Awareness of and Potential Demand for Nutritionally fortified Cassava Products.

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Awareness of and Potential Demand for Nutritionally fortified Cassava Products.

Ashagidigbi Waheed [1], Amos Timothy[1,] Orobiyi Abiade [1]and Olagunju, Kehinde Oluseyi[2]

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Abstract

Nigeria remains one of the top twenty countries globally, with the burden of malnutrition, consuming food low in essential micronutrients. To checkmate the menace, cassava was nutritionally fortified in order to the improve households' food and nutritional security. Examining households' potential demand for the nutritionally fortified cassava products is imperative to reduce malnutrition. The study was carried out in South-west, Nigeria. Descriptive statistics was used to describe the socio-economic characteristics of the respondents and their level of awareness of the nutritionally fortified cassava products, namely: garri (Cassava granules) =1, lafun (Cassava powder) =2, starch=3, tapioca=4, fufu (cassava dough) =5, pupuru (cassava flour) =6). Probit regression model was adopted to examine the determinants of households' awareness of the nutritionally fortified products; while Choice-based Conjoint Analysis was adopted to determine the prices (upper and lower mark) the households are willing to pay for the products. The results revealed that age, habitation and gender had negative effect on awareness; while habitation reduces households' potential demand for bio-fortified cassava products. Awareness campaign about the nutritionally fortified products should be intensified among youths, male and rural respondents. Price control policy measure should also be an option in rural areas.

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JEL Classification codes: D, I, Q

Introduction

Agriculture is a major source of employment, as this sector employs about one-third of the total labour force and provides a livelihood for the bulk of the rural people (Federal Ministry of Agriculture and Rural Development, 2006). Cassava is a perennial wood shrub with an edible root, which grows in tropical and subtropical areas of the world (International Institute of Tropical Agriculture, 2009). Cassava tubers are one of the staple foodstuff for the people of Nigeria (Gistarea, 2013). It is a major source of dietary carbohydrate after rice and maize and provides food for over 60million people in Nigeria (Abdullahi, 2003). It was introduced into the country by Portuguese explorers and colonizer in the sixteenth century (Adeniji *et al*, 2005)

and has become vital to the economy of Nigeria as the largest producer of the commodity in the world (United Nations Conference on Trade Development, 2012). It is produced in 24 out of the 36 States of the Federation (IITA, 2012). Cassava has continually played very vital roles in the Nigerian economy; especially in ensuring rural household food security (Nweke, 2004; Obisesan, 2012).

Malnutrition is the insufficient, excessive or imbalanced consumption of nutrients (Breisinger *et al*, 2012). Nigeria is amongst the top six countries that accounts for half of its child deaths from malnutrition (International Save the Children Alliance, 2013). Kuku-Shittu *et al* (2016) stated that Nigeria remains one of the top twenty countries with the burden of malnutrition in the world consuming food low in vitamins and micronutrients. Vitamin A deficiency affects 20% of pregnant women and 30% of children below the age of 5, which ultimately leads to poor health, blindness and death (IITA, 2012). In addition, it can lower immunity and impair vision, which can lead to blindness and even death (Egesi, 2011). Babatunde (2012) noted that large component of vulnerable population, women of childbearing age and children in areas where cassava consumption is high are at risk of vitamin A deficiency. About 41% of children under-5 suffers stunted growth and ill health because of malnutrition.

However, cases of malnutrition are not peculiar to children alone as adults especially women are also suffering from it (Davidoff *et al*, 2013). Nnam (2013) stated that the malnourished children lack 13.5% of Intelligence Quotient, and if a pregnant woman were malnourished, the child's certain important brain parts would be irreversibly deformed. It can also be manifested in adults in terms of increased vulnerability to illnesses, reduced ability to fight infections, inactivity and reduced ability to work; impaired wound healing, depression, reduced fertility, increased complications, and even death (British Association of Parental and Enteral Nutrition, 2012). Major causes of malnutrition in Nigeria includes ignorance of parents about healthy diets for growing children and holding on to traditional practices of loading their family meals with a high percentage of carbohydrate with low protein content and vitamins due to the perceived 'high cost' of food rich in proteins and vitamins (Federal Ministry of Health, 2013). Due to the aforementioned, there is a concerted effort to enhance the nutritional content (protein and micronutrients) of cassava (Zhang *et al*, 2003) through the process known as 'Bio-fortification. That is, the breeding of micronutrients into food crops to increase its nutritive value.

However, it is not just enough for the food crops (cassava) to be bio-fortified, the people have to be aware of their existence and value in order to guard against the consequences of malnutrition whose effects can be life threatening in both adults and children. Likewise, the price of the products should also be an issue to emphasise. Thus, the study seeks to analyze consumers' awareness and potential demand for nutritionally fortified cassava products in South-west Nigeria.

Globally, vitamin and mineral deficiency affects one third of all people (Micronutrient Initiative, 2004). The study would help to justify the need for Vitamin A and other micronutrients present in the cassava products and their attendant benefits to address the problem of micronutrient deficiency and ensure that the recommended nutritional levels are met. Households' awareness and their willingness to pay for bio-fortified cassava products will also be determined, in order to sensitise the populace on the nutritional benefits of the products and make them available at much more affordable prices. In addition, the study will assist in formulating price policy measure that would enhance households' demand for the bio-fortified cassava products, which ultimately would improve their food and nutritional status.

Theoretical Framework

The Consumer Utility Theory

The basic economic framework of individual preferences is the standard microeconomic consumer theory of maximizing utility. An individual consumer chooses a consumption bundle faced with his budget restriction. It is assumed that the consumer will exhibit a rational behavior; choosing the bundle which is at least as good as any other among all the bundles. The individual is assumed to have a set of preferences over goods and services that can be ordered in a logical and consistent manner (Hanley and Splash, 1993). This preference ordering restricts an individual's demand for different consumption bundles. Utility function therefore serves as an index for the preference ordering. This allows us to express the most preferred consumption bundle by the highest level of utility. Economists measure changes in consumption bundles, which lead to increase in utility as consumer surplus. The consumer surplus therefore is the consumers' willingness to pay for the improved quality (Hanley *et al*., 1997). This study would employ the use of choice modeling (experiments) which is consistent with random utility theory in economics (Bennet and Blamey, 2001).

Materials and Methods

The study area is Ondo state, South-west, Nigeria. The choice of the state is due to the prevalence and distribution of bio-fortified cassava stems to farmers by Federal College of

Agriculture (FECA), Akure, Nigeria. The data were from primary source collected in 2018 with the use of well-structured questionnaire to obtain information from the respondents. Multi-stage sampling procedure was adopted in selecting the respondents. In the first stage, three out of the eighteen Local Government Areas (LGAs - Akure South, Akure North and Ifedore) in Ondo State were purposively selected due to the prevalence of the distributed bio-fortified cassava stems in the Local Government Areas (LGAs). Random selection of three communities in each of the selected local governments constitutes the second stage. At the third stage, fifteen consumers (15) were randomly selected from each community giving a sample size of One hundred and thirty five (135) respondents.

Analytical techniques adopted include, Descriptive statistics, which was used to describe the socio-economic characteristics of the respondents and their level of awareness of the bio-fortified cassava products, namely: garri (Cassava granules) =1, lafun (Cassava powder) =2, starch=3, tapioca=4, fufu (cassava dough) =5, pupuru (cassava flour) =6).

Probit Model

This was used to determine the factors influencing the awareness of consumers for bio-fortified cassava products in the study area. Probit model is appropriate when the response takes one of two possible outcomes.

This is expressed as Pi[Y=1]= [Fxi]…….(Gujurati,2003)

Where $Y= \beta 0 + \beta iXi$……..1

Explicitly,

$Y=\beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \beta 5X5 +……. + \beta 10X10 + U$……..2

Where,

Yi = Response with respect to awareness of bio-fortified cassava products. (Dichotomous variable 1=yes; 0=no)

βi = vectors of unknown coefficients

Xi = Independent variables

The explanatory variables are;

X_1 = Age of consumer (years)

X_2 = Consumption of cassava products (years)

X_3 = Marital status (married = 1, 0 otherwise)

X_4 = Gender of the consumer (male=1, female=0)

X_5 = Level of education of consumer (no formal education=0, adult education=1, primary school education=2, secondary education=3, tertiary education=4)

X_6 = Household size (number of persons)

X_7 = Estimated Annual income (₦)

X_8 = Employment status of consumer (employed=1, unemployed=0)

X_9 = Habitation (urban=1, rural=0)

X_{10}= Age^2 (years)

Choice-based Conjoint Analysis

This was used to determine the price the consumers are willing to pay for bio-fortified cassava products (garri, lafun, pupuru, startch, tapioca, fufu). Two prices (upper and lower marks) were set .Respondents' potential demand was determined by those that picked prices within the upper and lower mark. A respondent is unwilling to pay if he or she picks below the lower price mark.

Discrete choice approach using binary logistic model was used to analyze factors influencing respondents' potential demand for bio-fortified cassava products in the study area. Respondents that picked prices within the set limit are assigned 1, while those that picked prices below the lower mark are assigned zero (0). The model was chosen because of the discrete/dichotomous nature of the dependent variable (Gujarati, 2003). The model is empirically estimated as:

$Y^* = Xi\beta i + \mu$……..…….4

X_i = Explanatory variables

Where: β_i = are the coefficients of the independent variables.

Mathematically, it is expressed as:

$Y_i = \beta 0 + \beta 1X1 + \beta 2X2 + $ …….$\beta 12X12 + \mu$……5

Where;

Y = Willingness of consumers to pay for bio-fortified cassava products such that; Y=1 if consumers are willing to pay and 0 if otherwise

The explanatory variables are as stated under the factors influencing respondents' awareness of bio-fortified cassava products with the inclusion of:

X_{11} = Price of the product (₦/kg)

X_{12} = Awareness of bio-fortified cassava products (Aware=1, otherwise=0)

Results and Discussion

As revealed in Table1, the mean age of the respondents was 46.5years (Ashagidigbi, *et al, 2012*), implying that they are still in their active and productive age. Age of respondents may

however have effect on their awareness and willingness to pay for bio-fortified cassava products, as Coster *et al.* (2014) found out that respondents in their active age would welcome improvements and might be willing to pay for improved products or services. Over two-third of the respondents are males. This could possibly influence the awareness and willingness to pay for bio-fortified cassava products. Dipeolu *et al.* (2009) in their study on "Consumer awareness and willingness to pay for organic vegetables in southwest Nigeria" observed that the population of male-headed households was more than that of the female. Eight out of 10 respondents were married, while others were either single, widow or divorced. Furthermore, about 6% of the total respondents have no formal education, while others have one form of formal education or another. This indicates that majority of the respondents are literates and this could positively influence their awareness and willingness to pay for bio-fortified cassava products as supported by the findings of Awotide *et al*, (2015) who stated that education facilitates access to and productive use of new information. Majority of the respondents are farmers, while others are civil servants, artisans or traders. Okorie, (2012) defined household as the head, wife or wives, children and other dependents that live under the same roof. The household size of the respondents is moderate with a mean of six members.

The annual income of the respondents ranged between below ₦100, 000 ($277.8) and ₦300, 000 ($833.3). The mean annual income was ₦403,498 ($1,120.8). Hypothetically, households with higher income would have higher awareness and willingness to pay for the bio-fortified products. Both urban and rural households were well represented. About 47.4% of the respondents are urban dwellers while 52.6% of the respondents are rural dwellers. Habitation is an important factor that could influence the level of awareness and willingness to pay of respondents for bio-fortified cassava products.

Table 2 revealed that 81.5% of the respondents are aware of the bio-fortified cassava products in the study area. The high level of awareness could be attributed to the sensitization of the farmers by the researchers at the Federal College of Education Akure (FECA) about the products and the distribution of the cassava stems to the farmers who produces and sell to either their direct consumers or marketers in the study area.

As shown in Table 3, identified bio-fortified cassava products in the study area are that of garri (cassava granules), fufu (cassava dough), starch, lafun (cassava flour), tapioca and pupuru (cassava powder). It was revealed that 81.8% and 59.1% of the respondents are aware of bio-fortified garri and fufu products, while starch has the least awareness level (25.5%). This

however shows that garri and fufu are the two bio-fortified cassava products with the highest awareness level.

Table 4 profiled the determinants of respondents' awareness for bio-fortified cassava products in the study area, with the use of probit model. Thirteen variables were included in the model, of which nine were significant. The significant variables include, age of the respondents, primary, secondary and tertiary levels of education; and employment status were significant at 1%. Years of consumption of conventional cassava products, sex of the respondents, age^2 were significant at 5%, while habitation was significant at 10%.

Age of respondents was positively related to the awareness of nutritionally fortified cassava products and significant at 1%. The finding of this result is in consonance with that of Safdar *et al* (2015) who established that the awareness for healthier food increases with age because older respondents are more health conscious than the younger ones. Therefore, the probability of a respondent's awareness and adopting an improved method increases as age increases.

Primary, secondary and tertiary levels of education were also significant at 1% with positive effect on the awareness of bio-fortified cassava products. This implies that the level of education of the respondents' have positive effect on their awareness of the products. Haq *et al,* (2008) stated that educational level of the consumers increases their awareness and exposure level, thus they will be more receptive to policy that leads to improved livelihood and welfare. Therefore, access to formal education tends to enhance the urge for new ideas and new technology in which bio-fortified cassava is one.

Employment status was significant at 1% and had a positive effect on the awareness of bio-fortified cassava products in the study area. This implies that respondents that are employed are more aware of the products than the unemployed respondents. This result agrees with that of Oviahon *et al,* (2011) who stated that respondents are likely to be aware and subscribe to buying of safety food products since most of them are gainfully employed.

Years of consumption of cassava products was significant at 5% with positive effect on the awareness of nutritionally fortified cassava products. This implies that respondents that have been consuming the conventional cassava products for many years tend to be more aware of the bio-fortified cassava products.

Gender was statistically significant at 5% probability level with a negative sign. Given the negative sign, which, is in favour of the female gender, this means that female-headed

households are more likely to be aware of the nutritionally fortified cassava products compared to their male counterpart. This corresponds with the findings of Innocensia (2013) who stated that women are more aware of fresh and new products that is mostly available in the markets because they are mostly responsible for the household food purchases.

Age^2 had a positive effect on the awareness of bio-fortified cassava products and was significant at 5%, implying that respondents will be more aware of the bio-fortified cassava products as they grow older. This corresponds with the findings of the study carried out by Dontsop *et al* (2011) where it was observed that older people are aware of associated health problems in consuming unhealthy products are likely to be more aware of safety labels for nutritional products.

Habitation was statistically significant at 10% with a positive effect on the respondents' awareness of bio-fortified cassava products. This means that respondents in the urban area are more aware of the products than those in rural area, which might be because of the location of Federal College of Agriculture (FECA) in the urban region of the study area. This institution is involved in the sensitization and dissemination of the bio-fortified cassava products to the respondents. This is in consonance with (Ashagidigbi et al, 2019; Pambo (2013) who indicated that urban consumers have statistically higher level of awareness and decision to consume fortified products than rural consumers do.

Table 5 showed that 70.4% of the respondents prefer the bio-fortified cassava products to the conventional one. Thus, implying that majority of the households would like to consume the bio-fortified products relative to the conventional products.

Using a Likert scale on a scale of 0-5 (that is, NP-Not Preferred, LP-Least Preferred, I-Indifferent, P- Preferred and MP- Most Preferred), preference level of respondents for nutritionally fortified cassava products was constructed based on their identified attributes (taste, colour, texture, nutritional benefits, accessibility, digestibility, price and ease of preparation). As observed, garri had the highest preference level, followed by fufu; while starch had the least (Table 6).

Table 7 showed the various prices at which the conventional and bio-fortified cassava products are sold. Garri has the highest price/kg; ₦600 ($1.67) and ₦400 ($1.11) for both bio-fortified and conventional cassava products. While starch has the least prices of ₦400 (($1.11) and ₦250 ($0.63) respectively. However, the price variation between the bio-fortified and conventional

cassava products is highest for garri ₦200 ($0.56) while it is lowest for lafun, tapioca and pupuru ₦100 ($0.28).

Tables 8 and 9 described the respondents' potential demand for nutritionally fortified garri (cassava granules) and fufu (cassava dough) products in the study area. The result was limited to garri and fufu alone because they are the bio-fortified products, which the respondents are mostly aware of and preferred the most.

It was observed that 66.7% of the respondents were willing to pay for the bio-fortified garri while 57.8% were willing to pay for the fufu within the set prices of ₦600 ($1.67) to ₦1000 ($2.78) and ₦500 ($1.39) to ₦1000 ($2.78) respectively. The reason why most of the respondents were willing to pay for the bio-fortified products was due to their nutritional and health benefits, which could be obtained at cheaper rate.

The results of the logistic regression analysis of the determinants of consumers' potential demand for bio-fortified cassava products (garri and fufu) revealed that the model is of good fit and had overall significance at 1 percent level. The chi square showed the overall goodness of fit of the model (Table10).

The results of marginal effects of the logistic regression analysis are presented as follows; Out of the seventeen (17) explanatory variables included in the regression model, eleven variables are significant. The willingness to pay for garri is influenced by years of consumption, the price of the product, age of the consumer, adult education, primary, secondary and tertiary levels of education; awareness of the product, habitation, age^2 and preference for the product.

While the willingness to pay for fufu is influenced by age of consumer, years of consumption, sex, adult education, tertiary education, income, price of the product, awareness of the product and habitation.

A unit increase in the number of years households have been consuming conventional cassava products tends to increase the willingness to pay for the bio-fortified cassava garri by 0.2335 and reduce that of fufu by 0.009. This implies that respondents with longer years of consumption of the conventional cassava products have the tendency to pay for the bio-fortified garri and have lower likelihood to pay for bio-fortified fufu. Habitation of the respondents had a positive relationship with the willingness to pay for bio-fortified cassava garri and fufu with probability score of 2.7887% and 34.388% respectively. This is in consonance with Asia *et al.,* (2015) who established that urban respondents' awareness and willingness to pay are more

inclined towards improved products. This indicates that urban dwellers are more willing to pay for both products relative to their rural counterpart.

The results also showed that educational level (adult, primary, secondary and tertiary) of respondents had a positive and significant effect on the willingness of respondents to pay for bio-fortified garri products. Results of the marginal effects showed that the likelihood of respondents with adult, primary, secondary and tertiary levels of education to pay for bio-fortified garri increased by 0.2800, 0.2863, 0.2963 and 0.3515 respectively. This means that respondents' level of formal education positively influences the willingness to pay for bio-fortified garri. However, for fufu products, only adult and tertiary levels of education were significant at 1% with the probabilities of 0.3438 and 1.2268 respectively. In other words the more literate a respondent is, the higher is his or her willingness to pay for the nutritional products. This result correlates with Ogunjiuba *et al*, (2013) who stated that household with higher level of education will have higher willingness to pay for a product than the less educated ones.

Age had a positive and significant effect on respondents' willingness to pay for bio-fortified garri and fufu products. This means that a year increase in age of the respondents increases their willingness to pay by 0.0367 and 0.0497. This implies that older respondents have the higher likelihood to know and appreciate the value of nutritional products than young ones. Carolina *et al* (2009) stated that older respondents have more positive attitude towards genetically modified products. In other words, older people, who are aware of health problems associated with consuming unbalanced diets, are more likely to be willing to pay for bio-fortified cassava garri and fufu.

With respect to age^2, a negative and significant effect coefficient (0.0004) implies that as older respondents advanced in age, the less likely they are to spend more on bio-fortified garri. That is, a year increase in the future age of the respondents decreases their willingness to pay by a factor of 0.0004. As submitted by Dontsop *et al* (2011), they stated that expenditure on products starts to decrease as age-squared increases, which implies that in future, respondents are likely to spend less on products than in their present age.

Respondents' awareness of bio-fortified garri and fufu increase their willingness to pay by 3.42% and 19.55%, connoting that increase in the awareness of the nutritional benefit of the products will have a positive influence on the respondents' willingness to pay for the products. This result corresponds with the findings by Farinola *et al* (2014) who stated that increase in level of awareness increases the likelihood of households paying for products rich in vitamins.

Gender was statistically significant and had a negative relationship with the respondents' willingness to pay for fufu. This implies that male-headed households' willingness to pay for bio-fortified fufu reduces by 0.2032 in relation to their female counterpart. This reveals that female respondents are more willing to pay for bio-fortified fufu than their male counterpart is. This result corresponds with the findings of Carolina et al (2009) who stated that female respondents are willing to pay significantly more for bio-fortified products than male as it could reduce vitamin A deficiency and thus improve their nutritional and health status.

A percent increase in the preference level of bio-fortified cassava garri increases the willingness to pay for the products by 8.579%. This implies that increase in the preference level of bio-fortified cassava garri would increase the willingness to pay extra amount for the bio-fortified cassava product. This is in line with the findings of Pambo (2013) that consumers prefers vitamin A products and highly appreciate the nutritional benefits evident in the top ranking of nutritional attributes by both urban and rural consumers.

However, the coefficient of income is negative and statistically significant at 1%. A naira increase in income would reduce respondents' willingness to pay for bio-fortified fufu by $7.2\times10^{-}7$. The implication of this finding is that, high-income earning households would probably rather purchase products rich in vitamins and micronutrients rather than buying bio-fortified cassava products. This result is in consonance with that Yahaya (2008) who submitted that households with lower income are less willing to pay for safer products than those with higher income.

A naira increase in the price of bio-fortified garri product would increase respondents' willingness to pay for the product by 0.222%. Likewise, willingness to pay for fufu increases by 0.095%, for every naira increase in the price of bio-fortified fufu. This could be due to the respondents' awareness of the health and nutritional benefits of the products and regarding the bio-fortified cassava products as cheap source of Vitamin A and micronutrients. This is however contrary to the findings of Abimbola *et al* (2013) and Farinola *et al* (2014) who observed that as price increases the willingness to pay for a particular product reduces.

Conclusion and Recommendations

The study revealed relatively higher awareness and preference of the respondents for the bio-fortified cassava products, due to the increased consciousness of the nutritional and health

benefits of the bio-fortified cassava products. However, rural respondents' low awareness and unwillingness to pay for the products might not be unconnected to inadequate awareness campaign in the area and the price of the bio-fortified products. Thus, there is the need for intensification of awareness campaign especially among youths and male respondents. Furthermore, price control policy measure should be an option among respondents in rural areas in order to achieve the ultimate goal of food and nutritional security for all.

Table1: Socio-economic Characteristics of the Respondents

Variables	Frequency	Percentage
Age (Years)		
Less than 30	12	8.9
31-40	50	37.0
41-50	12	8.9
51-60	50	37.0
Above 60	11	8.1
Mean 46.5		
Gender		
Male	95	70.4
Female	40	29.6
Marital Status		
Single	11	8.10
Divorced	4	2.96
Widowed	6	4.40
Married	114	84.40
Educational Level		
No Formal education	8	5.9
Adult education	8	5.9
Primary Education	30	22.2
Secondary Education	56	41.5
Tertiary Education	33	22.4
Household size		
1-5	65	48.1
6-10	65	48.1
>10	5	3.7
Mean : 6		
Annual Income N	50	37.0

Below 100,000 ($277.8)	49	36.4
100,001 – 300,000($277.8 –$833.3)	20	14.8
300,001 – 500,000 ($833.3 – $1,388)	16	11.9
Above 500,000 ($1,388)		
Primary Occupation		
Farming	61	41.2
Civil Service	21	15.6
Business/Trading	39	28.9
Artisan	13	9.6
Retired	1	0.7
Habitation	64	47.4
Urban	71	52.6
Rural		

Table 2: Distribution of Respondents According to the awareness of bio-fortified cassava products

Awareness	Frequency	Percent (%)
Aware	110	81.5
Not Aware	25	18.5
Total	135	100.0

Table 3: Distribution of Respondents According to Awareness of specific Bio-fortified Cassava Products

Bio-fortified Cassava Products	Frequency	Percentage	Rank
Garri (Cassava granules)	90	81.8	1st
Fufu (Cassava dough)	65	59.1	2nd
Tapioca	33	30.0	5th
Lafun (Cassava powder)	55	50.0	3rd
Pupuru (Cassava flour)	45	40.9	4th
Starch	28	25.5	6th

Table 4: Probit Estimates of the Consumers' Awareness of Bio-fortified Cassava Products

Variables	Coefficients	Std. Error	P > | z |
Age of the consumers	0.2764	0.1017	0.007***
Years of Consumption of cassava products	0.0388	0.0168	0.021**
Marital Status of the consumers	-0.5631	0.3435	0.409
Gender of consumers	-0.7239	0.3435	0.035**
Adult Educational level	0.9760	0.8024	0.224
Primary Educational level	0.0355	0.0137	0.010***
Secondary Educational level	0.0847	0.0280	0.003***
Tertiary Educational level	0.0286	0.0088	0.001***
Household size	0.0102	0.0935	0.913
Annual income of the consumers	2.19e-07	3.13e-07	0.484
Employment status of the consumers	0.0395	0.0138	0.005***
Age squared	-0.0023	0.0010	0.025**
Habitation	0.0047	0.0025	0.055*
Constant	-4.5518	2.1107	0.031**

*** Significant at 1% ** Significant at 5% *significant at 10%

Table 5: Distribution of Respondents' Based on the Preference for Bio-Fortified Cassava Products

Preference	Frequency	Percentage
Preferred	95	70.4
Not Preferred	40	29.6

Table 6: Preference Level of Respondents for the Bio-fortified Cassava Products

Products	Garri	Fufu	Tapioca	Lafun	Pupuru	Starch

Index	0.84	0.49	0.28	0.32	0.35	0.25

Table 7: Distribution of average prices for both conventional and bio-fortified cassava products

Products(kg)	**Prices of Bio-fortified cassava products ₦/kg**	**Prices of Conventional cassava products ₦/kg**
Garri	600 ($1.67)	400 ($1.11)
Fufu	500 ($1.39)	350 ($0.97)
Lafun	400 ($1.11)	300 ($0.83)
Tapioca	500 ($1.39)	400 ($1.11)
Pupuru	500 ($1.39)	400 ($1.11)
Starch	400 ($1.11)	250 ($0.63)

Table 8: Distribution of Respondents Based on their Willingness to Pay for Bio-Fortified Garri (Cassava granules) Products.

Willing to pay 600₦/kg ($1.67)	Frequency	Percentage
Yes	90	66.7
No	45	33.3
Total	135	100.0

Table 9: Distribution of Respondents Based on their Willingness to Pay for Fufu (Cassava dough) Products.

Willing to pay 500₦/kg ($1.39)	Frequency	Percentage
Yes	78	57.8
No	57	42.2
Total	135	100.0

Table 10: Logit Estimates of Factors Determining Respondents' Potential Demand for Bio-Fortified Cassava Products.

	Bio-fortified garri (Cassava granules)	Bio-fortified fufu (Cassava dough)
Variable	**dy/dx**	**dy/dx**
X_1 age	.0366904 (1.88)*	.0496615(1.70)*****
X_2 years of consumption of cassava products	.2335296 (3.59)***	-.0094901(-2.67)***
X_3 marital status	-.18755 (-1.53)	-.2376943(-1.48)
X_4 gender	-.0388013 (-0.50)	-.2031732(-2.74)***
X_5 adult educational level	.2800043(1.84)*	.3438803(5.59)***
X_6 primary educational level	.2863733(2.47)**	.0232303(0.42)
X_7 secondary educational level	.2963142 (2.46)**	-.0501851(-0.30)
X_8 tertiary educational level	.3515239 (2.69)***	1.2268(7.48)***
X_9 household size	-.0030029 (-0.22)	-.0212611(-1.06)
X_{10} annual income	1.41e-08 (0.50)	-7.20e-07(-3.45)***
X_{11} employment status	.0341644 (0.68)	-.0523332(-0.66)
X_{12} price of garri	.0022225 (11.21)***	.9664133(0.77)
X_{13} price of fufu	-.0000261 (-0.23)	.0009564(4.57)***
X_{14} awareness of bio-fortified cassava products	.0341525 (2.29)**	.1955079(1.78)*
X_{15} habitation	.0278873 (2.56)**	.3438803 (5.59)***
X_{16} age squared	-.0003872 (-1.99)**	-.0004057(-1.32)
X_{17} preference for bio-fortified cassava products	.0857888 (2.39)**	.0016302(0.02)
Constant	-15.72856 (-3.08)***	-3.704121(-0.89)

******* Significant at 1% ****** Significant at 5% *****significant at 10%

The z-ratios are in parentheses
Number of obs (fufu) = 110
LR chi2(16) = 65.41
Prob > chi2 = 0.0000 Log likelihood = -42.442283

Number of obs (garri) = 110
LR chi2(17) = 100.85
Prob > chi2 = 0.000
Log likelihood = -59.936509

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