1± 0.3 (6.2± 0.3)	5.2± 0.0 (5.3± 0.1)	5.8± 0.2 (5.9± 0.2)	6.3± 0.3 (6.2± 0.2)	Wheat chin-chin
10% Sweetpotato bread	6.0± 0.1 (6.2± 0.3)	5.7± 0.2 (6.1± 0.1)	5.5 ±0.3 (6.2± 0.4)	6.1± 0.2*** (6.4± 0.3)	100% Wheat bread
Sweetpotato cake	5.2± 0.0 (6.0± 0.1)	5.2 0.1 (6.0± 0.1)	5.2± 0.3 (5.9± 0.1)	5.3± 0.2*** (6.1± 0.2)	Wheat cake
Sweetpotato biscuits	5.5± 0.4 (5.6± 0.3)	5.7± 0.3 (5.8± 0.2)	5.1± 0.3 (5.6±0.1)	5.8± 0.1*** (6.0± 0.2)	Wheat biscuits
Sweetpotato pancake	4.7± 0.0 (5.8± 0.1)	5.4± 0.2 (5.2± 0.3)	5.3± 0.2 (5.6± 0.2)	5.4± 0.3*** (5.7± 0.2)	Wheat pancake
Sweetpotato crunch	5.5± 0.2 (5.7± 0.0)	6.1± 0.3 (5.7± 0.1)	6.0± 0.2 (5.5± 0.3)	6.0± 0.3 (5.7± 0.2)***	Wheat crunch
Sweetpotato muffins	4.0± 0.4 (6.0±0.3)	5.0± 0.2 (6.0± 0.2)	5.8± 0.3 (4.9± 0.2)	5.2± 0.1*** (6.2± 0.3)	Wheat cake

* 7-point hedonic scale.

** Figures in parenthesis are for control samples (samples produced from 100% wheat flour).

*** Significant differences between sweetpotato based product and control sample.

In Table 2, the result also showed that all the other (non-confectionery) food forms developped from sweetpotato namely *abacha, ncha,* wrap, *morn,* balls, salad cream, *fufu,*

stew and soup were acceptable to the taste panelists, but the control samples were preferred. However, the sweetpotato morn was an exception. The taste panelists found the sweetpotato morn sample more acceptable than the control (Quaker oats), although no significant differences ($P<0.05$) existed among the samples.

Table 2: Sensory qualities of (non-confectionery) sweetpotato based foods and control food products.

***Sensory Attributes**					
Non-confectionery Sweetpotato based foods	**Colour**	**Flavour**	**Texture**	**General Acceptability**	**Control food products**
Sweetpotato *Abacha*	5.1±0.2 (5.7±0.2)**	5.5±0.3 (5.0±0.1)	5.4±0.2 (5.4±0.3)	5.8±0.1*** (5.3±0.1)	Cassava *abacha*
Sweetpotato *Nsisa*	5.6±0.0 (6.2±0.1	5.4±0.2 (6.2±0.3)	6.0±0.1 (6.4±0.2)	6.1±0.3*** (6.7±0.4)	Cassava *Nsisa*
Sweetpotato Wrap	5.8±0.2 (4.5±0.3)	6.0±0.1 (4.6±0.1)	5.5±0.2 (4.4±0.3)	5.7±0.3*** (4.5±0.3)	Plaintain wrap
sweetpotato *Morn*	4.5±0.4 (5.8±0.3)	5.1±0.0 5.4±0.1)	5.2±0.2 (5.7±0.3)	5.6±0.3 (5.5±0.2)	Quaker oats
Sweetpotato Balls	5.2±0.2 (5.6±0.1)	5.9±0.4 (5.3±0.2)	5.8±0.3 (4.5±0.3)	5.8±0.1*** (5.2±0.3)	Yam balls
Sweetpotato Salad cream	5.6±0.2 (6.5±0.4)	5.5±0.3 (6.3±0.2)	5.6±0.4 (6.3±0.1)	5.8±0.2*** (6.1±0.3)	HENIZ Salad cream
Sweetpotato *Fufu* (from fermented flour	5.0±0.1 (4.6±0.2)	5.1±0.3 (5.3±0.2)	5.3±0.1 (5.7±0.3)	5.2±0.2*** (5.6±0.3)	Pounded yam
Sweetpotato Leaf stew	5.9±0.3 (5.8±0.3)	5.9±0.2 (6.0±0.1)	5.8±0.3 (5.8±0.4)	6.3±0.3*** (6.1±0.0)	Spinach leaf stew
Sweetpotato leaf soup	5.9±0.0 (6.2±0.3)	5.8±0.2 (6.1±0.2)	5.6±0.3 (6.2±0.4)	6.1±0.1*** (6.6±0.3)	*Telfairia* leaf Soup

*7-point hedonic scale.
** Figures in parenthesis are for control samples.
*** Significant differences between sweetpotato based product and control sample.

The results obtained from these experiments are indeed encouraging when they are related to the current status of sweetpotato as a food crop in Nigeria. Sweetpotato is an under-exploited crop in Nigeria; at the best it is rated as food for the poor and there has been little or no research on diversification of its food uses in the country. However, the information generated from this study strongly suggest, that sweetpotato can be matched with cassava, the latter's very high potential for production of diverse food forms notwithstanding.

IMPLICATIONS FOR FOOD SECURITY AND INCOME EARNINGS

The findings have shown that sweetpotato crop (roots and leaves) can be used for production of a wide range of diverse food forms and should be aggressively exploited. Extensive and intensive use of sweetpotato for production of confectioneries and other food forms has the potential of reducing the use of cassava as food crop and enhancing its status as export crop. Furthermore, the use of sweetpotato will not only result in improved nutrition of consumers of root crops in Nigeria but also ensure national food security.

REFERENCES

Almazan, A. M. (1986). Selecting non-sweet clones of sweetpotato from the IITA germplasm collection. In: Terry, E.R., Akoroda. M.O., and Arene, O.B.(eds.). Root Crops and the African Food Crisis: Proc. 3rd Treinnial Symp. ISTRC-AB, Owerri, Nig., 17-23 Aug., 1986.

Bradbury, J.A. and Holloway, W.D. (1988). Chemistry of Tropical Root Crops: Significance of Nutrition and Agriculture in the Pacific. In: Product Development for Root and Tuber Crops Vol. III. Gregory J. Scott and Princess Ferguson (eds.).

FAO (1990). Food and Nutrition Series, No. 24. Roots, Tubers, Plaintain's and Bananas in Human Nutrition.

Kay, D.E. (1983). Root Crops. Tropical Products Institute, Lond., UK. Crops and Products Digest 2.

Kumagai, T.Y., Umemura, I.B. and Iwanga, M. (1990). Inheritance of amylase null in storage roots of sweetpotato (*Ipomoea batatas*). Theoretical and Applied Genetics 70(3): 369-376.

Lin, S.S., Peet, C.C., Ghen, D.M.and Lo, H.F. (1985). Sweetpotato production and utilization in Asia and the Pacific. Bouwkam, P. (ed.). Sweetpotato products: A Natural Resource for the Tropics, CRC Press, Boca Raton, Florida.

Odaga, A. and Wanzie, R. (1993). The Use of Sweetpotato in Bakery Products in Cameroon. Product Development of Root and Tuber Crops Vol. III. Gregory, J.I. Scott and Princess fergoson (eds.).

Oji, M.A. (1999). Foods from Roots and Other Crops. New Africa Publishing Co. Ltd. Owerri, Imo State, Nigeria xi + 72pp.

Onabolu, A., Abbass, A. and Bokanqz`ga, M. (2003). New Food Products from Cassava. 2nd edition. IITA, Ibadan, Nigeria, 40pp.

Onwueme, I.C. (1978). The Tropical Root Crops. Chichester, UK. John Wiley, 234pp.

Woolfe, J.A. (1992). Sweetpotato: an untapped food resource. Cambridge University Press, published in collaboration with the International Potato Centre, Lima, Peru.

Appendix 1: Recipes for non-confectionery sweetpotato based foods.

Food forms	Ingredients	Methods of preparation
Abacha	Sweetpotato	Peel sweetpotato root; wash thoroughly and steep in waster in a pot; boil in water till done; allow to cool; slice with kitchen knife

		thinly (3-4cm wide and 4-5cm long); steep in water for 24 hrs; de-steep and wash thorough to yield *abacha.*
Ncha	Sweetpotato *abacha* 500g Cooked *odudu*(African yam beam) or *Ukpaka* (oilbean, *Pentaclethra macrophylla*) 200g Palm oil 60ml Pepper To taste Salt To taste Water as required Cooked fish/meat (optional) as required Onion 1 medium size Maggi 1 cube *Kenwa* (trona, sodium sesquicqrbonate) 15 cube *Utazi (Congronema latifolium)* 50g	Make a solution of trona; add palm oil and stir, add *odudu* or *ukpaka* and fold into the mixture; add *abacha*, pepper, salt, and maggi cube and stir vigorously; add pieces or meat or fish; garnish with onion and *utazi.*
Wrap	Grated sweetpotato 675g Crayfish flour 100g Fresh pepper To taste Salt To taste Onion 1 medium size Maggi 1 cube Palm oil 60 ml Aluminum foil (for wrapping) as required	Add ground crayfish, onion, pepper, magi and salt to grated sweetpotato in a bowl and mix thoroughly, wrap the mixture with aluminum foil and steam for about 30 min.
Morn	Garified sweetpotato* 100g Water 960 ml Milk 960 ml Sugar 40g	Add garified sweetpotato to boiling water in a pot and stir vigorously for about 5mm; remove from heat and add sugar and milk.

Fufu(reconstituted from fermented sweetpotato flour)	Fermented* sweetpotato flour 200g Water 250 ml	Bring the water to boil and stir-in the sweetpotato flour; continue stirring vigorously for about 3 minutes, additing water if necessary until dough of desired consistency is obtained.
Sweetpotato leaf stew	Fresh tomato 500g Fresh pepper To taste Onions 1 medium size Meat 1 kg Vegetable oil 120 ml Maggi 2 cubes Salt To taste Curry 10g Thyme 10g Fresh sweetpotato leaves 500g Water as required	Pick the sweetpotato leaves, blanch and drain; grind the fresh tomato and pepper and chop-up the onions; cut up the meat into desired sizes and cook in water with a cube of magi, curry, thyme, salt and some onion until tender, pour the oil in a pot, heat, add onions and fry for about 2 minutes; add the fresh tomato and pepper and fry until dry; add the cooked mean and simmer for 5 minutes; add the blanched sweetpotato leaves, stir carefully and remove from heat.
Sweetpotato leaf soup	Egusi 500g Fresh tomato 200g Fresh pepper To taste Onions 1 medium size Meat 1 kg Dry fish 200g Cray fish 50g Maggi 2 cubes Salt To taste Palm oil 120ml Fresh sweetpotato leaves 500g Water as required	Grind the egusi, crayfish, fresh tomato and pepper and chp-up the onions, cut the meat into required sizes, pick the fish and wash; cook the meat and fish in water with a cube of magi, some onion, and salt; pick the sweetpotato leaves, blanch and drain; heat the oil in a pot, add the remaining oil and heat for 3 minutes, add the fresh tomato and pepper and stir for 10 minutes; add crayfish to the simmering mixture, stir for another 10 minutes; add the blanched sweetpotato leaves, stir and remove from heat.

*Sweetpotato grated, dewatered and toasted.