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International Journal of Moringa and Nutraceutical Research highlights new developments and perspectives on Moringa and Nutraceutical Research, including roles in health, wellness, sustainable development, environmental protection and global food security.

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The International Journal of Moringa and Nutraceutical Research (IJMNR) aims is to provide an effective medium for dissemination and publication of scientific information emanating from research on Moringa and Nutraceuticals. The Journal publishes original research papers, review articles, technical notes and book reviews on Moringa and Nutraceutical Research and related subjects.

Key areas covered by the journal are: Human and Animal Health and Nutrition; Processing, Value Addition and Food Science; Industrial Chemistry and Engineering; Economics and Management, Carbon Balance, Water Economics, Environmental Footprint management; Science of Human Behaviour and Demographics; Historic, Contemporary and Projected Associations in Language, Religion, Arts and Culture; Agronomy, Crop Protection and Ecology and all other original research and Data-driven perspectives on Moringa and Nutraceutical Research.

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Willingness to Pay for *Moringa Oleifera* Leaf Powder Fortified Bread among Consumers in Kwara State, Nigeria

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Abstract

This study was carried out to examine consumer's willingness to pay for bread fortification with *M. Oleifera* leaf powder in Kwara State, Nigeria. Primary data and secondary information were used for the study. Survey instrument used was structured questionnaire, administered to 240 respondents randomly selected in a four-stage sampling procedure. Analytical tools employed include descriptive statistics, Contingent Valuation Method and Regression technique. The study revealed that bread related purchases are predominated by males who account for up to about 63% of purchases. Almost half of the respondents were willing to pay 20% premium over the amount they would pay for a plain loaf of bread while 28.3% of the respondents were willing to pay up to 60% premium above the cost of a plain bread loaf. At 5% level, factors that significantly and positively determine consumers' willingness to pay for *M. Oleifera* leaf powder fortification in their bread were: educational status, monthly income, awareness of the nutritional benefits of *M. Oleifera*, consumers' perception of *M. leaves*, and ongoing management of health challenge while the amount spent by consumer on pharmaceutical dietary supplement was negatively significant. The study recommends that bread manufacturer should take advantage of the consumers' willingness to pay for *M. fortification* to their bread and hence make the product available. Given that an impressive percentage of respondents were willing to pay for *M. fortification* to their bread, it could prove to be a means to tackling the issue of micronutrient deficiency heads-on since bread is a widely acceptable staple in the country. There is the need to create even more awareness on the health and nutritional benefits of the *Moringa* plant as there are vast opportunities along food processing value chains which will impact positively on the economy considering that individuals are willing to pick up supplement-fortified food products in Nigeria.

Keywords: Bread, Contingent Valuation Method, Micronutrient deficiency, *Moringa Oleifera*, Willingness-to-pay, food fortification

Introduction

Micronutrient deficiency has been a topical issue especially in developing countries, Nigeria inclusive. Quite a reasonable number of people in such countries live below the poverty line and are likewise food insecure. The focus for such individuals will therefore be more attuned to having enough quantity of food to eat rather than in the quality of their food consumption. According to Ajibade *et al.* (2016), culturally, the bulk of daily diets in developing countries, Nigeria inclusive, are mostly constituted by carbohydrates partly due to their relative cheapness, stemming from the fact that they are the most commonly grown commodities. For these reasons, conscious efforts have to be made to ensure the daily nutritional requirements are met from food intake in terms of energy, protein, vitamins and minerals.

According to Tulchinsky (2010), Micronutrient deficiency conditions are widespread among 2 billion people in developing and in developed countries and these are silent epidemics of vitamin and mineral deficiencies affecting people of all genders and ages, as well as certain risk groups. They not only cause specific diseases, but they act as exacerbating factors in infectious and chronic diseases, greatly impacting morbidity, mortality, and quality of life. Deficiencies in some groups of people at special risk require supplementation, but the most effective way to meet community health needs safely is by population based approaches involving food fortification.

In Nigeria, as in most other tropical countries of Africa where the daily diet is dominated by starchy staple foods, vegetables are the cheapest and most readily available sources of important proteins, vitamins, minerals and essential amino acids (Thompson & Kelly, 1990).

Due to the increasing awareness on health status and well-being, a large number of people are becoming more conscious of the quality of their consumption despite the financial constraints that they may be experiencing. Over time, this has paved ways for indigenous nutritional supplements to gain grounds giving the very high and even increasing cost of imported food supplements.

One widely acceptable indigenous nutritional supplement is the *Moringa Oleifera*. The plant has over the years gained so much popularity around the world. This is attributable to the various health and nutritional properties that have been ascribed to it based on well documented research. In Nigeria, *Moringa Oleifera* has become a household name and various parts of the plant is commonly taken as food supplements in different forms by many. According to Fahey (2005), all parts of the Moringa tree, particularly the leaves, are edible and with reported nutritional, prophylactic and therapeutic uses. These are attributed to the high levels of macro-, micronutrients and phytonutrients in the *Moringa Oleifera* hence the alias "Miracle Tree" (Manaois *et al.*, 2013).

Several studies have been carried out on the proximate analysis of the Moringa plant and all of these give credence to the high nutrient density of the plant. For instance, the Moringa leaves have the highest amount of calcium and phosphorus among vegetables (Prabhakar and Hebbar 2008). It is likewise rich source of vitamin C, B vitamins, potassium and Iron, beta-carotene which is capable of reducing cholesterol (Oinam, 2012). Moringa leaves also contain all essential and sulfur-containing amino acids at levels higher than the FAO/WHO/UNO recommendation for a 2-5-year old child (Makkar and Becker, 1997). Phenolics as well as antioxidants, anti-inflammatory nutrients, omega 3 and 6 fatty acid are also present in the Moringa leaves (Kasolo *et al.*, 2010).

According to Mouminah (2015), Moringa plant provides a rich and rare combination of zeatin, quercetin, kaempferol and many other phytochemicals. Bukar *et al.* (2010) stated some of the medicinal uses of Moringa as cardiac and circulatory stimulants, possession of antitumour, antipyretic, antiepileptic, anti-inflammatory, antiulcer, antispasmodic, antihypertensive, antidiabetic, antibacterial, antifungal, cholesterol lowering attributes among others. Turner *et al.*, (2015) suggested that Moringa leaves contain a potent mixture of direct and indirect antioxidants that can explain its various health promoting effects. Fahey(2005) submitted that Moringa leaves contain more vitamin A than carrots, more calcium than milk, more iron than spinach, more vitamin C than orange, more potassium than

bananas as well as the protein quality of the Moringa leaves which rivals that of milk and eggs.

According to Mannaos *et al.* (2013) and Albigos (1996), Moringa leaves should be considered as a supplementing food ingredient in different food preparations as addition of nutrient-rich indigenous vegetables such as Moringa has shown to effectively enhance the nutrient profile of the food without compromising quality and consumer acceptability. Based on literature, in various countries where Moringa is indigenous, the leaves were tested as an inexpensive ingredient to boost the nutritional quality of various food products (Dachana *et al.*, 2010, Owusu, 2011, Liu 2012), food processors have also formulated different food products with added Moringa. For instance, in the Philippines, different noodle products have been processed with added Moringa (Arceo, 2010; Esconde, 2010), rice crackers with added Moringa (Mannaos *et al.*, 2013).

Researches carried out by Dillard and German (2000) and Siddhuraju and Becker (2003) revealed that due to the presence of several sorts of anti-oxidants such as flavonoids, ascorbic acid, carotenoids and phenolics, Moringa is able to extend the period of safety in the food containing fats. This may account for reasons why Moringa leaves are easily incorporated into flour based food products.

Bread is a widely accepted food product in Nigeria and this is evident in the numerous number of bakeries and the businesses

along its value chain. Bread is made from dough of flour and other ingredients, usually by baking. It is even regarded as one of the oldest artificial foods, having been of importance since the dawn of agriculture. Bread is usually served in diverse forms with any meal of the day and may also be consumed as snacks while also having relevance in other culinary preparations. Bread is commonly sold and consumed in Nigeria being a ready-to-eat food well suited to majority of the populace who may be constrained by time hence the inability to consume home-made food at various times. Beyond being an on-the-go food, bread is also consumed in the homes being the main course at some mealtimes in the family. It is tantamount to saying that bread is a staple food in Nigeria and can offer a valuable dietary supplementation vehicle through which the nutritional profile of individuals can be enhanced.

Currently in Nigeria, Moringa is consumed with minimal processing as a lot of people have direct access to the plant and hence may consume these raw. There are as well a number of tea products that have evolved whereby people have access to Moringa teabags which they may simmer in water for consumption. There are also the processed Moringa powder which may be added directly to meals or consumed in other forms. In Nigeria, there are little or no popular food products with Moringa supplementation unlike some other countries where various food products such as bread, cookies, muffin, biscuits, rice crackers, noodles, children weaning diets among others have been fortified with

Moringa leaves and commercialized. Considering the benefits of the Moringa plants, its high acceptability amongst consumers in Nigeria, the high rate of bread consumption and the suitability of Moringa as a bread supplement, bread fortification with Moringa can therefore be an avenue to enhance the nutritional profile of consumers and hence be a means to tackling the issue of micronutrient deficiency

This study was therefore carried out to examine the willingness to pay for bread that is fortified with Moringa leaves among consumers in Kwara State, Nigeria. The specific objectives were to describe the socioeconomic characteristics of bread consumers in the study area; to evaluate consumers knowledge on the health and nutritional benefits of Moringa *Oleifera*; to assess the willingness to pay for bread fortified with *Moringa Oleifera* leaf which is an hypothesized product, not yet in the market, in the study area and to examine the determinants of bread consumer's willingness to pay for *Moringa Oleifera* leaf fortification in the food product.

This study is justified by the fact that there is an urgent need to reverse the trend of Micronutrient deficiency. In most cases, individuals focus more on the calorific and sometimes the protein requirement of the per capita daily intake in their effort to attain food security while so little attention is being paid to the daily per capita Micronutrient requirements. Even though the use of pharmaceutical dietary supplements is fast gaining popularity in

consumers' bid to meet up their daily requirement of micronutrient, the prices are still on the high side and *Moringa Olifera* has proven to be an indigenous supplement with outlandish and impressive health attributes hence making it a readily available, accessible and affordable solution to various health issues while also supplementing the consumers' diet. Having established, from literature, the suitability of *Moringa* leaves in bread fortification

without resulting in any significant loss in the taste of the bread nor compromise in consumers' acceptability, then such value addition to bread may be explored hence the relevance of this study.

Materials and Methods

The study was carried out in Kwara State, Nigeria which is depicted in Figure 1.

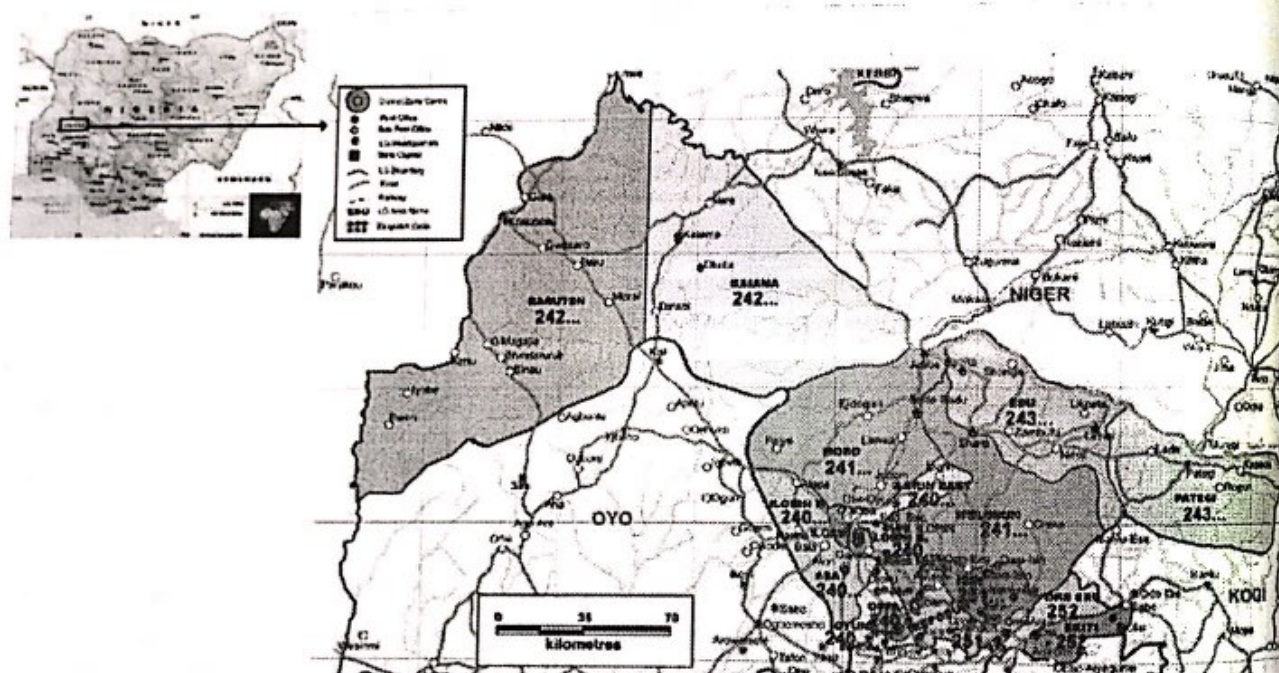


Figure 1. Map of Kwara State, Nigeria (Source: <https://www.google.com.ph>).

The geographical location of the state is between latitude $7^{\circ} 20'$ and $11^{\circ} 05'$ north of the equator longitude $2^{\circ} 5'$ and $6^{\circ} 45'$ East of the prime meridian (Ogunlade *et al.*, 2009). There are 16 Local Government

Areas in Kwara State. It has a total population of about 2,371,089 million and covers a total land mass of 32,500 square kilometers out of which 75.3% is cultivable (National Population Commission [NPC],

2010). Mainly, the area has dry and wet seasons. The dry season runs from the months of November to April. The Kwara State Agricultural Development Project identified four main agro-ecological zones based on the ecological characteristics, cultural practices and the administrative convenience of the project. Zone A comprises the Baruten and Kaiama Local Government Areas. Zone B includes Edu and Patigi Local Government Areas. Zone C composes the Asa, Ilorin East, Ilorin South, Ilorin West and Moro Local Government Areas. Zone D consists of Ekiti, Ifelodun, Irepodun, Isin, Offa, Oke-Ero and Oyun Local Government Areas.

Sampling procedure

This study engaged a three-stage sampling technique with the first stage being the purposive selection of the Kwara State capital which is Ilorin based on the fact that this is a major urban centre and the most populous city in the State with a large number of commuters who on daily basis traverse the city en-route other parts of the state and country and with vendors enjoying patronage from quite a number of these commuters as well hence giving an even better representation of bread consumers. There are numerous bread vending outlets strategically placed across the City. Likewise, bread hawkers sell their products along streets and around busy axes such as garages, motorparks, markets, schools among others hence making accessibility to bread easier across the City. The second stage involved the random selection of 12 streets using the Kwara

State street mapping guide. Selection of the major bread vending hub in each of the selected location was premised on the information gathered during preliminary survey which indicated that the major bread vending hub across the city were mostly situated such that they more accessible to adults than children considering the vehicular traffic. This is more suitable to this research because information required on willingness to pay would be more readily gotten from adults who can make decisions and are more likely to understand the health implication of the *Moringa Oleifera* leaf which is in discuss rather than children who would have been sent on errand to make such purchase. The third stage involved the selection of the major bread vending hub in each of the twelve locations while the fourth stage involved the systematic random sampling of 20 bread buyers at a sampling interval of five in each of the selected bread vending hub to give a total number of 240 respondents for the survey. Primary data and secondary information were used for the study. The primary data were collected using a semi-structured questionnaire which gathered information on socioeconomic characteristics, bread consumption pattern, awareness on *Moringa Oleifera*, consumer preferences among others. The questionnaire was designed to elicit the consumers' willingness to pay for an hypothesized product which is bread fortified with *Moringa Oleifera* leaf in the study area.

After having established starting bid values, an open-ended question was used to

determine the maximum amount the respondents' were willing to pay for the attribute of fortification of bread with *Moringa Oleifera* leaves in the study area. Secondary information was obtained from the internet, text books, journals and other publications. Data collected were analyzed using descriptive statistics, Contingent Valuation Method and Regression analysis. The descriptive statistics used to describe the socio-economic data includes frequencies and percentages. Contingent Valuation method was used to examine urban dwellers' willingness to pay for fortification of bread with *Moringa Oleifera* leaves. According to Teshome and Bogale (2015), willingness to pay is defined as the amount that must be taken away from household's income. The willingness data is collected through contingent valuation method (CVM), this method is also suited to solicit consumers' willingness to pay for a product that is not yet on the market. CVM is now increasingly used in developing countries (Alberini and Cooper, 2000).

Binary Logistic regression was used to examine the determinants of consumer's willingness to pay for fortification of bread

with *Moringa Oleifera* leaves in the study area.

This function for the Binary Logistic regression is expressed as: $Y = \beta X_i + e$

$$Y = \beta X_1 + \beta X_2 + \beta X_3 + \beta X_4 + \beta X_5 + \beta X_6 + \beta X_7 + D_1 + D_2 + e$$

Where, Y which is a dichotomous response variable (1 for consumers that are willing to pay and 0 otherwise), X_1 = age, X_2 = educational level (yrs of schooling), X_3 = Perception on the bread taste, X_4 = monthly income, X_5 = awareness of nutritional benefits of *Moringa Oleifera*, X_6 = amount spent on pharmaceutical dietary supplements, X_7 = consumer's perception of *Moringa Oleifera* leaves, D_1 = Marital status and D_2 = ongoing health management.

Results and Discussion

Some of the socioeconomic characteristics of the respondents considered include: gender, age, marital status, educational status, monthly income and household size. Tables 1 presents the distribution of the respondents based on their socioeconomic characteristics.

Table 1: Socio-economic characteristics of sampled Bread buyers in the study area

Variables	Category	Frequency	Percentages
Sex	Male	152	63.33
	Female	88	36.67
	Total	240	100.00
Age (in years)	11-20	15	6.25
	21-30	76	31.67
	31-40	59	24.58
	41-50	42	17.50
	>50	48	20.00
	Total	240	100.00
Marital Status	Single	86	35.83
	Married	154	64.17
	Total	240	100.00
Educ. Status	Primary education	24	10.00
	Secondary education	56	23.33
	Tertiary education	106	44.17
	Adult education	30	12.50
	No formal education	24	10.00
	Total	240	100.00
Monthly Income	≤ ₦20,000	34	14.17
	₦ 20,001 - ₦50,000	96	40.00
	₦ 50,001 - ₦ 80,000	26	10.83
	₦ 80,001 - ₦ 110,000	25	10.42
	₦ 110,001 - ₦ 150,000	25	10.42
	> ₦ 150,000	54	22.50
	Total	240	100.00
Household Size	1-3	36	15.00
	4-6	140	58.33
	7-9	48	20.00
	10-12	16	6.67
	Total	240	100.00
Awareness on benefits of Moringa Oleifera	Yes	146	60.83
	No	94	39.17
	Total	240	100.00

Source: Field survey, 2016

Results in Table 1 revealed that about 63% of the bread buyers sampled were male which is far higher than the female counterparts. The modal age range was 21-40 years with about 56% falling within this range. This may be due to the fact that this is an active age bracket with many upwardly mobile individuals who may be constrained by time in home food preparation hence the preference for bread at some times. Majority of the respondents were married while up to 90% of the respondents had some form of formal education with about 44% having up to tertiary level of education. This may be due to the fact that the study was carried out in an Urban center which has a high number of working class individuals. This finding is in tandem with the result of Farinola et al. (2014), in a study carried out in Oyo state on willingness to pay for Moringa powder which revealed that up to 85.3% of the respondents had some form of formal education.

The study revealed that up to 86% of the respondents earn higher than the minimum wage which is set at N18,000 in Nigeria. This may be an indication that majority of the bread consumers are working class individuals who place more premium on time hence their opting for such convenience foods as bread. The modal household size ranged between 4 and 6 with about 58% of the respondents falling within that range. Of the respondents, 60.83% stated that they had knowledge on the nutritional benefits of *Moringa Oleifera* plant which accounts for why they

endeavor to consume the plant. This agrees with the findings of Farinola et al. (2014) where they found out that majority of consumers in Oyo state are aware of the health benefits of Moringa. It is also consistent with the findings of Oyekale et al. (2015) in a study of awareness and willingness to pay for Moringa which revealed that the level of awareness is quite high.

Results on Willingness to Pay for fortification of Bread with Moringa Oleifera in the Study Area

The results generated from analysis carried out on the willingness to pay for a hypothetical product which is Bread fortified with *Moringa Oleifera* Leaf powder, as a form of diet supplement, by the bread consumers in the study area is as shown in Table 2.

The result as shown in table 2 reveals that about 49.2% of the respondents were willing to pay 20% in addition to the cost of a loaf of plain bread if the bread were to be fortified with *Moringa Oleifera* leaf powder. Up to 40% of the respondents were willing to pay 40% in addition to the cost of a loaf of plain bread if it were to be enhanced with *Moringa Oleifera* powder while only about 28.3% were willing to pay up to 60% in addition to the cost of a plain loaf of bread having stated their preference for the fortified bread over a plain loaf if available considering the health attributes of such fortification. This result is in consonance with the findings of Oni et al.

(2005), Oviahon et al. (2011) and Farinola et al. (2014) where it was revealed that

increase in prices reduces the consumers' willingness to pay for food commodities.

Table 2: Results of Willingness-To-Pay for Fortification of Bread with Moringa Oleifera Leaf Powder in the Study Area

Hypothetical Product	Willingness to pay 20% in addition to the cost of Plain bread		Willingness to pay 40% in addition to the cost of Plain bread		Willingness to pay 60% in addition to the cost of Plain bread	
	Frequency	Percentage (%)	Frequency	Percentage (%)	Frequency	Percentage (%)
Bread fortified with Moringa Oleifera Leaf Powder	118	49.20	96	40.00	68	28.30
Additional amount willing to be paid for enhancement of Plain bread worth N350 using powdered Moringa Oleifera	NGN 70		NGN 140		NGN 210	
Amount willing to be paid for plain bread of N350= anfter fortification with Moringa Oleifera leaf powder	NGN420		NGN490		NGN560	

Source: Field survey data. 2016. Number of observation: 240 Cost of Big Loaf of Plain Bread NGN300 WTBP – Willing to be paid

Results for Determinants of Willingness to Pay for Moringa Oleifera Leaf Powder Fortification by Consumers in the Study Area

To identify the determinants of Willingness to Pay for Bread fortified with Moringa Oleifera leaf powder in the study area, the

binary logistic regression model was used. Table 3 shows the result of the analysis where it is revealed that the logistic model explains 78.4% of the consumer's willingness to pay for bread fortified with Moringa Oleifera leaf powder for consumption in the study area.

Table 3: Parameter estimate for the Logistic Regression Model

Variables in the Equation		Coeff.	S.E.	Z-stat	Prob.
Step 1 ^a	X ₁ - age	0.5373	0.4089	1.3140	0.1891
	X ₂ - educational level	0.2646**	0.3140	0.8426	0.0274
	X ₃ - Perception on the bread taste	0.3908	0.3582	1.0910	0.0582
	X ₄ -Monthly Income	0.7749**	0.3429	2.2598	0.0017
	X ₅ -awareness of nutritional benefits of <i>Moringa Oleifera</i>	0.6894**	0.3185	2.1645	0.0302
	X ₆ -amount spent on pharmaceutical dietary supplements monthly av.	-0.8956**	0.4021	-2.2273	0.0030
	X ₇ -consumer's perception of <i>Moringa Oleifera</i> leaves	0.6042**	0.3325	1.8171	0.0492
	D ₁ - Marital status	0.8074	0.2471	3.2675	0.3985
	D ₂ - ongoing health management	0.9643**	0.2889	3.3378	0.0000
	Constant	-1.6612**	0.5271	-3.1515	0.0098

a. Variable(s) entered on step 1: X₁, X₂, X₃, X₄, X₅, X₆, X₇, D₁, D₂

b. Overall case correctly predicted 78.4%

c. Model Chi-square 54.27

Findings from the regression results revealed that the consumer's level of education, monthly income, awareness of the nutritional benefits of *Moringa Oleifera*, consumers' perception of *Moringa* leaves, and ongoing management of health challenge were positively and statistically significant while the amount spent by consumer on pharmaceutical dietary supplement was negatively

significant at 5% level. Some of the significant variables are in tandem with the findings of Farinola et al. (2014) where they identified some of the factors that were significant to be level of education, level of awareness, occupation among others.

Contrary to apriori expectation, the age of the respondents was statistically insignificant which may be an indication that the consumers' knowledge of the

nutritional benefits in *Moringa Oleifera* is not related to the age hence the product will be acceptable across various age groups. The finding is in misalignment with that of Oyekale *et al.* (2015) in the study which revealed that age played significant role in willingness to pay for Moringa.

Likewise, perception on what Moringa fortified bread may taste like was statistically insignificant at 5% level and that may be an indication that consumers are more conscious of the health benefits therein rather than the sensory or taste attribute of the hypothetical Moringa fortified Bread.

Given that the consumers' awareness of the health attributes of the Moringa leaf is positive and significant at 5%, then it implies that an increase in awareness will further endear consumers to Moringa fortified bread hence widening the market for such product when it gets to the market. The import of this will be felt by the bread producers however this is in no way near the benefits that will accrue to the consumers especially in the aspect of being able to meet the daily micronutrient requirements while consuming the regular staple food which is widely accepted across board. The ease of access to bread product will as well boost the opportunities that abound in using the staple as a vehicle for delivery of the inherent benefits in the Moringa leaves to majority of the populace that are bread consumers.

Recommendations and conclusion

Bread is a common and highly acceptable staple food in the study area. Likewise, *Moringa Oleifera* has over the years become a household name with various health and nutritional benefits proven and well documented. The consumption of *Moringa Oleifera* in the study area has been largely limited to tea commodities and powdered Moringa. There are still vast opportunities to explore in incorporating *Moringa Oleifera* into the daily diet of the populace given the nutritional benefits and the therapeutic uses as this will increase the range of menu available to the people for consumption while still enjoying their regular meals. This is therefore a pointer to the various manufacturing opportunities that may be taken in the area of food processing hence job creations along the value chain of *Moringa Oleifera* and Bread and thereby improving the welfare of the producers. This same avenue in discussion may prove to be highly useful in ameliorating the topical issue of Micronutrient deficiency which is a problem affecting billions of people globally.

Having established the willingness to pay for bread fortified with powdered *Moringa Oleifera* leaf, with 28.3% of the respondents willing to pay up to 60% additional cost to the price of a plain loaf of bread, then it has become pertinent to work on bread fortification with *Moringa Oleifera* leaf targeted at providing bread consumers with such product which they are willing to pay for given the health and nutritional attributes of the supplement.

Such an enhancement to bread which is a staple food in Nigeria will likewise be providing an appropriate avenue to make the nutrient more available to the consumers and thereby impacting positively on the micronutrient deficiency situation which is a cause for great concern globally.

Moringa Oleifera has high health and nutritive value, however, there is the need for more consumers to know these health benefits as this will go a long way in their forming consumption-related decisions. The fact that Nigeria, like most other developing countries do not have adequate

food labeling on such products in the market implies that there is little knowledge the consumers may get directly from the market except in cases where they make conscious efforts to get dietary information from sources like books, internet, word of mouth etc. It is important that awareness be created on the health and nutritive benefits of *Moringa Oleifera* in order to help strengthen decision making by consumers especially when food products such as bread fortified with *Moringa Oleifera* gets commercialized and readily available in the market.

References

- Abilgos R.G. (2009). Utilization of Malunggay (*Moringa Oleifera* Lam.) leaves in rice (*Oryza sativa* L.) flat noodle production. (MSc thesis) College, Laguna, Philippines: University of the Philippines Los Baños. 74p. (Available at PhilRice Library).
- Ajibade T.B.; Omotesho K.F.; Animashaun J.O.; Opaleke D.O., Ajibade E.T. (2016) Willingness to pay for detached Mallow Leaves (*Corchorous Olitorius*) amongst Vegetable Consumers in Kwara State, Nigeria. Paper presented at 14th Globelics International Conference held in Bandung Indonesia 11th – 14th October, 2016
- Alberini A. and J. Cooper (2000). Application of contingent valuation method in developing countries. *Economic and social development paper. No. 146*, FAO, Rome
- Arceo M. 2010. DoST lauds maker of veggie noodles. <http://www.mb.com.ph/articles/244314/dost-lauds-maker-veggie-noodles>. Date accessed: October 6, 2016
- Bukar, A.; Uba, A. and Oyeyi, T. (2010): Antimicrobial profile of *Moringa Oleifera* Lam. extract against some food – borne microorganisms. *Bayero Journal of Pure and Applied Science*, 3 (1) 43 – 48.
- Dachana K.B, Rajiv J., Indrani D., Prakash J. 2010. Effect of dried moringa (*Moringa Oleifera* Lam.) leaves on rheological, microstructural, nutritional, textural, and organoleptic characteristics of cookies. *Journal of Food Quality* 33:660–677.

- Dillard, C. and German, J. (2000): Review Phytochemicals: nutraceuticals and human health. *J Sci Food Agric*, 80, 1744-6.
- Esconde E.B. 2010. Bataan traders venture into malunggay, camote, squash noodles processing. <http://punto.com.ph/news/printpage/7219>. Date accessed: July 20, 2015
- Fahey J.W. 2005. *Moringa Oleifera*: A review of the medical evidence for its nutritional, therapeutic, and prophylactic properties. Part 1. Trees for Life Journal 1:5. <http://www.TFLJournal.org/article.php/20051201124931586>. Date accessed: August 25, 2016
- Farinola L.A., Famuyide O.O., Awe F., Adio A.F. and Ewolor A.S. (2014). Households' perception, awareness and willingness to pay for Moringa Oleifera Lam powder in Oyo State. *Journal of Agricultural and Crop Research Volume 2(6)*, pp 94-103 ISSN 2384-731X
- Kasolo, J.; Bimenya, G. and Ojok, L. (2010): Phytochemicals and uses of *Moringa Oleifera* leaves in Ugandan rural communities. *J Med Plants Res*, 4, 753-577.
- Liu X, Liu S, Lu Y. 2012. Impact of oleifera powder on nutritional and function properties of wheat flour product. *International Journal of Food Engineering* 8(3):1556-3758.
- Manaois R.V., Morales A.V., Abilgos-Ramos R.G. (2013) Acceptability, Shelf Life and Nutritional Quality of Moringa-Supplemented Rice Crackers *Philippine Journal of Crop Science (PJCS)* August 2013, 38 (2):1-8
- Makkar HPS, Becker K. 1997. Nutrients and antiquality factors in different morphological parts of the *Moringa Oleifera* tree. *Journal of Agricultural Science, Cambridge* 128:311-322.
- Moumina H.H.S. (2015). Effect of dried *Moringa Oleifera* leaves on the nutritional and organoleptic characteristics of Cookies. *Alexandria Science Exchange Journal, Volume 36, No. 4*
- National population Commission (2010)
- Ogunlade, I., Oladele, O.I., and Babatunde A.O. (2009). Farmers' Attitude to beneficiary funding of Extension Services in Kwara State, Nigeria. *Journal of Human Ecology*, 26(3), 215-220.
- Oinam N., Urooj A., Phillips P.P., Niranjana N.P. 2012. Effect of dietary lipids and drumstick leaves (*Moringa Oleifera*) on lipid profile and antioxidant parameters in rats. *Food and Nutrition Sciences* 3:141-145.
- Oni O., Oladele O., and Inedia I. (2005). Consumer willingness to pay for food safety labels in Nigeria: A case study of Potassium Bromate in Bread. *J. Central Eur. Agric.*, 6(3):382-387
- Oviahon I., Yusuf S., Akinlade J., Balogun O. (2011). Determinants of bread consumers' willingness to pay for safety labels in Oredo Local Government Area, Edo State Nigeria. *New York Sci, J.* 4 (9).

- Owusu D., Oduro I., and Ellis W.O. (2011). Development of crackers from cassava and sweetpotato flours using *Moringa Oleifera* and *Ipomoea batatas* leaves as fortificant. *American Journal of Food and Nutrition* 1(3):114-122.
- Oyekale T.O., Elebute T.E. and Amao I.O. (2015). Awareness and willingness to pay for Moringa. *International Journal of Vegetable Science Volume 21, Issue 5* Pp 491-495
- Prabhakar M., Hebbar S.S., (2008). Annual drumstick (*Moringa Oleifera* Lam.). In: Peter, K.V., editor. *Underutilized and Underexploited Horticultural Crops, Vol. 4. New Delhi, India: New India Publishing. 111-130p.*
- Siddhuraju, P. and Becker, K. (2003). Antioxidant properties of various solvent extract of total phenolic constituent from three different agroclimatic origins of drumstick tree (*Moringa Oleifera* Lam.) leaves. *J Agri Food Chem*, 51, 2144-5.
- Teshome H. and A. Bogale (2015) Willingness to pay for rainfall risk insurance by smallholder farmers in Central Rift Valley of Ethiopia: The case of Dugda and Mieso Districts. *African Journal of Agricultural Research* Vol. 10 (28), pp. 2738-2747. DOI: 10.5897/AJAR2014.9360 Article: Number: 9B1EBD653970 ISSN 1991-637X <http://www.academicjournals.org/AJAR>
- Thompson, H.C. and W.C. Kelly (1990). *Vegetable Crops*. 5th Ed. New Delhi: Mac Graw Hill Publishing Company Ltd, 120-125.
- Tulchinsky T.H. (2010). Micronutrient Deficiency Conditions: Global Health Issues. *Public Health Reviews*, Vol. 32, No 1, 243-255
- Turner, T.; Rojas – Sva, P.; Poulev, A. and Raskin, I. (2015). Direct and indirect antioxidant activity of polyphenol- and isothiocyanate-enriched fractions from *Moringa Oleifera*. *J. Agric Food Chem*. 63(5):1505-1513.