Determination of the Effect of Steeping and Blanching Pretreatments and Drying Temperatures on the Proximate Properties of White-Fleshed Sweet Potato Variety

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***Abstract*—** *Agricultural products require suitable preservation methods for retention of their nutritional qualities and attributes. Sweet potatoes are underutilized due to cost implications of their preservation using modern storage techniques. Enzymatic discoloration of freshly cut potato flesh surfaces from exposure to air affects processed potato qualities adversely. While steeping/blanching pretreatment is deployed in curbing this challenge, varying the steeping/blanching and drying treatments can assist in arriving at the optimum process conditions for white-fleshed sweet potatoes. 4 kg of similarly sized and healthy white-fleshed sweet potato tubers obtained from Eke Awka market (Latitude 6.210528 °N and Longitude 7.072277 °E) in Anambra state, Nigeria, was washed with clean tap water, peeled and cut into 4 mm by 10 mm by 10 mm slices. The experiment was designed using the Response Surface Methodology (RSM) software. The chipped potatoes were divided into 24 samples of 100g each for the analysis. 19 samples were pretreated in water at temperature range of 11ºC to 100ºC and 5 samples were not pretreated (served as control). All the pretreated samples were held in the fluid for period of 2 mins to 18 mins as contained in the design matrix. Both the pretreated and control samples were grouped and dried in convective oven at set temperatures of 53 °C, 60 °C, 70 °C, 80 °C and 87 °C and weighed every 30 mins until there was no further weight loss at three consecutive readings. The dried sweet potato chips were grated into flour, for the determination of the proximate composition of the chips. Optimized drying and pretreatment conditions were analyzed from the results using RSM software. Result of the analysis showed significant increase in proximate composition of the samples with increase in both the steeping and drying temperatures and indicated significance of the model terms. The error analysis showed a high degree of correlation between the observed and the predicted values. From this work the optimal conditions predicted by the RSM model were blanching temperature of 70 ºC, blanching time of 5 mins and drying temperature of 80 ºC for 4 mm-thick 100g of sliced white-fleshed sweet potato chips to yield 2.40% Crude protein, 73.95% Carbohydrate, 2.54% Fiber, 4.31% Ash, 3.24% Fat and 9.86% Moisture content which served as a guide for high quality sweet potato chips production from freshly harvested white-fleshed sweet potato tubers. The dried potato chips can be grated into flour and used as the major ingredient for bread, noodles and cake making. The application of the outcome of the work will help in reduction of post-harvest losses of the crop.*

Keywords*— *Sweet potato chips, Steeping/blanching pretreatment, Steeping temperature, Steeping time, Drying temperature.

I. INTRODUCTION

Sweet Potatoes (*Ipomea batatas*) are among the world's major food crops and most consumed herb belonging to the family of *Solanaceace* (Rahman *et al.*, 2015). It is rich in active ingredients such as Vitamins B_1, B_3, B_6 and C, minerals, antioxidants, fiber, carbohydrate (Kingsford, 2021; Saraiva and Rodrigues, 2011), with the leaves and tubers as the most vital parts of the plant. In some African countries such as Guinea, Liberia and Uganda, the young tips of the vine and young leaves are valuable as they are usually eaten as vegetable (Orhevba and Abimaje, 2019) and serve as good sources of Vitamins A, C, and B_2 as well as an admirable source of lutein (Carotenoid Pigment). It has variety of sizes and color which include orange, white, and purple fleshed with its origin believed to be Central/South America before it spread to other countries such as Mexico, China, Japan and continent of Africa (Orhevba and Abimaje, 2019). Today, Sweet potato is widely grown and consumed throughout the world and can be used for various purposes in the food industry and households (Arum *et al.,* 2022)

Huang *et al* (2018), Alam *et al*. (2020) and Omodamiro *et al*. (2022) revealed that orange-fleshed sweet potatoes are rich in nutrition including starch, protein, vitamins, polyphenols, and trace elements. Julson (2023) indicated that orange-fleshed sweet potatoes may help improve insulin sensitivity in diabetes and in maintaining healthy blood pressure levels Asadi *et al*. (2017) hinted on the efficacy of Anthocyanin-enriched sweet potatoes in cancer prevention. The perishable nature of the crop poses some challenges as majority of the produced crop is wasted as a result of high cost or unavailability of modern storage facilities to maintain their freshness and nutritional values. The high moisture content of sweet potatoes makes them to easily rot and sprout during storage (Delaplace *et al*., 2008). Enzymatic discoloration of the surface of freshly-cut potato on exposure to air also poses a challenge to quality of processed potato. Blanching pretreatment is applied to both fruits and vegetables to inactivate some natural food enzymes present in them and are usually carried out by immersion of the food products in heated water of 80 °C to 100 ℃ temperature range for 20 seconds to 20 minutes (Sun *et al.*, 2020). Blanching pretreatment are non-toxic and easier to apply compared to other chemical pretreatment and anti-browning methods like Sulfites deployment. Steeping pretreatment is carried out in unheated water mainly at or below room temperature. The blanched products can be dried in hot-air oven at 60 °C to 80 °C temperature ranges (Kingsford (2021).

Products drying reduce moisture content and help to minimize microbial activities and other sources of food spoilage during storage (Omodamiro *et al.*, 2022). Hii *et al.* (2021) indicated many drying methods in processing of fruits and vegetables which include hot-air oven drying, infrared drying, freeze drying, microwave drying, and hybrid drying technology. Murayama *et al.* (2015) showed that sweet potato chips can be produced from the starch-rich tubers with the process involving peeling, slicing, soaking, blanching, drying and packaging. This indicates that sweet potatoes can be utilized as raw material for flour production, and a major ingredient for bread, noodles and cake making (Daiki *et al*., 2015; Nemar *et al.*, 2015). By drying and processing the tubers into other useful end products such as sweet potato chips, the crop can be properly utilized and the post-harvest losses averted.

Higher blanching and drying temperatures may affect the rate of moisture release during drying (Orhevba and Abimaje, 2019). Pretreatment and drying of food materials such as orange-fleshed sweet potatoes and yam tubers help in retention of their nutritional qualities, color attributes and guarantee longer shelf life of the materials. Sun *et al.* (2020) studied the effect of blanching and drying on the Vitamin C content and the color and morphology of potato chips. Chhe *et al.* (2018) carried out blanching at only 96 °C and 5 minutes in studying the effects of pretreatment on the firmness, color, total dissolved solid and certain chemical properties of sweet potatoes from Japan. Orhevba and Abimaje (2019) studied the nutrient content for 55, 70 and 85 °C drying and blanching temperatures for sweet potatoes obtained from Gidan Kwano Niger State Nigeria. There is the need to investigate the effects of more varied steeping and blanching pretreatments on the proximate properties of sweet potato chips. This study therefore aims at finding the optimal treatments for steeping/blanching and drying of white-fleshed sweet potato at various temperatures and time intervals.

The Response Surface Methodology (RSM) is popularly used for experimental design. Statistical analysis indicates the level of significance of models and how valuable and accurate its response prediction can be. Abonyi *et al*. (2020) indicated that the larger the F-value and the smaller the p-value, the more significant the corresponding response model term will be. The lack of fit test measures the failure of the selected model in representing the predicted data within the experimental territory.

II. MATERIALS AND METHODS

2.1 Materials Used:

Freshly harvested and healthy white-fleshed variety sweet potato tubers were purchased from Eke Awka market (6.210528 °N and 7.072277 °E) in Anambra state of Nigeria), Metler analytical weighing balance of 0.01g accuracy, convective oven, vernier caliper, stainless knife, hot plate, desiccators, thermometer, stainless pot and stop watch.

2.2 Methods Used:

2.2.1 Preparation of samples:

The tubers were washed with clean tap water, peeled and cut into chips of 4mm thickness and 10mm length and10mm width as recommended by (Omodamiro *et al.*, 2022), using a stainless steel knife. The chips dimensions were measured using a Vernier Caliper and the weight measured for each run of the experiment using analytical weighing balance.

2.2.2 Steeping/blanching pretreatment:

Each of the weighed samples of approximately 100 g was placed in air-tight plastic container and labeled A to X for the pretreatment and drying (Table 1). Based on RSM design, Nineteen (19) of the samples were steeped in water at five different temperatures of 11 ºC, 32 ºC, 64 ºC, 95 ºC and 100 ºC for time duration of 2 mins to 18 mins as described by Sun *et al*. (2020). Five (5) control samples were not blanched at all before drying. The pretreated samples were spread on a wire mesh at the end of each process to allow draining of the surface water before convective oven drying.

2.2.3 Convective oven drying of samples:

The pretreated and control samples were dried at five (5) convective oven drying temperatures of 53 °C (T_1), 60 °C (T_2), 70 °C (T_3), 80 °C (T_4) and 87 °C (T_5) as recommended by Kingsford, (2021). The samples drying conditions are also shown in Table 1. All the drying samples were weighed every 30 mins until there was no weight loss at three consecutive readings. For nutrient properties determination, the dried sweet potato chips were grated using a milling machine sealed in air-tight polythene bags and placed in desiccators to prevent moisture gain in the samples. Proximate composition of the samples was determined according to the standard methods described by the Association of Official Analytical Chemists (AOAC, 2015).

2.2.4 Moisture Content Determination:

Moisture Content of the dry samples was determined by the gravimetric method described by the AOAC (2015). A measured weight of the sample (5.0 g) was weighed into a previously weighed moisture dish. The sample in the dish was dried in the oven at 105 ºC for 3 hours, and cooled in a desiccator and weighed. It was returned to the oven for further drying, cooling and repeated weighing at hourly interval until constant weight was obtained for 3 consecutive times. The weight of moisture lost was calculated and expressed as a percentage of the weight of sample analyzed. It was given by the expression below:

$$\text{Moisture Content (\% wb)} = \frac{M_2 - M_3}{M_2 - M_1} \times 100 \tag{1}$$

Where:

M_1 = Mass of empty moisture dish, (g)

M_2 = Mass of dish + Sample before drying, (g)

M_3 = Mass of dish + sample dried to constant weight, (g)

2.2.5 Crude protein (CP) determination:

This was done using Kjeldahl method according to AOAC (2015). 1 g of the sample was prepared into a micro Kjeldahl flask. 25 mL of Sulphuric acid (H_2SO_4), 1 g of Copper Sulphate ($CuSO_4$) and ten grams of Sodium Sulphate (Na_2SO_4) was added into the micro Kjeldahl flask containing the sample. The flask was heated at an inclined angle (60 ºC). The other steps of the method were duly followed, including the titration with 0.1N H_2SO_4 (titrant) against the content in the conical flask till a light pink color was obtained.

$$\text{\% Protein} = \text{\% Nitrogen} \times \text{Protein Factor} \tag{2}$$

Where

$$\text{\% Nitrogen} = \frac{Tv \times 0.0014}{M} \times 100 \tag{3}$$

Where:

Protein factor = 6.25

M = Weight of sample

Tv = Titrant volume (volume of H_2SO_4 used for the titration).

TABLE 1
PRETREATMENT AND DRYING CONDITIONS OF SAMPLES

SAMPLE	Steeping Pretreatments		Drying Temperature (°C)
	Temperature (° C)	Time (mins)	
P	100	10	70
K	32	5	60
Q	95	15	60
L	95	5	60
A	64	10	53
D	95	5	80
W	32	5	80
T*	64	10	70
O	64	18	70
S	64	2	70
V	95	15	80
R	11	10	70
X*	64	10	70
U	32	15	80
B	64	10	87
H*	64	10	70
G	32	15	60
M*	64	10	70
N*	64	10	70
F	0	0	53
I	0	0	60
J	0	0	70
C	0	0	80
E	0	0	87

Samples T, X, H, M and N were replicated according to the RSM design.

2.2.6 Ash content determination:

This was done by the furnace incineration gravimetric method according to AOAC (2015). Exactly 10 g of the sample was measured into a previously weighed porcelain crucible. The sample was burnt to ashes in a muffle furnace at 550 ºC for three hours. When it has become completely ash or turned grey, it was cooled in desiccator and weighed. The weight of ash obtained was determined by difference and the content calculated as a percentage of the weight of sample thus:

$$\% \text{ Ash} = \frac{M_2 - M_1}{M} \times 100 \quad (3)$$

Where:

M_1 = Mass of empty crucible, (g)

M_2 = Mass of crucible + Ash, (g)

M = mass of sample, (g)

2.2.7 Determination of crude fiber content (CF):

This was done using the method described by the AOAC (2015). 2 g of the defatted sample was weighed into a conical flask. 200 mL of 1.25% or 0.127N H_2SO_4 was added and the content boiled on a heating mantle at 80 ºC for 30 minutes. The other steps of the method were duly followed including burning the product inside a crucible in a muffle furnace at 600 ºC for 5 hours. After which it was cooled and weighed as M_5.

$$\%\ \text{Fiber} = \frac{M_7}{M} \times 100 \quad (4)$$

Where:

$M_3 = M_2 - M_1$

$M_6 = M_5 - M_4$

$M_7 = M_3 - M_6$

Where:

M_1 = mass of filter paper, (g)

M_2 = mass of dry filter paper and its residue, (g)

M_4 = mass of washed, dried and cooled crucible, (g)

M_5 = mass of dried crucible burnt for 5hrs at 600ºC in a muffle furnace, (g)

2.2.8 Crude fat determination:

This was determined by Soxhlet extraction method described by AOAC (2015). Five (5) grams of sample was wrapped in a porous paper (Whatman filter paper) and put in a thimble. The thimble was put in a Soxhlet reflux flask and mounted into a weighed extraction flask containing 250ml of petroleum ether. The fat in the sample was extracted by Soxhlet extraction and was dried in the oven at 60 ºC for 30 mins to remove any residual solvent. It was cooled in a desiccator, weighed and recorded as M_2. The weight of oil (fat) extract was determined by difference and the weight percentage calculated as below.

$$\%\ \text{Fat} = \frac{M_2 - M_1}{M} \times 100 \quad (5)$$

Where:

M_1 = Mass of empty extraction flask, (g)

M_2 = Mass of flask + oil (fat) extract, (g)

2.2.9 Carbohydrate content determination:

This was determined by difference method by deducting the mean values of other determined parameters from 100% composition calculation.

% Carbohydrate = 100 – (% Mc + % Cp + % Fat + % Crude fiber + % Ash) (6)

Where

% Mc = Moisture content

% Cp = Crude Protein

% Fat = Fat

2.2.10 Analysis of Variance (ANOVA):

The RSM software was used to perform the ANOVA to ascertain the correctness or otherwise of the regression model. Statistical values such as probability value (p-value), F-value, coefficient of determination (R^2), adjusted coefficient of determination (R^2_{adj}) as well as degree of freedom (Df) were useful in the valuation. The F-value and P-value were used in validating the significance of each of the model parameters. The F-value relates between the curvature variance and the residual variance and the p-value explains the probability of obtaining the observed F-value if the null hypothesis was valid. A confidence level of 95% ($\alpha = 0.05$) was adopted for determining the statistical significance in the analysis.

III. RESULTS AND DISCUSSION

3.1 Effect of the Treatments on Nutrient Content of Potato Chips:

Proximate values of both treated and untreated samples of the sweet potato chips dried under various conditions were determined in terms of percentage (%) Crude Protein content, Carbohydrate content, Ash content, Crude Fiber, Fat and oil and Moisture content as presented in Table 2. Changes in the nutritional properties of the potato chips were observed under different pretreatment and drying conditions.

Crude Protein content of the samples was observed to increase with increase in both blanching and drying temperatures (Fig. 1). Sample A (blanched in 64 ºC water for 10 mins and dried at 53 °C) had the highest protein content; 2.54%, which was more than that of sample R (steeped in water at 11 ºC for 10 mins and dried at 70 ºC) which had crude protein content of 2.13%. It was also observed that the control sample (E) dried at 87 ºC had the highest crude protein value of 2.40% among the control samples. This appears to corroborate the fact that protein is denatured at higher drying temperatures.

TABLE 2
PROXIMATE COMPOSITION OF THE SWEET POTATO CHIPS

Drying Temp (°C)	Steeping Pretreatment		Sample No	Sample Properties (% Content)					
	Temp. (°C)	Time (min)		Crude Protein	Carb.	Crude Fibre	Ash	Fat	Moisture
53	0	0	F	2.37	73.12	2.43	4.29	3.22	10.08
	64	10	A	2.54	72.99	2.58	4.26	3.55	10.32
60	0	0	I	2.31	73.43	2.41	4.23	3.24	10.06
	32	5	K	2.38	72.89	2.63	4.22	3.43	10.52
		15	G	2.41	73.09	2.57	4.27	3.46	10.49
	95	5	L	2.33	73.12	2.63	4.39	3.48	10.01
		15	Q	2.23	73.54	2.42	4.32	3.46	9.96
70	0	0	J	2.35	73.41	2.39	4.21	3.33	9.89
	11	10	R	2.13	72.71	2.6	4.59	3.48	10.23
	64	2	S	2.38	74.11	2.67	4.19	3.37	9.95
		10	H	2.37	73.79	2.75	4.31	3.36	10.13
			M	2.36	73.83	2.78	4.32	3.37	10.17
			N	2.37	74.05	2.79	4.4	3.36	10.18
			T	2.33	73.79	2.73	4.31	3.35	10.09
			X	2.36	73.79	2.73	4.31	3.35	10.09
		18	O	2.32	74.19	2.51	4.13	3.36	10.16
	100	10	P	2.2	73.52	2.51	4.36	3.27	9.97
80	0	0	C	2.38	73.49	2.31	4.28	3.34	9.68
	32	5	W	2.3	73.61	2.55	4.53	3.36	9.72
		15	U	2.31	73.41	2.71	4.52	3.35	9.98
	95	5	D	2.31	73.56	2.35	4.31	3.17	9.94
		15	V	2.27	74.01	2.24	4.21	3.09	10.18
87	0	0	E	2.4	74.01	2.3	4.31	3.37	9.45
	64	10	B	2.46	73.72	2.46	4.36	3.19	9.88

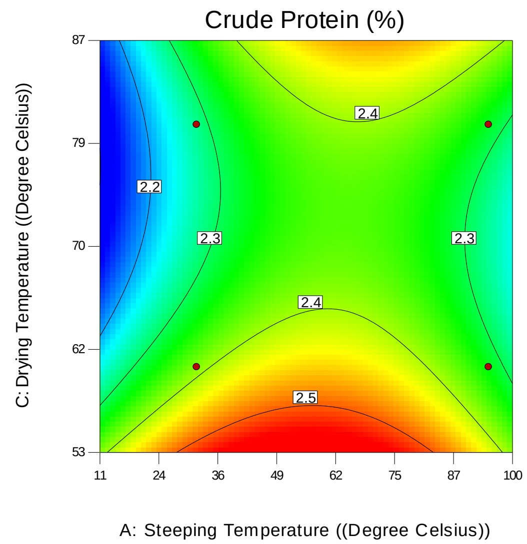

FIGURE 1: Contour model graph of steeping and drying temperatures effect on protein content of potato chip

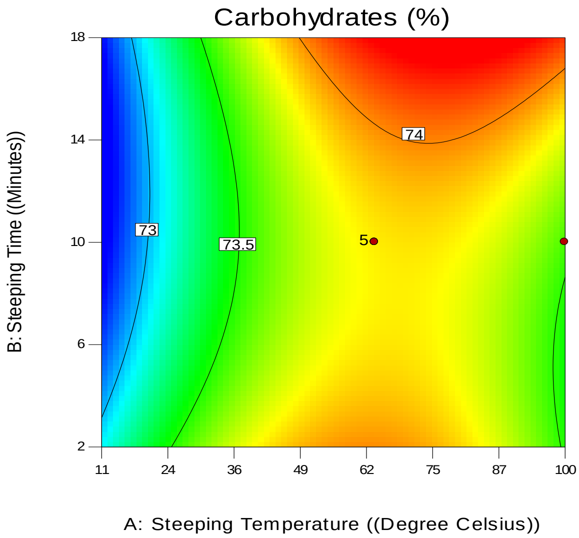

FIGURE 2: Contour graph of steeping temperature and time effect on sweet potato chips carbohydrate content

The Carbohydrate Content also showed significant increase with increased blanching time, and blanching and drying temperatures (Fig. 2). Sample O (blanched at 64 ºC for 18 mins and dried at 70 ºC) had the highest value of 74.19% while sample R (steeped in refrigerated water at 11 ºC for 10 mins and dried at 70 ºC) had the lowest value of 72.71%. The highest carbohydrate value of 74.01% for the control samples was observed in Sample E (at 87 ºC drying).

Crude Fiber Content was observed to be highest in sample N (blanched in 64 ºC water for 10 mins and dried at 70 ºC) with a value of 2.79% and sample V (blanched in heated water at 95 ºC for 15 mins and dried at temperature 80 ºC) having the lowest fiber content of 2.24%. Among the five control samples, F (dried at 53 ºC) had a higher value of 2.43% while E (dried at 87 ºC) had the lowest fiber content of 2.30%. Fig. 3 shows that crude fiber content increased slightly with increase in both steeping and drying temperatures with the value decreasing slightly with increase in drying temperature among the control samples. Sweet potato chips dried by microwave at 90 W; corresponding to their lowest drying temperature used gave highest crude fiber content (Nwajinka *et al.*, 2020).

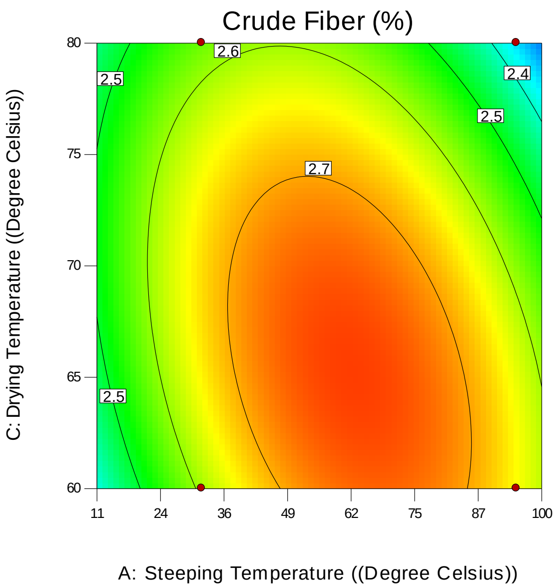

FIGURE 3: Plot of steeping and drying temperatures versus crude fiber content of sweet potato chips

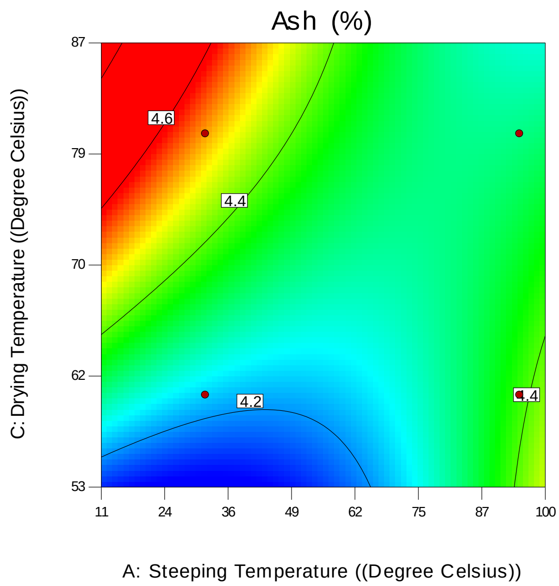

FIGURE 4: Effect of steeping and drying temperatures on ash content of sweet potato chips

The Ash Content of the samples was observed to decrease with increase in blanching temperature among the pretreated samples (Fig. 4). Sample E (dried at the highest temperature of 87 °C) had the highest ash content value of 4.31% among the control samples**.** Reduction in moisture content will increase the dry matter content, and therefore the ash content. The proximate values of the samples were in agreement with the recommendation reported by Olatunde *et al*. (2015) except for the Ash Content. The variation may be attributed to pretreatment and drying conditions of the samples as well as variety of sweet potato used for the experiment. Nwajinka *et al.* (2020) obtained highest value ash content in the un-blanched dried sweet potato chips for microwave drying at 90 W.

Fat and Oil content was observed to be highest in sample dried under the lowest drying temperature of T_1 (Fig. 5). Among the control samples, E (87 ºC drying) had the highest value of 3.37% followed by I (60 ºC drying) with 3.24% and F (dried at 53 ºC) with 3.22%, and. Samples D (95 ºC blanching for 5 mins and 80 ºC drying) had value of 3.17% and sample V (95 ºC blanching for 15 mins and 80 ºC drying) had 3.09%. It was generally noticed that the Fat content of the samples reduced with increase in both blanching and drying temperatures among the pretreated samples but increased with increase in drying temperature among the control samples. Fat becomes more mobile with increasing temperature as observed in cooking of foods.

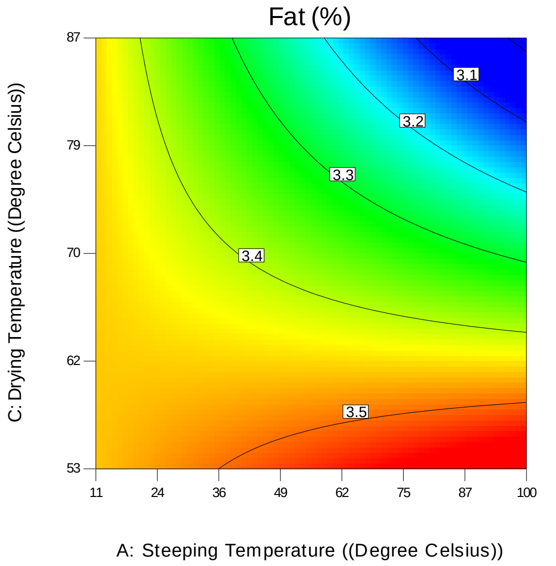

FIGURE 5: Contour graph of the effect of steeping and drying temperatures on fat content of sweet potato chips

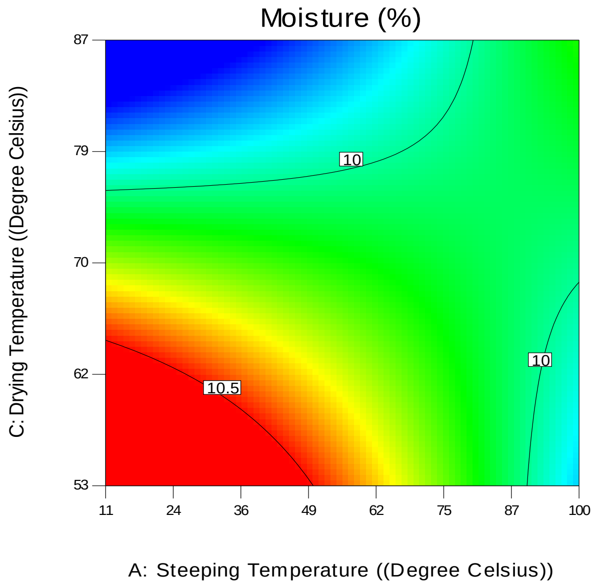

FIGURE 6: Contour graph of steeping and drying temperatures versus moisture content of sweet potato chips

The Moisture content of the samples decreased significantly with increase in drying temperatures. Higher moisture was obtained in many of the higher blanching temperatures. The trend was not same for all the blanching temperatures used. It was also observed that the control samples dried at the lower temperatures; F (53 °C) and "I" (60 °C) had higher moisture contents of 10.08% and 10.06% respectively than those dried at higher temperatures such as 87 °C for E with 9.45% and 80 °C for C with 9.68%. Samples A and F (dried at lowest temperature of 53 °C) showed higher values of moisture contents of 10.32% and 10.08% respectively. Higher drying temperatures gives higher temperature gradients and thus higher affinity for moisture removal. The highest moisture content in all the samples was observed in sample K; steeped at 32 °C for 5 mins and dried at 60 °C. Optimal moisture values were obtained between 11 ºC to 50 ºC steeping temperatures and 53 ºC to 65 ºC drying temperatures (Fig. 6). Steeping temperatures above 50 ºC and drying temperatures above 67 ºC showed reduced value of moisture content of the samples. Orhevba and Abimaje (2019) obtained higher moisture values for dried sweet potato chips with above 70 ºC blanching pretreatment, and argued that starch gelatinization inhibits easy release of moisture during drying.

3.2 ANOVA of Sample Results:

ANOVA on the samples showed significance of model F-values. The p-values for the samples indicated significant model terms. The "Lack-of-Fit F-value" for all the samples showed non-significance of the Lack of Fit relative to the pure error. The "Predicted R-Squared" values for all samples showed reasonable agreement with the "Adjusted R-Squared" values with the difference less than 0.2. The coefficient of determination (R^2) values also showed a high degree of correlation between the observed value and the predicted values. This implies that the variations in the convective oven drying process were explained by the independent variables of the models (steeping temperature, steeping time and drying temperature). The predicted R^2 values of the samples implied good predictability of the quadratic models. Optimization result of the variables showed the optimum treatment to be 70.45 ºC steeping temperature, 5 mins steeping time and 80 ºC drying temperature for desirable high quality sweet potato chips production. In response, the predictions showed the effects of the combinations of the treatments on the proximate composition of the samples as 2.40% for protein, 73.96% for carbohydrate, 2.54% crude fiber, 3.25% for ash content 9.86% for moisture content.

IV. CONCLUSION

The study, targeted at reducing the rate of post-harvest losses and underutilization of Sweet potato tubers in Nigeria, seeks to ascertain the possible pretreatment and drying conditions suitable for sweet potato chips production from the local white fleshed variety. The results of the experiment showed that steeping temperature, steeping time and drying temperature are essential factors in the production of high quality sweet potato chips. It was also observed that sweet potato chips contain lots of nutrients such as protein, carbohydrate and other essential vitamins and minerals which were noticed to be enhanced in the pretreatment and drying processes. In conclusion, the quadratic regression model successfully revealed the effects of the independent variables on the pretreatment and drying process with coefficient of determination (R^2) values as 0.9840, 0.9664, 0.9811, 0.9671, 0.9737, 0.9877.

The values of Protein, carbohydrate and crude fiber content of the samples were observed to be enhanced in pretreated samples than the control samples; especially samples blanched at temperatures above 32 ºC as the values were observed to gradually increase with increase in both the blanching and drying temperatures across the samples. The moisture content was observed to be generally higher in samples steeped in water of temperatures lower than 64 ºC. It increased with increasing blanching temperatures but gave peak values with blanching time variation in some temperatures. The dry samples moisture contents were within the recommended value for storage of sweet potato chips. The study has shown that steeping and drying temperatures of white-fleshed sweet potato for chips production should be above room temperature and less than 100ºC for good quality and nutritious sweet potato chips production. The optimal process conditions were predicted using the RSM as 70 ºC blanching temperature, 5 mins blanching time and drying temperature of 80 ºC; which yielded 2.39% Crude protein, 73.95% Carbohydrate, 2.54% Fiber, 4.31% Ash, 3.24% Fat and 9.86% Moisture content. Application of study findings will help to reduce postharvest crop losses and enhance sweet potato chips production.

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