

SWEETPOTATO RESEARCH AT KNUST (KWAME NKRUMAH UNIVERSITY OF
SCIENCE AND TECHNOLOGY)

ABSTRACTS OF SELECTED WORKS (PART 2)

INTRODUCTION

Sweetpotato, *Ipomoea batatas* is a versatile root crop grown in all parts of tropical and subtropical world. It is valued for its short growing period of 90 to 120 days, high nutritional content and its sweetness. Despite these values, it has not gained popularity in Ghana due to minimal integration into the average Ghanaian diet. Limited product diversity coupled with little awareness of its potential benefits and physical properties could account for its low consumption in Ghana. These notwithstanding, the unavailability of ready market and storage limitations that cultivators, mostly in northern Ghana have to grapple with, possess great challenges. It is against this background that several studies have been conducted in the Food Science & Technology and Biochemistry & Biotechnology Departments to investigate the nutritional qualities, physicochemical properties as well as the potential of product diversities from different varieties of sweetpotato. Studies on sweetpotato leaves and root tubers have yielded good results though further studies are required to consolidate some findings. This will enhance broad utilization of sweetpotatoes which will be of economical advantage to the country, while encouraging many farmers to go into its cultivation

1. Sweet potato Non-Alcoholic Beverage

Sweet potato tubers were processed into non-alcoholic beverage flavoured with citrus lime and ginger. Two varieties namely Faara and Sauti were used. The following parameters were determined; pH, total sugars, total solids, vitamin C and vitamin A. Sensory evaluation was conducted to assess the acceptance preference of the product. The result of total titratable acidity (TTA) ranged between 0.45-1.6 with lime flavoured having higher TTA than the ginger flavoured. Total solids varied significantly and ranged from 12.57-13.78 with Faara having higher values than Sauti. Vitamin C content was generally low because of the heat treatment. The beverage was thus fortified with ascorbic acid. Vitamin A content ranged from 44.8 – 101.08 $\mu\text{g L}^{-1}$ with Faara variety having higher vitamin A equivalent. The sensory results showed that significant differences existed between different flavoured samples and not between

varieties. Generally the beverage had good consumer preference with the ginger flavoured being the most preferred. The properties of the sweet potato non-alcoholic beverage are within the range of fruit juices; drinks and non-alcoholic beverages thus can serve the purpose of already existing fruit drinks/beverages.

2. Breakfast meal from sweet potato/rice composite

In order to enhance the consumption of sweet potato due to its nutritional advantages, it is important to combine it with a popular dish like rice which is the most important tropical cereal. One variety of sweet potato (Sauti) and four varieties of rice (Tox 3142, 3108-brown, Sikamo-white, 3142-white) were mixed in various composite proportions. Proximate analysis and physicochemical properties such as bulk density, specific gravity, gelation and dispersability were determined. All samples bound to water two to three times their weight, but degree of water bind capacity increased with increased rice percentage had the higher bulk densities and specific gravity. The bulk density of the samples ranged from 0.58 to 0.73. Tox3142 had the highest protein content (9.79%) while SP100 had the least (4.38%). Sensory evaluation revealed that product (porridge) containing 100% sweet potato (SP100) had the highest preference score in all the sensory attributes evaluated when they were made to compete with products from the Ghanaian market. While breakfast meal made solely from sweet potato can be developed, products made from rice and sweet potato composites (with higher rice proportions) can also be encouraged.

3. Proximate analysis on a formulated weaning food using sweet potato and soybean flour

This study also seeks to formulate a nutritious weaning food from the best sweet potato and soybean composite proportions that would be afforded by nursing mothers. Proximate analysis were carried out on six composites of soybean (Anidaso variety) and sweet potato (Kamara and Mogamba varieties) in the ratios 25:75, 50:50, and 75:25. Flour composites of kamara sweet potato with 50% and 75% proportions of soybeans were higher in crude protein(27.20, 29.05), and crude fat content (12.2, 14.01), comparable to Mogamba sweet potato. However the fibre

(2.09) and carbohydrate content (44.04) were lower in those proportions than composites with higher sweet potato (2.9, 53.64). Only flour composite proportion of 75:25 sweet potato/soybean had low crude fat and fibre content but retained an appreciable protein and carbohydrate content, with the Mogamba sweet potato variety being even better. Based on the Standard Formulation Guidelines for commercially processed weaning food blends, it is important to keep the fibre and fat content low with a higher protein content, therefore sweet potato and soybean flour composite with higher sweet potato ratios will be most suitable in formulating a nutritious but less expensive weaning foods for infants.

4. Screening of sweet potato for poundability into fufu

Sweet potato is a nutritious, high energy food crop but it is not well integrated into the average Ghanaian diet due to its limited product diversity. In line with a wider effort to broaden its utilization base by developing products that fit into already existing food patterns 13 sweet potato accessions were screened for their suitability in making fufu. Fufu is a popular food in Ghana usually prepared by pounding boiled yam, cocoyam or plantain in combination with boiled cassava into a smooth paste and eaten with soup. It is highly acceptable to consumers if it has a cohesive, elastic texture. The objective of this work is to identify sweet potato varieties that have acceptable pounding qualities in order to encourage their utilization alongside the starchy staples that are already widely consumed in the country. In this preliminary work, the parameters studied were optimum cooking time, total soluble sugars, pounded texture and overall eating quality. Cooking time ranged from 8 to 15 minutes and total soluble sugars range of 6.06-27.12%. Among the 13 accessions, 4 were identified as having acceptable fufu quality and one particular accession was adjudged to have excellent fufu quality.

5. Physicochemical and pasting properties of flour from four sweet potato varieties in Ghana

Flours were obtained from four varieties of sweet potato (Sauti, Santum pona, Faara and Okumkom) recently released in Ghana. The sweet potato flours were prepared by peeling the tubers, chipping, soaking in 0.5% sodium metabisulphite solution and washing in water prior to drying in a solar tent dryer. The dried chips were milled and sieved to obtain the flour. Physicochemical and pasting characteristics of the flours were determined. Wheat samples (Hard and Soft), which served as reference, were also analyzed. The findings showed that moisture levels of the flours were low (9.67-11.81%). The ash content (1.26-2.33%) and crude fibre (1.9-3.00%) of the sweet potato flours were higher than the wheat flour with the exception of Santum Pona (1.9%). The crude protein and fat contents were low, ranging from 1.31-3.72% and 0.94-1.32% respectively. The carbohydrate and total sugar levels for the flours were high 70.09-83.19% and 20.51-32.65% respectively. The swelling power (9.04 and 10.06%) and water binding capacity (160.87-178.65%) for the sweet potato flours were higher than that for wheat flour (7.3-7.87% and 63.22-64.98% respectively). The significant variation in pasting characteristics of the flour samples may be due to variety. The flour from sweet potato has a potential of being a good substitute for wheat flour. Further studies were conducted on possibility and acceptability of a baked product (roc buns) from flour composite (70% sweet potato of three varieties and 30% wheat). Although sensory analysis of the roc buns from the flour composite did not yield results comparable to that from only wheat flour in terms of color, taste, texture and flavor, the roc buns with the Dugbadza variety had widest acceptability among the three sweet potato varieties used. It is therefore recommended that further studies should be conducted on other varieties of sweet potato flours in order to find out those which will be comparable to wheat flour products.

6. Nutritional studies on some sweet potato vines

Studies on the vines of three varieties of sweet potato namely, Faara, Sauti and Santum pona, showed significant differences amongst the various parts of the different varieties with respect to fat, ash, protein, crude fibre and minerals. The leaves of all the varieties had the highest protein (10.74-9.98%) and fat contents (3.36-2.61%), followed by the stems and petioles respectively. The petioles had the highest percentages in terms of moisture and ash. With the exception of iron, potassium, sodium and phosphorus levels were appreciably high in the vines. Thus sweet potato vines have potentials in supplying various nutrients.

7. Establishment of optimum processing conditions for cassava/sweet potato composite gari

Response surface methodology was used to investigate the combined influence of three independent variables in the processing of composite gari from cassava and sweet potato. Processing conditions such as cassava/sweet potato ratio (C/SP), fermentation time and frying time were selected as independent variables. Transformed values of the independent variables were subjected to multiple regression analysis to establish a full model. Based on the coefficient values of the independent variables obtained from the regression equation, it was clear that both the fermentation time having the with maximum values 48-54hours and the frying times also with maximum value of 30 minutes had significant effect on the physical and physicochemical attributes of the composite gari product such as the moisture content, ash content, swelling capacity, acidity, color and particle size. The derived equation was used to plot the response surface plots at fixed cassava/sweet potato ratios of 0.9, 0.8, and 0.6. thus the derived equation and the response surface plots helped in predicting the optimum processing conditions for the cassava/sweet potato composite gari using the conventional processing method.

8. Determination of total protein and hemoglobin levels in the blood of male wistar rats fed on weaning diets formulated with sweet potato and soybean

A weaning food was formulated using two varieties of sweet potato (kamara and Mogamba) as the carbohydrate base fortified with soybean (Anidaso variety) as a protein source. Six composite samples were prepared from varying proportions of sweet potato and soybean. The composites were fed to 21 day old male wistar rats for 28 days. A group of the rats were also fed on maize fish meal which served as the control diet. At the end of the 28th day, blood samples of the rats were collected and the total protein and hemoglobin (Hb) concentrations in their blood serum were determined. The total protein levels of all the rats increased generally but those fed on composites 103 and 203 showed the highest increase in total protein, which is 78.69% and 72.46% respectively. Also, there was a general increase in the Hb levels of all the rats but those fed on composites 102 and 103 showed the highest increase being 50.31% and 44.31% respectively. Sweet potato and soybean in the ratio of 50:50 can therefore be used to formulate a highly nutritious but less expensive weaning food for infants.

9. Minimal processing and shelf-life studies of sweet potato chips

In order to combat the annual loss of food and periodic food shortages that affect Ghana and the world as a whole, there is the need to invent new methods of food preservation so as to prevent harvest losses. Two varieties of sweet potatoes, faara and Santom pona, were used for the analysis. It was necessary to determine the effect of storage on some sensory attributes of the sweet potato chips. The two sweet potato varieties were minimally processed into chips and subjected to pre storage steaming treatment. The processed samples were then stored in a freezer at -20C and the consumer acceptability of the fried products was then determined for six weeks based on the sensory parameters; color, texture and taste. The product based analysis for both varieties of sweet potatoes showed a general acceptability of the fried product, with the response for faara being relatively higher than that for Santom pona.

10. Minimal processing of yam and sweet potato

In order to maintain freshness and enhance convenience in the use of yam and sweet potato to the consumer it is vital to determine the effect of storage on the sensory quality of yam (pona and Prunjo) and sweet potato (Faara and Santom pona). Yam slices (small, medium, large), yam chips and sweet potato were subjected to two types of pre-treatments; steaming and parboiling. These samples were stored at -20C over a period of 12 weeks and sensory evaluation was conducted at two-week interval over the period. Product based analysis for faara and Santom pona showed no significant change in responses for the sensory parameters; taste, color, texture and size over the storage period of 12 weeks. For pre-treatment acceptability of products was the same for both parboiling and steaming. This study has shown that Santom pona and faara can be successfully minimally processed and would enjoy consumer satisfaction irrespective of the method of pre-treatment over the period of 12 weeks. The pona variety of yam showed significant differences for all the sensory parameters over the period of study, for the product-based analysis. There was general acceptability for boiled yam, however analysis of variance for taste and size indicated significant differences in their responses over the period of analysis. Consumer-based testing showed a general acceptability for the sensory parameter; taste, color, texture and size were general acceptability for pona (boiled). With the exception of size, analysis of variance for all the sensory parameters indicated no significant differences. There general acceptability for steamed pona (chips and slices), with analysis of variance showing significant differences for the sensory parameters, to indicate variation in the response over the period of analysis. Steamed products of pona yam were more accepted than boiled ones but generally responses for sweet potato were better than the pona yam.

11. Sensory evaluation of cassava and sweet potato wheat composite flour products

Sensory analysis on the three varieties of sweet potato wheat composite flour and four varieties of cassava wheat composite flour were studied to find out the best alternative for wheat flour in the baking industry. Seventy percent of hard wheat flour was mixed with 30% of each of the varieties of potato or cassava flour and 20% of the soft wheat flour was mixed with 80% of each variety of sweet potato or cassava flour to obtain the composite flours. Among the cassava wheat

composite, Afisiafi wheat composite flour for bread and cake was most preferred. For the sweet potato wheat composite, Sauti wheat flour cake and faara wheat composite flour bread were the most preferred. Of all the cake samples, sample SSB (Sauti+soft wheat flour cake) was most preferred cake sample. Results were also comparable to soft and hard wheat flour products indicating the acceptance of sweet potato wheat flour composite in the baking industry as substitute for wheat flour.

12. Production of custard powder from sweet potato starch

In an attempt to find another use of sweet potato, its starch was extracted using the traditional extraction method from three sweet potato varieties namely Sauti, L-Red and Dugbadza. The starch was dried using the solar tent dryer and the tray dryer after which the dried starch was made into powdered starch product with two different treatments; with and without sugar. Assessing the products in terms of its nutritional content and physicochemical properties revealed that they compared favorably with the commercial custard. Sensory evaluation also showed that samples from Sauti were most preferred even though those of L-Red showed good characteristics. Thus sweet potato is a potential tuber in custard production.

CONCLUSION

These studies on sweetpotatoes have demonstrated that this root crop has potential for product diversity and vast utilization. The general acceptability of the sweetpotato food products by the sensory panelists is also an indication of the possibility of its success on the Ghanaian market which will promote consumption like other root crops. Boarding schools and the school feeding program introduced by the government can take advantage of integrating products of this crop with their menus in order to encourage consumption among school children.

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