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RESEARCH ARTICLE

Consumer Perception and Willingness to Pay for Vitamin A Fortified Garri in Ibadan North Local Government Area of Oyo State, Nigeria

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Abstract: Vitamin A deficiency is one of the major micronutrient deficiencies contributing to child mortality globally. This study assessed consumers' perception and willingness to pay (WTP) for vitamin A fortified garri in Ibadan North Local Government Area, Ibadan, Oyo State, Nigeria. A total of 170 respondents were interviewed. Socioeconomic characteristics of respondents, perception of and factors that influence their willingness to pay for fortified vitamin A garri and the mean willingness to pay (MWTP) were all analysed. The study revealed that most of the respondents were aware of vitamin A fortified garri but they hardly purchased it. The computed MWTP for vitamin A fortified garri was ₦190 ($0.35) indicating a positive mean willingness to pay. The result of the logistic regression analysis showed that out of the twelve variables examined, four were statistically significant at various levels. Specifically, sex, ethnicity and marital status were all negatively significant at 10%, 5% and 10% respectively while health status was positively significant at 1%. It was concluded that a higher proportion of the respondents perceived vitamin A fortified garri to be healthier and more nutritious and were also willing to pay it. The paper recommended that efforts should be geared towards encouraging production and consumption of vitamin A fortified garri by creating more markets for the product.

Keywords: Awareness; Biofortification; Consumer perception; Vitamin A fortified garri; WTP

1. Introduction

Nigeria's estimated population of 202,386,606 makes it the most populated country on the African continent as well as the country with seventh highest population globally. With a land area of 910,770 square

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kilometers (351,650 square miles), covering several agroecological zones [1], the country is also one of the largest and most ecologically diverse in Africa. Micronutrient deficiency, often known as hidden hunger, is one of the most serious types of malnutrition observed in Nigeria.

Micronutrient deficiencies are a major cause of global child mortality. Moreover, vitamin A and zinc deficiencies result in approximately 600,000 and 400,000 deaths annually respectively [2]. In Nigeria, 1 out of every 4 children below six years of age, on average, suffers from vitamin A deficiency [3]. Poor development, visual problems, and compromised epithelial integrity could arise from this. Additionally, iron deficiency, the primary cause of anaemia, affects 47% of Nigerian women between the ages of 15 and 49 years. Reduced energy, physical activity, and productivity, weakened immune systems and decreased brain development are some additional consequences of iron deficiency anaemia which, eventually, lead to a rise in maternal and infant deaths [4]. Studies have also revealed that vitamin A dietary intake is inadequate in 83% of pre-school aged Nigerian children [5].

Many health-related studies have explored people's awareness of, as well as their willingness to pay for biofortified commodities. Consumer demand for high quality food has been on the rise due to increased knowledge about the links between diet and health, awareness of the desirable characteristics of food consumed along with greater access to information food nutritional value. Oparinde *et al*. [6] in their study on information and consumer willingness to pay for biofortified yellow cassava in rural households in Oyo and Imo states, respectively, showed, by their results, that nutrition information results in consumers being willing to pay a large and significant price premium for biofortified yellow cassava in both study areas. They discovered that buyers who cared about environmental degradation and a healthy diet were more likely to purchase organic food and were prepared to pay a premium of between 15% and 25% over the cost of conventional goods. Domonko *et al*., [7] reported, in their study on consumer risk perception of vitamin A deficiency and acceptance of biofortified rice in the Morogoro region of Tanzania, that the most at-risk groups, such as females and low-income households, tended to underestimate the risk of vitamin A deficiency or did not fully understand the relationship between vitamin A deficiency and severe visual impairment. Therefore, as Padilla *et al*., [8] explained, consumers' food choices were more influenced by demographic and socio-cultural variables, consumer attitudes, and the development of new lifestyles, rather than health considerations.

According to Saltzman *et al*. [9], biofortification is the process of producing and supplying staple food crops with higher micronutrient content; that is, increasing the nutritional value of food crops using agronomic methods, traditional plant breeding or contemporary biotechnology. Given that staple crops make up the bulk of the diets of the rural poor, it is an economical approach to lowering micronutrient deficits [10]. Over 30 nations have officially published more than 290 varieties of 12 biofortified crops, including important staples like iron beans, iron pearl millet, vitamin A cassava, vitamin A maize, vitamin A orange sweet potato (OSP), zinc maize, zinc rice, and zinc wheat. Many of these countries are presently evaluating thousands of varietal lines. Crop development research is leading to enhanced nutrient density and improved crop adaptation to changing climate and consumer preferences through the use of biofortified cultivars.

Vitamin A is a micronutrient that is vital to health and is found in a variety of foods. One such food source is cassava products manufactured from yellow cassava varieties that are highly provitamin A biofortified, or classic white cassava types that are fortified with red palm oil containing provitamin A. The coloured pigmentation in provitamin A gives both products a similar yellow look.

Willingness to Pay (WTP) for a biofortified food product can be perceived as a measure of the resources individuals or households are willing to give up in order to reduce their probability of experiencing health hazards that may compromise their well-being [11]. Technically speaking, WTP is the maximum price (premium) a consumer is agreeable to paying for a particular quantity of a product or a service [12]. At that price, the consumer is indifferent to buying or not buying, as WTP reflects the product's inherent value, to the consumer, in monetary terms. In context of this study, it measures the extra amount (in monetary terms) that consumers can pay for vitamin A cassava to be purchased for consumption and it is determined by a number of factors as highlighted in Figure 1.

The objectives of this study, therefore, were to analyze consumers' perception of vitamin A fortified garri, to examine consumers' willingness to pay (WTP) for vitamin A fortified garri, and to obtain the determinants of consumers' WTP for vitamin A fortified garri in Oyo state, Nigeria.

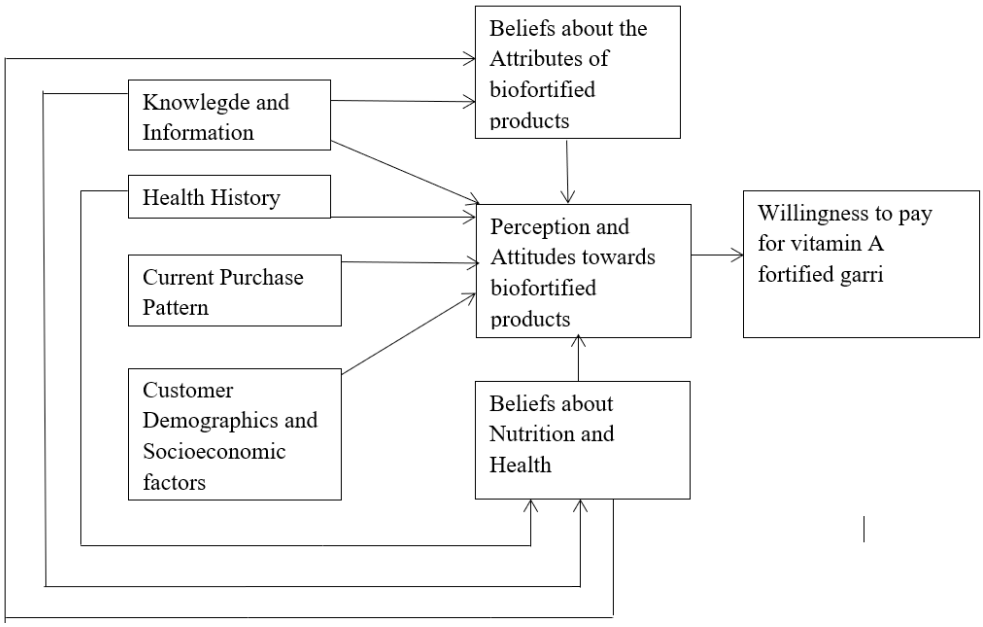

Figure 1. Determinants of Willingness to Pay.

Source: Munene CN [13].

Theoretical Framework

This study is underpinned by two major theories: (1) Willingness to Pay (WTP) Theory which is premised on the economic analysis of the premium consumers are willing to pay for a product or service, as a measure of its perceived value to its users. The contingent valuation/choice modeling strategy was employed in this study. WTP for vitamin A fortified garri was measured using a structured survey and choice experiments in which consumers were presented with different price levels they could chose to pay for vitamin A fortified garri in the light of its perceived health benefits. (2) The Consumer Perception Theory which describes how consumers make judgments about the products and/or services at their disposal as well as how this influences their decisions to use them. According to the theory, the main determinants of a consumer's choice are perceived quality (such as taste, packaging etc.), perceived value in terms of economic benefits, and brand trust. In this study, this theory was applied to assess consumer perceptions in order to determine the influence of factors like age, sex, education, ethnicity and health status of the respondents on their willingness to pay for vitamin A fortified garri. These two theories provide a clear framework for the decisions consumers made with regards to consuming vitamin A fortified garri.

2. Materials and Methods

2.1 Study Area

The study was carried out in Ibadan North Local Government Area in Ibadan, Oyo State, Nigeria. The Ibadan North Local Government Area is divided into twelve wards with its major residential areas including Samonda, Bodija, Bere, Oke Are, Ashi, University of Ibadan, Gate, Mokola, Secretariat, Agbowo, Sango, Ikolaba, Yemetu among others.

Ibadan is the largest indigenous city in West Africa with an urban density of 464.71 km^2 and population of over three million. The city is located with the coordinates 7°23'47''N 3°55'0''E / 7.39639°N 3.91667°E [14]. Ibadan is a commercial centre hosting various people from different parts of the country. The area was selected for this study because of its high population density and strategic location. Economic activities in Ibadan include mainly trading, agriculture and public service employment. The sheer amount and variety of food product demand in the area has fueled a greater drive for agricultural production in the city's environs.

2.2 Sources of Data and Sampling Method

Both quantitative and qualitative data were used for the study. Data were collected from respondents using a well-structured questionnaire. Further, a multistage sampling procedure was used to collect the data for

the study. The first stage was the purposive selection of the Ibadan North Local Government Area of Oyo state, Nigeria. This non-probabilistic selection was made based on the fact that it is an urban LGA in Oyo state. The second stage was the random selection of ward 4, ward 10, ward 5 and ward 11 out of the 12 wards in Ibadan North LGA. The third stage was the random selection of 50 consumers each in the 4 selected wards of the local government. In all, a total of 200 questionnaires were administered but 170 were considered fit to be analyzed as 30 were dropped due to incomplete, inaccurate or inadequate information.

2.3 Methods of Data Analysis

The analytical tools used for the study include the following:

Likert Scale Measure

The Likert scale measure was used to analyze the perception of the respondents with regards to the health-related benefits of consuming vitamin A fortified garri. This allowed the respondents to express how much they agreed or disagreed with a particular statement based on five pre-coded responses with the neutral point being "undecided". Respondents, therefore, rated their perception, knowledge and awareness using a 5-point Likert scale ranging from Strongly Agree (5), Agree (4), Undecided (3), Disagree (2) and Strongly Disagree (1).

Logit Regression Analysis

This method of analysis was used to derive the log-likelihood of willingness to pay as well as its determinants. It was chosen because of its comparative mathematical simplicity and asymptotic characteristics.

$$P_i = (Y = {}^{1}/_{X_n}) = \frac{1}{1+e^{-(\beta_0 + \beta_n X_n)}}$$

Where;

P_i = Probability that consumers will be willing to pay a premium for vitamin A fortified garri

Y = Consumers' willingness to pay (1 = willing to pay, 0 otherwise

β_0 = Intercept

β_n = Coefficients to be estimated for the explanatory variables X_n ($X_1 \ldots X_{12}$)

X_1 = Sex of respondent (1 = male, 0 otherwise)

X_2 = Age of respondent (in completed years)

X_3 = Married (1 = married, 0 otherwise)

X_4 = Single (1 = single, 0 otherwise)

X_5 = Separated (1 = separated, 0 otherwise)

X_6 = Household size (number)

X_7 = Health imbalance (1 = yes, 0 otherwise)

X_8 = Monthly household income (in Naira)

X_9 = Islamic religion (1 = Islam, 0 otherwise)

X_{10} = Traditionalist religion (1 = Traditionalist, 0 otherwise)

X_{11} = Hausa (1 = Hausa, 0 otherwise)

X_{12} = Igbo (1 = Igbo, 0 otherwise)

Contingent Valuation Method (CVM)

Contingent valuation is the earliest technique employing a subject's stated preference as a method of non-market valuation of economic goods. The CVM used for this study involved asking the respondents directly, using a well-structured questionnaire in a dichotomous choice format, what they would be willing to pay (or willing to accept as compensation) for a change in their preferences. This technique is called contingent valuation because it is contingent on a hypothetical market. It is most preferred because it deals with both use and non-use values and survey responses to willingness to pay or willingness to accept hypothetical questions which are accompanied by the monetary measures of utility change. Certain methodological procedures must be followed when designing a good CVM study and they include:

i. Creating a survey instrument:
   - Designing hypothetical scenarios;
   - Deciding whether to use WTP or WTA format for asking questions
   - Creating hypothetical scenarios about the means of payment or compensation.

ii. Methods of asking questions: They include open ended questions, dichotomous choice enquiries, iterative bidding approach as well as the payment card approach.

iii. Data collection: Survey responses can be obtained by face-to-face or telephone interviews or questionnaires.

iv. Analyzing survey responses: This entails calculating the total WTP/WTA based on the sample drawn from the population, determining the population's mean WTP/WTA, and evaluating the survey results in order to determine how accurate the estimates are.

3. Results and Discussion

3.1 Socioeconomic Characteristics of Respondents

Table 1 shows that majority of the respondents

(34.12%) were within the age range of 26-35 years, indicating that they were still in their economically active years. Most (53.53%) of the respondents were also female. An analysis of marital status revealed that most (54.12%) of the respondents were single, while their household sizes ranged mostly between 1–5 persons. In terms of ethnicity, most of the respondents were of the Yoruba ethnic group which made up 62.9% of the sample. Further, most (91.20%) of the respondents perceived themselves to be healthy and had obtained tertiary education (50.59%), implying a high educational attainment within the sample. It was further revealed that a high percentage (46.47%) of the respondents earned monthly incomes between ₦40,001-₦50,000 which indicates a relatively low general income level among the respondents. This scenario can have significant ramifications for their consumption of improved products, especially where they have to pay higher prices for them.

3.2 Awareness and Sources of Information

Based on the percentages recorded in the "Agree" column of the results in Table 2, a large proportion of the respondents were aware of vitamin A fortified garri, with 73% agreeing that they had heard about it and 72% agreeing that they knew about its health benefits. This high level of awareness shows the importance of effective information dissemination, as opined by Oteh *et al* [15], who found that consumer awareness and nutritional knowledge are crucial for the adoption of biofortified cassava and cassava products in Nigeria.

Table 1. Socioeconomic Distribution of Respondents.

Socioeconomic Variables	Percentanges (n = 170)	Socioeconomic Variables	Percentanges (n = 170)	Socioeconomic Variables	Percentanges (n = 170)
Age(years)		**Perceived Health Imbalance**		**Occupation**	
18-25	27.65	Yes	8.80	Civil servant	24.71
26-35	34.12	No	91.20	Trader	12.35
36-45	15.88	**Household Size**		Farmer	2.35
46-55	14.12	1-5	81.18	Artisan	1.18
56-65	4.71	6-10	17.65	Professional	8.24
66-89	3.53	11-15	1.18	Student	42.94
Sex		**Educational Attainment**		Unemployed	8.24
Male	46.47	Primary	6.47	**Monthly Income**	
Female	53.53	Secondary	22.35	≤10,000	12.94
Marital Status		NCE	4.71	10,001-20,000	10.00
Married	41.18	OND	8.82	20,001-30,000	4.71
Divorced	1.18	HND	7.06	30,001-40,000	2.94
Single	54.12	Degree	50.59	40,001-50,000	46.47
Separated	3.53			50,001-250,000	22.94
Ethnic Group					
Yoruba	62.90				
Hausa	6.50				
Igbo	30.60				

Source: Authors' computation from survey data

Table 2. Distribution of Respondents Based on their Awareness of Vitamin A Fortified Garri (n = 170**).**

Awareness statement	SA	A	UD	D	SD	Mean	Remarks
I know about biofortification of food	59	73	9	16	13	2.1	A
I have heard about vitamin A fortified garri	66	74	7	12	11	1.1	A
I know about health benefits of vitamin A fortified garri	59	72	12	14	13	1.1	A

Source: Authors' computation from survey data

The study also showed that relatives and advertisements were key sources of information, with 29.41% of respondents becoming aware of biofortified garri through family and 24.7% through advertisements. This finding is consistent with Hans *et al* [16], who highlighted the importance of effective communication channels to promote biofortified crops. The sources of awareness, points of purchase used and factors considered by respondents in making their purchase decision are summarized in Table 3.

Table 3. Source of Awareness and Access to Vitamin A Fortified Garri.

	Frequencies (n=170)	Percentanges
Source of Awareness		
Friend	38	22.35
Relative	50	29.41
Advert	42	24.71
Internet	31	18.24
Others	9	5.27
Point of Purchase		
Market	34	20.00
Agent	19	11.18
Outlet	9	5.29
Did Not Purchase	*108*	*63.53*
Factors Considered in Purchase Decision		
Price	16	9.41
Taste	8	4.71
Quality	38	22.35
Did Not Purchase	*108*	*63.53*

Source: Authors' computation from survey data

3.3 Perception and Purchase Behavior

The perception analysis in Table 4 reveals that consumers generally viewed vitamin A fortified garri to be superior in taste, nutrition, and quality compared to non-biofortified varieties. However, concerns about affordability and accessibility were common among the respondents, with 69% disagreeing that the product is cheap and 57% disagreeing that it was readily accessible to them. These concerns align with many studies on biofortification, which often highlight economic and logistical barriers to market penetration. For instance, Ferrari *et al* [17] found that clear labeling and addressing affordability are crucial for consumer acceptance of genetically modified foods. Similarly, Olum *et al* [18] identified affordability and market access as significant factors influencing the adoption of biofortified crops.

3.4 Willingness to Pay

As seen in Table 5, an overwhelming majority of the respondents (84.7%) expressed a willingness to pay for vitamin A fortified garri, with an average WTP of ₦ 190/kg (Table 6), which is significantly higher than the minimum price of ₦70/kg. This willingness to pay a premium reflects the perceived value of the health benefits provided by the fortification, which is consistent with the findings of Qisthy *et al* [19] on organic rice in Indonesia.

Table 6 further shows that some of the respondents were willing to pay as high as ₦500/kg. This indicates that biofortification is a desirable attribute which consumers would be willing to pay for provided they were made aware of such products and the products were readily available.

Table 4. Distribution of Respondents by their Perception of Vitamin A Fortified Garri.

Perception Statement	SA	A	UD	D	SD	Mean	Remarks
I consider vitamin A fortified garri to taste better than regular garri	47	63	47	12	1	2.15	A
I consider vitamin A fortified garri to be of better quality than regular garri	66	62	36	5	1	1.90	SA
I consider vitamin A fortified garri more nutritious than regular garri	70	63	28	7	2	1.87	SA
I consider vitamin A fortified garri healthier than regular garri	66	62	35	5	2	1.91	SA
Vitamin A fortified garri is accessible in my environment	9	21	37	57	46	3.64	D
Vitamin A fortified garri is cheap	5	13	43	69	40	3.74	D
I prefer vitamin A fortified garri to regular garri	59	55	43	9	4	2.08	SA

Source: Authors' computation from survey data

Table 5. Distribution of Respondents by Willingness to Pay for Vitamin A Fortified Garri.

Willingness to Pay a Higher Price	Frequency	Percentage
Willing	144	84.70
Not willing	26	15.30
Total	170	100.00

Source: Authors' computation from survey data

Table 6. Mean Willingness to Pay for Vitamin A Fortified Garri.

Variable	Mean	Std. Deviation	Minimum	Maximum
Willingness to pay	190	67.35	70	500

Source: Authors' computation from survey data

3.5 Determinants of Willingness to Pay for Vitamin A Fortified Garri

The logistic regression analysis identified sex, marital status, health status, and ethnicity as significant determinants of WTP.

The analysis (in Table 7) shows that males were less likely to pay for fortified garri, with a negative and significant coefficient for sex (p = 0.08), suggesting that men might be less concerned about the nutritional quality of their food compared to women. Marital status, particularly being separated, also negatively affected WTP (p = 0.09), potentially due to reduced purchasing power of as a result of not having financial support once enjoyed from one's spouse. Moreover, the perceived health imbalance of respondents positively influenced WTP, with those without health imbalances being more likely to pay for fortified garri (p = 0.01). This implies that individuals with good health-seeking behavior (as indicated by the absence of perceived health imbalances) are more inclined to invest in biofortified foods. Ethnicity also played a role, with Hausa respondents showing a significantly lower WTP (p = 0.02), indicating potential cultural or socioeconomic factors influencing their purchasing decisions.

These results agree with the broader studies on biofortification and consumer behaviour. For example, Hans *et al* [20] highlighted the socioeconomic impacts of biofortified crops, emphasizing the need for targeted strategies to address demographic differences in WTP. Furthermore, the integration of economic valuation methods, as submitted by Hanemann [21], is important to allow for a robust framework for analyzing WTP and influencing pricing strategies for biofortified foods.

Table 7. Parameter Estimates of the Logit Regression for the Determinants of WTP for Vitamin A Fortified Garri.

Variable	Coefficient	Std.Error	z	p>|z|	dy/dx
Sex	–0.937	0.555	–1.73	0.08*	–0.105
Age	0.038	0.110	0.35	0.73	0.004
Marital status					
Married	–0.575	1.879	–0.31	0.76	–0.085
Single	0.835	0.750	1.11	0.27	0.089
Separated	–2.157	1.292	–1.67	0.09*	–0.389
Household size	0.024	0.155	0.15	0.88	0.002
Perceived health imbalance	1.978	0.725	2.73	0.01***	0.312
Monthly income	–0.355	0.041	–0.87	0.39	–0.038
Religion					
Islam	–0.713	0.641	–1.11	0.27	–0.087
Traditionalist	0.028	1.651	0.02	0.99	0.003
Ethnicity					
Hausa	–1.855	0.770	–2.41	0.02**	–0.296
Igbo	–0.577	0.640	–0.09	0.93	–0.006
Constant	2.606	4.502	0.58	0.56	
Number of observations = 169; LR chi2 (13) = 25.74; Prob > chi2 = 0.0221, Psuedo R2 = 0.1753; Log likelihood = -59.984376					

Note: *, ** and *** indicate statistical significance at 10%, 5% and 1% respectively.

Source: Authors' computation from survey data

4. Conclusion and Recommendations

This study revealed that the respondents' socioeconomic characteristics such as sex, marital status, and ethnicity affected their willingness to pay for vitamin A fortified garri. While most of the respondents were aware of vitamin A fortified garri, majority didn't purchase it due to lack of access to the product. Nevertheless, a high proportion of the respondents perceived vitamin A fortified garri to be healthier and more nutritious. Also, consumers were generally willing to pay a premium for vitamin A fortified garri.

Based on the foregoing, it is recommended that, since garri is derived from cassava, provision of improved, disease-resistant varieties to farmers should be increased. This will increase productivity and likely increase the consumption of vitamin A fortified garri by households. The study also revealed the need for more accessibility to biofortified garri among potential consumers. This can be achieved by strengthening distribution networks to ensure that fortified garri is readily available in local markets. Collaborating with local retailers and setting up dedicated points of sale in high-traffic areas will make the product more visible and convenient for consumers to purchase.

Furthermore, more awareness efforts can be channeled towards showing consumers how to access the product through radio and television adverts, social media channels, as well as community events. Efforts from both the public and private sectors should be geared towards encouraging production and consumption of vitamin A fortified garri by creating more market for the product. Further, in order to increase affordability, government can go into off-taker agreements with cassava farmers and processors in order to sell to the public at subsidized prices.

Author Contributions

C.O. Idiaye developed the concept, contributed to the literature review, data analysis, interpretation of the results and addressing the reviewers' comments. While I.B. Oluwatayo contributed to data analysis, results interpretation, proofreading of the final draft and addressing the comments from reviewers, N.C. Obano contributed to literature review, Data collection and results interpretation.

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Data Availability

Primary data collected and used this paper are available on request.

Conflict of Interest

Authors have no conflict of interest to declare.

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