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SCIENTIFIC PAPER

CONSUMER WILLINGNESS TO PAY A PREMIUM FOR A FUNCTIONAL FOOD IN GHANA

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Abstract: *Interest in functional foods has been growing in sub-Saharan Africa due to consumer concerns with diet and nutrition. This paper analyses consumer awareness, perceptions and effects of the determinants of consumer willingness to pay (WTP) a premium for Moringa bread in Ghana. An ordered probit model is employed. The empirical results indicate that consumer knowledge of the nutritional and health benefits of Moringa bread is what matters most to consumers in respect of their WTP a higher premium for the product. Consumers with knowledge on Moringa products are more willing to pay above 50% price premiums for Moringa bread. Fruitful policy recommendations are made in the paper.*

Keywords: *Functional foods; Ghana; Moringa bread; Ordered probit model; Willingness to pay*
(JEL code: *D12*)

INTRODUCTION

Interest in functional foods has been growing in Ghana and other parts of sub-Saharan Africa due to consumer concerns with diet and nutrition. Functional foods contain one or more added ingredients which provide positive health benefits over and above the functions of normal food products (Frewer et al. 2003; Doyon and Labrecque, 2008; Szathvary and Trestini, 2014). These added nutritional benefits could either be naturally occurring or added at the point of production (Traill, 2008; Markosyan et al. 2009; Lähteenmäki, 2013). The nutritional emphasis in the past on survival, hunger, and prevention of adverse effects is now being expanded to include the use of foods that promote the state of well-being and better health and which help to reduce the risk of diseases (Maynard, 2003; Niva and Makela, 2007). Increasingly, consumers are seeking for functional foods to control their own health and well-being (Frewer et al. 2003; Krystallis et al. 2008; Markosyan et al. 2009). Moreover, consumers with more information on food safety issues tend to shift their demand for food from "eating fully" to eating well" or "eating safely" resulting in consumer willingness to pay (WTP) for higher premiums for such foods (Liu et al. 2009; Berning et al. 2011; McCluskey et al. 2011). To sustain consumers' interest in nutritional and health benefits of foods, functional foods are being developed all over the world to specifically promote healthy lifestyle and to reduce the risks of diseases (Niva and Makela, 2007; Markosyan et al. 2009; Betoret et al. 2011).

Various types of functional food ingredients exist worldwide but products from the *Moringa oleifera* plant are the most abundant in developing countries. Materials from Moringa plant are sustainable and potent in fighting micronutrient malnutrition in developing countries (Aboagye et al. 2007). The World Health Organization (WHO) argued that *Moringa oleifera* is the most low cost health enhancer in the poorest countries around the world (WHO, 2002). *Moringa oleifera* thrives well in Ghana but the production and consumption of its products are still in the infant stages (Sauveur and Broin, 2010), leading to low patronage of Moringa products in Ghana. Policy makers, researchers, Moringa Associations, NGOs, and nutritional and health experts are making conscious efforts to promote the production and consumption of Moringa products in the country (Sauveur and Broin, 2010). It is argued that one possible ways through which functionality of food could be delivered to consumers is through bakery products (Krystallis et al. 2008; Sirò et al. 2008).

Functional foods are increasing in popularity for dairy products or confectionery sectors worldwide (Maynard, 2003; Alldrick, 2007; Sirò et al. 2008), but market information on functional bakery products is relatively very scanty in Ghana. Consumer studies that have examined consumer preferences for functional foods (Frewer et al. 2003; Markosyan, et al. 2009; Annunziata and Vecchio, 2011; Cranfield et al. 2011) did not consider the market for Moringa products. Most of the existing literature on Moringa products in Ghana (Aboagye et al. 2007; Oduro et al. 2008; Sauveur and Broin, 2010) and in Africa (McBurney et al. 2004; Rweyemamu, 2006**;** Moyo et al. 2011), focused mainly on the nutritional and health potency of Moringa leaves. Rigorous research on the awareness, perceptions and consumer preferences for Moringa products or consumer WTP a premium for Moringa bread in Ghana have not been adequately researched. Relevant policies on consumer preferences for functional foods would assist agribusiness firms to investment and improve upon their marketing strategies (Veeman, 2002; Annunziata and Vecchio, 2011). Notably, any agribusiness firm that wants to increase its chance of success in today's market cannot ignore consumer perceptions and attitudes toward functional foods (Sirò et al. 2008; Annunziata and Vecchio, 2011).

Given that consumers generally have positive attitudes toward functional foods (West et al., 2002), the understanding of factors which influence consumers' preferences and WTP for functional foods becomes relevant. Amongst these factors, consumer socio-economic characteristics such as age, gender, education, income level, the level of consumer awareness and perceptions, knowledge of the product, as well as product characteristics, including taste, nutrition and health have received attention in the empirical literature. Liu et al. (2009) found an inverted-U-shaped relationship between age and consumer WTP for additive free foods, indicating that WTP increases with age but decreases as age increases beyond a threshold age. Females in particular tend to pay higher premiums for safer foods (Liu et al, 2009). Consistent with these findings, Cranfield et al. (2011) reported that *females and older individuals have positive attitude towards functional foods and tend to consume foods with more functional ingredients in them*. Educated consumers are assumed to be knowledgeable on the importance of functional foods to the body in terms of dietary needs and improvement in health status (Markosyan et al. 2009). The level of consumer income may play a critical role in determining if the consumer would pay higher premiums for functional food products (Herath et al. 2008). Consumer WTP is expected to increase as income of the consumer increases (Teratanavat and Hooker, 2006; Liu et al. 2009) due to negative correlation between consumer WTP for food safety and marginal utility of money. In contrast, Stranieri et al. (2010) found a negative relationship between consumers' income and their nutritional claims, the possible reason been that the time pressure of high-income consumers tend to affect their information use on nutrition labels. This therefore makes the effect of income on consumer WTP inclusive in the empirical literature.

The perception of consumers about the healthiness of functional foods is the main factor which affects their attitudes toward them (Annunziata and Vecchio, 2011). The level of consumers' cognition of food safety therefore has a positive impact on the WTP for such healthy foods (Liu et al. 2009). Markosyan et al. (2009) indicate that consumers who have positive feeling about nutritionally enriched foods are more likely to pay higher premiums for them whilst those with negative perceptions are less likely to pay higher premiums for the functional foods. Cranfield et al. (2011) pointed out that if consumers are aware of the nutritional value of functional foods and know that the functional ingredients in them have direct link to their health, they will be willing to consume foods that are incorporated with functional ingredients.

The main objective of the present paper is to analyze consumer perceptions, attitudes and WTP a premium for Moringa bread in Ghana. The study contributes to the existing literature on consumer preferences for functional foods by providing an empirical analysis on consumer WTP a premium for Moringa bread. The paper is organized into five sections. Section 2 provides the material and methods. Section 3 presents the results of the study. Section 4 discusses the results. Section 5 provides conclusions and recommendations.

MATERIALS AND METHODS

Conceptual Framework

Willingness to pay (WTP) is the premium a consumer is willing to pay for non-marketed good or product which is not yet on the market. Different consumers have different WTP. It is therefore the distribution of WTP among the target population that offers interesting market information on the product. Generally, consumers are assumed to maximize their preferences or utilities for such non-market goods subject to their budget constraints (Hanemann and Kanninen, 1998). WTP for non-market product is not directly observable but its distribution and parameters, including the mean WTP in monetary terms could be estimated using a survey data (Lusk and Hudson, 2004) from a contingent valuation survey (Hanemann et al. 1991; Hanemann and Kanninen, 1998).

The present paper follows the double-bounded dichotomous choice (DBDC) framework proposed by Hanemann et al. (1991). The double-bounded approach has been used extensively to analyze consumer acceptance of functional foods (Li et al. 2003; Markosyan et al. 2009). The technique provides asymptotically more efficient estimates by incorporating adequate information on the consumer WTP (Hanemann et al. 1991). In terms of statistical efficiency, the double-bounded approach is better than the single-bounded approach. Also the double-bounded approach is simple, incentive compatible and provides tighter confidence intervals (Mitchell and Carson, 1989) than the single-bounded technique. Other studies have also employed the multiple-bounded and polychotomous choice methods that require limited information on the bids (Alberini et al. 2003) but they are often associated with design bias on the range of bids to use (Vossler et al. 2004).

Using the double-bounded dichotomous choice (DBDC)

framework in a contingent survey, the consumer is presented with two consecutive bids. The bids are presented in such a way that the second bid depends on the response to the first bid. If the consumer responded "YES" to the first bid (Λ_1), the second bid (Λ_2^H) is set higher, but if the response to the first bid was "NO", then the second bid (Λ_2^L) is set lower. The four possible outcomes from the proposed bids are "YES–YES"(Λ_2^H, ∞); "YES–NO" (Λ_1, Λ_2^H); "NO–YES" (Λ_2^L, Λ_1); and two consecutive "NO–NO" responses $(-\infty, \Lambda_2^L)$. In the present paper, the outcomes are collapsed into three WTP categories or latent constructs (Markosyan, et al. 2009) and the factors affecting consumers' WTP for each of the three categories are estimated jointly with the ordered probit model (Cranfield and Magnusson, 2003). The advantages of estimating the ordered probit model is to allow for the predicted probabilities of each WTP category and marginal effects to be computed (Cranfield and Magnusson, 2003). The three price premium categories investigated in the present paper are consumers' unwillingness to pay (UWTP) for any of the proposed price premiums for Moringa bread (i.e. WTP=0, representing respondents who responded "NO–NO" to the proposed bids), consumers' WTP for 1% – 50% price premiums for Moringa bread (i.e. WTP=1, representing respondents who responded "NO–YES" and "YES–NO"), and consumers' WTP for price premiums above 50% (i.e. WTP=2, representing respondents who responded "YES–YES").

The determinants of consumers' WTP for Moringa bread is examined using the ordered probit model specification:

$$\Re_i^* = \lambda' Z_i + \varepsilon_i \quad (1)$$

where $\Re_i^*$ is latent and a continuous measure of the WTP category of the consumer i, Z_i is a vector of explanatory variables, λ' is a vector of parameters to be estimated and ε_i is a random error term that assumes a standard normal distribution. Since $\Re_i^*$ is latent, we observe coded discrete responses of the variable $\Re_i$ as:

$$\Re = \begin{cases} 0 \text{ if } -\infty \le \Re_i^* < \Lambda_2^L & \text{(UWTP any price premium)} \\ 1 \text{ if } \Lambda_2^L \le \Re_i^* < \Lambda_2^H & \text{(WTP 1\% to 50\% price premium)} \\ 2 \text{ if } \Lambda_2^H < \Re_i^* \le \infty & \text{(WTP above 50\% price premium)} \end{cases}$$

(2)

The choice probabilities of the consumers' WTP for the jth categorized premium for Moringa bread is represented as:

$$\Pr(\Re = j) = \begin{cases} \Pr(\Re_i^* < \Lambda_2^L) = \Phi_1(\lambda' Z_i) \\ \Pr(\Lambda_2^L \le \Re_i^* < \Lambda_2^H) = \Phi_2(\lambda' Z_i) - \Phi_1(\lambda' Z_i) \quad j = 0,1,2 \\ \Pr(\Lambda_2^H < \Re_i^* \le \infty) = 1 - \Phi_2(\lambda' Z_i) \end{cases}$$

(3)

The vector of parameters λ' and the thresholds $\Lambda' s$ are jointly estimated using the maximum likelihood estimation (MLE) procedure which yields consistent and asymptotic estimators. The ϕ**'s** assume a standard normal distribution (Greene, 2008).

The vector Z_i includes personal and household characteristics of the consumer such as age, gender, marital status, religion, education and income status, consumer awareness, consumers' sources of information on Moringa bread, and consumer knowledge and perceptions on the nutritional and health potency of Moringa bread. Age is hypothesized to have a positive relationship with consumer preferences for foods with health and nutritional claims (Barrena and Sanchez, 2010; Stranieri et al. 2010). Liu et al. (2009) posit that after the consumer's age has increased beyond a certain threshold, the WTP tends to decrease with age. Females are expected to pay higher premiums for foods with high nutritional and health claims (Stranieri et al. 2010; Cranfield et al. 2011). Married consumers are expected to pay higher premiums for functional foods since they may have younger children and family members who are ill and living with them (Annunziata and Vecchio, 2011). It is hypothesized that religious consumers will be willing to pay higher premiums for functional foods (Annunziata and Vecchio, 2011). Income is expected to have a positive effect on consumer WTP a premium for functional foods (Herath et al. 2008; Teratanavat and Hooker, 2006). Higher educated consumers are hypothesized to pay higher premiums for functional foods (Markosyan et al. 2009). Consumers' awareness of functional foods is expected to have a positive influence on their WTP premiums (Liu et al. 2009; Cranfield et al. 2011). Consumers will be willing to pay higher premiums for functional foods if they have knowledge of the nutritional and health claims of such food products (Barreiro-Hurle et al. 2010; Annunziata and Vecchio, 2011; Cranfield et al. 2011). Moreover, consumers with positive perceptions of functional foods will be willing to pay higher premiums for the products (Markosyan et al. 2009).

Data Description

The data employed in this study were obtained from a contingent valuation survey of 400 consumers in the Kumasi Metropolis of Ghana in 2010. The city of Kumasi is the second largest city in Ghana and the administrative capital of the Ashanti Region in Ghana. The unique centrality of

the metropolis makes it conducive for vigorous marketing activities. As an urban economy in a developing country, the agricultural sector in Kumasi is very small accounting for only about 10% of the regional Gross Domestic Product. The city's population is about 1,520,117 with a growth rate of 5.47% (GSS, 2010). The survey was essentially based on consumers in Bomso, Ayeduase and Denyase suburbs of the Kumasi Metropolis. Specifically, 175 consumers were randomly selected from Bomso, 190 from Ayeduase and 35 from Denyase making a total sample size of 400 consumers. Primary data on socio-economic variables such as consumer characteristics, including age, gender, education, religion and income status were collected with a carefully designed structured questionnaire. The price bids and consumer knowledge, awareness and perceptions on functional foods (notably, Moringa bread) were also solicited.

In the contingent valuation (CV) survey, the respondents were asked about their frequency of consumption of non-Moringa bread. They were asked about how much they were willing to pay for Moringa bread given proposed prices or bids. In stating the bids, the price of Moringa bread was assumed to be more expensive than that of non-Moringa bread (i.e. the normal bread, which is already on the market) because of the health and nutritional advantages. The bid price of 1 kilogram (kg) of Moringa bread was set by computing a percentage increase of the market price of 1kg non-Moringa bread. Employing the double-bounded dichotomous choice (DBDC) technique, about 50% increase in the price of 1kg of the non-Moringa bread was proposed to the respondents as a base price or bid for the Moringa bread. Respondents who responded "NO" to this first bid were given a bid lower than 25% of the price of 1kg non-Moringa bread. If the response to the first bid was "YES", a 100% increase in the price of 1kg non-Moringa bread was proposed to the respondents.

RESULTS

The empirical distributions of the respondents with the 3 categorized WTP premiums are provided in Table 1. Respondents who are unwillingness to pay premiums for Moringa bread are 32%. Those with WTP of 1%–50% price premiums are 42.2% and those with WTP above 50% price premiums for Moringa bread are 25.5%. The respondents generally have positive perceptions on the nutritional and health benefits of consuming Moringa bread (Table 2). About 44% agreed that Moringa bread is more nutritious than non-Moringa bread, giving an average perception score of 0.21. Averaging the two scores results in nutrition perception index of 0.22. Consumers were asked about their perceptions on health benefits of Moringa bread. Approximately 44% agreed that Moringa bread could solve the malnutrition problems in Ghana, giving an average perception score of 0.19. Almost half (49.25%) of the respondents agreed that Moringa bread could prevent many known diseases. With this statement, the average score on the Likert scale is 0.23. Averaging the two scores yields a positive health perception index of 0.21.

Table 1. Empirical distributions of consumer WTP for Moringa Bread

	WTP=0	WTP=1	WTP=2
Distribution of respondents	129(32.2)	169(42.2)	102(25.5)
Proposed mean bid for 1kg of Moringa bread (GH¢)	0	1.3012	1.9951
Awareness and Knowledge			
Awareness of Moringa bread	77 (59.7)	122 (72.2)	64 (62.7)
Knowledge on nutrient content of Moringa oleifera	97 (75.2)	153 (90.5)	91 (89.2)
Have you eaten any Moringa bread before?	50 (38.8)	101 (59.8)	57 (55.9)
Do you still eat Moringa bread?	16 (12.4)	42 (24.9)	37 (36.3)
Sources of information on Moringa bread			
Media	43 (33.3)	57 (33.7)	32 (31.4)
Friends and relatives	84 (65.1)	109(64.5)	60 (58.8)
Books/internet	17 (13.2)	23 (13.6)	15 (14.7)

Note: Figures in parentheses are percentages
1 US Dollar (US$) = 1.4012 Ghana Cedi (GH¢) in 2010
WTP=0 denotes consumer unwillingness to pay any price premium for Moringa bread; WTP=1 denotes consumer willingness to pay for 1%–50% price premium and WTP=2 denotes consumer willingness to pay above 50% price premium.

Source: Authors' computations based on survey data

The descriptive statistics of the variables used in the regression model specifications are provided in Table 3. The maximum likelihood estimates (the coefficients and the marginal effects) from the ordered probit model are presented in Table 4. The value of the likelihood ratio (LR) test statistic is highly significant indicating a rejection of the null hypothesis that the parameters in the model are jointly equal to zero. This also suggests that the estimated ordered probit model has a statistically significant explanatory power. The marginal effect of the age variable is negative in the unwillingness to pay category specification but positive for in other two WTP category specifications (i.e. WTP for 1%–50% premiums and WTP above 50% premium). The marginal effect for the marital status variable is positive and statistically significant in the "unwilling to pay" specification but exhibit negative and significant marginal effects in the willingness to pay a premium of above 50% for Moringa bread specification. We observe opposite empirical findings with respect to the religion variable. The education variable is not statistically significant even at the 10% level in all the WTP categories investigated in the ordered probit model.

The awareness variable (AWARE) has a significant positive marginal effect in the unwillingness to pay (WTP=0) specification but exhibits statistically insignificance even at the 10% level in the other two WTP specifications (i.e. WTP for 1%–50% price premiums and WTP above 50%

Table 2. Consumers' perception on Moringa bread

Perception statement	Number of respondents									Mean scores		
	Agree (Score=0.5)			Neutral (Score=0)			Disagree (Score= -0.5)			Consumer Aware	Consumer Unaware	Overall
	Yes	No	Total	Yes	No	Total	Yes	No	Total			
Moringa oleifera contains almost all micro-nutrients	138 (34.5)	50 (12.5)	188 (47)	116 (29)	85 (21.3)	201 (50.3)	9 (2.3)	2 (0.5)	11 (2.8)	0.25	0.18	0.22
Moringa bread is more nutritious than non-Moringa bread	147 (36.8)	29 (7.3)	176 (44)	111 (27.8)	105 (26.3)	216 (54)	5 (1.3)	3 (0.8)	8 (2)	0.27	0.10	0.21
Nutrition perception index *(NPI)*										0.26	0.14	0.22
Moringa bread helps solve malnutrition problems in Ghana	139 (34.8)	36 (9)	175 (43.8)	112 (28)	92 (23)	204 (51)	12 (3)	9 (2.3)	21 (5.3)	0.24	0.10	0.19
Moringa bread helps prevent many known diseases in man	147 (36.8)	50 (12.5)	197 (49.3)	105 (26.3)	82 (20.5)	187 (46.8)	11 (2.8)	5 (1.3)	16 (4)	0.26	0.16	0.23
Health perception index *(HPI)*										0.25	0.13	0.21

Note: Figures in parentheses are percentages
Source: Authors' computations based on survey data

price premiums). In contrast, respondents with knowledge on Moringa products are more willing to pay higher premiums for Moringa bread (i.e. WTP for 1%–50% price premiums and WTP above 50% price premiums). The same empirical findings emerge for the respondents who have eaten Moringa products (EATEN) or Moringa bread (EATBREAD) before. As expected, the respondents are less "unwilling to pay" any premium for Moringa bread but are more willing to pay higher premiums of above 50% for Moringa bread as the number of years of consumption of Moringa products increase. The marginal effect of the perception variable (PCEPDISEA) indicating consumers' agreeing perceptions on the potency of Moringa products to cure diseases is significantly negative in the "unwillingness to pay" category specification but shows significant positive marginal effects in the other two WTP category specifications (i.e. WTP for 1%–50% price premiums and WTP above 50% price premiums). This variable was measured as a dummy variable indicating 1 if the respondents agree that Moringa products can cure some of the known diseases in man and 0 otherwise.

There is a higher probability of being more "unwilling to pay" a premium and less willingness to pay higher premiums for Moringa bread when the source of information on Moringa bread are from friends or relatives and from the media. Statistically, two of the three interaction terms of the explanatory variables investigated in the WTP models are significantly different from zero.

DISCUSSIONS

The effects of consumer socioeconomic characteristics and product attributes were analyzed with the ordered probit model. The discussions on the empirical estimates focus on the marginal effects, which are of policy interest rather than the estimated coefficients. For each variable, the marginal effect show the change in the predicted probability for each WTP category for an average consumer (Cranfield and Magnusson, 2003). The significant negative marginal effect of the age of the consumer for the unwillingness to pay a premium category indicates that younger individuals are unwilling to pay a premium for Moringa bread. The significant positive marginal effects of the age variable in the other WTP category specifications (i.e. WTP for 1%–50% premiums and WTP above 50% premium) and the negative marginal effects of the quadratic age variable indicate that consumers' WTP for higher premiums for Moringa bread increases with age but decreases as age increases beyond a threshold age. These empirical results are line with what Liu et al. (2009) found for Chinese data. Cranfield et al. (2011) also reported that *individuals who consume more functional ingredients and have positive attitudes toward functional foods tend to be older.*

The positive marginal effect of the marital status variable indicates that married respondents are more "unwilling to pay" for Moringa bread. However, the positive marginal effects of the variable in the other WTP categories suggest that married respondents are less willing to pay above 50% premium for Moringa bread. The negative marginal effect for the religion variable suggests that Christian respondents are less "unwilling to pay" premiums for Moringa bread. They are however more willing to pay higher premiums of above 50% for Moringa bread. The statistically insignificant marginal effects of the education variables in all the three specifications imply that education exerts no effect on WTP to pay for Moringa bread. The relatively less variation in the education variables may have contributed to these statistical insignificant results.

The empirical findings on awareness and knowledge on

Table 3. Descriptive statistics of the variables used in the ordered probit model

Variable	Definition of variables	WTP=0	WTP=1	WTP=2
AGE	Age of respondent in years	24.38 (9.34)	24.27 (8.82)	23.74 (7.27)
GEN	1 if respondent is a female, 0 otherwise	0.54 (0.50)	0.44 (0.49)	0.50 (0.50)
MARITS	1 if the respondent is married, 0 otherwise	0.15 (0.36)	0.12 (0.33)	0.08 (0.28)
RELIG	1 if respondent is a Christian, and 0 otherwise	1.08 (0.28)	1.10 (0.33)	1.16 (0.37)
NYEDUC	Number of years of formal education	16.67 (1.63)	16.62 (1.64)	16.81 (1.21)
LOWINC	1 if respondent's income is less than GH¢50, and 0 otherwise	0.2326 (0.42)	0.26 (0.44)	0.29 (0.45)
MIDINC	1 if respondent's income is between GH¢50 – GH¢200, and 0 otherwise.	0.51 (0.50)	0.59 (0.49)	0.50 (0.50)
HIGINC	1 if respondent's income is above GH¢200, and 0 otherwise	0.25 (0.43)	0.14 (0.35)	0.20 (0.40)
AWARE	1 if the respondent is aware of Moringa bread, and 0 otherwise	0.59 (0.49)	0.72 (0.44)	0.62 (0.48)
KNOW	1 if the respondent has knowledge on Moringa product, and 0 otherwise	0.75 (0.43)	0.9053 (0.2936)	0.89 (0.31)
EATEN	1 if respondent has eaten any Moringa product before, and 0 otherwise.	0.38 (0.48)	0.59 (0.49)	0.55 (0.49)
EATBREAD	1 if respondent has eaten any Moringa bread before, and 0 otherwise.	0.30 (0.46)	0.42 (0.49)	0.30 (0.46)
YRUSEM	Number of years consumer has used Moringa products	1.87 (2.3)	2.03 (1.53)	2.66 (2.94)
FRIEND	1 if the respondent had information on Moringa products from friends/relatives, 0 otherwise	0.65 (0.47)	0.64 (0.47)	0.58 (0.49)
MEDIA	1 if the respondent had information on Moringa products from the media, 0 otherwise	0.33 (0.47)	0.33 (0.47)	0.31 (0.46)
BOOKS	1 if the respondent had information on Moringa products from books, 0 otherwise	0.13 (0.33)	0.13 (0.34)	0.14 (0.35)
PCEPDISEA	1 if respondent agrees that Moringa products can cure known disease in man, 0 otherwise	0.29 (0.45)	0.59 (0.49)	0.57 (0.49)

Note: ***Figures represent means and those in parentheses are standard deviations***
1 US Dollar (US$) = 1.4012 Ghana Cedi (GH¢) in 2010
WTP=0 denotes consumer unwillingness to pay any price premium for Moringa bread;
WTP=1 denotes consumer willingness to pay for 1 – 50 price premium and WTP=2 denotes consumer willingness to pay above 50 price premium.
Source: Authors' computations based on their survey data

argue that consumers are more likely to pay higher premiums for functional foods if they have adequate information on the product. The empirical results thus suggest that awareness of Moringa products alone Moringa bread are in agreement with the study by Cranfield et al. (2011) that consumers are more likely to consume functional foods if they know the direct link between the nutritional value of functional foods and their health. Markosyan et al. (2009)

does not translate into paying higher premiums by consumers but having knowledge on the nutritional and health benefits of the functional food is what matters most to consumers when it comes to paying higher premiums for functional foods. Chadwick et al., (2003) posited that consumers are likely to be cautious about making changes to their established consumption patterns when they are unclear about functional foods and their purported health effects.

The empirical findings on the health potency of Moringa products are consistent with the studies by Annunziata and Vecchio (2011) and Liu et al. (2009) that consumers with positive perceptions on health benefits of functional foods are more likely to pay higher premiums for them. As noted by Sun (2008), the likelihood of functional foods' consumption increases as consumers' concern on threat of infection of non-communicable diseases increases.

The findings on the sources of information on Moringa products suggest that the variable has no influence on consumer WTP to pay for Moringa bread. The results on the interaction terms indicate the relevance of the inclusion of these interaction terms in the WTP specifications. Notably, Christian respondents with knowledge on Moringa products (RELIG*KNOW) are less "unwilling to pay" for Moringa bread but are more willing to pay higher premiums for

Table 4. Ordered probit estimates on consumer WTP for Moringa bread

Variables	Coefficient	Marginal effects		
		WTP=0	WTP=1	WTP=2
AGE	0.1042*(1.81)	-0.0367*(-1.81)	0.0047*(1.73)	0.0319*(1.81)
AGE*AGE/100	-0.1291*(-1.78)	0.0454*(1.78)	-0.0059*(-1.72)	-0.0396*(-1.78)
GEND	-0.0268(-0.21)	0.0094(0.21)	-0.0012(-0.21)	-0.0082(-0.21)
MARITS	-0.7733**(-2.22)	0.2946**(2.20)	-0.1105*(-1.64)	-0.1840***(-3.05)
RELIG	1.4164**(2.13)	-0.4981**(-2.13)	0.0642*(1.76)	0.4339**(2.12)
NYEDUC	0.0020(0.04)	-0.0007(-0.04)	0.0001(0.04)	0.0006(0.04)
LOWINC	-0.1568(-0.53)	0.0561(0.52)	-0.0094(-0.42)	-0.0467(-0.55)
MIDINC	-0.3244(-1.23)	0.1129(1.25)	-0.0128(-1.12)	-0.1002(-1.22)
AWARE	-0.4611*(-1.64)	0.1550*(1.71)	-0.0072(-0.65)	-0.1478(-1.56)
KNOW	1.6617**(2.19)	-0.5923***(-2.91)	0.2934**(2.09)	0.2990***(4.34)
EATEN	0.3762***(2.47)	-0.1322***(-2.48)	0.0179*(1.67)	0.1143***(2.50)
EATBREAD	0.3208**(1.88)	-0.1150**(-1.85)	0.0203(1.31)	0.0947**(1.95)
YRUSEM	0.0522*(1.71)	-0.0183*(-1.71)	0.0024(1.30)	0.0160*(1.70)
FRIEND	-0.2732*(-1.77)	0.0941*(1.81)	-0.0083(-1.25)	-0.0857*(-1.73)
MEDIA	-0.2660*(-1.79)	0.0954*(1.76)	-0.0167(-1.26)	-0.0787**(-1.85)
BOOKS	-0.2338(-1.27)	0.0853(1.24)	-0.0183(-0.88)	-0.0670(-1.37)
PCEPDISEA	0.4246***(3.45)	-0.1482***(-3.49)	0.0183*(1.69)	0.1299***(3.46)
RELIG*KNOW	1.2725**(1.85)	-0.4475**(-1.85)	0.0577*(1.75)	0.3898**(1.84)
AWARE*LOWINC	0.3763(1.05)	-0.1229(-1.14)	-0.0018(-0.08)	0.1247(0.98)
AWARE*MIDINC	0.6057**(1.88)	-0.2021**(-2.01)	0.0079(0.54)	0.1942**(1.82)
Predicted probability		0.3076	0.4587	0.2337
No. of observations	400			
Log- likelihood	-400.8782			
Wald $x^2(20)$	60.18***			

Note: z-values are in parentheses
**** P <0.001 denotes 1 percent significant level*
*** P <0.05 denote 5 percent significant level*
** P <0.01 denotes 10 percent significant level*
*AGE*AGE/100 denotes the product of the age variable divided by 100*
*RELIG*KNOW denotes the product of the dummies representing religion and knowledge of consumers of Moringa products.*
*AWARE*LOWINC denotes the product of the dummies representing awareness of Moringa bread and consumers with income less than GH¢50.*
*AWARE*MIDINC denotes the product of the dummies representing awareness of Moringa bread and consumers with income between GH¢50 – GH¢200.*
WTP=0 denotes consumer unwillingness to pay any price premium for Moringa bread; WTP=1 denotes consumer willingness to pay for 1 – 50 price premium and WTP=2 denotes consumer willingness to pay above 50 price premium.
1 US Dollar (US$) = 1.4012 Ghana Cedi (GH¢) in 2010.

Source: Authors' computations based on their survey data

Moringa bread. The implication of this result is that the effect of KNOW depends upon RELIGION and the vice versa. The same empirical results hold for middle income respondents who are aware of Moringa products (AWARE*MIDINC). This result confirms the hypothesis that consumers' income plays a critical role in determining their WTP for Moringa bread.

CONCLUSIONS AND RECOMMENDATIONS

This study has analyzed consumer willingness to pay (WTP) for Moringa bread with a contingent valuation data collected from 400 consumers in the Kumasi Metropolis of Ghana. Consumer awareness, attitudes and perceptions of Moringa bread were analyzed. The results of the study indicate that consumers generally have positive perceptions of the health and nutritional potency of Moringa bread. In addition, the empirical estimates from the ordered probit model indicate that socio-demographic factors such as age, marital status and religion of consumers and the number of years consumers have been using Moringa products significantly influence consumer WTP for Moringa bread. Consistent with other studies, our findings suggest that consumer knowledge of the nutritional and health benefits of functional food (specifically, Moringa bread) is what matters most to consumers when it comes to paying a higher premium for the product.

The results of the study provide a benchmark for the formulation of policies by the government towards effective regulation of foods with nutritional claims. Policies which promote foods that incorporate micro-nutrients should be encouraged and supported. Stakeholders should intensify the campaign of improving the awareness and knowledge of consumers concerning the health and nutritional benefits of Moringa bread. Agribusiness managers should shift their emphasis from promoting only the consumption of Moringa leaves to bakery and confectionery food products that incorporate Moringa products. In addition, agri-food businesses should evolve promotional campaigns and marketing strategies that consider household-level demographic characteristics such as the age, marital status religion and income status of consumers.

REFERENCES

Aboagye LM, Obirih-Opareh N, Amissah L, Adu-Dapaah H. Underutilized Species, Policies and Strategies: Analysis of existing national policies and legislation that enable or inhibit the wider use of underutilized plant species for food and agriculture in Ghana. Council for Scientific and Industrial Research, Ghana, 2007, 1-4.

Alberini A, Boyle K, Welsh M. Analysis of contingent valuation data with multiple bids and response options allowing respondents to express uncertainty. Journal of Environmental Economics and Management 2003; 45: 40–62. https://doi.org/10.1016/S0095-0696(02)00010-4.

Alldrick AJ (2007). The Bakery: A potential leader in functional food applications. Functional Food News. http://www.functionalfoodnet.eu/images/site/assets/5-bread.pdf.

Annunziata A, Vecchio R. Factors affecting Italian consumer attitudes toward functional foods. AgBioForum 2011; 14:20-32.

Barreiro-Hurle J, Gracia A, de-Magistris, T. The effects of multiple health and nutrition labels on consumer food choices. Journal of Agricultural Economics 2010; 61:426–443. doi:10.1111/j.1477-9552.2010.00247.x

Barrena R, Sanchez M. Differences in consumer abstraction levels as a function of risk perception. Journal of Agricultural Economics 2010; 61:34–59. doi:10.1111/j.1477-9552.2009.00224.x

Berning JP, Chouinard HH, McCluskey JJ. Do positive nutrition shelf labels affect consumer behavior?: Findings from a field experiment with scanner data. American Journal of Agricultural Economics 2011; 93:364–369. http://dx.doi.org/10.1093/ajae/aaq104

Betoret E, Betoret N, Vidal D, Fito P. Functional foods development: Trends and technologies. Trends in Food Science and Technology 2011; 22: 498–508. https://doi.org/10.1016/j.tifs.2011.05.004

Chadwick R, Henson S, Moseley B, Koenen G, Liakopoulos M, Midden C, Palou A, Rechkemmer G, Schroeder D, von Wright A. (eds.). Functional Foods. Berlin: Springer. 2003.

Cranfield JAL, Magnusson E. Canadian consumer's willingness-to-pay for pesticide free food products: An ordered probit analysis. International Food and Agribusiness Management Review 2003; 6: 13–30. http://EconPapers.repec.org/RePEc:ags:ifaamr:34381

Cranfield J, Henson S, Masakure O. Factors affecting the extent to which consumers incorporate functional ingredients into their diets. Journal of Agricultural Economics 2011; 62:375–392. doi:10.1111/j.1477-9552.2011.00293.x

Doyon M, Labrecque J. Functional foods: A conceptual definition. British Food Journal 2008; 110:1133-1149. https://doi.org/10.1108/00070700810918036

Frewer L, Scholderer J, Lambert N. Consumer acceptance of functional foods: Issues for the future. British Food Journal 2003; 105:714-731. https://doi.org/10.1108/00070700310506263

GSS. Ghana Statistical Service Information and Database, Accra Ghana: Ghana Statistical Service, 2008.

Greene WH (ed.). Econometric Analysis. Upper Saddle River, NJ Prentice, 6th Edition, 2010.

Hanemann WM, Loomis J, Kanninen BJ. Statistical efficiency of double-bounded dichotomous choice contingent valuation. American Journal of Agricultural Economics 1991; 73: 1255-1263. https://doi.org/10.2307/1242453

Hanemann WM, Loomis J, Kanninen BJ. The Statistical analysis of discrete response CV Data in valuing environmental preferences. In I.J. Bateman and K.G. Willis, (eds.), Oxford University Press, New York, 302-442, 1999.

Herath D, Cranfield J, Henson S. Who consumes functional foods and nutraceuticals in Canada? Results of cluster analysis of the 2006 survey of Canadians' demand for food products supporting health and wellness. Appetite 2008; 51:256–265. https://doi.org/10.1016/j.appet.2008.02.018

Krystallis A, Maglaras G, Mamalis S. Motivations and cognitive structures of consumers in their purchasing of functional foods. Food Quality and Preference 2008; 19:525-538. https://doi.org/10.1016/j.foodqual.2007.12.005

Lähteenmäki L. Claiming health in food products. Food Quality and Preference 2013; 27:196–201. https://doi.org/10.1016/j.foodqual.2012.03.006

Liu Y, Zeng Y, Yu X. Consumer willingness to pay for food safety in Beijing: A case study of food additives. Contributed paper prepared for presentation at the International Association of Agricul-

tural Economists Conference, Beijing, China, 2009.

Lusk JL, Hudson D. Willingness-to-pay estimates and their relevance to agribusiness decision making. Review of Agricultural Economics 2004; 26:152-169. doi:10.1111/j.1467-9353.2004.00168.x

Markosyan A, Mccluskey JJ, Wahl TI. Consumer response to information about a functional food product: Apples enriched with antioxidants. Canadian Journal of Agricultural Economics 2009; 57:325–341. doi:10.1111/j.1744-7976.2009.01154.x

Maynard LJ, Franklin ST. Functional foods as a value-added strategy: The commercial potential of "cancer-fighting" dairy products. Review of Agricultural Economics 2003; 25:316-31. https://doi.org/10.1111/1467-9353.00141

McBurney RPH, Griffin C, Paul AA, Greenberg C. The nutritional composition of African wild food plants: from compilation to utilization. Journal of Food Composition and Analysis 2004; 17:277-289. https://doi.org/10.1016/j.jfca.2004.03.008

Mccluskey JJ, Mittelhammer RC, Asiseh F. From default to choice: Adding healthy options to kids' menus. American Journal of Agricultural Economics 2011; 94: 338–343. doi:10.1093/ajae/aar106

Mitchell RC, Carson RT. Using surveys to value public goods: The contingent valuation method. Resources for the Future, Washington, DC, 1989.

Moyo B, Masika PJ, Hugo A, Muchenje V. Nutritional characterization of Moringa (Moringa oleifera Lam.) leaves. African Journal of Biotechnology 2011; 10:12925-12933. http://dx.doi.org/10.5897/AJB10.1599

Niva M, Makela J. Finns and functional foods: Socio-demographics, health efforts, notions of technology and the acceptability of health-promoting foods. International Journal of Consumer Studies 2007; 31:34-45. doi:10.1111/j.1470-6431.2005.00482.x

Oduro I, Ellis WO, Owusu D. Nutritional potential of two leafy vegetables: Moringa oleifera and Ipomoea batatas leaves. Scientific Research and Essay 2008; 3: 057-060.

Rweyemamu LMP. Challenges in the development of micronutrient-rich food ingredients from soya beans and Moringa oleifera leaves. Proceedings of the Conference: Moringa and other highly nutritious plant resources: Strategies, standards and markets for a better impact on nutrition in Africa. Accra, Ghana, 2006.

Sauveur AD, Broin M. Growing and processing Moringa leaves. Moringa news / Moringa Association of Ghana, 2010. http://www.moringanews.org/documents/moringawebEN.pdf

Szathvary S, Trestini S. A hedonic analysis of nutrition and health claims on fruit beverage products. Journal of Agricultural Economics 2014; 65(2):505–517. doi:10.1111/1477-9552.12056

Sirò I, Kapolna E, Kapolna B, Lugasi A. Functional food. Product development, marketing and consumer acceptance- a review'. Appetite 2008; 51: 456-67. https://doi.org/10.1016/j.appet.2008.05.060

Stranieri S, Baldi L, Banterle A. Do nutrition claims matter to consumers? An empirical analysis considering European requirements. Journal of Agricultural Economics 2010; 61:15–33. doi:10.1111/j.1477-9552.2009.00223.x

Sun CYH. Health concern, food choice motives and attitudes towards healthy eating: The mediating role of food choice motives. Appetite 2008; 51: 42–49. https://doi.org/10.1016/j.appet.2007.11.004

Teratanavat R, Hooker NH. Consumer valuations and preference heterogeneity for a novel functional food. Journal of Food Science 2006; 71:S533-S541. doi:10.1111/j.1750-3841.2006.00120.x

Traill WB, Arnoult MHP, Chambers SA, Deaville ER, Gordon MH, John P, Jones PJ, Kliem KE, Mortimer SR, Tiffin JR. The potential for competitive and healthy food chains of benefit to the countryside. Trends in Food Science and Technology 2008; 19: 248-254. https://doi.org/10.1016/j.tifs.2008.01.004

Veeman M. Policy development for novel foods: Issues and challenges for functional food. Canadian Journal of Agricultural Economics 2002; 50: 527-39. doi:10.1111/j.1744-7976.2002.tb00353.x

Vossler CA, Poe GL, Welsh P, Ethier RG. Bid design effects in multiple bounded discrete choice contingent valuation. Environmental and Resource Economics 2004; 29: 401-418. doi:10.1007/s10640-004-9457-2

West GE, Gendron C, Larue B, Lambert R. Consumers' valuation of functional properties of foods: Results from a Canada-wide survey. Canadian Journal of Agricultural Economics 2002; 50: 541-58. doi:10.1111/j.1744-7976.2002.tb00354.x

WHO. Reducing risks, promoting healthy life. In The World Health Report 2002. Geneva: World Health Organization, 2002.