



Adoption of Sweet Potato Processing Technologies Introduced by the National Root Crops Research Institute in Anambra state, Nigeria

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Abstract

The study assessed the adoption of sweet potato postharvest processing technologies introduced by the National Root Crops Research Institute (NRCRI) in Anambra State. Specifically, the identified the processors' sources of information on sweet potato processing technologies, determined the sweet potato processors' level of awareness and perception of sweet potato processing technologies, determined the sweet potato processors' level of adoption of the recommended sweetpotato processing technologies, The population of the study was delimited to all sweet potato processors in Anambra State. Multi-stage sampling procedure was used in selecting one hundred and twenty (120) processors that were used for the study while data for the study were collected through primary source using a well-structured questionnaire and analyzed using frequency counts, percentage, and mean scores. The findings of the study revealed that the majority (74.17%) of the total sample size were females, a greater proportion (50.83%) were between the ages of 41 - 50 years while majority (52.50%) of the sweet potato processors are married. Majority (64.17%) had household size of between 6 – 10 people while the majority (70.00%) had between 1 – 10years of processing experience. The result revealed that the sweet potato processors sourced information on sweet potato processing technologies via the National Root Crop Research Institute , radio , social media platforms, fellow sweet potato processors, family and friends, television, advisory services consultants and newspaper .The findings on sweet potato processors' level and extent of awareness of sweet potato processing technologies revealed that the sweet potato processors recorded high level of awareness in the following sweet potato processing technologies: boiled sweet potato eaten with red oil or sauce, processing of sweet potato root tubers as fried food , processing of sweet potato root tubers as porridge, processing sweet potato as roasted food, processing of unfermented sweet potato into flour), and processing of sweet potato into crisps . Meanwhile, the findings on the processors' perception of the sweet potato processing technologies shows that the sweet potato processors strongly perceived the sweet potato processing technologies as improved processing technologies with health benefits, processing technologies that requires low cost, improved processing technologies with greater chances of employment opportunities, processing technologies that requires less stress, and processing technologies that is compatible with the peoples' values . The findings of the study further revealed that the grand mean adoption score of processing of unfermented sweet potato flour was 4.65, while the adoption index of the processors was 0.93. On the adoption of processing sweet potato as roasted food, it was revealed that the grand mean adoption score of processing sweet potato as roasted food was 4.38, with adoption index score of 0.88. Whereas, the grand mean adoption score of processing sweet potato into fufu flour was 3.64, with adoption index value of 0.73. The result in addition, revealed that the grand mean adoption score of processing sweet potato into starch was 3.53, with adoption index value of 0.71. The grand mean adoption score of processing sweet potato leave as animal feed was 3.33, while the adoption index was 0.66. This implies that 66.0% of the processors were involved in the various adoption stages of processing sweet potato leaves as animal feed.

Keywords: Adoption, Production, Processing, Sweetpotato, Marketing.

Introduction

Sweetpotatoes (*Impomea Batatas*) is an important traditional crop that is grown customarily by farmers in many countries mainly for household consumption. According to Issah, Bonaventure, Eli, and Kusi (2017), sweetpotato is believed to be typically grown and consumed by resource poor households. It is one of the most important staple carbohydrate foods in Sub-Saharan Africa and are grown in most parts of Nigeria in diverse agro-ecological zones. The crop has moved up from the minor status to an enviable position of being the fourth most important root and tuber crop in Nigeria after cassava, yam and cocoyam (Ejechi, Ode, and Sugh, 2020). It can be boiled, fried or roasted. In the semi-arid zone, its flour is popularly used as sweetener, used in making local dishes and beverages like kunu, while in the urban markets of the humid south, the fried chips are produced and marketed as snacks (Dian-Adi, 2015). In Nigeria, cassava and sweetpotatoes are often grown on the same farm or same region, and farmers frequently turn to sweetpotatoes when cassava fails due to pest and disease attacks (Nanbol and Otsanjugu, 2019). As an economic crop, Kaguongo, Ortmann, Wale, Darroch, and Low, (2012) indicated that sweetpotato can be harvested piecemeal as needed, as well as offer a flexible source of food and income to rural households that are mostly vulnerable to crop failure and consequently fluctuating cash income.

According to Heck, Hugo, Barker, Okello, Arun, Erick, Lynn, and Ekin (2020), sweetpotato have comparative advantage as high yielding and fast-growing crops and have frequently been used as crisis response crops following natural disasters in Africa. Sweetpotatoes are highly adaptable to relatively marginal soils and erratic rainfall and has high productivity per unit (Okeke and Mbah, 2021) and guarantees high yield under adverse weather conditions. Sweetpotato assortments exist in many shades of skin and flesh, ranging from white to purple, however, the white and yellow-orange flesh are the most widely recognized. According to Egwuonwu and Ozor (2020), the fresh sweetpotato can be boiled, roasted, baked and fried as chips which may be sold as snacks or salted and eaten as sweetpotato crisp in Nigeria. Also, they can be fed to livestock, and processed industrially into alcohol, starch, noodles, and flour (Nsa, Udoh and Essein, 2018). Sweetpotato is inadequately utilized as a food in Nigeria. Therefore, Food and Agriculture Organization (FAO) (2020) advised that the production of sweetpotatoes should be increased in both quantity and quality. Egwuonwu *et al.*, (2020); and Onuwa, Folorunsho, Binuyo, Emefiene and Ifenkwe (2020), on the other hand, opined that the insignificant use of sweetpotato in Nigeria is clearly due to the non-accessibility of satisfactory sweetpotato-based recipes that fulfill the food propensity for users in Nigeria.

Consequently, the National Root Crops Research Institutes (NRCRI), embarked on a thorough and dynamic research into the genetic improvement, production, processing, storage, utilization, and socio-economies of root and tuber crops of economic importance in Nigeria (NRCRI, 2014). In a bid to actualize their mandate, the National Root Crops Research Institutes provided the necessary environment for the production, processing and marketing of value-added products of various root and tuber crops towards food security, income generation, beneficial business and quick industrial turn of events. Okeke and Mbah (2021), reported that these research efforts by the National Root Crops Research Institutes have led to the introduction of improved varieties of sweetpotato such as TIS 87/0087, TIS 2532, OP.1.13, TIS 8441 and TIS 8164 which are high yielding and tolerant to prevalent pests, notably sweet potato weevil, *Cylas* spp and with wide adaptation across Nigeria.

Technological innovation in agriculture has over the years transformed the farming systems among smallholder farmers, leading to the realization of economic incentives of higher outputs, profits, and sustainability (Tsinigo and Behrman, 2017). It is assumed that notable improvements can be recorded in Nigeria agricultural sector, if the available technologies are accepted and adopted by the farmers. However, the success of any technology depends on its dissemination among the potential users, which ultimately is measured by the level of adoption of that technology (Ibrahim, Mustapha and Nuhu, 2012). The adoption of improved sweet potatoes processing technologies can lead to improved food security through the enhancement of value addition. Adoption as described by Rogers (2015), refers to a decision to make full use of an innovation as the best course of action available. Similarly, Eneh (2010), defined "adoption" as the stage in which a technology is selected for use by an individual. It is defined as the integration of new technologies into existing practices and is usually preceded by a period of trying and some degree of adaptation (Mwangi and Kariuki, 2015). Mudzingwa and Kabote (2014) on the other hand, indicated that technology adoption can be described as a process that begins with awareness of the technology and progresses through a series of steps that end in appropriate and effective usage. Thus, technology adoption can be looked at as an evolutionary process where the old is upgraded or replaced by new to align the solution to emerging problems or solving old problems in a better way.

According to United Nations International Children's Emergency Fund (UNICEF) (2012), sweetpotato is an important root crop in Nigeria, not just because of its adaptability in slightly loose soil, but also its broad agro-ecological adaptability. Sweetpotato is regarded as a second root crop in Nigeria but due to poor agronomic practices adoption of sweet potato by the farming population, its tremendous potentials as a Vitamin A and Food security powerhouse is still in doubt. However, the processing of sweetpotato into chips, and different snacks are not common in Nigeria due to

inadequate information on improved processing technologies (Udemezue, Obasi, Chinaka, Oyibi, Awa and Onyiba, 2018).

In the light of the above, the objectives of the study were to describe the socio-economic characteristics of the sweet potato processors, identify the processors' sources of information on sweet potato processing technologies and determine the processors' level of awareness, perception of the sweet potato processing technologies and determine the sweet potato processors' level of adoption of the NRCRI recommended sweet potato processing technologies.

Methodology

The study was carried out in Anambra State. It is one of the 36 States that makes up the Federal Republic of Nigeria, located in the South-Eastern geopolitical zone of Nigeria. Anambra State is made up of 21 Local Government Areas and one hundred and seventy-seven (177) communities that spread across the four existing Agricultural Zones (AZs), namely, Awka, Anambra, Aguata, and Onitsha. It is an inland state with its capital in Awka, located between longitude 6°36' and 7°21' E and latitude 5°38' and 6°47' N and occupies a land area of 4,416 km² and 70% of which is arable land. It has an estimated population of 5,527,800 people, with male population of 50.9% and female 49.1%, which stretches over 60 kilometers between surrounding communities (City-population, 2016). The State is bordered in the North by Kogi State, in the West by Delta State, in the South by Imo State, and in the East by Enugu State.

The State experiences two major seasons, the rainy season which starts at the end of the month of March and lasts till end of October and the dry season which starts in the month of November and ends in the month of March. It records about 3,000mm of rainwater per annum, this makes the area suitable for agricultural production. The state is predominantly occupied by the Igbo ethnic group who by nature are crop farmers, fishermen, craftsmen and traders. According to Ofoedu, Ugwumba and Chidebelu (2018), the climate of the area is comparatively good for crop production, livestock farming, fishery and agro-forestry. Majority of the farmers are producing at small-scale level while major food crops produced are rice, cassava, sweet potato, maize, cocoyam, yam and varieties of citrus fruits. Off-farm activities like agricultural processing and marketing are the vital components while the inhabitants also engage in fishing, particularly those living in the riverside areas.

The population for the study was delimited to all sweet potato processors in Anambra State. Multi-stage sampling procedure was used in selecting one hundred and twenty sweet potato processors that were used for the study. In stage I, a purposive selection of two Agricultural Zones (Anambra AZ and Onitsha AZ) was made as against the four Agricultural Zones in existence in the state. The selection was made based on the number of sweet potato processors and farmers living in the areas selected and where sweet potato farming and processing is predominant. Stage II involved a simple random selection of three (3) extension blocks from each of the selected Agricultural zones to give a total of six (6) extension blocks. In stage III, two (2) circles were selected from each of the blocks using simple random sampling technique to give twelve (12) circles. While in stage IV, ten (10) sweet potato processors were selected randomly from each of the circles selected, making it 120 respondents (60 from Anambra AZ and 60 from Onitsha AZ) that were used for the study.

The data for the study were collected through primary source using a well-structured questionnaire. The questionnaire contained relevant questions which were divided into sections according to the number of the objectives of the study. Data collected from the processors bordered on their socio-economic characteristics (age, gender, marital status, educational level, farm size, household size and years of experience), processors' sources of information, level of awareness and perception of sweet potato processing techniques, level of adoption of the NRCRI's recommended sweet potato processing techniques, and major constraints to adoption of the processing techniques. In order to facilitate the study, four enumerators were engaged and trained on questionnaire distribution and data collection. However, occasional visits were made to the study area covered by the enumerators in order to ensure that the collection was done properly.

Results and Discussion

Socio-Economic Characteristics of the Sweet Potato Processors in the Area

The socio-economic characteristics of the sweet potato processors sampled are displayed in Table

4.1. The socio-economic characteristics of the respondents described includes: age, gender, marital status, educational level, household size, years of experience, sources of fund, and membership of cooperative.

Sex of the respondents

The result in Table 4.1 revealed that 89 of the sweet potato processors, representing 74.17% of the total sample size were females. Meanwhile 31 (25.83%) out of the total respondents sampled, were males. The implication of the finding is that processing of sweet potato in the study area has high ratio of females compared to the males who are mainly engaged with sweet potato production. The dominance of women over men's involvement in the processing of sweet potato in the study area is an indication that women play a central role in the crops' value chain. The result further shows that certain

agricultural activities are considered gender specific in most African countries and this is because of the general acceptance and belief that such enterprise are suited to a particular gender. The result is in agreement with the popular idea that production and processing of sweet potato is more of women's enterprise. Hence, the result aligns with the findings of Okeke, *et al.*, (2020) and Udemezue, *et al.*, (2018) whose studies revealed that woman dominated sweet potato enterprise in the South-Eastern Nigeria.

Age of the respondents

The results of the study as shown in Table 4.1 revealed that 23.33% of the respondents were within the age bracket of 20 – 40 years, 50.83% of the respondents were between 41- 50 years of age and 25.83% were 51 years old and above with mean age value of 46.8 years. This is an indication that the sweet potato processors were within the active age range, thus, a promising future exists in the enterprise. Also, this suggests that the sweet potato processors have innovative and active mindsets which will help them in the adoption of emerging sweet potato processing technologies in the area. It is worthy to note that age could influence farmers' ability to perform tasks that requires physical strength and canas well, influence their willingness to adopt improved technologies/techniques. The finding aligns the age statistics of sweet potato processors, which according to Ume, Onunka, Nwaneri and Okoro (2016) shows that sweet potato farmers in the study area were between 41-50 years of age.

Marital status of the respondents

The result of the findings on marital status of the respondents as shown in Table 4.1 reveal that the majority (52.50%) of the sweet potato processors in the study area was married, 17.50%, 14.17%, 9.17%, and 6.66% were single, divorced, widow and widowers, respectively. This finding, simply implies that married sweet potato processors dominated the enterprise in the study area. The result shows that marriage as an institution confers great responsibilities unto couples. As such, married couples engage in many pre and post agricultural activities in other to feed and provide for their dependents. Also, marriage as an institution encourages synergy among farm families which could be used to accomplish certain farming activities and as such promote the spread of innovations on sweet potato production and processing as the members of the farm families are potential sources of information to other farmers. As reported by Kanu, *et al.*, (2016), marriage encourages division of labour among rural farm households, thus, reducing the cost of labour and increasing the return on investment.

Educational level of the respondents

An analysis on the educational status of the sweet potato processors shows that a greater proportion (40.00%) of the respondents attended secondary, while 31.67% attended primary school education. About 14.17% of the sweet potato processors had no formal education, meanwhile another 14.17% out of the total population attended tertiary institution of higher learning. The spread pattern of the educational level of the sweet potato processors shows that 85.83% of the sweet potato processors attained a minimum of one form of formal education or the other. The result indicates that most of the respondents are educated enough, and have the ability to read and write, and understand better the core essence of adopting agricultural technologies/techniques. According to Nwaobiala (2014) as cited by Okeke, *et al.*, (2020), it was opined education has the capacity to enhance individuals' ability to communicate, access and adopt innovations. In addition, Paltasingh and Goyari, (2018). opined that the level of education attained by a farmer not only increases his/her productivity but also enhances his/her ability to evaluate new production/processing technologies. The result agrees with Adesina, *et al.*, (2017), who reported that a greater proportion of the respondents in their study had secondary education.

Household size of the respondents

The result of the findings on household size of the respondents as shown in Table 4.1 reveals that majority (64.17%) of the sweet potato processors had household size of between 6 – 10 people, 34.17% had 1 – 5 people while 01.66% had between 11 and above with household mean value of 7 people. The findings shows that the sweet potato processors in the study area have a relative big household size which indicates availability of family labour for the various sweet potato processing activities. Household size as an important socio-economic characteristic that plays an important role in farm production in most developing countries where human labour is the major source of labour and manpower (Nolte and Ostermeier, 2017). Over decades, farm families have served as the major source of labour to many farm families. The results is agreement with Chah, *et al.*, (2020), who reported that the average household size was six (6) people per family, indicating the probable availability of household labour for the production of sweet potato.

Major occupation of the respondents

The entries in Table 4.1 revealed that a greater proportion (50.83%) of the sweet potato processors were mainly civil servants, 34.17%, and 15.00% were farmers and traders, respectively. The result of the analysis suggests that majority of the respondents were full time civil servants who engage in processing of sweet potato, in order to raise more fund and make up their earnings from the civil service. The reason behind this diversification for alternate source of livelihood is simply to avoid over dependency on civil service, as a result of the unstable payment of salaries. Also, the reason could be to raise more money since the government salaries does not cover their monthly expense.

Processing experience of the respondents

The result in Table 4.1 reveals that the majority (70.00%) of the processors had between 1-10 years of processing experience, 27.50% and 02.50% had 11 - 20 and 21 and above years of processing experience, respectively. The mean sweet potato processing experience was 11.33 years. This is a clear indication that the processors had a relatively high years of processing experiences that could improve their output in the area. Also, it is expected that they sweet potato processors must have acquired a reasonable wealth of knowledge over the years which will in turn, impact positively on their income. This is simply because producers or processors with reasonable years of production or processing experience, knows the major problems involved in most agricultural production and processing ventures, and they are in better position to overcome them. This finding corroborates Okeke, *et al.*, (2020) and Uzuegbunam, *et al.*, (2015) whom were of the view that enough years of processing experience will serve as an advantage in the adoption of improved technologies.

Respondents' sources of funds

According to the finding as displayed in Table 4.1, 67.50%, 22.50%, and 10.0% of the sweet potato processors sourced funds for the sweet potato processing enterprise through their personal savings, friends/relations, and commercial banks/cooperatives, respectively. The findings implies that the majority of the sweet potato processors ventured into the sweet potato processing enterprise with their personal savings, and this suggests that the conditions for borrowing from commercial banks and cooperatives, may have been the reason why the processors depended on their personal savings for their enterprise. Therefore, the sweet potato processors probably do not have access to enough fund to expand their scale of production. It is of the essence to note that credit plays a crucial role in agricultural productivity and development (Emilia, *et al.*, 2020), as it is among other things that capitalizes individuals' adoption of new technologies and provision of working capital (Sial, Awan and Waqas, 2011).

Table 4.1: Socio-economic characteristics of the respondents (n=120)

Socio-Economic Characteristics	Frequency (n=120)	Percentage (%)	Mean (\bar{X}) Score/Mode
Sex			
Male	31	25.83	
Female	89	74.17	Female
Age (years)			
20 – 40	28	23.33	
41 – 50	61	50.83	
51 and above	31	25.83	46.8 years
Marital status			
Single	21	17.50	
Married	63	52.50	
Divorced	17	14.17	
Widow	11	09.17	
Widower	08	06.66	Married
Educational level			
No formal education	17	14.17	
Primary education	38	31.67	
Secondary education	48	40.00	
Tertiary education	17	14.16	10.01 years
Household size			
1 – 5	41	34.17	
6 – 10	77	64.17	
11 and above	02	01.66	6 persons
Major occupation			
Civil servant	61	50.83	
Farmer	41	34.17	
Trader	18	15.00	Civil servants
Processing experience			
1 – 10	84	70.00	
11 – 20	33	27.50	

21 and above	03	02.50	11.33 years
Sources of fund			
Personal savings	81	67.50	
Friends and relatives	27	22.50	
Commercial banks/cooperative	12	10.00	Personal savings

Source: Field survey 2022.

Sources of Information on Sweet Potato Processing Technologies

The distribution of the respondents according to their sources of information is presented in Table 4.2. The result of the analysis shows that the sweet potato processors sourced information on sweet potato processing technologies from the National Root Crops Research Institute ($\bar{x}=2.71$), radio ($\bar{x}=2.66$), social media platforms($\bar{x}=2.57$), fellow sweet potato processors ($\bar{x}=2.50$), family and friends ($\bar{x}=2.55$), television ($\bar{x}=2.47$), advisory services consultants and extension agents ($\bar{x}=2.36$), and newspaper ($\bar{x}=2.23$). Also, the study further revealed that the sweetpotato processors indicated research journals ($\bar{x}=1.93$) and textbooks ($\bar{x}=1.72$) as minor sources of information. The results of the analysis implies that the sweet potato processors in the area have access to numerous sources of information as regards to sweet potato processing techniques in the area. Information generation and dissemination is necessary for agricultural development, as it gives room for an effective and efficient transfer of technologies and techniques that are designed to boost agricultural production. Hence, there is no doubt that information is very important in all aspects of agricultural activities, starting from planning to production (Adio, *et al.*, 2016).

Table 4.2: Distribution of the respondents according to their sources of information

Sources of Information	Mean (\bar{x}) Score	Rank	Remark
National Root Crops Research Institute (NRCRI)	2.71*	1 st	Major source
Radio	2.66*	2 nd	Major source
Social media (internet, whatsapp, facebook, etc)	2.57*	3 rd	Major source
Fellow sweet potato processors	2.50*	4 th	Major source
Friends and relatives	2.55*	5 th	Major source
Television	2.47*	6 th	Major source
advisory services consultants/extension agents	2.36*	7 th	Major source
News paper	2.23*	8 th	Major source
Research journals	1.93	9 th	Minor source
Books	1.72	10 th	Minor source

Source: Field survey, 2022.

Processors' Extent of Awareness and Perception of Sweet Potato Processing Technologies

Processors' extent of awareness of the sweet potato processing technologies

The findings on sweet potato processors' level and extent of awareness of sweet potato processing technologies are displayed in Table 4.3. The results reveals that the sweet potato processors in the study area recorded high level of awareness in the following sweet potato processing technologies: boiled sweet potato eaten with red oil or sauce ($\bar{x}=5.00$), processing of sweet potato root tubers as fried food ($\bar{x}=4.86$), processing of sweet potato root tubers as porridge ($\bar{x}=4.67$), processing sweet potato as roasted food ($\bar{x}=4.35$), processing of unfermented sweet potato into flour($\bar{x}=4.29$), and processing of sweet potato into crisps($\bar{x}=3.89$). The result further revealed low level of awareness in the processing of sweet potato into puff-puff, chin-chin, cake ($\bar{x}=2.68$), processing of fermented sweet potato into fufu flour ($\bar{x}=1.96$), processing of sweet potato into starch ($\bar{x}=1.73$), and sweet potato leaves processed as animal feed ($\bar{x}=1.63$).The result is an indication that the sweet potato processors are in the know of the various sweet potato processing technologies. The result further implies that they can easily make a choice of any sweet potato processing technologies if need be.

Table 4.3: Processors' level of awareness of the sweet potato processing technologies

Improved sweet potato processing technologies	Mean (\bar{x}) Score	Rank	Remark
Boiled sweet potato eaten with red oil or sauce	5.00	1 st	HLA
Processing of sweet potato root tubers as fried food	4.86	2 nd	HLA
Processing of sweet potato root tubers as porridge	4.67	3 rd	HLA
Processing sweet potato as roasted food	4.35	4 th	HLA
Processing of unfermented sweet potato into flour	4.29	5 th	HLA

Processing of sweet potato into crisps	3.89	6 th	HLA
Processing sweet potato into puff-puff, chin-chin, cake, etc	2.68	7 th	LLA
Processing of fermented sweet potato into fufu flour	1.96	8 th	LLA
Processing of sweet potato into starch	1.73	9 th	LLA
Sweet potato leaves processed as animal feed	1.63	10 th	LLA

Source: Field Survey, 2022. Note: HLA = High level of awareness; LLA = Low level of awareness

Processors' perception of sweet potato processing technologies

The findings on sweet potato processors' perception of the sweet potato processing technologies is displayed in Table 4.4. The result revealed that the sweet potato processors, strongly perceived the sweet potato processing technologies introduced by the National Root Crop Research Institutes as improved processing technologies with health benefits ($\bar{x}=4.64$), processing technologies that requires low cost ($\bar{x}=4.23$), improved processing technologies with greater chances of employment opportunities ($\bar{x}=3.70$), processing technologies that requires less stress ($\bar{x}=3.63$), and processing technologies that is compatible with the peoples' values ($\bar{x}=3.35$). The results of the study further indicated that the sweet potato processors were undecided on their perception of the sweet potato processing technologies as improved processing technologies with difficulties ($\bar{x}=2.93$), improved processing technologies that takes longer time to experiment ($\bar{x}=2.81$), and improved processing technologies that are not readily available and accessible ($\bar{x}=2.68$).

Table 4.4: Processors' perception of sweet potato processing technologies

Perception of sweet potato processing technologies	Mean (\bar{x}) Score	Rank
Improved processing technologies with health benefits	4.64	1 st
Improved processing technologies that requires low cost	4.23	2 nd
Processing technologies that provides employment opportunities	3.70	3 rd
Processing technologies that requires less stress	3.63	4 th
Processing technologies that is compatible with the peoples' values	3.35	5 th
Processing technologies with difficulties	2.93	6 th
Processing technologies that takes longer time to experiment	2.81	7 th
Processing technologies that is not readily available and accessible	2.68	8 th

Source: Field survey, 2022.

Processors' Adoption Levels of the Sweet Potato Processing Technologies

Entries in Table 4.5 reveals the results of the analysis on the adoption levels of some sweet potato processing techniques introduced by the National Root Crops Research Institute (NRCRI). Some of the sweet potato processing techniques includes: processing of sweet potato root tubers as fried food, processing of sweet potato into crisps, processing of unfermented sweet potato into flour, processing sweetpotato as roasted food, processing of fermented sweetpotato into fufu, processing of sweet potato into starch, and sweet potato leaves processed as animal feed.

Processing of sweet potato root tubers as fried food

Table 4.5 shows that the grand mean adoption score of processing sweet potato into fried food was 5.00, while the adoption index was 1.00. This implies that the processors were at the adoption level of the adoption process and 100% of the processors were involved in the adoption process of fried food processing. The high level of adoption is an indication that the majority of the processors are aware of the advantages of fried food. This is in line with Udemezue (2019) who opined that more than half of the sweet potato produced in Nigeria is boiled or fried. This is an indication that the sweet potato technology had gained popularity and the processors in the study areas were into fried food processing as recommended to them by the NRCRI in Anambra state, Nigeria. The result of the study is in agreement with Okeke, *et al.*, (2020) who reported that the technologies which have been disseminated to the sweet potato processors were developed for sustainable increase in both productivity and income, in other to gain and improve their standard of living.

Entries in Table 4.5 shows that the grand mean adoption score value of processing sweet potato into crisps was 4.86, with adoption index of 0.97. The result of the analysis implies that the sweet potato processors were at the adoption stage of the adoption process and 97.0% of the sweet potato processors were involved in the adoption processes of processing sweet potato into crisps. Also, the result implies that processing of sweet potato into crisps as recommended by the

National Root Crops Research Institute in Anambra State was a welcome idea as the processing technology seem compactible with the processors' values and has a comparative advantage over other existing sweet potato processing technologies. In Nigeria, a survey conducted by Mulyono, Suryana, and Suryana (2021), it was found that the adoption rates of an agricultural innovation depend on the adopter's perception of the attributes of the improve innovation. Hence, this is consistent with the results of the present study.

Processing of unfermented sweet potato into flour

Data in Table 4.5 reveals that the grand mean adoption score of processing of unfermented sweet potato flour was 4.65, while the adoption index of the processors was 0.93. This suggests that the majority of the sweet potato processors were at adoption level of the adoption process and 93% of the processors were involved in the adoption process of processing unfermented sweet potato into flour as recommended by the NRCRI in Anambra state. The standardized processes recommended by the NRCRI for processing unfermented sweet potato into flour include: peeling and washing of the sweet potato root tubers, grating of the root tubers into mash, dewatering of the mash in a clean bag, sun-drying on a raised platform or oven- drying at a temperature of 50°C, milling of the dried mash and packaging the flour in polythene bags or air tight containers (Okeke, *et al.*, 2020). The result suggests that the processors have passed the stages of awareness, interest, evaluation, trial to adoption of sweet potato processing technologies. The high level of adoption by the sweet potato processors in the study area signifies that the processors were into processing of unfermented sweet potato into flour.

Processing sweet potato as roasted food

Table 4.5 further reveals that the grand mean adoption score of processing sweet potato as roasted food was 4.38, with adoption index score of 0.88. This means that the sweet potato processors in the area were at the trial stage of the adoption process, and 88.0% of the processors were involved in the various adoption processes of processing sweet potato as roasted food. The high adoption is suggesting that the processors in the study area are aware of the potentials of sweet potato as one the major stable crop consumed by many Nigerian households (Adeola, *et al.*, 2020), and this validates the fact sweet potato fulfills a number of basic roles in the global food system, all of which have fundamental implications for meeting the high demand for food, reducing poverty, and achieving a sustainable food security (El-Sheikha and Ray, 2017). Processing of fermented sweet potato into fufu flour

Table 4.5 shows that the grand mean adoption score of processing sweet potato into fufu flour was 3.64, with adoption index value of 0.73. The implication is that the sweet potato processors in the study area were at the evaluation stage of the adoption process while 73.0% of the processors were involved in the various adoption processes of fufu flour. The low adoption recorded might be that the sweet potato processors had inadequate knowledge of the recommended improved technology, or probably because of the fact that the processors considered existing technology to have relative advantage over the one introduced by the National Root Crop Research Institute in the study area. Therefore, the reason behind the low adoption recorded among the sweet potato processors in the study area. This is an evidence that sweet potato processing technology in the study area have not improved due to low adoption of the improved processing technology. Hence, the majority are still making use of local processing technologies that will likely expose them to dangers or difficulties. Okeke, *et al.*, (2020), indicated that the standard practices involved in processing sweet potato into fufu flour are peeling and washing of sweet potato, cutting the root tubers into 2.5-3.0mm chips, fermenting the chips by soaking in water for 24 hours and draining of water from fermented chips. Others include: sun drying of the chips on raised platform or oven drying at a temperature of 50°C, proper milling of the dried chips to produce the flour and packaging of flour in polythene bags or air-tight containers.

Processing of sweet potato into starch

The result in Table 4.5 reveals that the grand mean adoption score of processing sweet potato into starch was 3.53, with adoption index value of 0.71, which suggests that the sweet potato processors were at the evaluation stage of the adoption process and 71.0% of the sweet potato processors were involved in the various adoption processes of processing sweet potato into starch. The standardized practices for processing sweet potato into starch includes as follows: peeling and washing of sweet potato, grating of root tubers into mash, dewatering of mash in clean bags and mixing dewatered mash with quantity of water that is 10 times the volume of mash, sieving of mash with muslin cloth, sedimenting, decanting and collection of starch, sun drying of starch on raised platform or oven- drying at a temperature of 50°C, milling of the dried starch and packaging in polythene bags or air tight containers. The below average adoption of these processing starch innovation might be that processors had inadequate knowledge of the technology. This means that starch processing in the study area has not improved due to low adoption level of the improved facilities; the majority are still processing starch locally using traditional methods and are exposed to dangers of poor quality products.

Sweet potato leaves processed as animal feed

Table 4.5 further indicated that the grand mean adoption score of processing sweet potato leave as animal feed was 3.33, while the adoption index was 0.66. This implies that 66.0% of the processors were involved in the various adoption stages of processing sweet potato leaves as animal feed. The relative high level of adoption is an indication that a greater proportion of the processors are aware of its importance as it serves as a source for animal feed. The findings is in line with Spore (2015), who according to his findings, reported that the sweetpotato vines are another valuable animal feed providing more protein and dry matter per unit areas than other staple feeds.

Table 4.5: Adoption level of sweet potato processing technologies

Improved sweet potato processing technologies introduced by the NRCRI	Grand mean (\bar{x}) adoption score	Adoption index
Processing of sweet potato root tubers as fried food	5.00	1.00
Processing of sweet potato into crisps	4.86	0.97
Processing of unfermented sweet potato into flour	4.65	0.93
Processing sweet potato as roasted food	4.38	0.88
Processing of fermented sweet potato into fufu flour	3.64	0.73
Processing of sweet potato into starch	3.53	0.71
Sweet potato leaves processed as animal feed	3.33	0.66

Source: Field survey, 2022.

Conclusion and recommendations

The sweet potato processors in the study area are still in their active age and have promising future in the enterprise. The sweet potato processors had access to adequate information on sweet potato processing technologies. The processors had high level of adoption of some of the improved sweet potato processing technologies.

To resolve to a reasonable extent, the challenge of inadequate financial resources, the sweet potato processors should be given financial assistance so as to expand their scale of enterprise. This can be achieved by the various government agencies through provision take-off grants and low interest loans. There is need for intensification of awareness campaign by the advisory services consultants, health agencies, and nutritionists on the responsibilities of giving public health enlightenment and sensitization on the nutritional values of sweet potato in addressing Vitamin deficiencies. To solve the problem of inadequate knowledge of most of the modern sweet potato processing technologies, trainings should be organized by the extension workers in order to enlighten the farmers, and other stakeholders in the sweet potato value chain on the usage and applications of these modern technologies.

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