

# Determinants of Household Heads Willingness to Pay for Labelled and Certified Moringa Products: Evidence from GamoGofa, Segen Peoples and South Omo Zones

Afewerk Berhanu<sup>1</sup>, Alemayehu Acha<sup>2</sup>

Lecturer, Department of Economics, Arba Minch University, Ethiopia

**Abstract:** *The main objective of this study was estimating the mean willingness to pay of household heads for the certified and labeled moringa leaf tea product in ArbaMinch, Sawula, Karat and Jinka Town. A contingent valuation method survey was applied to a sample of 397 household heads using the multi bounded discrete choice format which contained a matrix of the five response options with different level of certainty. The survey also included socio-economic, demographic, and environmental characteristics, which are expected to determine the households' willingness to pay for the certified and labeled moringa leaf tea product. The survey data was analyzed by using ordered logit model. The result of the study contained descriptive and econometric analysis. The descriptive analysis revealed that household heads are generally willing to have certified and labeled moringa product. The econometric analysis result was shown that household heads' WTP is found to be significant determined by education, monthly income; religion and prevalence of diseases in the households etc. Generally, the finding of this study would suggest that the value of certified and labeled moringa leaf tea product could have better welfare effect if it can be supplied by considering the demand side of the product.*

**Keywords:** Labelled and Certified Moringa Leaf Tea, Willingness to Pay, Contingent Valuation Method, Multi Bounded Discrete Choice Format

## 1. Introduction

Ethiopia has a great potential for agricultural production, which is far from being fully exploited. At the same time, there is a need to diversify agricultural and export products. In this regard, promising areas are plants, such as the moringa tree, whose commercial potential remains mainly untapped. Moringa is a plant, out of which a number of products can be made for a variety of purposes, such as tea powder, vegetable oil or nutritional supplements. Virtually all parts of the tree are edible or can be processed for therapeutic, prophylactic, medicinal and cosmetic purposes. In Ethiopia, moringa trees grow naturally given the country's suitable land and excellent climatic conditions. Therefore, moringa is well-known and mostly consumed as moringa leaf. There is a great potential for smallholders to engage in moringa production, offering them both a crucial nutritional input for their own families and an income opportunity, by selling surpluses to the market (Federal Ministry for Economic Cooperation & Development, 2013).

Globally, the demand for moringa products, such as moringa leaf powder and moringa oil, has been growing. Moreover, international organizations and institutions are exploring the best ways on how to use moringa as a nutritional supplement and in food fortification (Ibid).

Moringa oleifera is the most widely cultivated species of a mono generic family, the moringa ceae. This rapidly-growing tree was utilized by the ancient Romans, Greeks and Egyptians; it is now widely cultivated and has become naturalized in many locations in the tropics. It has been advocated for traditional medicinal and industrial uses. It is already an important crop in India, Ethiopia, the Philippines and the Sudan, and is being grown in West, East and South

Africa, tropical Asia, Latin America, the Caribbean, Florida and the Pacific Islands. (Jed W. Fahey, 2005)

The leaves of moringa oleifera are eaten in African countries, such as Ghana, Ethiopia, Nigeria, East Africa and Malawi. Moringatree is cultivated for foods and medicinal purposes (Olson, 2002). Moringa leaf is a natural antihelmintic, antibiotic, detoxifier, outstanding immune builder used in some countries for the treatment of malnutrition and malaria (Thilzaet al., 2010).

According to Fugile (2000), Moringa leaves are known to have a high content of protein, minerals and vitamin, hence an ideal nutritional supplement, (Fletcher, 1998). Moringa leaves have been used to combat malnutrition, especially among infants and nursing mothers and hasten uterine contraction during child birth in pregnant women.

It's antihypertensive, diuretic, antispasmodic, antiulcer, anti-cancer and cholesterol lowering activities have been reported (Caceres, 1992; Fahey *et al.*, 2004). The leaves and pods are helpful in increasing breast milk in nursing mothers during breastfeeding and leaf decoction has been found useful in the treatment of asthma, back pain and rheumatism (Anthonia O. Oluduro, 2012).

Investigations show that the traditional uses of M. stenopetala, a species that grows widely in southern parts of Ethiopia also known as Halekoo Shiferaw among local communities, has a variety of uses, many of them medicinal. Thus, as with Moringa oleifera, there is good potential to exploit the plant both as a nutritious food supplement and to isolate and characterize lead compounds for pharmaceutical product development. (The Multi-purpose Moringa tree:

Ethiopia, Institute of Pathobiology, Addis Ababa University, 1996-2002).

This paper was studied the determinants of willingness to pay for certified and laballedmoringa leaf tea product in selected towns of Gamo zone, Gofa zone South omo zone and Konso zone. It focused on the demand side of the product and expected to provide valuable information for both the public policy makers in designing of the new product and in understanding the role the new product among the beneficiaries.

Ethiopia, a country, endowed with great varieties of natural resources and diverse agro-ecological zones of arid and humid climatic areas have a huge potential to Moringa production than the status quo. Moringa consumption is limited to the southern nation and nationalities. The intention to popularize and scale up in drier parts of the central, northern and other parts of the country showed resistance of consuming due to lack of habit of consuming tree cabbage and also the bitter taste the leaves poses (Dechasa Jiru,et.al, 2006).

However, the demand for moringa products is too limited in our country. Since Moringa provides only few products in Ethiopia: such as, *leaves* - either fresh or dried and powdered - are used as vegetable in meals (Locally fresh leaves are marketed), *seed oil*, locally oil is used for lighting, *seedcake* used for water purification. At local level it is reported that seedcake is used as coagulant purifier (Bosch, 2004), but no indication that seeds are traded for this purpose. Currently in Ethiopia there seems to be no market for the seedcake that can be used as water purifier. No information was found that shows that water purification plants in Ethiopia already use moringa instead of chemicals (Jochem S., 2011).

Different contingent valuation method (CVM) studies on the labeled and certified moringa products are conducted on different countries of Africa but not still in Ethiopia. Most of the studies about the moringa tree in Africa particularly of Ethiopia concentrate on identifying its traditional, nutritional and medicinal value. The socio-economic value of it captured only few studies, nearly null in our country. Empirical studies in its marketability are rare. Much more has been talked about moringa's extensive nature of values. However, its consumption coverage is limited only to the local areas where it's habitual to the customary subsistence. The implementation of the innovative experience i.e., the dissemination of moringa trees throughout Ethiopia is still in its early stages. The continuing effort of the researches and propagations may provide a good opportunity to introduce the benefits of the moringa tree to the wider population (DechasaJiru, et.al, 2006).

There were studies conducted on moringa product in Addis Ababa city by the team of Addis Ababa University institute of Pathobiology in relation to the multi-purpose moringa tree. Their studies focuses on the theoretical and empirical review of analyzing the multi – purpose moringa tree but there project study is not analyzed through econometric models which is a gap that will be filled by this study (Baseline Study Report of the multi-purpose moringa tree:

Ethiopia, Institute of Pathobiology, 2002), DechasaJiru, et.al, 2006), Caswell and Mojdzuska, (1996), (Adesopeet *et al.*, 2010).

Apart from the above studies, Obayelu, O. A.,et.al, (2015) made a study consumers' willingness to pay for labeled and certified moringa products in Nigeria. However, this study used the single bounded dichotomous format to estimate the mean willingness to pay of households for labeled and certified moringa product.

This method is criticized by many researchers (Cooper and Osborn,1998); (Cameron and Huppert, 1989); (Hanemann, Loomis and Kanninen ,1991); (Wang ,1997); (Walsh and Poe, 1998); (Alberini, Boyle and Walsh, 2003). This criticism is based on that respondents are uncertain to make a decision on their preference. To fill this gap and to avoid the problem of censored dependent variable, this study will necessary include a multi bounded discrete choice format. This can help to estimate reliable and efficient mean WTP of the respondents and it reduces the number of no response (zero value of WTP) for the product. Additional variables like prevalence of disease, perception level for the labeled and certified moringa product and religion are incorporated to the existing study to examine their impacts on the willingness to pay for the new product.

Based on the argument, this study was conducted by using multiple bounded discrete choice format (MBDC) to elicit the mean willingness to pay (WTP) of the respondents for the labeled and certified moringa product in selected towns of Arbaminch, Karat, Sawula and Jinka.

## 2. Objectives of the Study

The general objective of this study was to identify the determinants of household's willingness to pay for the labeled and certified moringa product in selected towns of Arbaminch, Karat, Sawula and Jinka.

The specific objectives of this study are:-

- To analyze the factors that affect households' willingness to pay for labelled and certified moringa leaf tea product.
- To determine the households' mean willingness to pay for 3 gram labelled and certified moringa leaf tea product.
- To investigate households' perception towards labelling and certifying.

## 3. Review of Empirical Literatures

A study by Berhe et al (2007) shows that moringa stenopetala (locally called "hallako") is a green, drought-resistant plant where leaves are commonly used in cooking for human consumption. The plant is a widely deciduous plant that is eaten as a vegetable in the daily diet which is distributed in the South of Ethiopia at an altitude range of about 1100-1600 meters (Mekonnen and Gessesse, 1998). Leaves from the moringa tree are a very important vegetable source which more than 5 million people depend on, especially during dry seasons (Abuye et al., 2003). The tree is resistant to both insects and pests character and is known

to be a fast growing plant where one moringa tree can support a large family for many years (Ibid).

Moringa stenopetala, which is most common in Ethiopia and Kenya, has the second highest content compared with the other species (Yang et al., 2006). It is stated that all four types have an enormous potential to contribute to improved diet and health, where moringa stenopetala is the most important economic species. Compared to other fruit and vegetables rich in antioxidants, moringa has a high content of antioxidants and is also rich in protein, calcium and iron (Ibid).

Results from a study that compared nutrient composition in moringa stenopetala leaves, kale and Swiss chard in South-western Ethiopia reported that both raw and cooked leaves of moringa contained lower amounts of protein and iron compared to kale and Swiss chard but contained a higher percentage of calcium, fiber and carbohydrate (Abuye et al., 2003). Even if the comparison of nutrient composition show that moringa leaves in most of the cases is lower compared to kale and Swiss chard, it is stated that moringa is a plant rich in vitamins and minerals that can be important in dry seasons in areas where there is lack of other vegetables (Ibid).

A study that was conducted in the area in Southern Ethiopia provides some information on the use of moringa stenopetala. The results from this study show that fresh leaves of moringa are eaten as a vegetable that is cooked and seasoned with oil and salt where almost every household have at least one or two moringa trees in their compound (Mekonnen and Gessesse, 1998). Both leaves, seeds and the roots get used for multiple purposes according to the practice of the local people.

They further revealed that chopped moringa leaves are mixed with water and used as tea which has a treating effect on diseases like curing malaria, hypertension, stomach pain, expulsion of retained placenta in addition to other health problems like diabetes and asthma. The roots are especially used for malaria treatment and the seeds are used for clearing muddy water, women also sell fresh leaves in markets (Ibid).

Hegde & Hegde in their research noted that the demand for the moringa in Ethiopian recipe is un-identified. Even though, moringa provides nutritional support. Ethiopian's have the most benefit from the rising importance of moringa. The demand may be huge in future and it will create promised job opportunity not only for rural or farmers but also can see urban horticulture. They also continued in their explanation said the growing population in Ethiopia is a good opportunity. The commercialization of moringa products in Ethiopia is still very informal and makes it difficult to get reliable information of production volumes and prices. To effectively exploit the existing market potential, the commercialization should become more structured and formalized. Thus, the coordination between producers, wholesalers and retailers should be improved in vertically (Ibid).

Over the last decade, a growing middleclass population in Ethiopia, primarily in semi-urban and rural areas and have brought about changes. Consumer tastes and Lifestyle changes brought about by improved economic conditions have an impact on eating habits. Exotic and imported foods as well as health foods and organic foods are now in high demand by consumers. Next most dynamic changes in Shopping habits are more time spent in the work place and less time available for food preparation. The horticultural exports of Sub-Saharan Africa now exceed USD, 2 billion, yet this is only 4 per cent of the world's total. Thus, moringa is a horticulture product with a greater value and high returns for economic development in Ethiopia (Ibid).

Ethiopia has an ample scope to expand the moringa production. For, Instance, India is the largest producer with an annual production of 1.1 to 1.3 million tons of tender fruits from an area of 380 km<sup>2</sup>.

Even in Ethiopia, rural population income is less than 2 dollars per day reported by OSSREA. Ethiopia is the fast developing countries with a rapidly growing population must give some attention to the importance of horticulture products. Today, a half of the world's population (3.5 Billion) lives in urban areas, according to UN estimation, 2/3 of the population will in cities by 2030. Thus, it may be one of the urban horticulture produce soon (Ibid).

Ethiopia has environment conduciveness and labor potential country. Many products can associate in market for economy. For example, Moringa leaf Powder, Moringa leaf powder in Teabag, moringa fortified fruit juice/honey, Moringa in capsule/tablets, moringa fortified confectionaries and moringa fresh leaf and so on. Moringa seeds are effective against skin-infecting bacteria. The leaf juice has a stabilizing effect on blood pressure. The leaf juice controls glucose levels in diabetic patients. Fresh leaves and leaf powder are recommended for tuberculosis patients because of the availability of vitamin A that boosts the immune system.

Finally, they recommended that Ethiopia has to popularize the moringa tree for indigenous agro-forestry and a multiple-use species with similar potential to other species. Markets for moringa leaf exist at both the local and international levels. Thus, Moringa product has ample scope for economic development in Ethiopia.

Mekonnen in his study concluded that moringa oleifera tree is indeed a miracle tree with enormous potentials yet to be fully explored in medicinal and food application. All parts of moringa oleifera tree is said to have useful assets that can help humankind. Generally, moringa oleifera offers very interesting opportunities for smallholder farmers as food supplement, medicine, nutrition, watertreatment, livestock feed, vegetable, oil, foliar spray, green manure, natural fertilizer, cosmetic, fodder, care products, soil and water conservation and reduce greenhouse gas emission. moringa should be promoted for further consumption to improve nutrition and medicinal functions and as well as for climate change mitigation.

Study in Nigeria by Obayelu et al. on consumers attitudes towards labelling and certification of moringa product majority of them preferred labelled and certified moringa products to the unlabelled and uncertified (72.0 percent) and could not consume unlabelled and uncertified moringa products (66.7 percent). Further, 63.3 percent of the respondents claimed that labelling and certification affects their purchase price decisions.

The study further assessed consumers' willingness to pay for three labelled and certified moringa products: moringa tea, moringa spice powder and moringa oil. Results showed that half of the respondents were willing to pay a premium for certified moringa tea and moringa oil respectively while 48.9 percent of them were willing to pay a premium for moringa spice/powder (Ibid).

Therefore, packaging is an important aspect of marketing and could largely influence the acceptability of any product by its consumers. The same study results indicated that a higher proportion of the respondents preferred to have their moringa tea and moringa spice/powder packaged in sachets(Ibid).

The results of the logit models on determinants of willingness to pay (WTP) for selected labelled and certified moringa products all the coefficients are significant.

It is stated that researchers at the Asian Vegetable Research and Development Center (AVRDC) showed that leaves of four moringa species (oleifera, peregrina, stenopetala and drouhardii) all contained high levels of nutrients and antioxidants. They also found that nutrient content varied little between ten accessions of moringa oleifera. (Martin, L)

It is mentioned that in Mozambique, the benefits of moringa products are well-known due to media broadcasts and information campaigns. Most popular is moringa leaf powder, which is commercially produced and merchandised in the country. Many of the persons interviewed, across all income groups, mentioned that they regularly consume moringa leaf powder.

Evidences show that many countries with moringa leaf powder production have mandatory national standards in place that define the minimum quality requirements for the respective product. In this regard in Mozambique, the responsible institution in that regard is the National institute of Standardization and Quality (iNNoQ). A national standard would provide a strong incentive to further invest in moringa production given that it increases the market value of the product by enhancing the trust of traders as well as of consumers.

As quoted by Tolulope Olayemi, et al., consumer awareness could determine demand for a product; willingness to pay is the amount a person is willing to pay for a higher level of a commodity quality or new product. In their study they got the mean price respondents were willing to pay for a kilogram of moringa was not high (N 314.89 ± 785.31), implying that they are not willing to pay much for the product despite the fact that about half of them believed it is not expensive. Age, educational status, and preference for

other vegetables determined consumer willingness to pay for moringa. As age increases, consumer likelihood to pay for moringa increases; this could imply that older persons know the benefits of a medicinal or herbal plant such as moringa. Being educated increases the likelihood of consumer willingness to pay for Moringa.

Fatoki et al, conducted research on consumers' willingness to pay for moringa oleifera Leaf Powder and moringa oleifera Seed using the Contingent Valuation Method and reached the mean willingness to pay for 100g of moringa oleifera leaf powder and seed was N610 and N517 respectively.

In the study the researchers were concluded that majority of the respondents were willing to pay for moringa oleifera products. The study therefore recommends that there is the need for enlightenment programmes to enhance consumer knowledge on advantages and health benefits of MOP consumption as well as design of empowerment programme target at increasing household income.

## 4. Research Methodology

### 4.1 Sampling Procedures

Three - hundred ninety seven respondents of the study area were randomly selected since to avoid bias. According to Catherine Dawson (2009), the correct sample size in a study is dependent on the nature of the population and the purpose of the study. Although, there are no general rules, the sample size usually depends on the population to be sampled. In this study to select sample size, a list of household population who are residing in Arbaminch town 19,548, Sawula 5869, Karat 1689 and Jinka 5492. Then the total household population of the four towns 32,598 (CSA, 2007 E.C) were obtained.

Accordingly, using Yamane (1967: 886) formula, 395 respondents were selected from the total of 32,598 households. Sample size can be determined as follows:

$$n = \frac{N}{1 + N e^2} \dots\dots\dots (1)$$

$$\frac{32,598}{1 + 32,598(0.05)^2} \approx 395$$

n – The size of sample N – Number of target household populatione –the desired margin of error (the level of statistical significance test) 95% confidence level and p= 0.05 are assumed. From the total number of 32,598 households, 397 respondents were selected.

The sample size that was selected here was considered as representative of Arbaminch town, Sawula town, Karat town and Jinka town. Therefore, all households are randomly selected from the homogeneous population of each towns.

### 4.2 The Analytical Framework

In this paper we applied the ordinal, polychotomous choice method. The study was used ordered logit model to investigate and determine the effect of descriptive variables of sex of household head, age of household head, family size



of the household, religion of the household head, education level of household head, monthly income of the household heads, perception about the applicability of the new product, prevalence of diseases in the households and impact of each variable on the likelihood of individuals to choose one of five bids levels of 1 birr, 2 birr, 3 birr, 4 birr and 5 birr. Therefore,  $\mu_i$ , the mean willingness to pay of the individual respondent for the improved service can be estimated, and once  $\mu_i$  is estimated for each individuals, a model can be constructed and analyzed their determinants, or the log linear functional form of  $\mu_i$  becomes

$$\text{Log}(\mu_i) = \beta_0 + \beta_1 \text{age} + \beta_2 \text{sex} + \beta_3 \text{M\_income} + \beta_4 \text{family size} + \beta_5 \text{religion} + \beta_6 \text{education} + \beta_7 \text{employment status} + \beta_8 \text{perception} + \beta_9 \text{prevalence of disease} + \epsilon_i \dots (8)$$

However, in this paper we apply the ordinal, polychotomous choice method. Ordered logit model was used based on a continuous latent variable ( $y^*$  is unobserved). Ordinal logistic regression models are used to model the relationship between independent variables and an ordinal response variable when the response variable category has a natural ordering. Ordinal logistic regression is an extension of binary logistic regression for analyzing ordinal response variable having more than two categories by considering the ordering of the response variable categories.

The study was used ordered logit model to investigate and determine the effect of descriptive variables of sex of household head, age of household head, family size of the household, religion of the household head, education level of household head, monthly income of the household heads, perception about the applicability of the new product, prevalence of diseases in the households and impact of each variable on the likelihood of individuals to choose one of five bids levels of 1 birr, 2 birr, 3 birr, 4 birr and 5 birr. The model is as follows:

$$y_i^* = \beta'x_i + \epsilon_i \quad -\infty < y_i^* < +\infty$$

Where  $y_i^*$ : WTP

$\beta_i$ : vector of parameters that should be estimated

$x_i$ : observed vector of non-random explanatory variable which shows the characteristic of  $i$ th person

$\epsilon_i$ : residual error which is logically distributed.

Since  $y_i^*$  is a latent variable, standard regression techniques are not applicable to estimate the sample size.

If  $y_i$  is considered as a discrete and observable variable which shows different levels of HH heads WTP, the relation between latent variable  $y_i^*$  and observable variable  $y_i$  is obtained from ordered logit model as follows:

$$\begin{aligned} y_i = 1 & \quad \text{if} \quad -\infty \leq y_i^* < \mu_1, & i = 1, \dots, n, \\ y_i = 2 & \quad \text{if} \quad \mu_1 \leq y_i^* < \mu_2, & i = 1, \dots, n, \\ y_i = 3 & \quad \text{if} \quad \mu_2 \leq y_i^* < \mu_3, & i = 1, \dots, n, \\ \dots & \quad \dots & \dots \\ y_i = J & \quad \text{if} \quad \mu_{J-1} \leq y_i^* < +\infty, & i = 1, \dots, n, \end{aligned}$$

In which 'n' is the value for the sample size. ' $\mu$ ' is the threshold that define observed discrete answers and should

$$\text{Log}(\mu_i) = \beta_0 + \beta_i X_i + \epsilon_i \dots (11)$$

Where;  $\mu_i$  is the mean willingness to pay of the individual respondent for the labeled and certified moringa product (in monetary terms, Birr),

$\beta_0, \beta_i$  are coefficients to be estimated from the model.

$X_i$  are explanatory variables which are personal and socio-demographic characteristics, and the model can be written as,

be estimated. The probability of  $y_i = j$  should be calculated by the following relation:

$$\Pr(y_i = j) = \Pr(y_i \geq \mu_{j-1}) = \Pr(\epsilon_i \geq \mu_{j-1} - \beta x_i) = F(\beta x_i - \mu_{j-1})$$

In cumulative probability expression, ordered logit model estimates the likelihood of person 'I' to be at 'jth' level or less (1,...,j-1). It should be noted that the answer groups in ordered logit model are ordered.

Ordered logit model is expressed as follows:

$$\log \left[ \frac{\gamma_j(x_i)}{1 - \gamma_j(x_i)} \right] = \mu_j - [\beta_1 x_{i1} + \beta_2 x_{i2} + \dots + \beta_k x_{ik}]$$

$$j = 1, \dots, J; i = 1, \dots, n$$

In which 'Y j' cumulative probability is as following:

$$\gamma_j(x_i) = \gamma(\mu_j - \beta'x_i) = P(y_i \leq j | x_i)$$

$\beta_i$  is the column vector and of ( $\beta_1, \beta_1, \dots, \beta_k$ ) parameters and  $x_i$  is the column vector of explanatory variables.  $\mu_j$  is only dependent on probability of predicting category and is not dependent on explanatory variables

Furthermore, the crisp part

$$\beta_1 x_{i1} + \beta_2 x_{i2} + \dots + \beta_k x_{ik}$$

is the independent part of the category. These two characteristics ensure that the answers groups are ordered and show that the results are a series of parallel lines.

The odds of the cumulative probabilities of the response variable for the J-1 categories

$$\text{odds}[\pi_j(X)] = \frac{\pi_j(X)}{1 - \pi_j(X)}, j = 1, \dots, J - 1$$

The logarithm of the odds first j-1 cumulative probabilities

$$\ln(\text{odds}[\pi_j(X)]) = \ln \left( \frac{\pi_j(X)}{1 - \pi_j(X)} \right), j = 1, \dots, J - 1$$

The relationship between the response variable and the set of predictors is not linear in ordinal logistic regression model. The logistic regression function uses the logit transformation of  $\pi(X)$  cumulative probabilities of the response,

$$\pi_j(X) = P(Y \leq j|X) = \frac{\exp(\alpha_j - (\beta_1 X_1 + \dots + \beta_K X_K))}{1 + \exp(\alpha_j - (\beta_1 X_1 + \dots + \beta_K X_K))}$$

$$\ln \left[ \frac{P(Y \leq j|X)}{1 - P(Y \leq j|X)} \right] = \ln \left[ \frac{\pi_j(X)}{1 - \pi_j(X)} \right] = \alpha_j - (\beta_1 X_1 + \dots + \beta_K X_K)$$

Equivalent to:

$$\text{logit}[P(Y \leq j|X)] = \alpha_j - \sum_{k=1}^K \beta_k X_k, j = 1, \dots, J-1 \quad \dots\dots\dots(16)$$

The proportional odds model (POM) to predict cumulative logits across J-1 response categories. This model estimates ln (odds) of being at or below the j<sup>th</sup> category and assume that there is a linear relationship between the logits and the parallel regression lines and hence this model estimates simultaneously multiple equations of cumulative probability. The model is solved for each category of the dependent variable except the last category (McCullagh, 1980; Hosmer and Lemeshow, 2000).

In the model each logit has its own  $\alpha_j$  a term called the threshold value and their values do not depend on the values of the independent variables and the  $\beta_k$ 's are the logistic regression coefficients and the estimated values of these parameters show the direction and the strength of the relationship between the explanatory variables and the logit (log odd) of the dependent variable.

However, these regression coefficients interpretations are a little different from the usual regression coefficients and the interpretation for categorical explanatory variable is the effect (more likely and less likely) of the estimated category of the independent variables relative to the reference category on the log odds being in higher levels of the categories of the dependent variable. If the effect of each explanatory variable is the same in each logit models then the model is called proportional odds model. In the POM, cumulative logits are simultaneously modeled using the maximum likelihood estimation method. Prior to fitting a POM, it is important to check whether the assumption of

proportionality is satisfied by each of the explanatory variables in the model.

As to Maddala (1988) the calculation of the marginal effect of one unit change in  $X_k$  predictor on the probability of 'j' category is as follows:

$$\frac{\partial P(y_i = j | x_i)}{\partial x_k} = \left[ \frac{\partial \gamma(\mu_j - \beta' x_i)}{\partial x_k} - \frac{\partial \gamma(\mu_{j-1} - \beta' x_i)}{\partial x_k} \right]$$

$$= \left[ \lambda(\mu_{j-1} - \beta' x_i) - \lambda(\mu_j - \beta' x_i) \right] \beta_k$$

In which  $\mu_j = +\infty$ ,  $\mu_0 = -\infty$ ,  $\lambda_j(x_i) = \frac{\partial \gamma_j(x_i)}{\partial x_k}$  .....(17)

Making decisions about using variables' value in estimation is very important, because the marginal effect depends on the values of all explanatory variables. Since total probability always equals 1, the total marginal effect for each variable is zero. But it should be noted that the marginal effect is not direct on binary variables, and it can be obtained by calculating the difference between the two possible probabilities.

## 5. Results and Discussions

### 5.1 Descriptive Analysis of the Survey Data

#### 5.1.1 Summary Statistics & Mean Difference Test in WTP

From the total 397 sampled household heads, all survey questionnaires were found to be complete and have no recording error. The socio-economic characteristics like age of the household head, education, family size and monthly income of the household head, employment status, perception level, characteristics like age of the household head, education, family size and monthly income of the household head, employment status, perception level and prevalence of diseases in the household were examined.

**Table 1: Mean difference of willingness to pay for continuous variables**

Variables	if wtp<=2			if wtp>=4		Mean diff test
	Mean	Std.Dev	t-value	Mean	Std.Dev	
Educ	8.568182	3.979001	-0.5049	9.735294	3.776393	-1.6038
	8.901639	3.673469		10.93103	3.249087	
Age	37.20455	9.571225	-1.0424	38.5	10.80755	0.9228
	38.84426	8.712127		36.81034	6.770568	
f_size	4.295455	1.268208	-0.7050	4.058824	1.179141	-0.9464
	4.459016	4.219374		4.275862	.9875204	
Income	3084.205	2075.917	-1.3958	4085	3078.328	-1.2715
	3673.689	2507.1		5023.362	3597.969	

\*\* Significance at 5%, \*\*\*significance at 1%, Two-sample t test with equal variances, n=397

Source: (Survey Result, 2020)

The age composition of the surveyed household heads indicates that, the age of the household head ranges from 18 to 70 year with an average age of 38.15. The average age of the household heads at lower level bid (wtp<=2) and at higher level bid (wtp>=4) is 37.20 and 38.5 in the first group and 38.84 and 36.81 in the second group respectively. However, the mean difference, t-test value shows is

statistically insignificant. This may indicate that the mean age difference of these two groups of household heads has no significant effect in willingness to pay for the moringa leaf tea product.

**Table 2:** Summary statistics of dummy and categorical variables used in WTP equation (n=397)

List of Variables	Category	Household head willingness to pay for bid					Pearson $\chi^2$
		Wtp=1	Wtp=2	wtp =3	wtp =4	wtp =5	
Sex	Female	8	40	35	3	12	10.4256**
	Male	36	82	104	31	46	
Religion	Muslim	1	1	4	2	5	11.8791
	Orthodox	39	115	131	31	51	
	Protestant	4	6	4	1	2	
Employment status	Self emp.	38	108	125	29	54	1.9521
	Otherwise	6	14	14	5	4	
Perception to CLM product	High perception	35	93	121	22	46	10.3318**
	Low perception	9	29	18	12	12	
Prevalence of diseases in HH	High prevalence	38	117	139	34	57	16.9136***
	Low prevalence	6	5	2	0	1	

\*significance at 10%, \*\* significance at 5%, \*\*\*significance at 1%  
(Source: survey result, 2020).

The mean difference of the household size who prefer to pay the higher and the lower bid prices is insignificant in the t-test. This shows that household size does not affect the choice among different bid levels. The mean of the household heads income at lower level bid (wtp<=2) and at higher level bid (wtp>=4) is 3084.205 and 4085 in the first group and 3673.689 and 5023.362 in the second group respectively. The t-test values indicated that the mean difference between income of lower and higher bid groups was statistically insignificant at all probability level (Tab.1). This may show that the mean difference in income of household heads does not affect their willingness to pay for the new product. In the surveyed area, sex composition of sampled household heads indicates that 79.24% of the households are male headed and the rest 20.76% are female headed. One might expect that sex difference has effect on WTP for the new product. The  $\chi^2$  statistic (10.4256) and its significance level ( $p < 0.034$ ) indicate existence of relationship between a household's WTP and the sex of the household heads (Tab.2).

It might be believed that consumers perception to the new rebelled and certified products increase. This is because of their expectation that labeling and certifying of the traditionally used product may increase its quality (Caswell and Mojduška, (1996). The  $\chi^2$  statistic (10.3318) and its significance level ( $p < 0.035$ ) indicates existence of relationship between a household's WTP and the perception of the household heads (Tab.2). Adesope et.al .2010, further added that driven by increasing consumer demand for healthier, safer, and more environmentally friendly food products, the use of food labeling has become increasingly important in recent years.

The frequent prevalence of diseases in the household members could lead to seeking medicinal tree leaves. This is because of their belief that such products might improve the health condition. It is also backed by the  $\chi^2$  statistic (16.9136) and its small significance level ( $p < 0.002$ ) which indicates the existence of association between a household's WTP and the prevalence of the diseases in the household head (Tab. 2).

### 5.1.2 Household heads willingness to pay for different bid prices

Only 11.08 % of the sample household heads are in the category of willingness to pay one birr, roughly 31% willing

to pay two birr, 35.01% willing to pay three birr, and for the remaining bids ( i. e, 4 & 5 birr) only 23.17%. Nearly 65.74% consumers' willingness to pay is close to the mean WTP price (2.85 birr).

**Table 3:** Summary of Household Heads WTP for Different Bids

Household head wtp for bids	Frequency	Percent
wtp for 1 birr	44	11.08
wtp for 2 birr	122	30.73
wtp for 3 birr	139	35.01
wtp for 4 birr	34	8.56
wtp for 5 birr	58	14.61
Total	397	100.00

Source: (Survey, 2020)

### 5.1.3 Comparative Analysis of WTP based on the gender of the household heads

This section compares the household head willingness to pay for the product according to their sex. The first section of the table 4 was shown that the female headed household. Their total sample size is 98 (25%). Their age distribution of was found between the age of 26 & 63 and their mean age in the study areas was 37.67 which implies that majority of the respondents are in their active working age category. Looking at the educational status of the respondents, the result indicates that the mean year of schooling is 8.79. This shows that females have lower year of schooling compare to male headed households. The mean household size is approximately 4 persons. The mean income of the household head earns 2,933.93 birr. Finally, their mean price to pay is 2.70 which is not far from the mean of the total sample.

The second section of the table 4 shows that the male headed household. Their total sample size is 299 (75%). This result shows that the majority of the sampled household heads are male headed.

Their age distribution was found between the age of 18 & 70 and their mean age was 38.31. Their mean year of schooling was 9.64, which is slightly greater than that of female headed. The mean household size is approximately 4persons. The mean income of the household head was 4174.80 birr which is far better than that of female headed. Their average price was 2.90 birr which is very close to the mean price the total sample.

**Table 4:** Comparative analysis of WTP based on the sex of the household head

Sex		Sample	Mean	Std. Dev.	Minimum	Maximum
Female	Willingness To Pay	98	2.704082	1.08608	1	5
	Year of schooling HH head	98	8.795918	3.727743	1	15
	Age of household head	98	37.66327	7.863453	26	63
	Family Size of HH	98	4.540816	4.540816	2	8
	Monthly Income of HH	98	2933.929	2365.385	200	14500
Male	Willingness To Pay	299	2.896321	1.212056	1	5
	Year of schooling HH head	299	9.638796	3.776912	1	15
	Age of household head	299	38.31438	8.644828	18	70
	Family Size of HH	299	4.354515	1.173564	2	8
	Monthly Income of HH	299	4174.799	2651.546	200	15000

(Source: STATA Result)

## 5.2 Econometric Result

### 5.2.1 Ordered Logit Model Estimation result (with robust standard error)

The ordered models treat the certainty categories as ordered response propensities and, from the data, estimate threshold parameters that define where respondents switch between certainty levels. In order to avoid recoding uncertain responses into yes/no decisions or assigning probability weights, Alberini, Boyle, and Welsh (2003) estimate an ordered probit model and Cameron et al. (2002) estimate an ordered logit model. Each response option is retained as a separate category and, from the data, thresholds are estimated that imply bounds on WTP for responses within each category. Then ordered logit model was used to factor out the major determinants of households' WTP for the labelled and certified moringa leaf tea.

This section discusses the logit model estimation result. The study test the joint significance of the explanatory variables by using the Wald test with a null hypothesis of coefficients of all explanatory variables included in the models are equal to zero. The Wald test, which follow  $\chi^2$  distribution with 10 degrees of freedom (*DF*) is about 36.08. From  $\chi^2$  distribution table with 10*df* the critical value is 3.94 at 5 % level of significance. In the other words the likelihood ratio chi-square of 36.08 with a p-value of 0.0000 tells us that our model as a whole is statistically significant, as compared to the null model with no predictors. This implies that the joint null hypothesis of all slope coefficients of explanatory variable are equal to zero is rejected (Tab. 4.4). Thus, the overall significance of the model is good (i. e. explanatory variables have some joint effect on willingness to pay). Another method of goodness of fit is pseudo  $R^2$ , which measures how well the model fits the data and it is 0.0361 for this study showing the very good model fit.

**Table 5:** The ordered logit model estimation (with robust standard error)

Wtp	Coefficient	Std. Err.	Z-value	P> z	[95% Conf. interval]	
Sex	.1568126	.2225832	0.70	0.481	-.2794425	.5930678
Educ	.0589368	.0261667	2.25	0.024**	.007651	.1102226
relig						
orthodox	-1.309464	.5866848	-2.23	0.026**	-2.459345	-.1595825
protestant	-2.095815	.8193873	-2.56	0.011**	-3.701784	-.4898452
Age	-.010688	.0112659	-0.95	0.3433	-.0327687	.0113927
f_size	-.0815295	.0697853	-1.17	0.243	-.2183061	.055247
Empl	-.396597	.326079	-1.22	0.224	-1.0357	.2425061
income	.0001256	.000049	2.56	0.010***	.0000296	.0002216
perce	.0174438	.2501955	0.07	0.944	-.4729304	.5078181
preval	1.585305	.5967328	2.66	0.008***	.4157297	2.754879
_cons	2.95432	.6112297	4.83	0.000	1.752564	4.156077
Number of observations				397		
Wald chi <sup>2</sup> (10)				36.08		
Prob> chi <sup>2</sup>				0.0000		
Pseudo R <sup>2</sup>				0.0361		
Log pseudo likelihood				-560.71539		

\*significance at 10%, \*\* significance at 5%, \*\*\*significance at 1%

(Source: Survey Result, 2020)

In table 5 we see the coefficients, their standard errors, z-tests and their associated p-values, and the 95% confidence interval of the coefficients. The ordered logit model estimation result shows that among the variables included in the model all except one have the expected sign though only four of them have the were found to be significant in affecting WTP decision. These include household heads education, household heads monthly income, religion and prevalence of diseases in the households. Among the

significant variable, household heads, household's education, income and prevalence of diseases affect WTP positively but religion affects WTP decision negatively although statistically insignificant sex has shown expected sign.

So for education, we would say that for a unit increase in education, we expect a 0.059 increase in the log odds of being in a higher level of WTP, given all of the other



variables in the model are held constant. For a one unit increase in income, we would expect a 0.00013 increase in the log odds of being in a higher level of WTP, given that all of the other variables in the model are held constant. The ordered logit for orthodox being in a higher level of WTP category is -1.31 less than muslim and -2.1 than protestant. Finally, for a one unit increase in prevalence of diseases (i.e., going from 0 to 1), in the household, would be expected a 1.59 increase in the log odds of being in a higher level of WTP, given that all of the other variables in the model are held constant.

Different socio-economic factors affect household heads' abilities to purchase the new product. Therefore, in this

study, the ordered logit model analyzed what determines the likelihood of household heads willingness to pay. In the logit model estimation, only the sign of the variable are important since the magnitude does not show the effect of each independent variable on the probability of consumers' WTP for the LCM leaf tea. In order to analyze the effects of each explanatory variable on the probability that respondents accept or reject the bids, the partial derivatives of explanatory variables with respect to MBDC responses must be taken (Greene, 1993). i.e., we need to estimate the marginal effects. Before we proceed to the marginal effects analysis let us interpret the coefficient of odd ratio.

**Table 6:** The Odd ratio estimation (with robust standard error)

wtpr	Odd Ratio	Std. Err.	Z-value	P> z	[95% Conf. interval]
sex	1.169776	.2603726	0.70	0.481	.7562052 1.809531
educ	1.060708	.0277552	2.25	0.024**	1.00768 1.116527
relig orthodox	.2699648	.1583843	-2.23	0.026**	.085491 .8524996
protestant	.12297	.1007601	-2.56	0.011**	.0246795 .6127212
age	.9893689	.0111461	-0.95	0.343	.9677624 1.515476
f_size	.9217055	.0643215	-1.17	0.243	.8038793 1.056802
empl	.672605	.2193224	-1.22	0.224	.3549778 1.274439
Income	1.000126	.000049	2.56	0.010***	1.00003 1.000222
perce	1.017597	.2545982	0.07	0.944	.6231734 1.661662
preval	4.880777	2.91252	2.66	0.008***	1.515476 15.71914

\*significance at 10%, \*\*significance at 5%, \*\*\*significance at 1%  
(Source: Survey Result, 2020)

In the output above the results are displayed as proportional odds ratios. For education, a one unit increase in education, the odds of being in the higher WTP is 1.06 times greater, which is statistically significant at 5%. This means that someone with more year of schooling is 1.06 times more likely to be willing to pay than someone with a lesser year of schooling.

For religion, the odds of being in the higher level of WTP of orthodox is 0.27 times less than that of muslim and the odds of being in the higher level of WTP of protestant is 0.13 times less than that of muslim, given that all of the other variables in the model are held constant. This is also statistically significant at 5%. This means that, there is greater probability for muslim to be in the higher level of WTP or muslim are more willing to pay than others. Likewise, a one unit increase in income, the odds of being in the higher WTP is 1.00 times greater. This means there is greater probability for higher income groups to pay than that of lower incomes, which is also statistically significant at 5%.

Finally, a unit increase in the prevalence of diseases in the household (i.e. going from 0 to 1), the odds of high WTP is 4.88 times more likely to be willing to pay than that of healthier. That is to say the more frequent the prevalence of diseases in the households, the more they are WTP for this medicinal product. This is also statistically significant at 1% significance level.

The summary results of this conventional logit model with its marginal effect for identifying the factors affecting WTP are reported in table below.

**Table 7:** Marginal Effect Estimates of the ordered logit model

Variables	wtpr for 1 brr	wtpr for 2 brr	wtpr for 3 brr	wtpr for 4 brr	wtpr for 5 brr
sex	-0.015 (0.478)	-0.021 (0.484)	0.009 (0.482)	0.008 (0.490)	0.019 (0.480)
educ	-0.005 (0.026)**	-0.008 (0.024)**	0.003 (0.030)**	0.003 (0.029)**	0.007 (0.030)**
orthodox	0.076 (0.000)***	0.168 (0.008)***	0.034 (0.552)	-0.052 (0.000)***	-0.226 (0.076)**
protestant	0.172 (0.055)**	0.254 (0.001)***	-0.041 (0.647)	-0.088 (0.002)***	-0.297 (0.025)**
age	0.001 (0.340)	0.001 (0.342)	-0.001 (0.336)	-0.001 (0.341)	-0.001 (0.349)
f-size	0.008 (0.241)	0.011 (0.243)	-0.004 (0.232)	-0.004 (0.253)	-0.010 (0.250)
empl	0.037 (0.226)	0.052 (0.222)	-0.022 (0.227)	-0.019 (0.235)	-0.048 (0.226)
income	-0.000 (0.015)**	-0.000 (0.008)***	-0.000 (0.019)**	-0.000 (0.013)**	-0.000 (0.012)**
perce	-0.002 (0.944)	-0.002 (0.944)	0.001 (0.944)	0.001 (0.945)	0.002 (0.944)
preval	-0.148 (0.007)***	-0.207 (0.010)***	0.087 (0.013)**	0.078 (0.017)**	0.190 (0.010)***

mtable, dydx(\*)

Making decisions about using variables' value in estimation is very important, because the marginal effect depends on the values of all explanatory variables. Since total probability always equals 1, the total marginal effect for each variable is zero.

According to the results presented in table 7, with the increase in variables of education, the likelihood of people to be placed at lower levels of WTP decreases and being placed at higher levels of WTP increases. In this case, holding other

things remain constant, a unit increase in the education level (years of schooling) of the household heads decreases the probability of accepting the lower bids by about 0.5% and 0.8%, but increases the probability of accepting the higher bids by about 0.3% and 0.7% respectively. This is likely to the hypothesized one, indicating that additional year of schooling brings additional awareness to the household heads to consume such medicinal product.

Educated people are also expected to earn more income, which will make them more willing to pay for Moringa. Studies by T.O. Oyekale et.al, (2016), Fatoki O.A et al, (2015) and Ajibade T.B.et al (2016) also found similar results.

As for the religion of the household head, the study found out that the probability to pay of being orthodox headed households was higher than that of the being muslim headed households. The likelihood of willingness to pay for one birr, two birr and three birr increases by 7.6%, 16.8% and 3.4% respectively, while the probability of willingness to pay four and five birr decreases by 5.2% and 22.6% respectively. In the same manner, the probability to pay higher bids by protestant household heads was greater than that of being muslim. Then the marginal effect shows that keeping other variable constant, being protestant increases by 17.2% and 25.4% of willing to pay for one birr and two birr, respectively. However, decreases by 4.11% and 8.8% and 28.7% for the remaining successive bids.

The marginal effects of household heads who had higher income were less likely willing to pay lower bids (negative sign) and more likely to pay higher bids (positive sign). That is, as income of the household heads increases the probability of accepting higher bids also increases. This result is in line with the findings of Ajibade T.B.et al (2016).

As priori expectation, frequent prevalence of diseases in the households' members has a positive sign and it is found to be strongly significant. As the time diseases prevail frequently that is the dummy going 0 to 1, the probability of household heads willing to pay for the LCM product fall by 15% and 21% for the first two lower bids; however, raise by 8.7%, 7.8% and 19% for the remaining subsequent higher bids. This seems rational that as diseases prevail people are more likely to accept whatever the price was. This result is consistent with the findings of Obayelu, O. A. et al (2014), health-conscious may have a positive attitude and be more willing to pay a premium for moringa tea leaf products. The result is also in consonance with the findings of Ajibade T.B.et al (2016), stated that the consumers' awareness of the health attributes of the moringa tea leaf is positive and significant.

### 5.2.2 Predicted Probabilities after Ordinal Logit

The predicted probability for each of the five outcomes can be obtained and we can also make comparison with the computed sample frequencies of each outcome. From the table below, the predicted probability of being in the first bid level is 11.1%. About 65.4% of the predicted probability was fall under bid two and three. The remaining 23.7% of the predicted probability was being under the level of bid four and five. Therefore, we can infer that about 65% of the

surveyed household heads were willing to pay the price which was close to the mean WTP, which is 2.85 birr

**Table 8:** Predicted probabilities

Variables	Observation	Mean	Std. Dev.	Min	Max
Plogit1	397	.1108405	.0716019	.014561	.5709378
Plogit2	397	.3039748	.0731885	.0722004	.4343284
Plogit3	397	.3501104	.0503106	.082383	.3875165
Plogit4	397	.0874805	.0281906	.0099685	.1497493
Plogit5	397	.1475938	.0736914	.0122996	.5286201

(Source: own computation from the survey data)

### 5.2.3 Households response levels to different bids

The relative frequency of the different amounts of WTP responses was analyzed. From the table below it is observed that for "definitely yes" responses household heads willingness to pay decreases as we move from the lower to higher bid levels. Consequently, the response level for "definitely no" responses was the reverse direction. This is in line with the economic theory, the higher the bid values ends up with the lower the WTP. For instance, for 1 birr 100% of the responses was concentrated in the category of definitely yes, other categories are of 0%.

**Table 9:** Distribution of certainty scores across bid levels

Response levels	wtp birr 1	wtp birr 2	wtp birr 3	wtp birr 4	wtp birr 5
Definitely yes	397	353	235	92	58
Probably yes	0	35	95	113	24
Definitely no	0	6	12	51	221
Probably no	0	1	32	51	29
Not sure	0	2	23	90	65
Total	397	397	397	397	397

### 5.2.4 Statistical Diagnostic Test

#### 5.2.4.1 Multicollinearity Test

For this model the existence of multicollinearity was checked and it is found that the problems are not serious. Post estimation variance inflation factors (VIF) were used to check the multicollinearity problem of all the explanatory variables and as well pair wise correlations were used for dummy variables in particular. Based on the VIF ( $X_i$ ) values, the value of VIF is by far less than 10. As a result, all quantitative explanatory variables are included in the model. Thus, the result indicates multicollinearity problem is not a serious problem in the data in the study area (App.I).

#### 5.2.4.2 Link Test

The model specification error was checked by link test, the test of  $\hat{u}$  and  $\hat{u}^2$  were 0.582 and 0.834 respectively which are insignificant. We can say that the link test has failed to reject the hypothesis that the model is specified correctly. So we don't have a specification error (App.II).

### 5.3 Estimating Aggregate Willingness to Pay and Total Revenue

In this section total WTP and the total revenue at various prices that household's would be WTP is calculated. Based on the multi bounded discrete choice model (MBDC) estimates, the mean WTP of household heads for 3 gram of LCM leaf tea in the study area was 2.85 ETB and the household head data from the total population of the study

area was 32,598. Total WTP for 3 gram of the LCM leaf tea computed by multiplying the mean WTP MBDC responses by the total number of households (Mezgebo et al, 2013).

**Table 10:** The Mean Willingness to Pay for LCM leaf tea product

Variable	Obs	Mean	Std. Dev.	Min	Max
Wtp	397	2.848866	1.183784	1	5

(Source: Own Computation from the Survey Data, 2020)

$$\begin{aligned}
 TWTP &= \frac{HH * nWTP}{n} \\
 &= \frac{32,598 * 397}{397} = 31,202 \\
 &= 32,598 * 2.85 \\
 &= 92,578.32 \text{ ETB}
 \end{aligned}$$

Mitchell and Carson (1989) indicates that, before computing total WTP, we should be careful on population choice bias, sampling frame, sample non response bias, and sample selection biases to have valid aggregation of benefits. Using a random sampling method in selection of the final household, using in person interview, exclusion of protest zero bidders, using of mean WTP for measuring aggregate value minimize the occurrence of such biases and hence valid estimation of aggregate demand (Mezgebo et al, 2013).

## 6. Conclusions and Policy Implications

This paper provides an assessment of household heads WTP and perception for labelled and certified Moringa Leaf Tea product. The study was used 397 sample household heads which were collected from Arba Minch, Sawul, Karat and Jinka. To elicit household heads' WTP for the LCM leaf tea product, the study was used multiple bounded elicitation method of the contingent valuation method.

Moringa products are used by all of the study population in the surveyed areas and lack of awareness about the benefits of Moringa products was not a major reason for the poor-usage. In the study the researchers investigated that lack of standardization of the Moringa products and formulations with a view to integrating them into the healthcare system.

The descriptive analysis was shown that only about 23.17% of the sampled population was willing to pay price greater than or equal to five birr, which was maximum bid. Moreover, the intensity of response level, *definitely yes*, to this category reflected relatively low percent. The mean and total WTP which calculated from the surveyed data were nearly close to the average of the highest bid price which is not satisfactory. From this we could also conclude that consumers value less to the product given its high nutritional and health benefits.

The ordered logit model (OLM) which was used a data from the CV survey shows the determinants of household demand for LCM leaf tea product. It has been observed from the marginal effect output that years of schooling, the religious view of the household heads, monthly income of the household heads and the frequent prevalence of diseases in the households, were the most important factors in

influencing the likelihood of household heads' WTP for the labelled and certified moringa leaf tea product.

The study was also revealed that variables like ages of the household heads and perception towards the new product shown insignificant result probably owing to the quality of information they had about the products. Thus, intensification of awareness programs would enhance effective move towards labelling and certification of the moringa products. Campaign and orientation programs to improve both suppliers and consumers' perception and attitudes towards labelling and certification should be embarked with different promotional and sales programs. Based on the findings of the study, the researchers were recommended that;

- Since all the respondents were willing to pay for Moringa leaf tea product, effort should be made to make the product available and accessible to all.
- Based on the findings from the study, education is a significant factor affecting willingness to pay for Moringa leaf tea product. Therefore, there is the need to enhance knowledge on product by incorporating its benefits into different promotional and sales programs.
- The study also revealed a low level of awareness of moringa products among the consumers probably owing to the quality of information they had about the products. Thus, intensification of awareness and inducement programs would enhance effective move towards certification and standardization of the moringa products.
- The positive relationship between WTP for moringa leaf tea and prevalence of diseases in the households suggests that the suppliers of these product should target the promotional activities to the health benefits of the product.
- Since religious differences have shown significant result due attention should be given to create public awareness during the congregational meetings.
- Any policy that will increase the per capita monthly income will enhance the likelihood of consumers' willingness to pay for labelled and certified moringa leaf tea.
- In order to maximize profit, it is recommended that producers (suppliers) should package moringa leaf tea.

## 7. Acknowledgment

This study would never be completed without the contribution of many people to whom we would like to express our gratitude. For most, we would like to express our deepest gratitude for Arba Minch University for covering all the necessary costs of this study.

## References

- [1] Abuye C, Urga K, and Knapp H. (2003) A compositional study of *Moringa Stenopetala* leaves. East Afr Med J 80, 247-252.
- [2] Adesope, A. A. A., Awoyemi, T. T., Falusi A. O. and Omonona, B. T (2010). *Willingness to pay for safety labels on sugar and vegetable oil among Households in*



- south-western Nigeria. *Journal of Agricultural and Social Research* 10(1).
- [3] Ajibade T.B, Omotesho K.F., Animashaun J.O., Opaleke D.O., Ajibade E.T. (2016). *Willingness to pay for MoringaOleifera leaf powder fortified bread among consumers in Kwara state, Nigeria*. Department of Agricultural Economics and farm management, university of Ilorin, Nigeria.
  - [4] Alberini, A., K. Boyle, and M. Welsh (2003). *Analysis of contingent valuation data with multiplebids and response options allowing respondents to express uncertainty*. *Journal of Environmental Economics and Management* 45 (1), 40.62.
  - [5] Arrow, K. J., R. Solow, P. Portney, E. Leamer, R. Radner, and H. Schuman (1993). *Report ofthe NOAA panel on contingent valuation*. Technical Report 58: 4601-4614, Federal Register.
  - [6] Berhe, N., Halvorsen, B.L., Gundersen, T.E., Myrvang, B., Gundersen, S.G. and Blomhoff, R. (2007). *Reduced serum concentrations of retinol and alpha-tocopherol and high concentrations of hydroperoxides are associated with community levels of S. mansoni infection and schistosomalperiportal fibrosis in Ethiopian school children*.
  - [7] Bosch, C.H. 2004. *Moringa oleifera* Lam. In: G.J.H. Grubben, and O.A. Denton (eds.).PROTA 2: Vegetables/Légumes. [CD-Rom]. PROTA,Wageningen, the Netherlands.
  - [8] Caceres A, A Saravia, Srizzo, L Zabala, Ede Leon, F Nave (1992). Pharmacologic properties of *Moringa oleifera*. *Journal of Ethnopharmacology* 36: 233-237.
  - [9] Cameron, Trudy A., Gregory L. Poe, Robert G. Ethier, and William D. Schulze(2002). *Alternative Nonmarket Value-Elicitation Methods: Are Revealed and Stated Preferences the Same? Journal of Environmental Economics and Management* 44(3):pp. 391-425
  - [10] Caswell, J. A. and Mojduszka, E. M. (1996). *Using informational labeling to influence the market For quality in food products*. *American Journal of Agricultural Economics*.
  - [11] Cummings, R. G., D. S.Brookshire, and W. D. Schulze (1986). *Valuing Environmental Goods: An Assessment of the Contingent Valuation Method*. New York: Rowman & Allanheld.
  - [12] Dechasa Jiru1, Kai Sonder, Lalisa Alemayehu, Yalemtshay Mekonen and AgenaAnjulo. (2006). *Leaf yield and Nutritive value of Moringastenopetala and Moringaoleifera Accessions: Its potential role in food security in constrained dry farmingAgroforestry system, Accra, Ghana*.
  - [13] Fahey, J. (2005). *Moringaoleifera: A Review of the medicinal evidence for its nutritional, Therapeutic, and prophylactic properties*. Part 1. *Trees for Life Journal* 1:5.
  - [14] Fatoki O.A, Oguntoye O.T, Apata O.V, Ojo O.B, and Tewogbade S.O(2015). *Consumer Willingness to Pay for Health Benefits of MoringaOleifera Products in Ogun State*. Forestry Research Institute of Nigeria P.M.B. 5054 Ibadan, Oyo State, Nigeria.
  - [15] Freeman III, A. M. (1993). *The Measurement of Environmental and Resource Values: Theory and Methods*. Washington D.C.: Resources for the Future.
  - [16]Freeman III, A. Myrick III, Joseph A. Herriges, and Catherine L. Kling (2003). *The measurement of environmental and resource values. Theory and Methods* (3rd ed.). Washington, DC: Resources for the Future.
  - [17]Fuglie, L. J. (2001). *Combating malnutrition with moringa: Development potentials for moringa Products*. October 29th –November 2nd 2001, Dar es Salaam, Tanzania.
  - [18]Institute of Pathobiology, The multi-purpose Moringa tree: Ethiopia Addis Ababa University, 1996-2002.
  - [19]Green, W. H. (1997). *Econometric Analysis: Upper Saddle River: Prentice Hall*.
  - [20]Greene, W. H. (2003). *Econometric analysis: Pearson Education India*.
  - [21]Hosmer DW. And Lemeshow S. (2000). *Applied logistic regression* (2nd ed.). New York: Wiley & Sons.
  - [22]Jed W. Fahey (2005). *Moringa oleifera: A Review of the Medical Evidence for Its Nutritional, Therapeutic, and Prophylactic Properties*. Part 1.Johns Hopkins School of Medicine, Department of Pharmacology and Molecular Sciences, Lewis B. and Dorothy Cullman Cancer Chemoprotection Center, 725 N. Wolfe Street, 406 WBSB, Baltimore, Maryland, USA 21205-2185.
  - [23]Jochem Schneemann (2011). *Moringa (stenopelata) production and use for water purification in Ethiopia: FINAL REPORT By Commissioned by ICCO Fair*.
  - [24]Josephine N. Kasolo1, Gabriel S. Bimenya, LonzyOjok, Joseph Ochieng and Jasper W. Ogwal-Okeng(2010). *Phytochemicals and uses of Moringa oleifera leave in Ugandan rural Communities*.
  - [25]Katko T. (1989). *The Role of Cost Recovery in Water Supply in Developing Countries*.(Temper University of Technology: Department of Civil Engineering. Institute of Water and Environmental Engineering)
  - [26]McCullagh P. (1980). *Regression models for ordinal data (with discussion): Journal of the RoyalStatistical Society Series B*, 42, 109-142.
  - [27]Maddala, G.S. (1988). *Introduction to Econometrics: 2<sup>nd</sup>ed*, Macmillan Publishing.
  - [28]Marine L.G.(2009). *Definition, Measurement and Determinants of the Consumer's Willingness to Pay: Applications Marketing*, 24 (2), pp.91-113.
  - [29]Mark-Herbert, C.(2003).*Development and marketing strategies for functional foods: AgBioForum* 6(1&2): 75-78.
  - [30]Martin L. Price, (2007). *Moringa Products: Opportunities and Challenges for Mozambique*.
  - [31]Mattia, S., Oppio, A., &Pandolfi, A.(2010). *Contingent valuation method and market value: Applying Stated Preference Methods in Real Estate Market*. In the proceedings of 17th annual European Real Estate Society conference in Milan, Italy.
  - [32]McCullagh P. (1980). *Regression models for ordinal data (with discussion). Journal of the Royal Statistical Society Series B*, 42, 109-142.
  - [33]Mekonnen Daba, (2016). *Miracle Tree: A Review on Multi-purposes of Moringa oleifera and its Implication for Climate Change Mitigation: Journal of Earth Science & Climatic Change*. Oromia Agriculture Research Institutes, Bako Agricultural Research Center, Ethiopia.



- [34] Mekonnen Y. & Gessesse A.(1998). *Documentation on the uses of Moringa stenopetala and its possible antileishmanial and antifertility effects*: Ethiop J Sci, 21, 287-295.
- [35] Mitchell, R. C. and R. T. Carson (1989). *Using Surveys to Value Public Goods*: Baltimore: Johns Hopkins University for Resources for the Future.
- [36] Nikita Lyssenko and Martínez-Españeira (2009). *Respondent uncertainty in contingent valuation: the case of whale conservation in Newfoundland and Labrador*. Department of Economics, Memorial University of Newfoundland St. John's, NL Canada. A1C 5S7.
- [37] Obayelu, O. A., Adeoti, A. I. and Akinlade, A. A(2015). *Consumers' willingness to pay for labeled and certified Moringa products in Ogun State, Nigeria*: International Food Research Journal 22(1): 122-130 Departments of Agricultural Economics, University of Ibadan, Nigeria.
- [38] Odeyinka, S.M., D.O. Torimiro, J.O. Oyedele, and V.O. Asaolu. 2007. Farmers' awareness and knowledge of Moringa oleifera in Southwestern Nigeria: A perceptual analysis. Asian J. Plant Sci. 6(2):320–325. Olson, E.M. 2001. Introduction to the Moringa Family, pp. 66–73. In: L.J. Fuglie (ed.). The Miracle tree. CTA and CWS Publication, Dakar, Senegal.
- [39] Oluduro, A.O. (2012). *Evaluation of antimicrobial properties and nutritional potentials of Moringaoleifera Lam. leaf in South-Western Nigeria*: Malaysian Journal of Microbiology 8(2): 59-67
- [40] Sreepada Hegde & Vijayalaxmi Hegde (2015). *An Overview of Moringa Production in Ethiopia*: International Journal of Science and Research (IJSR): Volume 4 Issue 4, School of Business & Economics, Madawalabu University, Ethiopia.
- [41] Thilza, L. B., Sanni, S., Zakari, A. I., Sanni, F. S., Talle, M. and Joseph, B. M. (2010). *In- vitro antimicrobial activity of water extract of Moringa oleifera leaf stalk on bacteria normally implicated in eye diseases*: Academia Arena 2(6): 80-82.
- [42] Tolulope Olayemi Oyekale, Tomilola Esther Elebute & Ifeoluwapo Oluwaseun Amao(2016). *Awareness and Willingness to Pay for Moringa*: Institute of Food Security, Environmental Resources and Agricultural Research, Federal University of Agriculture, Abeokuta, Nigeria, Idi-Ishin, Ibadan, Nigeria.
- [43] Walker, S.H. and Duncan, D.B.(1967). *Estimation of the probability of an event as a function of Several independent variables, Biometrika*, vol. 54, no. 1/2, pp. 167-179.
- [44] Wooldridge J.M. (2000). *Introduction to Econometric: A Modern Approach* (2 ed). MIT Press.

## Appendix I

```
. ** postestimation test
. vif //after OLS reg
```

Variable	VIF	1/VIF
sex	1.09	0.917113
educ	1.24	0.809121
relig		
1	2.31	0.431988
2	2.34	0.426708
age	1.10	0.908825
f_size	1.09	0.915446
enpl	1.19	0.838983
Income	1.53	0.652880
perce	1.06	0.945413
preval	1.04	0.957485
Mean VIF	1.40	

## Appendix II

```
. linktest
```

Source	SS	df	MS	Number of obs	=	397
Model	54.443387	2	27.2216935	F(2, 394)	=	21.43
Residual	500.488603	394	1.27027564	Prob > F	=	0.0000
Total	554.93199	396	1.40134341	R-squared	=	0.0981
				Adj R-squared	=	0.0935
				Root MSE	=	1.1271

  

wtp	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
_hat	.7256392	1.31805	0.55	0.582	-1.865651 3.316929
_hatsq	.0481826	.2299114	0.21	0.834	-.4038239 .5001891
_cons	.3839648	1.884024	0.20	0.839	-3.320033 4.087962