SVU-International Journal of Agricultural Sciences
Volume 5 Issue (1) pp.: 46-56, 2023
Print ISSN 2636-3801 | Online ISSN 2636-381X
Doi: 10.21608/svuijas.2023.195864.1273
RESEARCH ARTICLE

Utilization of pro-vitamin A cassava products by consumers in Ikot-Ekpene senatorial district of Akwa-Ibom State, Nigeria.

Ekanem, J.T.[1]*, G.B. Adesiji [2] and B. TomDick [3]

[1] *Department of Agricultural Economics and Extension, Faculty of Agriculture, Akwa Ibom State University, 520001 Akwa Ibom State, Nigeria.*
[2] *Department of Agricultural Extension and Rural Development, University of Ilorin, 240003 Ilorin, Kwara State, Nigeria.*
[3] *Faculty of Agriculture, Akwa Ibom State University, 520001 Akwa Ibom State, Nigeria.*

Abstract

The study examined the level of utilization of Pro-Vitamin A Bio-fortified Cassava (PVABC) products among consumers in the rural areas of Ikot Ekpene Senatorial District of Akwa Ibom State. A two-stage sampling procedure was used in the selection of 200 consumers and an interview schedule was used to obtain data. Percentages, Pearson Product Moment Correlation, and multiple regressions were used to analyze the data collected for the study. All (100.0%) of the respondents had a basic knowledge of biofortified cassava (PVABC) products and a favourable perception of biofortified cassava. Yellow Garri ($\bar{X}$ =2.98), Fufu ($\bar{X}$ = 2.57), and Tapioca ($\bar{X}$ = 2.11) were the major (PVABC) products utilized by consumers but garri was the most preferred. The study provides empirical evidence of the fact that knowledge, perception, and attitude play a greater role in the utilization of Pro - vitamin A biofortified cassava products in the study area. The high level of knowledge of the Pro - vitamin A biofortified cassava products in the study area led to a positive attitude toward the utilization of the products. The study recommends that Pro-vitamin A biofortified cassava materials should be made available, by stakeholders, to the other senatorial districts of the State and increased awareness campaigns should be carried out by Extension Agents to boost the knowledge level of consumers so as to upscale the PVABC utilization by every household in the State.

Keywords: Attitude; Cassava Products; Consumers; knowledge; Pro-Vitamin A; Utilization.

1. Introduction

Hidden hunger, commonly known as micronutrient deficiency, has reportedly been on the increase affecting over two billion people across the world (Oteh *et al.,* 2020). Sadly, Nigeria falls among the leading countries in the world with severe micronutrient malnutrition issues which have given rise to alarming economic and health concerns (Onuegbu *et al.,* 2017). A report from the National Health Component of the National Strategic Plan of Action for Nutrition (2014–2019) shows that about 8.5% of the population representing 14 million people is reportedly undernourished in Nigeria. Additionally, the number of stunted children is reportedly high in Nigeria contributing to the estimate of 10 million such children in Africa. Thirty-seven percent of these stunted children are under the age of five, 29 percent are equally underweight, and 18 percent are wasted, (Oteh *et al.,* 2020). These horrible developments have been attributed to a combination of poor awareness of dietary requirements, feeding practices, and high levels of poverty (Agwu, 2011; Nwajiuba, 2013). Considering that these issues are food related, the food system is fundamental for progress in ending issues of

.**Corresponding author: Jemimah Timothy Ekanem
Email: jemimahekanem@aksu.edu.ng
Received: February 23, 2023; Accepted: March 11, 2023; Published online: March 14, 2023.

global poverty, hunger, and under-nutrition (Low *et al.,* 2007).

Looking at the specifics, Vitamin A deficiency has been figured out as one of the leading causes of stunted growth, diarrhea, measles, and premature death of children. As reported by Maziya-Dixon *et al.* (2007) and World Health Organization (2017), Vitamin A deficiency can also cause severe night blindness and a high mortality rate in pregnant women. According to Ogunleye *et al.* (2017) many Nigerians irrespective of age, gender, and geographical location get less Vitamin A than the required amount. Low availability and inadequate consumption of Vitamin A diets constitute the major determinants of Vitamin A deficiency. Animal sources that are good sources of Vitamin A are expensive and out of reach to the poor communities' thus leaving foods of plant sources as an important source of Pro-Vitamin A in developing countries, (Tumuhimbise *et al.,* 2013).

As a prevention strategy, the Nigerian government commenced the immunization, supplemented with Vitamin A, a programme for children within the age range of 6 months to 5 years and has mandated the fortification of certain food items like sugar, wheat flour, and vegetable oil with Vitamin A since the year 2000, (Ogunleye *et al.,* 2017). In order to avert and mitigate the prevalence of Vitamin A Deficiency (VAD), various strategies including fortification and bio-fortification methods have been developed by scientists across the world (Ogunleye *et al.,* 2017). Besides food crops like sugar, wheat flour, and vegetable oil, Cassava is also an important food staple and cash crop in many developing countries. The Nigerian economy attaches both functional and strategic importance to cassava, (Ogunleye *et al.,* 2017).

Insecurity problems, community unrest, soil infertility, drought, and the rapid increase in population have increased the necessity for the utilization of cassava as an economical, easily reached, and versatile crop that is resistant to harsh environmental conditions (Asonye, 2001). Taking into consideration the important role of cassava in the health and diets of Nigerians, the National Root Crops Research Institute (NCRI) Umudike and International Institute of Tropical Agriculture (IITA), Ibadan collaboratively developed cassava varieties bio-fortified with Vitamin A in order to complement government efforts to check Vitamin A deficiency and malnutrition in the country. These varieties are yellow in colour owing to their high beta-carotene (pro-Vitamin A) content; hence they are also called Yellow Cassava.

Biofortification, the process of breeding and delivering staple food crops with higher micronutrient content, has proven a potential solution to the problem of hidden hunger. The success of biofortified Pro-vitamin A cassava products, as a cost-effective and sustainable food-based intervention, in bridging micronutrient deficiencies has been widely reported in different parts of the world including Nigeria (Caswell and Joseph, 2007; Kotler and Armstrong, 2008; Loopstra, 2018). However, the progress of scaling biofortified foods is challenged by persistent shifts in consumer preferences, mindsets, and perceptions about the nature of these foods (Oteh *et al.,* 2020). It has been reported that many consumers are not open to food developed using biotechnology, especially as information regarding the potential risk of these products is still a subject of debate among policymakers and Civil Societies Organizations (CSOs), leading to controversies in consumer demand or acceptance/rejection [FAO (Food and Agricultural Organisation) 2011; Creswell, 2014].

Ikot Ekpene senatorial district was selected for this study for several reasons. Firstly, Ikot Ekpene senatorial district was one of the agricultural areas where the initial field trials of pro-vitamin A biofortified cassava were conducted by The West African Agricultural Productivity Programme (WAAPP) Nigeria, in collaboration with the Agricultural Extension unit of the

University of Uyo, Uyo. Cassava cuttings were donated to farmers for cassava farming. This was in line with WAAPP's ideal objective of creating enabling conditions for sub–regional cooperation in technology generation and dissemination (Akpabio, 2015).

In 2005, the World Bank designed the African Action Plan (AAP) as the centre piece of its strategy to help Africa and its sub-regional groups such as the Economic Community of West African States (ECOWAS) to reach the Millennium Development Goals (MDG) of reducing the number of hungry people by 50% by 2015. ECOWAS, in response to the African Action Plan (AAP), formulated the West African Agricultural Productivity Program (WAAPP) as an implementing instrument for achieving two principal objectives of the focal areas which are: To make agriculture more productive and sustainable and to support sub-regional integration.

Secondly, given that the problem of malnutrition remains considerably high in Akwa Ibom state and other parts of the country, more effort and a possible least-cost solution is required to mitigate malnutrition, which biofortified cassava could provide. With the trial of pro-vitamin A biofortified cassava in the Ikot Ekpene senatorial district of the state, there is also a significant number of biofortified cassava farming and processing households available in the different agricultural communities of the district. These farmers/processors play strategic roles in the cassava supply chain. Their number and potentials are very much of interest to scholars to smoothen the path to more sustainable agriculture, with an emphasis on biofortification.

McCluskey (2015) and Sayre (2011) observed that perception affects product choice and consumer willingness to pay for such brands in the market. This manifests as consumer skepticism of perceived risk and is assumed to be high over safety and other issues (Kotler and Keller, 2010). Cognitive factors such as belief, risk perception, knowledge, and limited trust have emerged as critical elements for explaining the differences in consumer mindset for biotech crops in European countries (Petty and Krosnick, 1995). The above is further aggravated by the poor awareness of the nature of products such as biofortified foods as a cost-effective food enrichment measure within the alimentary culture. Nguema *et al.,* (2010) observed that household food security and awareness levels of the benefits of biofortification affect the decision to adopt such products, and by extension, their market presence.

This obviously introduces a gap in information circulation and reflects the opinion that information dissemination is poor and cannot direct a high level of participation in product acceptance for both consumers and producers of such agricultural products (Meenakshi *et al.,* 2010). Oteh *et al.* (2020) only found a handful of respondents who highly adopted biofortified cassava variants such as garri, cassava bread, cassava fufu flour, high-quality cassava flour, cassava starch, cassava cake, and cassava chips in their study. But between 2014 and 2015, the number of households that had access to Pro-vitamin A cassava in Nigeria increased to 68%, but only 10 percent out of the estimated 7,000 tons of Vitamin A cassava roots harvested were reportedly sold in local markets (Bouis and Saltzman, 2017). This indicates that Pro-vitamin A cassava products consumption constitutes a few percent of the total food consumption in the country with its attendant effect on efforts to deepen consumer demand and supply for the products. Occasioned by the limited availability of findings on the acceptability and utilization of Pro-vitamin A cassava products in Akwa Ibom State, this study set out to bridge the gap and provide a basis for policy intervention that addresses issues relating to the utilization of Pro-vitamin A cassava products in Akwa Ibom State. Specifically, the study

- examined the respondents' knowledge level of Pro-Vitamin A biofortified cassava products.

- ❖ assessed the perception of respondents on Pro-Vitamin A biofortified cassava products;
- ❖ assessed the attitude of respondents towards Pro-Vitamin A biofortified cassava products;
- ❖ examined the level of utilization of pro-vitamin A biofortified cassava products by the consumers

Hypotheses of the study

There is no relationship between respondents' attitude towards Vitamin A Cassava and their utilization of Vitamin A cassava products.

There is no significant influence of perception and attitude towards pro-vitamin A Cassava on respondents' utilization of pro-vitamin A cassava products.

2. Materials and methods

The study was carried out in the Ikot Ekpene Senatorial District of Akwa Ibom State. Akwa Ibom State is one of the thirty-six (36) states in Nigeria and is in the South-south geopolitical zone between latitudes 4°32′N and 5°33′N, and longitudes 7°25′E and 8°25′E. (AKS 1989). Ikot Ekpene senatorial district is in the Northwestern part of the state and is composed of 10 Local Government areas. It is the political and cultural capital of the Annang ethnic group of Nigeria. The area is known as a regional centre of commerce, with notable export of farm products, especially palm oil, kernels, raffia products including raffia fiber and its sweet wine, as well as the group's crops of yams, cassava, and corn. It is a tropical zone that has green foliage of trees.

2.1. Study Design and Population

The study adopted the survey research design with the study population comprising all the households that consume biofortified cassava in the study area. The precise number of biofortified cassava consumers was unknown given that there is no statistically available evidence of such a population in the State. Therefore, the population of this study is infinite.

2.2. Sampling Procedure and Sample size

Given an infinite population, as is the case in this study, Chen (2013) suggested that respondents could be chosen based on their convenience and availability. Therefore, the study adopted a multi-stage sampling technique for selecting locations and consumers. Based on the nature of the product of interest, it was considered that responses should be elicited from sources knowledgeable in biofortified cassava to limit measurement error. In stage 1: the purposive sampling technique was used to select 5 out of 10 Local Government Areas in the senatorial district. At stage 2, simple random sampling was used to select 2 communities from each of the selected LGAs. Thereafter, 20 households with a particular interest in the household heads were systematically selected. Altogether, 200 respondents were used for the study.

2.3. Method of Data Collection/ Analytical Procedure

Primary data were used in the study collected from a properly administered interview schedule. Collected data were analyzed using descriptive and inferential statistics. The descriptive statistics used include percentages, and the mean while the inferential statistics were Pearson's Product Moment Correlation (PPMC) and multiple regression.

3. Results and discussion

3.1. Results on Level of knowledge of respondents on Biofortified Cassava Products

From the results in Table 1, all the respondents have basic knowledge of biofortified cassava (PVABC) products. This contradicts the results of the findings of Duah *et al.* (2016) where only 36.6% of the respondents had knowledge about yellow flesh cassava and only 13% had knowledge of the nutritive value of the yellow flesh cassava. It also contradicts the reports in Kenya by Amaya *et al.* (2020), where low awareness was prevalent but corroborates the results of Okello *et al.* (2015), Onunka *et al.*

(2017), Oparinde *et al.* (2017), Sakala *et al.* (2018) and Uzokwe *et al.* (2021) that respondents had knowledge about the biofortified cassava**.** Most respondents (70.5%) know that PVAC can prevent Vitamin A deficiency, 65.5% of respondents cultivate PVAC on their farms, and 82.6% of the respondents can identify PVAC products. 77.6% of the respondents can differentiate between yellow garri and palm oil Garri and 79.5% of the respondents is aware of the nutritional benefits of consuming Pro-Vitamin A cassava products. The high level of knowledge of biofortified cassava by the respondents justifies the purposive sampling and shows that the products gain recognition in the study area.

Table 1. Level of knowledge of respondents on Biofortified Cassava Products.

S/N	STATEMENTS	YES	NO	DON'T KNOW	KNOWLEDGE	
					INDEX	REMARK
1	Have you heard about Pro-Vitamin A cassava?	200 (100)	0 (0)	----	1.00	High
2	Biofortified cassava can prevent Vitamin A deficiency	141 (70.5)	17 (8.6)	42 (21.0)	0.71	High
3	Do you cultivate biofortified cassava on your farm?	125 (62.5)	68 (34.0)	7 (3.5)	0.63	Average
4	Can you identify pro-vitamin A cassava fufu?	165 (82.6)	35 (17.5)	----	0.83	High
5	Can you identify pro-vitamin A cassava tapioca?	106 (53.0)	64 (32.0)	30 (15.0)	0.53	Average
6	Can you differentiate between yellow garri and palm oil garri?	155 (77.6)	45 (22.5)	----	0.78	High
7	Are you aware of the nutritional benefits?	159 (79.5)	41 (20.5)	----	0.80	High

Source: Field Survey, 2022

3.2. Perception of Respondents on Biofortified Cassava Products

Results in Table 2 show that all the respondents have a positive perception of pro-vitamin A cassava products as no mean was below the cut-off mark (3.0). They perceived the Pro-Vitamin A cassava as capable of improving the health of children (4.43), improving the health of mothers (4.25), and reducing the problem of eye defects (4.25). Also, the consumers perceived that mothers and children can consume yellow garri (4.28), yellow cassava reduces malnutrition (4.10), and that yellow cassava has a low starch content (4.01). It was Oteh, *et al.* (2020) who observed that there are multi-complex phenomena that influence how consumers perceive and acquire products and services, especially when there are alternatives. This result contradicts that of Uzokwe (2021) where only 39.6% of the respondents had a positive perception of the benefits of biofortified cassava but corroborates Olatade (2016), and Alabi *et al.* (2020), where there was a high perception of the biofortified cassava. This could be attributed to the respondents' high knowledge level of the products. This is because perception is basically fueled by the volume of information available to the decision-maker. According to Okello *et al.* (2017), much of perception research in consumer behavior is driven by the information-processing view, which has traditionally been a dominant paradigm within cognitive psychology.

Table 2. Perception of respondents on Biofortified Cassava products

PERCEPTION	MEAN	Std. D
Pro-Vitamin A cassava improves the health of children	4.43	0.89
It improves the health of mothers	4.25	0.83
Yellow cassava reduces the problem of eye defect	4.25	0.84
It matures earlier than white cassava	3.81	1.03
Yellow cassava has less acid content in it	3.80	0.90
Yellow cassava is not natural	3.74	1.36
Yellow cassava has a low starch content	4.01	0.91
Yellow cassava reduces malnutrition	4.10	0.98
Mothers and children of all ages can consume yellow garri	4.28	0.86
Yellow cassava products are not socially acceptable here	3.75	1.14
Yellow cassava is scarce/not readily available	3.98	1.13
Yellow cassava spoils easily	3.63	1.28
Yellow cassava is more watery than white cassava	3.78	1.24
Grand Mean	3.98	
Cut-off mark	3.00	

Source: Field survey, 2022.

3.3. *Attitude of Respondents to Biofortified Cassava Products*

Results in Table 3 show that all the respondents have a favourable attitudinal disposition toward biofortified cassava using the cut-off mark (3.00). Consumers' attitude favoured biofortified cassava products utilization because of its health benefits (4.47), Nutrient content (4.28), quality (4.07), it should be taste (3.95) and Colour (3.82). The findings corroborate Onunka *et al.* (2017) and Anugwa *et al.* (2021) who found that farmers had a favourable attitude toward biofortified cassava products in Abia and Anambra States, Nigeria respectively. The favourable attitude may be a result of their high knowledge of biofortified cassava products or because the majority of the respondents are young and have more access to information about biofortified cassava products.

Table 3. Attitudes of Respondents towards Bio-Fortified Cassava Products

STATEMENTS	MEAN	Std. D
I use yellow garri because it's good for my health	4.47	0.90
I use yellow garri because of its nutrient contents	4.28	0.85
I use yellow garri because its quality is better than the white garri	4.07	0.89
I utilize Pro-vitamin A cassava because I make a lot of money from it	3.74	1.08
I use Pro-vitamin A cassava products because it is less expensive	3.33	1.22
I use yellow garri because of its nice color	3.82	1.10
I use yellow garri because of its taste	3.94	1.06
I use yellow garri because it satisfies more than white garri	3.61	1.19
I use Pro-vitamin A cassava product because it is less expensive	3.46	1.23
I don't use yellow garri because of its watery content	3.42	1.24
I don't use yellow garri because of its high acidic content	3.49	1.18
I don't consume Pro-Vitamin A products because it is not readily available	3.70	1.15
I don't use yellow garri because it spoils quickly (does not last)	3.32	1.29
Grand Mean	3.74	
Cut off	3.00	

Source: Field survey, 2022.

3.4. Level of Utilization of Pro-Vitamin A Cassava Products

In examining the extent of utilization of the various forms of products that pro-vitamin A cassava can be processed into, yellow garri was more utilized by the consumers (2.98) than fufu (2.57) and Tapioca (2.11) as presented in Table 4. The findings agree with the findings of Amadi, Nzeakor, & Chimaraoke, (2020) who showed that there were high levels of consumption of garri, fufu, and flakes in the South Eastern and South-Southern states of Nigeria. However, their results also showed that the mean consumption for Imo and Delta states was lower than that of Anambra and Akwa Ibom states. This finding is also consistent with the findings of Duah, *et al.* (2016) who found that the majority of the participants consumed pro-vitamin A cassava in form of garri.

Table 4. Respondents' Level of Utilization of Pro-vitamin A Cassava Products.

Products	Never	Rarely	Sometimes	Always	Mean	Std. Dev.
Garri	7 (3.5)	51 (25.5)	80 (40.0)	62 (31.5)	2.98	0.84
Fufu	16 (8.0)	77 (38.5)	83(41.5)	24 (12.0)	2.57	0.80
Tapioca	57 (28.5)	77 (38.5)	52 (26.0)	14(7.0)	2.11	0.90

Source: Field survey, 2022.
Note: values in the parenthesis represent the percentage while values outside the parenthesis indicate the frequencies.

3.5. Hypotheses testing

3.5.1. There is no relationship between respondents' attitude towards Vitamin A Cassava and their utilization of Vitamin A cassava products.

Table 6 shows the correlation analysis that was adopted to determine if there is any significant relationship between respondents' attitude towards vitamin A cassava and their utilization of vitamin A cassava products in the study area. The table reveals that there is a positive relationship between attitude toward vitamin A cassava and their utilization of vitamin A cassava products. The table also indicates that the relationship, although low, is statistically significant r= 0.142, N=200, P< 0.05, R^2 =0.020164, showing that 2.016% of the variation in the utilization of vitamin A cassava products can be attributed to respondents' attitude towards vitamin A cassava. The null hypothesis is therefore rejected and concluded that there is a significant relationship between respondents' attitude towards vitamin A cassava and their utilization of vitamin A cassava products in the study area.

Table 6. Summary of Correlation Analysis between Respondents' Attitude towards Vitamin A Cassava and their Utilization of Vitamin A Cassava Products

Variables	N	Mean	SD	r-value	r-critical	P.value	Remark
Utilization	200	7.67	1.99	0.142	0.138	0.045	Significant
Attitude	200	48.69	8.74				

Source: Computed from Field Survey 2022

3.5.2. There is no significant influence of perception and attitude towards pro-vitamin A Cassava on respondents' utilization of pro-vitamin A cassava products.

Multiple regression was conducted to examine if there is any significant influence of perception and attitude of the respondents on their utilization of pro-vitamin A cassava products. Table 6 shows that the two (2) independent variables taken together had some level of influence on the variance in the utilization of pro-vitamin A cassava products among the respondents, R =

0.197. The table also accounted for a 3.2% variance in the utilization of pro-vitamin A cassava products by the two (2) independent variables. The joint influence of these independent variables on the utilization of pro-vitamin A cassava products was also statistically significant at $F = 3.257$; $P < 0.05$.

A critical examination of the Beta coefficients shown in the table reveals that one predictor (the attitude of the respondents towards pro-vitamin A cassava) significantly influenced the utilization of pro-vitamin A cassava products among the respondents. The coefficient of the attitude of the respondents towards pro-vitamin A cassava is 0.231. This means that a unit increase in the attitude of the respondents towards pro-vitamin A cassava will increase the utilization of pro-vitamin A cassava products among the respondents by 0.231 units implying that measures for increasing the attitude of the respondents towards pro-vitamin A cassava will work to improve and increase the level of utilization of pro-vitamin A cassava products among the respondents by 0.231 units.

Table 6. Influence of perception and attitude towards pro-vitamin A Cassava on respondents' utilization of pro-vitamin A cassava products.

S/N	Variables	Coefficients (Linear)
1	Perception towards Vitamin A Cassava	-0.141
		(-1.558)
		(0.204)
2	Attitude towards Vitamin A Cassava	0.231
		(2.551) *
		(.133)
	Constant	1.937
	R	0.179
	R^2	0.032
	Standard error of Estimate	0.2868
	F-value	3.257
	Significant	.041

Source: Computed from Field survey 2022
Note: Values in the middle represent t-values while values in the last parenthesis represent standard error.
** Significant at a 5% level of significant*

4. Conclusion and Recommendations

The study provides empirical evidence of the fact that knowledge, perception, and attitude play a greater role in the utilization of Pro - vitamin A biofortified cassava products in the study area. The high level of knowledge of the Pro - vitamin A biofortified cassava products in the study area led to a positive attitude toward the utilization of the products. The study recommends that Pro-vitamin A biofortified cassava materials should be made available, by stakeholders, to the other senatorial districts of the State and increased awareness campaigns should be carried out by Extension Agents to boost the knowledge level of consumers so as to upscale the PVABC utilization by every household in the State.

Authors' Contributions
All authors contributed to this research.
Funding
There is no funding for this research.
Institutional Review Board Statement
All Institutional Review Board Statements are confirmed and approved.
Data Availability Statement
Data presented in this study are available on fair request from the respective author.
Ethics Approval and Consent to Participate
Not applicable
Consent for Publication
Not applicable.
Conflicts of Interest

The authors disclosed no conflict of interest starting from the conduct of the study, data analysis, and writing until the publication of this research work.

5. References

Agwu, N. M. (2011). *'Patterns and determinants of fruit and vegetable consumption in urban and rural areas of Enugu state, Nigeria (unpublished doctoral thesis)',* University of Nigeria, Nsukka.

Akwa Ibom State (AKS) (1989). *'Physical background, soils and land use, and Ecological problems',* Technical Report of the Task Force on Soils and Land Use Survey. Akwa Ibom State Ministry of Lands and Surveys. Pp. viii-xv.

Alabi, D. L., Aribifo, D. L., Oluyemi, E. O. (2020). 'Rural Households' Perception of Vitamin A Biofortified Cassava and Its Products: Implications for Food Security', *Agronomic Research in Moldavia*, 103(184), pp. 400-413.

Amadi, P. E., Nzeakor, F. N., Chimaraoke, O.C. (2020). 'Selected Socio-Economic Factors Influencing Consumption of Pro-Vitamin A Cassava Products in South-East and South-South Nigeria', *Journal of Community & Communication Research*,5, (2), pp. 254-262.

Amaya, A.L., Kyallo, F., Judith, K., Okoth, P.K., Anselimo, M., Daniel, S., Mwai, J. (2020). 'Food Fortification: The Level of Awareness among Kenyan Consumers', *Hindawi J. Nutri. Metab.*, pp.1-7.

Anugwa, I. Q., Uzochukwu, E., Obazi, S. A. (2021). 'Knowledge and attitude of farmers towards the adoption of pro-vitamin A bio-fortified cassava in Anambra State, Nigeria', *Discovery Agriculture*, 7(17), pp. 101-109.

Asonye, C.C. (2001). *'Fortification of common Nigerian food-cassava meals',* in Scrimshaw N.S. (ed.) Dietary Approaches to Vitamin A Deficiency Food and Nutrition Bulletin, 22 (4), pp. 423-426.

Bouis, H. E., Saltzman, A. (2017). 'Improving nutrition through biofortification: a review of evidence from HarvestPlus, 2003 through 2016. Glob. Food Sec., 12, pp. 49–58. doi: 10.1016/j.gfs.2017.01.009

Caswell, J. A., Joseph, S. (2007). *'Consumer demand for quality: major determinant for agricultural and food trade in the future',* in University of Massachusetts Amherst, Department of Resource Economic Working Paper, # (Masachusetts) 2007–4. doi: 10.2139/ssrn.976707

Chen, W. (2013). 'The effect of different types of trust on consumer perceptions of food safety'. *China Agricult. Econ. Rev.,* 5, pp. 43–65. doi: 10.1108/17561371311294757.

Creswell, J. W. (2014). '*Research Design: Qualitative, Quantitative and Mixed Methods Approaches',* California, SAGE publication.

Duah, E. A., Parkes, E., Baah, R. O., Mensah, A., Danquah, A. Holger, K., Peter, K., Steiner- Aseidu, M. (2016). 'Consumption Trends of White Cassava and Consumer Perceptions of Yellow Cassava in Ghana', *Journal of Food and Nutrition Research*, 4(12), pp. 814-819. doi: 10.12691/jfnr-4-12-8 |

FAO (Food and Agricultural Organisation) (2011). *'A Cassava Industrial Revolution in Nigeria',* Available online at: www.fao.org/doerep/007/y5548e/y5548e0b.htm (accessed January 8, 2014).

Kotler, P., Armstrong, G. (2008). '*Principles of Marketing',* 10th Edn. Indian: Pearson Educational Inc.

Kotler, P., Keller, K. L. (2010). '*Marketing Management (13th ed.)*', New Delhi: Pearson Educational Inc.

Loopstra, R. (2018). 'Intervention to address household food insecurity in high income countries' *Proc Nutr. Soc.,* 77, pp. 270–281. doi: 10.1017/S002966511800006X

Low, J., Arimond, J. M., Osman, N., Cunguara, B., Zano, F., Tschirley, D. (2007). 'A food-based approach introducing orange-fleshed

sweetpotato increased vitamin A intake and serum retinol concentrations in young children in rural Mozambique', *J. Nutr.*, 137, pp. 1320–1327. doi: 10.1093/jn/137. 5.1320.

Maziya-Dixon, B., Dixon, A.G.O., and Adebowale, A.R.A., (2007). 'Targeting different end uses of cassava: genotype variations for cyanogenic potentials and pasting properties', *Inter. J. Food Sci. Technol.,* 42, pp. 969 – 976.

McCluskey, J. J. (2015). 'Changing Food Demand and Consumer Preferences', *Federal Reserve Research Papers.* Available online at: www.KansasCityFed.org/publications/research/rscp/rscp-2015

Meenakshi, J. V., Banerji, A., Manyong, V., Tomlins, K., Hamukwala, P., Zulu, R. (2010). *'Consumer Acceptance of Pro-Vitamin A Orange Maize in Rural Zambia',* Working Paper No. 4. Washington, DC: International Food Policy Research Institute (IFPRI).

Nguema, A., Norton, G. W., Fregene, M., Sayre, R. T., Manary, M. (2010). 'Economic benefits of meeting nutritional needs through biofortified cassava: an example from Nigeria and Kenya', *Af. J. Agric. Resour. Econ.,* 6, pp. 1–17. doi: 10.22004/ag.econ.156956

Nwajiuba, A. C. (2013). *'Does Agriculture Have a Future in Southeast Nigeria?',* An Inaugural Lecture Delivered at the Imo State University. Owerri: Imo State University Press.

Ogunleye, K. Y., Adeola, R. G., Bolarinwa, I. F. (2017). 'Yellow Cassava Attributes Influencing its Utilization among Cassava Processors in Oyo State, Nigeria', *International Journal of Environment, Agriculture and Biotechnology (IJEAB)*, 2(5).

Okello, J. J., Shikuku, K., Sindi, K., Low, J. (2015). 'Farmers' perceptions of orange fleshed sweet potato: Do common beliefs about sweet potato production and consumption really matter' *Afri. J. Food Agric. Nutri. Dev.,* 15, pp. 10153- 10170.

Olatade, K. O, Olugbire, O. O, Adepoju, A. A, Aremu, F. J., Oyedele, P. B. (2016). 'How Does Farmers' Characteristics Affect Their Willingness to Adopt Agricultural Innovation? The Case of Biofortified Cassava in Oyo State, Nigeria', *Int. J. Sci. Tech*., pp. 59-75.

Onuegbu, N. C., Ihediohanma, N. C., Eze, C. F., Okafor, D. C., Ojukwu, M. (2017). 'Biofortification of local staples in Nigeria: prospects and problems', J. *Food Biotechnol. Res.,* 1, pp. 5–15.

Onunka, B.N., Ume, S.I., Ekwe, K.P., Silo, B.J. (2017). 'Attitude of farmers towards pro-vitamin Acassava production technologies in Abia State, Nigeria', *Life Sci. Arch. (LSA).,* 3, pp. 1050-1059

Oparinde, A., Banerji, A., Birol, E., Ilona, P., Bamire, S., Asumugha, G. (2012). *'Consumer Acceptance of Biofortified (Yellow) Cassava in Imo and Oyo States, Nigeria: Preliminary Findings',* HarvestPlus. Unpublished Project Report. 2012.

Oteh, O.U., Hefferon, K., Agwu, N.M. (2020). 'Moving Biofortified Products closer to the Market in Nigeria', *Frontiers in Sustainable Food Systems,* 1(4).

Petty, R. E., Krosnick, J. A. (1995). *'Attitude strength: an overview',* in Attitude Strength: Antecedents and Consequences. eds R. E. Petty and J. A. Krosnick (Hillsdale, NJ: Erlbaum), 1–24.

Sakala, P., Kunneke, E., Faber, M. (2018). 'Household Consumption of Orange-Fleshed Sweet Potato and its Associated Factors in Chipata District, Eastern Province Zambia', *Food Nutr. Bull*., 39, pp. 127-126.

Sayre, R. T. (2011). '*Biofortification of Cassava for Africa: The BioCassavaPlus Program*. Korea: Smith Gordon press.

Tumuhimbise, G.A., Namutebi A., Turyashemererwa, F., Muyonga, J. (2013).

'Provitamin A Crops: Acceptability, Bioavailability, Efficacy, and Effectiveness', *Food and Nutrition Sciences,* 4, pp. 430-435.

Uzokwe, C. A., Iheme, G. O., Oteh, O. U., Ewude, M.C., Uruakpa, Q. (2021). 'Knowledge, Perception and Utilization of Biofortified Cassava and Orange-Fleshed Sweet Potato (Ofsp) in Selected Rural Areas in Nigeria', *Afr. J. Food Agric. Nutr. Dev*., 21(5), pp. 18019-18034. .Https://Doi.Org/10.18697/Ajfand.100.20290.

WHO (2017). '*Micronutrients Deficiency: Vitamin A Deficiency',* www.who.int/nutrition/topics/vad/en/ Retrieved on 5th August 2017.