

## Consumers' Willingness-To-Pay for Underutilized Vegetable Crops: The Case of African Leafy Vegetables in South Africa

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**ABSTRACT** The paper aimed to determine consumer's willingness-to-pay for African leafy vegetables and to explore the socio-economic and perception factors influencing willingness-to-pay for African leafy vegetables in the Limpopo Province of South Africa. Cross-sectional data were collected from 300 randomly selected households across three districts of the Limpopo Province using a contingent valuation questionnaire. The descriptive results revealed that almost 80 percent of the respondents would be willing to pay a premium for African leafy vegetables. An Ordered Probit model was applied for identification of households' socioeconomic and perception factors that influence willingness-to-pay. Willingness-to-pay was found to be mainly a function of socio-economic factors, namely gender, urbanization, age, distance to the market, tastes/preferences and availability of African leafy vegetables throughout the year. Demand and preference for African leafy vegetables were found to be high as they have been historically important food security crops to rural households. The empirical results will be useful for African leafy vegetable producers, plant breeders, marketers and policy makers in developing efficient production and marketing strategies. This, in turn, would provide a means of improving food security and livelihoods, especially in support of the rural poor African leafy vegetable farmers.

### INTRODUCTION

In most parts of the developed world, indigenous leafy vegetables, amongst others, are regarded as weeds. But in Africa and other developing countries, these plants form part of the daily diets of many rural households. The oldest inhabitants of South Africa have harvested indigenous leaves from wild and cultivated plants to supplement the meat from hunted animals (Van Rensburg et al. 2014). The use of green leafy vegetables continues to spread in South Africa, although Westernisation has decreased its overall use. The parts of the leafy vegetables which are mostly used are young leaves, succulent stems, flowers and very young fruit. Vegetable dishes may be prepared from single plants or a combination. In Sesotho and sePedi they are called *morogo*, or *imifino* in isiZulu and isiXhosa (Van Rensburg et al. 2007). The food consumption patterns of leafy vegetables of the households is highly variable and depends on

factors such as poverty status, degree of urbanisation, distance to fresh produce markets and time.

African leafy vegetables (ALVs) has become daily food in places like Limpopo (Vorster et al. 2007), but generally the knowledge of indigenous food has been lost in many South African communities (Lwoga et al. 2010), owing to factors such as politics, changes in lifestyle, and stigma associated with the use of indigenous food (Musinguzi et al. 2006). The dietary shift from ALVs to cash crops and exotic plant food sources increases the risk of malnutrition and other nutrition-related non-communicable diseases, especially in poor rural communities. Farm communities in South Africa have been associated with poor nutritional status and extreme poverty. ALVs have been found to be affordable sources of several micronutrients. However, knowledge of and the use of these plants are declining (Van der Hoeven 2013). They have long been regarded as minor crops and thus have attracted little marketing attention, most research and development effort going to major and cash crops (Lyatuu et al. 2009).

ALVs as a group of crops from the horticultural category have wide importance both as a source of food and health care (Faber 2010). However, their level of consumption is very low

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for reasons of unavailability and imperfect market. Even with limited areas of production, the products suffer from low prices and lack of markets. However, Backeberg (2013) argued that these leafy vegetables have advantages (such as drought and heat tolerance, ease of production, usually requiring less resources such as water, and are rich in micronutrients such as iron and Vitamin A) over exotic and local vegetable species that currently dominate supermarket shelves.

According to Chelang'a et al. (2013), ALVs would fetch a higher price at supermarkets than in open air markets (informal markets). One possible reason is that supermarkets are patronised by a more nutritionally aware clientele with higher incomes, who are more conscious of their health and are willing to pay extra to obtain these nutritional benefits. It is also possible that the atmosphere in supermarkets has an effect on prices and willingness to pay a premium as they employ modern retail technology in terms of storage, display and packaging. These factors were also reported by Kimemia and Oyare (2006) to be responsible, at a national level, for willingness to pay a premium.

There is a scarcity of studies on the economics of ALVs, especially in South Africa. Even though there is no organised market for ALVs in Limpopo, some anecdotal evidence suggests that there is a rising interest to buy among households. As information from a case study in a specific area cannot be generalised to the entire South African population, the objectives of paper were to empirically examine consumers' WTP (Willingness-To-Pay) for ALVs and to explore the socio-economic and perception factors influencing households' WTP for ALVs in the Limpopo Province. The results are expected to provide some important information to promote the production, value addition and consumption of ALVs, and may provide retailers with important information about the main socio-economic factors affecting household food consumption decisions regarding ALVs.

### **The Determinants of Willingness-to-Pay**

Consumer WTP studies are often used in determining the market potential for products. In most of these studies, researchers have hypothesized that consumers' WTP is influenced by socio-demographic factors like age, educa-

tion, income, gender, marital status and number of children in the family (Xia and Zeng 2008). In addition, consumer perceptions and knowledge are also important factors influencing WTP. According to Ariyawardana et al. (2009), many studies have shown that women are willing to pay a premium for organic ethnic produce, and so are better educated and high income groups.

Haghjou et al. (2013) report that factors such as income, family size and consumers' awareness of the products' characteristics significantly increase consumers' WTP a premium for organic food products. Also, married consumers as well as women were willing to pay a higher premium. In addition, those who had children younger than 10 years old, the elderly, or people with family members having special diseases were willing to pay a higher premium price for these products. A factor that was found to discourage willingness to pay was lack of advertising.

Boccaletti and Moro (2000) studied consumers' WTP for food products in Italy and found that WTP is mainly affected by income and information. Boccaletti and Nardella (2000) have also analysed consumers' WTP for pesticide-free fresh fruits and vegetables in Italy by taking a sample of 336 observations. The results showed that age, gender, education, place of residence, households with children, and household income were considered as socio-economic variables. In order to capture safety risk, knowledge on pesticide-borne health risks and two other indices (pesticide concern and food-borne risk concern) were incorporated in the model. Although the high income group was willing to pay a premium for pesticide-free produce, male respondents and those with a university degree were less likely to pay a premium for pesticide-free produce.

According to Ngigi et al. (2010), on the assessment of urban consumers' WTP for quality leafy vegetables in Kenya, using contingent valuation and the payment card method in eliciting consumers' WTP, the study found that WTP for quality was higher among high income consumers. It also found that age of children the consumer has and access to information about food safety are among the significant drivers of consumers' willingness to pay for quality leafy vegetables. Another survey conducted by Chelang'a et al. (2013), among urban consumers in Kenya, to determine the WTP a premium for

ALVs and the underlying determinants using the semi-double bounded contingent valuation choice and logit models, discovered that consumers generally preferred ALVs to exotic leafy vegetables and were willing to pay an average premium of 79% for them: 88% and 70% in open air and supermarkets, respectively. The WTP premium was positively influenced by age, presence of children in the household, years of schooling of the household decision maker, and the number of years the consumers had been consuming ALVs.

Alphonse and Alfnes's (2011) reported that, on average, consumers are willing to pay a premium for inspected and organically produced food. In addition, consumers have a strong preference for domestically produced food and do not neglect produce coming from areas associated with poor agricultural practices. Acheampong et al. (2012) reports that, to ascertain consumer perceptions, purchasing behaviour and WTP for safe vegetables in Ghana, labelling, visual appearance, freshness and availability had a significant influence on consumers' willingness to pay higher prices for safe vegetables.

## METHODOLOGY

The Limpopo Province is one of the nine provinces of the Republic of South Africa. It is situated in the far northern part of the country and its capital city is Polokwane (see Fig. 1). The



**Fig.1. Map of South Africa showing the position of Limpopo Province**

**Source:** [http://www.statssa.gov.za/Publications/HTML/Report-00-91-042004/html/Report-00-91-042004\\_12.html](http://www.statssa.gov.za/Publications/HTML/Report-00-91-042004/html/Report-00-91-042004_12.html)(2005)

province is divided into five districts, namely: Vhembe, Mopani, Capricorn, Waterberg and Sekhukhuni. The paper was conducted in Capricorn, Vhembe and Mopani Districts. The districts were selected because most of the crop farming operations in the Limpopo province occurs there.

A sample of 300 households was randomly selected in January 2012 across the three districts. Consumers were interviewed about their level of awareness regarding ALVs and their perception towards ALVs. Following the survey, data were entered and checked for consistency. One questionnaire was dropped because it had missing data.

## Conceptual Framework and Model

WTP for a product may be defined as the amount of money an individual or household is willing to pay for purchasing a product given her/his income, risk preferences and other characteristics (Ramasubramanian 2012). WTP is generally analysed using the CVM and it helps to estimate the value an individual places on a good, usually an intangible good. The contingent valuation method is originally designed to value goods and services the market fails to value. This is mainly the case for public goods, the environment and health care programmes (Blumenschein et al. 2001). However, CVM is now increasingly being used to value private market goods and services (Lusk and Hudson 2004); it also has been applied to value organic food products (Boccaletti and Nardella 2000; Gil et al. 2000; Fu et al. 1999), and indigenous vegetables (Weinberger and Msuya 2004).

CVM is often referred to as a stated preference model, in contrast to a price-based revealed preference model. Typically, the survey asks how much money people would be willing to pay (or willing to accept) to use (or be compensated for the loss of) organic food product features, such as environmental benefits. Indeed, CVM permits a direct estimation of WTP by means of different elicitation techniques (Boccaletti and Nardella 2000). Consumers simply indicate their WTP without purchasing the hypothetical product. As explained, the CVM relies on directly asking individuals about their WTP for a specific commodity. The most important part in applying CVM is to choose appropriate survey and elicitation methods to reach the most accurate data.

Various survey methods and questionnaire formats are possible for collection of data. In-person interviews are usually held to produce the highest-quality WTP data, although telephone and mail surveys have been applied in a number of studies (Haghjou et al. 2013).

There are various techniques for eliciting consumers' WTP. For instance, in a dichotomous-choice format, the respondent is given a question to indicate if he would pay  $Rx$  ( $R=Rand$ ) for the good, or not. Use of open-ended questions about a consumer's WTP is another technique. An alternative method is to present a number of possible WTP values on a card to the respondent, called a "payment card". The respondent would then choose the nearest quantity to his WTP among others written on the card. The chosen amount can be taken as the consumer's WTP. Since a payment card is simple, and it enlightens an unaware respondent's picking options by giving him a range of pre-designed price premiums, it is an appropriate approach in some studies (Boccaletti and Nardella 2000). In this paper, in-person interviews using a payment card format were applied to investigate factors affecting consumer's WTP for ALVs.

The data applied in this paper were collected through a contingent valuation survey. Household WTP for the ALVs was considered a dependent variable in this paper. Households in the Limpopo Province purchase ALVs either from the farms or informal market. Respondents were presented with the following WTP question: Suppose your favourite ALV has a price premium, would you pay more for ALVs? Respondents were asked to choose from five classes of WTP (see Table 2).

As this response variable assumes ordinal ranking of the WTP variable, an Ordered Probit regression is the natural choice (Greene 2008). The model is set up around a latent regression that begins with the following equation:

$$WTP^* X' \beta + \varepsilon \tag{1}$$

Where  $WTP^*$  is the willingness to pay,  $X'$  are a vector of explanatory variables,  $\beta$  are a vector of coefficients,  $\varepsilon$  is the error term.  $WTP^*$  is unobserved, and what can be observed is:

$$y = \begin{cases} 0 & \text{if } y \leq \mu_1 \\ 1 & \text{if } \mu_1 \leq y \leq \mu_2 \\ 2 & \text{if } \mu_2 \leq y \leq \mu_3 \\ \dots & \dots \\ j & \text{if } \mu_{j-1} \leq y \end{cases} \tag{2}$$

Model 2 is a form of censoring and the  $\mu$ 's are unknown parameters to be calculated with  $\beta$ . It is presumed that  $\varepsilon$  is normally distributed across observations. By normalizing the mean and variance of  $\varepsilon$  to zero and one, respectively, the following probabilities are obtained:

$$\begin{aligned} Prob(y = 0|X) &= F(-X'\beta) \\ Prob(y = 1|X) &= F(\mu_1 - X'\beta) - f(X'\beta) \\ Prob(y = 2|X) &= F(\mu_2 - X'\beta) - f(\mu_1 - X'\beta) \\ &\vdots \\ Prof(y=j|x) &= 1 - F(\mu_{j-1} - X'\beta) \end{aligned} \tag{3}$$

Because all probabilities must be positive, the following condition should be established:

$$0 < \mu_1 < \mu_2 < \dots < \mu_{j-1}$$

In this model, the coefficients are not necessarily equal to the marginal effects of regressors  $X$  on the probabilities. Yet, the marginal effects of changes in the regressors can be calculated as follows:

**Table 1: Descriptive statistics of the variables used in the analysis, Limpopo Province, 2012**

Variables	Description	Mean	SD
HHLd	Number of people in the household (Number)	4.23	.089
GENd	1 if the household is male, 0 otherwise (Dummy)	0.42	0.494
AGE	Age of the household (Years)	44	15.974
URBA	1 if the household resides in the urban area, 0 otherwise (Dummy)	0.47	0.029
INCO	1 if household income is less than R2000/month, 0 otherwise (Dummy)	0.33	0.473
AWAR	1 if the household is aware of ALVs, 0 otherwise (Dummy)	0.96	0.197
DISM	Distance to the market (Km)	6.79	8.834
TAST	Consumer perception on taste (1-5 Likert scale)*	3.59	1.484
AVAI	Consumer perception on availability (1-5 Likert scale)*	1.86	1.119
NUTR	Consumer perception on nutrition (1-5 Likert scale)*	4.36	1.258

Source: Survey data, 2012; \*Likert scale: 1= Totally Disagree...5= Totally Agree

$$\frac{\partial \text{Prob}(y=0|X)}{\partial x_j} = -F(-X'\beta) \beta$$

$$\frac{\partial \text{Prob}(y=1|X)}{\partial x_j} = [F(-X'\beta) - F(\mu_{j,1} - X'\beta)] \beta$$

$$\frac{\partial \text{Prob}(y=J|X)}{\partial x_j} = F(\mu_{j,J} - X'\beta) \beta \tag{4}$$

The aim of model estimation was to identify the relevant factors to explain consumers' WTP for ALVs. The final model, chosen to interpret the dependence of WTP on explanatory variables, was specified as follows:

$$WTP_i = \beta_0 + \beta_1 HHL D + \beta_2 GEND + \beta_3 AGE + \beta_4 URBA + \beta_5 INCO + \beta_6 AWAR + \beta_7 DISM + \beta_8 TAST + \beta_9 AVAI + \beta_{10} NUTR + \mu \tag{5}$$

Stata Version 13 software was used to estimate the regression. Model significance was verified by computing the Chi-square ( $\chi$ ) statistics, calculated from the restricted and unrestricted log-likelihood function ((2) x (Log likelihood ratio) =  $\chi$ ). It should be noted that the variables of model 5 are presented in the following section.

**RESULTS AND DISCUSSION**

**Descriptive Results**

Description and sample statistics of the independent variables used in the analysis are reported in Table 1. Some of them are continuous variables (HHL D, AGE and DISM), some are Likert scales (TAST, AVAI and NUTR) and the others are nominal (GEND, URBA, AWAR and INCO).

In the sample, the average household head was 44 years old, with an average family size of 4 members. About 42% of the consumers were males and few of them (47%) resided in the urban areas. Close to 33% of the households have an income of less than R2000 per month. Most

**Table 2: Distribution of WTP for ALVs, Limpopo Province, 2012 (n=299)**

WTP category	Frequency	Percent
Not willing to pay a premium	63	21.1
Willing to pay less than a 5% premium	118	39.5
Willing to pay a 6 to 10% premium	40	13.4
Willing to pay a 11 to 15% premium	25	8.4
Willing to pay more than a 15% premium	53	17.7
Total	299	100

Source: See Table 1

of the consumers (96%) were aware of ALVs; and it takes an average of almost 7 km to reach the ALVs market.

The results also revealed that consumers score ALVs in terms of Taste and Nutrition, on average 3.59 and 4.36, respectively in a scale of 1-5, reflecting the importance of these attributes among the sample consumers. In addition an average low score of 1.86 of ALVs in terms of Availability was scored, which implies that ALVs are not available throughout the year.

Table 2 shows the distribution of WTP for ALVs in the Limpopo Province. According to the WTP sample distribution, most respondents (almost 80 percent) were willing to pay a premium for ALVs. About 53 percent were willing to pay less than a 10% premium, while 18% were willing to pay more than a 15% premium.

**Factors Influencing WTP of ALVs**

Parameter estimates of the Ordered Probit model are presented in Table 3. As mentioned,

**Table 3: Estimates of the Ordered Probit model for households WTP for ALVs, Limpopo Province, 2012**

Variable	Coef.	Std. err.	z	P>z
HHL D	0.054	0.077	0.700	0.483
GEND	0.457**	0.227	2.020	0.044
INCO	0.375	0.269	1.400	0.163
URBA	-1.341***	0.295	-4.540	0.000
AGE	-0.013*	0.007	-1.700	0.089
AWAR	0.765	0.656	1.170	0.244
DISM	-0.308**	0.129	-2.390	0.017
TAST	0.578***	0.128	4.520	0.000
AVAI	0.538***	0.119	4.520	0.000
NUTR	0.119	0.121	0.980	0.328

Observations = 299 Log likelihood = -382.646 Pseudo R-squared = 0.60  
 Note: \*, \*\*, and \*\*\* shows significance at the 10%, 5%, and 1% levels, respectively  
 Source: See Table 1



the Ordered Probit model is non-linear, therefore, the estimated coefficients are not marginal effects. As such, coefficient estimates and marginal effects are discussed separately. The estimated model has a pseudo  $R^2$  of about 0.60. Of the 10 estimated coefficients, six are significant.

The results reveal a significantly positive relationship between being Male and WTP, explaining that male consumers are more likely to pay higher prices for ALVs as compared to females. This could mean that women are not willing to pay higher prices as they are the main producers of leafy vegetables. Moreover, rural women are relatively poor with marginal access to livelihood assets. However, some studies reported the opposite (Haghjou et al. 2013; Ariyawardana et al. 2009; Govindasamy and Italia 1999).

The variable Age had a significantly negative effect on consumers' potential WTP for ALVs. This indicates that age itself is an influencing factor on consumer's tendency to pay a higher price for ALVs. The younger generation is more willing to pay more for ALVs. Some other studies found opposite results (Chelang'a et al. 2013; Cranfield and Magnusson 2003), whereas Boccaletti and Nardella (2000) found no significant effect of age on WTP.

The variable URBA had a significantly negative effect on WTP for ALVs, meaning households in the urban areas are not willing to pay higher prices for ALVs. The reason could be that rural households are more knowledgeable about ALVs as compared to urban households who do not have information and experience about ALVs. Boccaletti and Nardella (2004) did not find any relationship between place of residence and WTP.

The variable DISM has a negative and significant estimated coefficient, indicating that distance to the market has a negative impact on WTP for ALVs. The further the consumer is from the market, the less the likelihood to purchase ALVs. However Nouhoheflin et al. (2004) reported the opposite results. Most ALVs are produced in the rural areas and may not easily be accessible by households in the urban areas.

The empirical results also indicate significant positive relationship between consumers' belief about the desirable taste attributes of ALVs and the WTP premium. The findings concur with Voon et al. (2011) that positive perception towards the tastes of food impacts willingness to purchase. Nouhoheflin (2004) and Owusu and Aniforib (2013) also found the same results. Availability of ALVs throughout the year was found to be a factor in willingness to pay a higher price and it provides an opportunity for promoting local production and a retail chain for ALVs. Acheampong et al. (2012) and Nouhoheflin et al. (2004) found the same results.

All other things equal, a one unit change in the explanatory variable will result in an increase or decrease in the predicted probability equal to the size of the marginal effect (Gunduz and Bayramoglu 2011). Nevertheless, for a binary variable, the marginal effect indicates change in the predicted probability based on whether the respondent falls into the category or not. Finally, the marginal effects show the change in the predicted probability for different classes of WTP regarding a household, concerning the particular variable. The marginal effects of explanatory variables on WTP probabilities are shown in Table 4.

The marginal effects for the GEND dummy variable were negative for the first two classes

**Table 4: Marginal effects after estimation of Ordered Probit model**

	<i>WTP=0</i>	<i>WTP=less than 5%</i>	<i>WTP=6% -10%</i>	<i>WTP=11% -15%</i>	<i>WTP=more than 15%</i>
HHLDD	-0.008	-0.005	0.004	0.003	0.006
GENDE	-0.062	-0.046	0.028	0.024	0.056
INCO	-0.050	-0.039	0.023	0.019	0.046
URBA	0.192	0.110	-0.080	-0.065	-0.158
AGE	0.002	0.001	-0.001	-0.001	-0.002
AWAR	-0.131	-0.027	0.054	0.035	0.070
DISM	0.043	0.029	-0.020	-0.016	-0.036
TAST	-0.080	-0.055	0.037	0.030	0.068
AVAI	-0.074	-0.051	0.035	0.028	0.063
NUTRI	-0.016	-0.011	0.008	0.006	0.014

Source: See Table 1

of WTP, that is, for the “not willing to pay” and “willingness to pay less than 5 percent” premium), whereas it was positive for the next three classes. This indicates male respondents are more likely to pay a premium of six percent or more (relative to female respondents). The marginal effects of URBA were positive for the first two classes of WTP, whereas it was negative for the next three classes. This suggests that residing in urban areas increases the probability of being unwilling to pay a premium and the probability of being willing to pay a modest premium (that is, less than five percent). However, residing in rural areas increases the probability of willingness to pay a premium of six percent or higher.

For the DISM variable, the probability of “WTP between 6-10 percent”, “WTP between 11-15 percent” and “WTP more than 15 percent” premium price decreased, while the probability of the first two mentioned classes of WTP increases. Households closest to the market are more likely to pay higher premiums as compared to those who are further away from the market.

The marginal effect for the variable TAST indicated that households who believe that ALVs are tasty were more likely to be willing to pay higher premium prices. The probability of being willing to pay more than 6% premium increased, while the probability of the first two mentioned classes of WTP declined. In addition, the marginal effects for the variable AVAI attributes belief indicated that households who believe that ALVs are unavailable throughout the year were more likely to be willing to pay a higher premium price. This implies that if ALVs are available throughout the year, most consumers are willing to buy.

### CONCLUSION

This paper has examined consumers' WTP for ALVs in Limpopo Province of South Africa. The socioeconomic and perception factors influencing WTP for ALVs were also identified. Most respondents (almost 80 percent) were willing to pay a premium for ALVs, which is consistent with other similar studies in other regions. This suggests a high potential demand and WTP a premium for ALVs by households in the Limpopo Province. Thus, ALVs might gain a larger market share in Limpopo Province as compared

to exotic leafy vegetables, such as cabbage, swiss chard, and lettuce.

Empirical analysis was used to indicate socio-economic and perception factors that influenced WTP for ALVs in the Limpopo Province. The study showed that differences among ALV consumers emanated from gender of the household-head, the perception that ALVs are tasty and availability of ALVs throughout the year. However, older consumers located in the urban areas far from the ALV market indicated that they are not willing to pay a premium for ALVs.

### RECOMMENDATIONS

Based on the empirical findings, the paper made the following recommendations:

Public awareness through media can help increase demand particularly for the male consumers and urban dwellers, but the paper also identified the need for more work at the supply end of the market chain. Adequate marketing structures such as the wholesale marketing structure should also be put in place. The wholesale marketing structure for vegetables includes linkages between groups of producer-oriented, consumer-oriented, and redistribution markets. This would make the exploration of both local and international markets possible.

Considering consumers' concern about the availability of ALVs throughout the year and its link to their WTP, ALV farming needs governmental support such as financial aid, subsidies, loan provision to the producers to access inputs, and investment in irrigation infrastructure to enable ALV farmers produce throughout the year. Government support to the farmers should emphasize target products and assist their production through national markets.

Rural producers, breeders and policy makers, by making use of this information, would be able to identify ways of developing the rural areas as the major source of the ALVs and ALV products. At the same time, it could promote further development of the ALVs subsector, while encouraging sustainable utilisation for conservation purposes in the Limpopo Province and other provinces with similar production circumstances. Therefore, there is the need to educate households through media programmes about the nutritional benefits of consuming ALV products. Promoting the production and consumption of ALVs also contributes to agrobiodi-

versity conservation, which contributes to sustainable farming.

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