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AWARENESS, PERCEPTIONS AND WILLINGNESS TO PAY FOR PRO VITAMIN A GARRI: EVIDENCE FROM IDO LOCAL GOVERNMENT OF OYO STATE, NIGERIA

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Abstract. Efforts made to combat vitamin A deficiency are a crucial feat for public health services dealing with vulnerable people in developing nations. Therefore, this study examined the awareness, perceptions and willingness to pay for pro-vitamin-A garri in Oyo state, Nigeria. A multistage sampling procedure was used to collect data from 150 sampled respondents. Data was analyzed using descriptive statistics and the double-hurdle model. The results revealed that while ca. 47.5% of the respondents are aware of the availability of pro-vitamin-A garri, the levels of awareness are low. However, 67.3% of the consumers are aware of pro-vitamin-A garri thanks to agricultural extension agents, radio and friends. The maximum, minimum and average amount the consumers were willing to pay per kilogram of pro-vitamin-A garri was NGN 500 (USD 1.39), NGN 160 (USD 0.44) and NGN 220.08 (USD 0.61), respectively. The double-hurdle model showed that income, other income streams and awareness exerted a significant and positive influence on the consumers' willingness to pay for pro-vitamin-A garri. Similarly, education and radio-induced awareness significantly and positively influenced the amount they were willing to pay per kilogram of pro-vitamin-A garri. Conversely, household size had a significant negative influence. The study advocates for nutrition education as an important tool in communicating the nutritional and health benefits of bio-fortified crops.

Keywords: awareness, perception, pro-vitamin-A garri, willingness to pay

INTRODUCTION

Cassava is an important and the most widely consumed staple food in Nigeria. It is a starchy root tuber which contributes to the staple of millions worldwide, many of whom live in sub-Saharan Africa (SSA). Cassava originates from Latin America but was introduced to Africa by the Portuguese in the sixteenth century as a possibly useful crop (Akinpelu et al., 2011). It was reported that ca. 121 million tons of cassava are produced in Africa (Parkes et al., 2013). Globally, cassava production and consumption has substantially increased over the past few years with sub-Saharan Africa having the highest growth from 48.3 million tons in 1980 to 95.3 million tons in 2011 (Egesi et al., 2006; FAO, 2013). This growth is championed by Nigeria, the largest producer of cassava, followed by Ghana (FAO, 2013). Cassava is a very versatile commodity with numerous uses and by-products. The roots are processed for human and industrial consumption. Various products can be derived from cassava, including garri, cassava flour, wet pulp, starch, smoked cassava balls and dried cassava (Truman et al., 2004).

Root crops are predominantly white in color and do not contain pro-vitamin-A. Over the decade, there have been a series of interventions to improve human diets as a result of increasing incomes and administration

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of vitamin-A capsules (Ilona et al., 2017; Egesi et al., 2006). The production of pro-vitamin-A cassava started in 2011 with the intervention of the International Center for Tropical Agriculture (CIAT) and the International Institute of Tropical Agriculture (IITA) funded by the HarvestPlus program. About five years after the intervention, statistics revealed that 1 million Nigerian farm households grow yellow cassava varieties which contain substantial quantities of pro-vitamin-A even after processing. In Nigeria diets, yellow cassava now represents an additional source of vitamin A (Saltzman et al., 2014). Human diets consist of two forms of vitamin A: preformed vitamin A (retinol) and pro-vitamin-A carotenoids. Preformed vitamin A is dominant in animal-sourced foods; pro-vitamin-A is found in some vegetable foods, and is metabolized by the body into retinol when consumed (Green and Fascetti, 2016; Tanumihardjo et al., 2016). The Estimated Average Requirement (EAR) for vitamin A is 275 μg retinol for children (between 4 and 6 years old), ca. 500 μg retinol for women and 600 μg retinol for men (Sanusi and Akinyele, 2006). Consumption of adequate quantities of vitamin A is imperative for sound and healthy immune functions (Sanusi and Akinyele, 2006; Katona and Katona-Apte, 2008). When deficient, it causes severe visual impairment and magnifies the risk of illness and death from common infections (Kennedy et al., 2003; FAO, et al., 2015; Kuku-Shittu et al., 2013; West and Darnton-Hill, 2008; West, 2002). Vitamin A is concentrated in relatively few foods (Meenakshi et al., 2010). Although the richest sources of preformed vitamin A in the Nigerian diet are animal-based (e.g. liver, dairy products, fish oils, and eggs), the most common sources of the nutrient are pro-vitamin-A carotenoids, including beta-carotene derived from orange and yellow fruits and vegetables (pumpkin, yellow squash, carrots, yellow sweet potatoes, green leafy vegetables, mango, papaya, and other local carotene-rich fruits), some of which are highly seasonal in availability (Ender et al., 2014; Oparinde et al., 2016).

The recent national outcome on vitamin A deficiency (VAD) in 2001 showed that 29.5% of pre-school children and 13% of women of childbearing age are vitamin A deficient (Maziya-Dixon et al., 2006). However, there is no recent comprehensive national data on vitamin A deficiency (VAD) in Nigeria. In lieu of this, it could be concluded that Nigeria is not effectively monitoring vitamin A deficiency. Owing to periodic disparity in dietary intake and vitamin A deposits in the body, its inadequacy does not always result in clinical VAD. The most effective and vast instruments for checking VAD are diet revitalization via nutrition education, adequate and constant supply of mega-doses of vitamin A and fortification of staple foods with vitamin A (Ilona et al., 2017; Kuku-Shittu et al., 2013). Nigeria has adopted all of these options but not well enough to exert a quantitative impact on consumers. Vitamin A became well-known after enacting laws requiring vitamin A fortification of all wheat flour, maize flour, edible vegetable oil, margarine and sugar (Sanusi and Akinyele, 2006; Uchendu et al., 2012; Ogunmoyela et al., 2013).

Cassava is a common staple food in Nigeria, and vitamin A cassava increases vitamin A intakes among its consumers. Since the varieties of cassava pulp normally consumed are white, an effective introduction of vitamin-A cassava (yellow cassava) will be contingent on its acceptability and consumption by the populace in Nigeria. In Nigeria, cassava is predominantly consumed as garri which means "free flowing creamy white or yellow granular partially gelatinized flour produced from cassava" (Cardoso et al., 2005). It is produced through the process of peeling, washing, grating, bagging and dehydration (with the aid of hydraulic press), fermentation, sieving, frying, cooling and packaging. Its longevity and ease of preparation (compared to other cassava food products) makes garri a widely consumed food (Sanni et al., 2008). Predilection for garri varies across ethnicity and regions of the country. The southeastern region consumes yellow garri, whereas most of the garri consumed in the southwest is white. However, garri can be possibly found in different shades of yellow in both regions (Oparinde et al., 2016). There are essential positive contributions of pro-vitamin-A garri in human diet: it provides up to 40% of vitamin A; it is richer in beta-carotene and a better source of energy than the local white garri; food like vitamin-A cassava moimoi fortified with beans and cassava custard is of good quality for children; pro-vitamin-A eba/garri (natural, without additional oil) has a good curling quality in lafun/eba (Talsma et al., 2016). A consumer acceptance study conducted in 2011 in two Nigerian states showed that vitamin-A cassava varieties, when supplied with nutrition information, were generally accepted and desired after an evaluation of their sensory features, form and texture. Also, the consumers' willingness to pay revealed the wide acceptability of vitamin-A cassava (Oparinde et al., 2016). However, if supplied without nutrition

information and awareness, the results were different. Garri mixed with palm oil was preferred over that made from vitamin-A cassava in Imo State, while Oyo State consumers mainly preferred garri made from a lighter, colored vitamin-A cassava variety.

Vitamin A deficiency is a major public health challenge among the vulnerable niche of young people in developing nations (Greiner, 2017) where food-based policies are recommended as encouraging methods to meet vitamin A needs. It is therefore expedient to improve the nutritional content and flavor of garri, and to produce a unit product with standard and improved nutritional content. However, it is against this background that pro-Vitamin-A Garri (VAG) as a new product of pro-vitamin-A cassava has a great potential to alleviate Vitamin A Deficiency (VAD). Consumer awareness, perceptions and willingness to pay will help in disseminating pro-vitamin-A garri to complement current efforts made to address VAD by delivering vitamin A through a staple food consumed on an everyday basis. Also, this can be a complementary approach to other interventions. In view of the above, this paper investigates the awareness, perception, willingness to pay and the intensity of willingness to pay for pro-vitamin-A garri among rural consumers in Ido Local Government Area of Oyo State, Nigeria.

THEORETICAL MOTIVATION AND CHOICE OF ECONOMETRIC MODEL

The review of relevant literature explains the techniques of estimating the consumer's willingness to pay (WTP) for agricultural produce. The following three techniques exist: contingent valuation method; the revealed preference theory; and a combination of the use of theory along with microeconomic household variables and market variables (used to indirectly estimate the appropriate market premium). However, of among the preference methods listed above, the contingent valuation method is vastly recommended in situations where there is no or little market information, and has been widely adopted and used by many researchers (Vandeveer and Loehman, 1994; Sarris et al., 2006; Liu and Zhang, 2011; Nakanyike, 2014; Taneja et al., 2014; Okoffo et al., 2016; Oyawole et al., 2016; Adekunle et al., 2016). This is because it helps to motivate the concept of choice in a market situation as respondents have the opportunity to accept or reject the product. The significant importance of the contingent valuation method widens its usage in various agriculture-related studies to estimate the farmers' and consumers' willingness to pay for a service, product or technology. For instance, Ulimwengu and Sanyal (2011) adopted the method in analyzing the farmers' willingness to pay for agricultural services. Other use cases include studies by Kwadzo et al. (2013) and Danso-Abbeam et al. (2014). The contingent valuation method relies on surveys that are specifically designed to measure the preferences and willingness to pay (Taneja et al., 2014). Based on its importance, the contingent valuation was used in this study.

One of the major problems often encountered in empirical studies like this one is the absence of response. Therefore, the Ordinary Least Square regression is unsuitable for this analysis as the estimates will be biased. A number of econometric models have been proposed and used to handle the observed zeros (in the dependent variable) based on the assumptions made by the researcher about the potential sources of the observed zero responses. These are the Tobit, Heckman, double-hurdle and infrequency of purchase models. Various studies used either the double hurdle model or Heckman's sample selection model in determining the willingness to pay for agricultural goods and services (Cragg, 1971; Norris and Batie, 1987; Gabre-Madhin et al., 2003; Sindi, 2008; Wodjao, 2008; Yu and Abler, 2010; Musah, 2013; Khan and Damalas, 2015; Okoffo et al., 2016). The double-hurdle model was adopted in this study because of its advantage over the Heckman's sample selection model. The Heckman sample selection model assumes that no zero response will be present in the second hurdle of the analysis once the first hurdle is passed. The double hurdle, on the other hand, recognizes the possibility of zero observations in the second stage (Wodjao, 2008). A zero-response situation is possible because the consumer may refuse to answer due to lack of knowledge or to the perceived complexity of questions. In addition, some consumers may only have partial information on their willingness to pay for pro-vitamin-A garri (Yu and Abler, 2010). For this scenario, it is possible that respondents cannot give a number representing their WTP but may recognize the fact that they have a positive WTP. Therefore, it is appropriate to use a double-hurdle model in which adoption behavior consists of two decisions: an adoption decision, i.e. a binary choice modeled using a logit; and a WTP amount decision, which is a truncated regression model (Cragg,

1971). The double hurdle is used in a situation where an event may occur or not; and when it does, it takes on continuous positive values (Gabre-Madhin et al., 2003). It is assumed that the consumers are faced with hurdles in their decision-making process. Hence, the decision to pay is made first, followed by the decision on how much to pay for pro-vitamin-A garri. The two equations are assumed to be independent.

METHODOLOGY

Study area

This study was conducted in Ido Local Government Area of Oyo State, one of the six states in southwest Nigeria. One of the ancient states of the nation, it is well known for agricultural practices. Just like other local government units, Ido Local Government (with Ido as the capital city) was created in May 1989. It is located at latitudes between 7°45'N, 7°15N and at longitudes between 3°30'E, 3°50'E, and has a population of 103,261 and an area of 986 km^2 (NPC, 2006). It has a relatively high humidity, with average daily temperatures ranging between 25°C (77°F) and 35°C (95°F) almost all year round (Weather2, 2017). The vegetation pattern consists of rainforest in the south and Guinea Savannah in the north. Ido enjoys abundant rainfall of over 1800 mm annually; south-westerly winds blow over the LGA during most of the year. The climate in the local government area favors the cultivation of crops like maize, yam, cassava, millet, rice, plantain, cocoa, oil palm and cashew (Denton and Ogunkunle, 2014). The study area is well known for the cultivation of crops and rearing of animals as the population's main occupation, the other being blacksmithing, carpentry, hairdressing, tailoring, trading etc. This area was chosen because Ido Local Government is predominantly known for cassava production.

Sampling procedure and sample size

Data for this study was collected from 150 respondents who were adult members of the houses interviewed in a cross-sectional survey using a structured questionnaire which served as the interview guide. The selection process involved three stages. First, Ido town was purposively selected out of every other town in the Local Government Area (LGA) because of high concentration of cassava production in the area. Then, five (5) towns were selected from the Local Government Area based on the simple random sampling procedure. Thereafter, thirty (30) buildings were randomly selected from each of the selected towns and an adult member (respondent) was selected in each building to make a total of 150 households. However, 30 questionnaires were not adequately filled by the respondents, making them unsuitable for analysis. Therefore, data from 120 respondents was eventually used for analysis in this study.

Methods of data collection and analysis

Primary data was collected from the respondents through a questionnaire complemented by interviews. Though conducted in English, the interviews were interpreted to respondents in their local languages to enable a better understanding when required. Data collected was analyzed with descriptive statistics (frequency, percentages and mean), perception index and the double-hurdle model. The dataset includes socioeconomic characteristics of respondents, awareness and perception about pro-vitamin-A garri, and willingness to pay for pro-vitamin-A garri.

Analytical procedure

Descriptive statistics

Descriptive statistics such as percentage, frequency and ranking were used to analyze the socioeconomic characteristics of the respondents' level of awareness and perception of pro-vitamin-A garri.

Awareness index

A set of questions (with yes or no response choices) were asked as appropriate to calculate the awareness index of pro-vitamin-A garri. Three questions were asked about the respondents' awareness of the availability and health benefits of pro-vitamin-A garri. The estimated index for each of the variables was computed for each respondent as follows:

$$S_{ij} = \frac{1}{n_j} \sum_{k=1}^{n_j} A_{kji} \quad (1)$$

where:

S_{ji}: estimated awareness index

A_{kji}: score assigned by an individual in response to the j-th question relating to attitude; in the estimation, a score of 1 was assigned if the response to a question is yes and 0 if the response is no; thus, A is the one or zero response to a specific question.

j: 1, 2, 3; represents the respondents' awareness of pro-vitamin-A garri
n_j: number of questions
k: 1, 2, 3,…, n_j.

By construction, the value of the index falls between 0 and 1. For the purpose of descriptive analysis, each index was further transformed such that 1 was assigned to any index value between 0 and 0.399; 2 was assigned to index values between 0.4 and 0.6; and 3 was assigned to index values between 0.61 and 1. Therefore, 1, 2, and 3 mean low, medium and high levels of awareness of pro-vitamin-A garri, respectively.

Perception index

The perception index was used to examine how pro-vitamin-A garri is perceived by the respondents. Data collected was analyzed with simple descriptive statistics such as a Likert-like 5-point rating scale. In the scale, "Strongly Agree" (SA) has 5 points, "Agree" (A) has 4 points, "Undecided" (U) has 3 points, "Disagree" (D) has 2 points and "Strongly Disagree" has 1 point. Mean Score (MS) is calculated by summation of the product of the rating point (RP) and observation (O) divided by the total number of sampled respondents (£f). Mathematically:

$$\mathrm{MS} = £\left(\frac{\mathrm{RP}\cdot\mathrm{O}}{£\mathrm{f}}\right) \tag{2}$$

Double-hurdle model

This study adopted the double-hurdle model introduced by Cragg (1971) which involves two equations: first, is the willingness-to-pay decision equation; and second, the amount an individual is willing to pay for pro-vitamin-A garri equation. The Cragg Model presumes that two hurdles have to be crossed by a consumer in order to record a positive willingness to pay (expenditure) for a commodity. The willingness-to-pay decision equation can be stated as follows:

Willingness-to-pay decision (probit) equation:

$$W^*_i = Z_i\delta + u_i \tag{3}$$

where:

W: latent variable that defines the rule as to whether a respondent would be willing to pay for pro-vitamin-A garri or not;
Z_i: vector of exogenous variables;
δ: coefficients associated with the repressors (Z), including the constant term;
u_i: error term assumed to be normally distributed (which means a zero mean and a unit variance).

The observed willingness to pay (W) is linked with the latent willingness to pay W^* as follows:

$$W = \begin{cases} 1 \text{ if } y^* > 0 \\ 0 \text{ otherwise} \end{cases}$$

The second equation (the amount willing to pay) is stated as:

$$A^*_i = X_i\beta + \varepsilon_i \tag{4}$$

where:

A^*_i: latent amount willing to pay for pro-vitamin-A garri;
X_i: vector of explanatory variables influencing the amount willing to pay (which may be the same as Z_i);
β: coefficients associated with the repressors (X), including the constant term;
ε_i: error term which is assumed to be normally distributed (with zero mean and constant variance).

The relationship between latent willingness to pay (W*), the latent amount willing to pay (A*) and the observed amount willing to pay for pro-vitamin-A (A) is as follows:

$$A = \begin{cases} A^* \text{ if } A^* > 0 \text{ and } W = 1 \\ 0 \qquad \text{otherwise} \end{cases}$$

The explanatory variables in both equations of the double-hurdle model are as follows:

X_1: age of respondents (years);
X_2: gender (1 if male, 0 otherwise);
X_3: marital status (1 if single, 0 otherwise);
X_4: education (1 if has at least a primary education, 0 otherwise);
X_5: household size (number);
X_6: household income (in NGN/USD equivalent);
X_7: other income sources (1 if yes, 0 otherwise);
X_8: awareness (1 if the respondent is aware of the health benefits of pro-vitamin-A garri via extension services, 0 otherwise);
X_9: family and friends (1 if the respondent is aware of the health benefits of pro-vitamin-A garri via family and friends, 0 otherwise);

X_{10}: radio/television (1 if the respondent is aware of the health benefits of pro-vitamin-A garri via radio and/or television, 0 otherwise).

The double-hurdle model was estimated using the "craggit option" of the STATA code written by Burke (2009). The standard error robust (OPG) option was selected during estimation. This option is derived from the asymptotic theory, and is robust to some kinds of misspecification and intra-group correlations.

RESULTS AND DISCUSSION

Socioeconomic characteristics of the respondents

The socioeconomic characteristics of the respondents are presented in Table 1. Most (48.33%) respondents were aged between 20 and 30 years while 0.83% were above 60 years. Only 11.67% of the respondents were aged between 41 and 50. The mean age of the respondents was 33.4 years and the maximum was ca. 79 years. A total of 58.33% of the respondents were males while 41.67% were females. Most (54.17%) respondents were married while 40.83% were single. About 88.33% of the respondents had a formal education, mostly junior/senior secondary education (49.17%), primary education (14.17%) and tertiary education (25.0%), with 11.67% of the respondents having no formal education. The relatively high level of formal education is expected to induce their willingness to pay for pro-vitamin-A garri. As shown in Table 1, ca. 68.33% of the respondents had between 4 and 6 members in their households, with an average household size being 5 persons. The results also showed that most respondents had an income between NGN 1000 (USD 2.77) and NGN 20,000 (USD 55.56), with the average monthly income being NGN 43,891.67 (USD 121.92).

Awareness and sources of information of respondents about pro-vitamin-A garri

Presented in Table 2 are the results indicating the respondents' awareness of pro-vitamin-A garri as regards its health properties and availability. The majority (54.17%) of respondents indicated they were aware that pro-vitamin-A garri is available in their community for purchase and consumption. Most (66.67%) of them also declared to be aware that pro-vitamin-A garri is produced from yellow cassava. However, majority (75%)

Table 1. Distribution of respondents by socioeconomic characteristics

Characteristics	Frequency (n = 120)	Percentage (%)
Age		
20–30 years	58	48.33
31–40 years	39	32.5
41–50 years	14	11.67
51–60 years	8	6.67
>60 years	1	0.83
Mean age	33.4 years	
Gender		
male	70	58.33
female	50	41.67
Marital status		
single	49	40.83
married	65	54.17
widowed	6	5.00
Education level		
no formal education	14	11.67
primary education	17	14.17
secondary education	59	49.17
tertiary education	30	25.00
Household size (persons)		
1–3	13	10.83
4–6	82	68.33
7–9	19	15.83
10–12	5	4.17
13–15	1	0.83
Mean	5	
Income		
1000–20000	55	45.83
20001–40000	26	21.67
40001–60000	17	14.17
60001–80000	8	6.67
80001–100000	3	
Mean income	NGN 43,891.67 / USD 121.92	

Source: field survey data, 2018.

Table 2. Distribution of respondents by awareness of pro-vitamin-A garri

Awareness-related questions	Frequency (n = 120)	Percentage (100%)
Are you aware that pro-vitamin-A garri is available in your community?		
Yes	65	54.17
No	55	45.83
Are you aware that pro-vitamin-A garri is made from yellow cassava?		
Yes	80	66.67
No	40	33.33
Are you aware that pro-vitamin-A garri is more beneficial than white garri?		
Yes	30	25
No	90	75
Overall awareness		
Low	63	52.5
Medium	–	–
High	57	47.5
Sources of information about pro-vitamin-A garri		
Agricultural extension agents	40	26.7
Radio	35	23.3
Friends	26	17.3

Source: field survey data, 2018.

of the respondents were not aware of nutrition benefits provided by pro-vitamin-A garri while 25% of them were aware of it. On the overall level of awareness, the results suggest that 47.5% of the respondents had high levels of awareness of pro-vitamin-A garri with respect to its availability and nutritional benefits. The level of knowledge is expected to have a positive effect on the willingness to pay.

Note that the consumers received information on pro-vitamin-A garri through agricultural extension agents (26.7%), radio (23.3%) and friends (17.3%).

Perception of the respondents about pro-vitamin-A garri

Table 3 shows the perception about pro-vitamin-A garri in the study area. The mean score was used in explaining the level of the respondents' perception about pro-vitamin-A garri. According to result, the respondents agreed that pro-vitamin-A garri has a yellow color and a fine look (with the mean score of $\bar{x}$ = 3.61). Also, with the mean score of $\bar{x}$ = 3.53, the respondents agreed that some additional health benefits can be derived from pro-vitamin-A garri. The respondents agreed to the fact that pro-vitamin-A garri is readily available in the market (with the mean score of $\bar{x}$ = 3.99). Furthermore, the respondents were in agreement to the fact that they prefer to consume pro-vitamin-A garri over other types of garri because of the taste (with the mean score of $\bar{x}$ = 3.52). In addition, the assertion that pro-vitamin-A garri has reduced the consumption of other types of garri intake indicated a mean score of $\bar{x}$ = 3.85 which shows that consumers agreed with the statement. The assertion that pro-vitamin-A garri will reduce the amount or quantity of other types of garri purchased carries a mean score of $\bar{x}$ = 3.55. This shows that the consumers were in agreement with this statement. The statement "the consumption of pro-vitamin-A garri will help reduce the amount I usually spend on my family members in the hospital" has the mean score of $\bar{x}$ = 3.55, indicating an agreement with the statement by the respondents. The result of the respondents' perception about pro-vitamin-A garri is consistent with the findings of De Moura et al., 2015 and Oparinde et al., 2017.

Consumers' willingness to pay an amount for pro-vitamin-A garri

The consumers' willingness to pay an amount per kilogram of pro-vitamin-A garri is presented in Table 4. The survey found that most (70.83%) consumers were willing to pay for pro-vitamin-A garri while 29.17% were not willing to do so. This indicates that consumers are aware of the importance of pro-vitamin-A garri. The consumers indicated that the product (pro-vitamin-A garri) contains nutritive values that could improve their health. The maximum amount the consumers were willing to pay per kilogram of pro-vitamin-A garri was NGN 500 (USD 1.39), the minimum amount was NGN 160 (USD 0.44) and the average amount was NGN 220.08 (USD 0.61). The majority (63.54%) of consumers were willing to pay between NGN 201

Table 3. Distribution of consumer perceptions about pro-vitamin-A garri

Perceptual statement	SA(5)	A(4)	U(3)	D(2)	SD(1)	MS	R
Pro-vitamin-A garri has a yellow color and a fine look	12	24	5	23	56	3.61	A
Some additional health benefits can be derived from pro-vitamin-A garri	12	22	12	28	46	3.53	A
Taste of pro-vitamin-A garri is not as palatable as products from other garri	45	–	6	69	–	2.84	U
Pro-vitamin-A garri is costlier than other types of garri	7	–	56	28	29	3.41	U
Pro-vitamin-A garri is readily available in the market	3	10	35	19	53	3.99	A
The health benefit outweighs its cost price	5	2	55	42	16	3.29	U
Prefer to consume pro-vitamin-A garri over other types of garri because of the taste	9	2	41	53	15	3.52	A
Pro-vitamin-A garri has reduced the consumption of other types of garri	10	3	40	26	41	3.85	A
Pro-vitamin-A garri will reduce the amount/or quantity of other types of garri purchased	11	3	32	65	9	3.55	A
Consumption of pro-vitamin-A garri will help reduce the amount I usually spend on my family members as hospital	12	2	28	69	9	3.55	A

Note: SA: strongly agree; A: agree; U: undecided; D: disagree; SD: strongly disagree; R: remarks; total number of respondents (£f) = 120; MS (mean score): summation (£) of rating point × number of observations/ £f
Source: field survey data, 2018.

Table 4. Consumers' willingness to pay and amounts they are willing to pay for pro-vitamin-A garri

Variable	Description	Frequency	Percentage
Willing to pay for pro-vitamin-A garri	Yes	85	70.83
	No	35	29.17
Amount the consumers are willing to pay per kg	100–200	16	16.67
	201–300	61	63.54
	301–400	17	17.71
	401–500	2	2.08
Minimum amount per kg willing to pay	NGN 160/kg (USD 0.44/kg)	1	1.04
Maximum amount per kg willing to pay	NGN 500/kg (USD 1.39/kg)	1	1.04
Average amount per kg willing to pay	NGN 220.08/kg (USD 0.61/kg)		

Source: field survey data, 2018.

(USD 0.56) and NGN 300 (USD 0.83) per kilogram of pro-vitamin-A garri. In turn, only 2.08% were willing to pay between NGN 401 (USD 1.11) and NGN 500 (USD 1.39) per kilogram of pro-vitamin-A garri. It can be established that although the respondents are willing to pay for this product, their willingness to pay does not mean the majority of them would pay a higher amount. The consumers who were not willing to pay any amount for the consumption of pro-vitamin-A garri indicated that they lack information or knowledge on its nutritive value.

Determinants of the consumers' willingness to pay and of the amounts they are willing to pay for pro-vitamin-A garri

Table 5 presents the results of the effects of explanatory variables on the probability that a consumer is willing to pay for pro-vitamin-A garri and the expected amount he/she is willing to pay for a kilogram of pro-vitamin-A garri. The estimate of sigma (ρ) that maximizes the likelihood function is 48.79 and is different from zero at a 1 percent level of significance which shows that it fits

significantly (Guerrero, 2007). Such significant sigma (ρ) value implies that the residuals of the first and second hurdle are highly correlated. This means that the joint estimation approach is appropriate for the data, and that efficiency is gained by the use of the approach. The log-likelihood function of the model is -544.38; the Wald chi-square value of 33.82 associated with the log-likelihood ratio is statistically significant at 1 percent ($p \leq 0.002$), implying that all the explanatory variables in the model jointly influence the probability that an average consumer in the study area is willing to pay for and consume pro-vitamin-A garri.

According to the results, consumer income was statistically significant at 10 percent and positively influenced willingness to pay for pro-vitamin-A garri. Intuitively, the increase in the income of consumers will make them more likely to purchase and consume pro-vitamin-A garri. This supports the expectations that consumer income will significantly increase the odds in favor of their decision to pay for pro-vitamin-A garri. This agrees with findings of Ezeh et al. (2012) that as monthly income increases, so does the monthly budget share on garri. Also, the coefficient of other income sources accrued by consumers is positive and statistically significant in determining the probability of their willingness to pay for pro-vitamin-A garri at a 10 percent level of significance. The results suggest that the probability of willingness to pay for pro-vitamin-A garri by the consumers increases with the increase in the amount of other sources of income.

The sources of awareness about the health benefits of pro-vitamin-A garri considered in this study have a positive influence on the probability that a consumer will pay for pro-vitamin-A garri. Extension services and word-of-mouth from friends are those that are statistically significant at a 5 percent level of significance. This implies that the more consumers are aware of pro-vitamin-A garri via these two sources, the more likely they are to be willing to pay for it. Also, these sources have a stronger effect on information dissemination, especially in rural areas and especially in terms of sales promotion and product advertisement. This outcome is in resonance with the findings of De Steura et al., 2016 and Oparinde et al., 2016 that information significantly enhances the willingness to pay for genetically modified foods fortified with vitamins in China.

On the other hand, the second hurdle explains that the coefficient of the consumers' education level (at primary level of education) is significant and has a positive influence on willingness to pay for pro-vitamin-A garri at a 1 percent level of significance. This implies that more

Table 5. Double-hurdle model for the determinants of consumers' willingness to pay and of the amounts they are willing to pay for pro-vitamin-A garri

	Coefficient	*z*-value	*p*>|*z*|
Willingness to pay			
Age	–0.0222	–0.96	0.335
Gender	–0.1139	–0.30	0.764
Marital status	–0.5866	–1.00	0.315
Education	0.0461	1.19	0.234
Household size	–0.0526	–0.53	0.598
Income	7.14e–06*	1.86	0.063
Other income sources	0.7509*	1.83	0.067
Awareness (extension services)	2.0519***	5.38	0.000
Awareness (friends)	2.9092***	7.01	0.000
Awareness (radio)	–0.6208	–1.41	0.159
Constant	0.6204	0.59	0.554
Amount willing-to-pay equation			
Age	0.9631	1.48	0.139
Gender	3.7405	0.35	0.725
Marital status	21.5762	1.44	0.150
Education	5.5982***	5.04	0.000
Household size	–7.8853**	–2.80	0.005
Income	–0.0001	–1.04	0.299
Other income sources	–8.7802	–0.73	0.463
Awareness (extension services)	6.3544	0.45	0.655
Awareness (friends)	–6.4233	–0.53	0.599
Awareness (radio)	26.9706**	2.33	0.020
Constant	253.1494	8.18	0.000
Sigma (ρ)	48.7936	13.86	0.000
Log likelihood	–544.3805		
Wald *chi*-square (10)	33.82		
p-value	0.0002		

***, **, and * denote statistical significance at 1%, 5% and 10%, respectively.
Source: field survey data, 2018.

educated consumers will be more willing to pay for pro-vitamin-A garri than less educated consumers. This supports the study by Gustavo et al. (2015) and Bechoff et al. (2018) who found that educated consumers play a crucial role in food consumption. Also, household size was statistically significant at 5 percent and negatively influenced the amount a consumer is willing to pay for one kilogram of pro-vitamin-A garri. This means that as the consumer's household size increases by one person, the amount the consumer is willing to pay for pro-vitamin-A garri reduces. This conforms to the *a priori* expectation and is in line with findings of Jin et al. (2014). The awareness of pro-vitamin-A garri ($p \leq 0.05$) positively affected the amount a consumer is willing to pay for pro-vitamin A garri. This means that awareness (induced via radio as a source of information dissemination) of health and nutritional benefits derived from consuming pro-vitamin-A garri would substantially enhance the amount a consumer is willing to pay for a kilogram of pro-vitamin-A garri, as also opined by Olatunji et al. (2012).

CONCLUSION AND RECOMMENDATION

Conclusion

This study investigated the awareness, perceptions and willingness to pay for pro-vitamin-A garri in Oyo state, Nigeria. A multistage sampling procedure was used to collect data from 150 respondents. The study shows that while ca. 47.5% of the respondents are aware of the availability of pro-vitamin-A garri, the levels of awareness are low. This is the result of inadequate dissemination of information from the right quarters. However, 67.3% of the consumers are aware of pro-vitamin-A garri thanks to agricultural extension agents, radio and friends. This shows that pro-vitamin-A garri is well known in the study area. Most of the respondents (70.83%) were willing to pay for pro-vitamin-A garri but only 1.04% of the respondents were willing to pay a maximum amount of NGN 500 (USD 1.39). It can be established that although the respondents are willing to pay for this product, their willingness to pay does not mean the majority of them would pay a higher amount. The double-hurdle model was used to determine the factors influencing the respondents' willingness to pay and the amount they are willing to pay for pro-vitamin-A garri in the study area. Income, other income sources and awareness (induced via agricultural extension agents and friends) significantly and positively influenced pro-vitamin-A garri consumers' willingness to pay for it. Similarly, education level and radio-induced awareness significantly and positively influenced the amount they were willing to pay for one kilogram of pro-vitamin-A garri. Conversely, household size of the consumers significantly and negatively influenced the amount they were willing to pay.

Recommendation

This study recommends that people be well informed and educated on nutritive values and health implications of food commodities, since most of the interviewees were not aware of or did not know the nutritive values and health implications of pro-vitamin-A garri. Also, nutrition education is an important tool in communicating the nutritional and health benefits of bio-fortified crops, and an important factor that affects their acceptability.

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