Original Research Article

Consumer Willingness To Pay (WTP) for Pesticide-Free Vegetables in Palakkad District of Kerala

ABSTRACT

Aims: To find the Willingness To Pay (WTP) for pesticide-free vegetables by the consumers of Palakkad district in Kerala and the factors influencing the decision.
Place and Duration of Study: The study was conducted in Palakkad district of Kerala, between March 2022 and December 2022.
Methodology: A sample of 80 consumers spread across the district were randomly selected. The factors influencing the WTP behaviour of the consumers were analysed using a logistic regression model with WTP as the dependent variable and annual income, awareness regarding the presence of pesticide residues, education, food habit, and type of market as exogenous variables.
Results: Out of 80 respondents, 54 of them (67.50 %) expressed their WTP for pesticide-free vegetables. The logit model analysis indicated annual income of the consumers, education level and awareness of the respondents regarding the presence of pesticide residues were significantly influencing the WTP decision.
Conclusion: The positive responses from consumers towards pesticide-free vegetables can be used as a driving force for farmers to produce and market the same in the study area, if they ensure proper marketing focussed on awareness promoting programmes on pesticide residues and by establishing the authenticity of the origin of the produce.

Key words: Willingness To Pay; Consumers; Pesticide-free vegetables; Palakkad; Logistic regression

1. INTRODUCTION

Every study in the field of agriculture that took place in the post-independence era begins with praising the contribution of green revolution to Indian agriculture. The contributions cannot be neglected since it was the backbone of the structural transformation that happened to the agriculture sector in India, which helped the country to attain self-sufficiency in food production. But these prosperities came with a cost, mostly in the form of environmental degradations, accrued through the intensive use of agrochemicals in agriculture. Agrochemicals are a general term used to represent productive inputs to boost up production in agriculture *viz;* chemical fertilizers, pesticides, weedicides and plant growth promoting hormones.

Among the agrochemicals, pesticides hold a prime position in its use. An estimated loss of 18-20 per cent occurs due to arthropod incidences in agriculture world wide, which accounts for US$ 470 billion in monetary terms (Savary *et al*., 2019). The incidences are observed to be higher in Asia and Africa, where a galloping expansion in population is observed, which necessitates the control

of the pests using higher quantities of chemical insecticides. Along with this, global warming is also found to be positively influencing the pest population, with a projected increase in yield loss of food grains by 10-20 per cent per degree of global mean surface warming (Deutsch *et al*., 2018).

Even though the per ha consumption of pesticides in India (0.36 kg) is less than that of other countries (Ecuador-14.03 kg/ha; Hong Kong-13.75 kg/ha; Taiwan-13.35 kg/ha; and China-13.34 kg/ha) (Ritchie *et al*., 2022), wide disparities are observed in its use among different states. In India, a higher portion of pesticides are used in the form of insecticides (51 %) followed by fungicides and bactericides (33 %), and herbicides (16 %) (Nayak and Solanki, 2021). The massive dependence on pesticides to ensure economic yield in commercial cultivation thus leads to externalities outside the production system. The pesticides can contaminate the air, water and the remnants of the same in the produce can enter into the food chain and could lead to serious health issues in consumers (Taylor *et al*., 2002; Sharma *et al*., 2017).

Where as in the modern era of consumerism, consumers are much more conscious and cautious about the foods they are purchasing. This is evident from the increasing demand and wider acceptability of foods marketed with labels such as certified, eco-labelled, organic or pesticide-free. Earlier it was in developed countries, that the demand for such safe foods was higher. At present, increasing trends are observed in developing countries also, owing to the increased awareness and concerns on both consumer safety and environmental safety. Along with this, numerous other factors may also significantly influence the purchasing decision and behaviour of consumers. Numerous studies are conducted under this purview across different countries (Misra *et al*., 1991; Kumara, 1995; Boccaletti, and Nardella, 2000; Vanit-Anunchai and Schmidt, 2004; Coulibaly *et al*., 2011).

The present study tries to examine the factors that influence the Willingness To Pay (WTP) behaviour of consumers and the average amount of WTP per kg of pesticide free vegetables. The extent of awareness and concerns over pesticide use and its resultant impact on health can be used by the producers to formulate new strategies for finding prospective consumers. The extent of WTP can be used by the sellers to market their produce and put prices on them accordingly. And hence this WTP can be a driving force for farmers to reduce the use of pesticides in cultivation, thus reducing its negative impact on the ecosystem.

2. MATERIALS AND METHODS

2.1. The study area and sampling strategy

The study was carried out in Palakkad district of Kerala. Palakkad is the largest district in Kerala and ranks first in terms of the production of vegetables in the state (GOK, 2022). A sample of 80 consumers was randomly selected from various markets across the district. The respondents were personally interviewed using a structured interview schedule and enquired regarding their awareness about the use of pesticides in vegetables and the presence of pesticide residues in the produce, and the amount of money that they were willing to pay for pesticide-free vegetables. The survey was carried out in the month of March of 2022.

2.2. Conceptual framework

Contingent Valuation Method (CVM) is used when there exists no physical market for a product and to estimate the value of such goods. In this stated preference approach, two elicitation methods are followed, namely, WTP and WTA. The former represents the highest amount that a person will spend so that they are indifferent between paying and enjoying the benefits. The latter denotes the lowest amount of money that individuals would take as compensation for losses, leaving them with no preference between receiving payment and enduring the losses.

The current study follows the WTP of consumers for pesticide-free vegetables. Numerous methods are used by the researchers in order to elicit the WTP from the respondents. In the Open Ended (OE) model, the respondents are asked about the amount that they were willing to pay, and the stated amount is taken as their WTP. Another method is the payment card approach. Here possible values of WTP are written on a few cards and the respondents are asked to pick a card which is matching with their WTP or bearing a value nearer to their WTP. The most common form of elicitation is Dichotomous Choice (DC) method. In the single bounded dichotomous choice model, the respondents are presented with a single value, and are invited to either accept or reject the amount. Since it only provides a single bound of WTP, it does not provide the exact value of the same and reveals only a few details on an individual's WTP. Hence a larger sample size will be required to accurately describe the population characteristics (Herriges and Shogren, 1996). While in the Double Bounded Dichotomous Choice (DCBC) model, a follow up bid, which is either higher or lower than the initial bid, based on the response of the first bid is presented. According to Hanemann *et al.* (1991), the DCBC is superior and more efficient than the single bound model asymptotically as well as for finite samples. Thus here DCBC is followed to elicit an error free WTP from the sample respondents.

2.3. The WTP elicitation procedure

WTP of consumers was elicited through the following steps.

1. The respondents were provided with a glimpse of the current status of pesticide use in modern agriculture, studies showing the presence of pesticide residues in the marketed vegetables, the ill effects these residues may create in the consuming individual, and the harmful impact that the overused chemicals may impart on the environment.
2. The respondents were invited to a hypothetical market situation, where the merchants were selling pesticide-free vegetables.
3. The respondents were asked to elucidate their opinion regarding their WTP per kg for pesticide-free vegetables.

The consumers were provided with an initial bid (B_i). If the consumer was ready to pay B_i to purchase a kg of pesticide-free vegetables, they were provided with a higher bid, B_u for the same ($B_u > B_i$). If the respondents were reluctant to pay B_i, a lower bid B_l ($B_l < B_i$) is presented (Khan *et al*., 2019).

The procedure is thus repeated by varying the amount of WTP, until they refused to pay more and the resultant amount was taken as their WTP. If the respondents were not willing to pay any amount in addition per kg of pesticide-free vegetables, their WTP was considered to be zero. Hence the data set ranged between zero and a positive value.

2.4. Empirical model

In order to find the factors influencing the consumer's willingness to pay behaviour, a logistic regression model was fitted. The dependent variable (here WTP) is dichotomous in nature. The variable takes value of 1, if the respondent was ready to pay for pesticide free vegetables, and takes the value zero, if he was reluctant to pay for it.

Hence, in the current study the logistic regression is fitted as follows

$WTP = \beta_0 + \beta_1$ (annual income) + β_2 (awareness of pesticide residues) + β_3 (education) + β_4 (food habit) + β_5 (type of market)

The details regarding the variables used in the logistic regression model is furnished in table 1.

Table 1. Variables used in binary logistic regression

Sl. No.	Variable	Measurement
1	WTP (Dependent variable)	Categorical No = 0, Yes = 1
2	Annual income	Rupees in lakhs
3	Awareness of pesticide residues	Categorical No = 0, Yes= 1
4	Education	Categorical Primary = 1, Secondary = 2, Pre-degree/HSC = 3, Degree/higher = 4
5	Food habit	Categorical Non vegetarian = 0, Vegetarian = 1
6	Type of market	Categorical Conventional markets = 0, Major organized retail outlets = 1

3. RESULTS AND DISCUSSION

The results from the survey are presented in three headings namely, socio-economic status of respondents, awareness regarding pesticide residues, and willingness of consumers to pay for pesticide-free vegetables.

3.1. Socio-economic status of the respondents

The socio-economic status of the consumers is given in table 2. Out of 80 respondents, 47 were male (58.75 %) and 33 were female (41.25 %). Larger proportion of respondents had age between 45 to 60 years (45%) followed by age between 30 to 45 years (28.75%). The mean age of the respondents was found to be 46.17 years. A larger proportion of the interviewed consumers had secondary education (32.5%), followed by degree/higher education (31.25 %). None of the consumers interviewed were illiterate. A high proportion of respondents had annual income between Rs. 2 lakh and 4 lakh. Hence the general socio-economic scrutiny of sample consumers revealed that a majority of consumers are middle aged, having better educational qualification and income level. The socio-economic status of the consumers are summarised in table 2.

Table 2. Socio-economic status of the respondents

Variable	Category	Number	Percentage
Gender	Male	47	58.75 %
	Female	33	41.25 %
Age (years)	< 30 years	12	15.00%
	30-45 years	23	28.75%
	45-60 years	36	45.00%
	> 60 years	9	11.25%
	Mean age (years)	46.17	
Education	Primary	17	21.25%
	Secondary	26	32.50%
	Pre-degree	12	15.00%
	Degree/higher	25	31.25%
Annual income (Rs.)	< 2 lakh	14	17.50%
	2 lakh – 4 lakh	48	60.00%
	> 4 lakh	18	22.50%

3.2. Awareness regarding the presence of pesticide residues in vegetables

Before enquiring about the WTP of the sample consumers, their awareness regarding the pesticide use in vegetables and presence of residues of pesticides in the produce were studied. Table 3 furnishes the statements and responses of sample consumers. It was observed that 97.25 per cent of the respondents were aware of pesticide application in vegetables, and 75 per cent of the respondents were aware of the presence of pesticide residues in the vegetables. Consumer

awareness regarding the presence of pesticide residues was higher among consumers of organized retail outlets (85%) when compared to the consumers of conventional vegetable selling centres (65%). Among the 80 respondents interviewed, 70 per cent of them expressed their concern regarding the health hazards these residues may create in future.

Table 3. Consumer perceptions on pesticide application

Sl.No.	Statement	Yes (Percentage)	No (Percentage)
1	Are you aware of pesticide application in vegetables	97.25	2.25
2	Are you aware that some of vegetables contain pesticide residues which are harmful to human beings	75	25
3	Are you concerned about pesticide residues in vegetables and the negative impact this may create in future?	70	30
4	Do you believe pesticide free vegetables are more environmentally friendly than conventional ones?	81.25	19.75
5	Are you willing to buy organic or pesticide-free vegetables even if the prices are too high considering it is healthy compared to conventional ones	67.50	32.50

3.3. Willingness to Pay for pesticide-free vegetables

Among the 80 consumers interviewed, 54 consumers expressed their willingness to pay for pesticide-free vegetables (67.5 %). In all the markets surveyed, consumers were willing to pay on an average of Rs. 10.93/kg as a premium for pesticide-free vegetables at the retail level. The amount that the consumers were willing to pay ranged from rupees three as the minimum to Rs. 40 as the maximum. Table 4 shows the results of binary logistic regression of the dichotomous WTP. The model has an R^2 value of 0.694, indicating the predictive accuracy of the model to be 69.4 per cent. The log-likelihood ratio of the model was -15.422, indicating the goodness of fit and that it is suitable for the model.

As per table 4, the socio-economic variables, *viz;* annual income and education were significantly influencing the WTP decision. Annual income was positively and significantly influencing the WTP at 5 per cent level of significance, whereas education was positively and significantly influencing the WTP at 1 per cent level. The awareness on presence of pesticide residues was positively influencing the WTP behaviour at 5 per cent level. Where as the food habit of the consumers (whether vegetarian or non-vegetarian) and type of market (whether organized retail outlets or conventional vegetable selling market) had no significant influence on the WTP decision. In other words, consumers who were aware of the presence of pesticide residues in vegetables, having a higher annual income and are well educated were willing to pay premium for the pesticide-free vegetables.

Table 4. Results of binary logistic regression of WTP

Sl. No.	Independent variables	Estimated coefficient	Standard error	*Z* value	*P* > *z*
1	Constant	-13.227	4.589	-2.88	0.004
1	Income (Rs.)	2.494**	1.230	2.03	0.043
2	Awareness of pesticide residues (Dummy, Yes= 1, No = 0)	2.627**	1.088	2.42	0.016
3	Education level (Scores)	3.185***	1.136	2.80	0.005
4	Food habit (Dummy, Vegetarian=0, Non vegetarian =1)	-0.839	1.065	-0.79	0.431
5	Market (Dummy; Major organized retail outlets=1, Conventional markets=0)	.508	0.920	0.55	0.581
6	Log likelihood	-15.414			
7	Pseudo R^2	0.694			
8	Prob > Chi square	0.000			
9	No. of observations	80			

**Significant at 5 per cent level

*** Significant at 1 per cent level

The consumers who expressed their reluctance on WTP were enquired regarding the reason for the same. Majority of them expressed their disagreement with the higher prices charged. According to them, eco-friendly practices costs less than conventional ones, thus the produce should also cost less. Another reason for dissent on WTP was the lack of trust on the produce. A part of the respondents believed that the origin of the produce should be well known to the consumers, then only the price hike will be justifiable. Certification of the produce was welcomed by a few, but the higher price was disagreed by some.

4. CONCLUSION

The study was an attempt to assess the willingness to pay behaviour and awareness regarding pesticide residues among vegetable consumers of Palakkad district in Kerala for pesticide-free vegetables. Along with this, the factors which influence the WTP decision were also evaluated. Out of 80 consumers interviewed, 75 per cent of the respondents were aware of the presence of pesticide residues in the vegetables, and 70 per cent of respondents expressed their concern over

the harmful effect of these on health. 54 of them (67.5 %) responded positively and were willing to pay for pesticide-free vegetables.

A logit model was fitted in order to understand the influence of variables on WTP. Among the variables, education, income, and awareness regarding the presence of pesticide residues were found to be significantly influencing the WTP behaviour of the sample respondents. The amount of WTP ranged between Rs. 3 to 40 per kg of vegetables which implies that the producers have a greater scope for producing and marketing of pesticide-free vegetables, if it is coupled with wider awareness promoting marketing strategies. Along with this, the source of the produce also should be made trustworthy to the consumers. Thus the cost of shifting the production practices and the resultant decrease in yield can be offset by extracting the potential WTP from prospective consumers.

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