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

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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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 the Palakkad district of Kerala, between March 2022 and December 2022.
Methodology: A sample of 80 consumers spread across the district was randomly selected. The factors influencing the WTP behaviour of the consumers were analysed using a logistic regression

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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 the 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 could be used as a driving force for farmers to produce and market the same in the study area if they ensure proper marketing focused on awareness promoting programmes on pesticide residues and by establishing the authenticity of the produce's origin.

Keywords: 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 the green revolution to Indian agriculture. The contributions cannot be neglected since they were the backbone of the structural transformation that happened to the agriculture sector in India, which helped the country attain self-sufficiency in food production. But these prosperities came with a cost, mostly in the form of environmental degradation, 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 [1,2].

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 worldwide, which accounts for US$ 470 billion in monetary terms [3]. The incidences were observed to be higher in Asia and Africa, where a galloping expansion in population was observed, necessitating the control of the pests using higher quantities of chemical insecticides. Along with this, global warming was 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 [4].

Even though the per ha consumption of pesticides in India (0.36 kg) was 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) [5], wide disparities were observed in its use among different states. In India, a higher portion of pesticides were used in the form of insecticides (51 %) followed by fungicides and bactericides (33%), and herbicides (16%) [6]. The massive dependence on pesticides to ensure economic yield in commercial cultivation thus leads to externalities outside the production system. The pesticides could contaminate the air, water and the remnants of the same in the produce could enter into the food chain and could lead to serious health issues in consumers [7,8].

Where as in the modern era of consumerism, consumers were much more conscious and cautious about the foods they were purchasing. This was 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 were 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 were conducted under this purview across different countries [9-13].

The present study aimed 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. Providing vegetables that were not treated with pesticides at reasonable prices and educating consumers about the need to buy them in order to preserve their health and the environment is a priority in our contemporary societies. The extent of WTP could be used by the sellers to market their produce and put prices on it accordingly. And hence, this WTP could be a driving force for farmers to reduce the use of pesticides in cultivation, thus reducing their negative impact on the ecosystem.

2. MATERIALS AND METHODS

2.1 The Study Area and Sampling Strategy

The study was carried out in the Palakkad district of Kerala. Palakkad is the largest district in Kerala and ranks first in terms of the production of vegetables in the state [14]. 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 about their awareness of the use of pesticides in vegetables, 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 2022.

2.2 Conceptual Framework

Contingent Valuation Method (CVM) was 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 were followed, namely, WTP and WTA. The former represents the highest amount that a person would spend so that they were 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 were used by the researchers in order to elicit the WTP from the respondents. In the Open Ended (OE) model, the respondents were asked about the amount that they were willing to pay, and the stated amount was taken as their WTP. Another method was the payment card approach. Here possible values of WTP were written on a few cards and the respondents were asked to pick a card which was 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 were presented with a single value, and were 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 would be required to accurately describe the population characteristics [15]. While in the Double Bounded Dichotomous Choice (DBDC) model, a follow up bid, which was either higher or lower than the initial bid, based on the response of the first bid was presented. According to Hanemann et al. [16], the DBDC is superior and more efficient than the single bound model asymptotically as well as for finite samples. Thus here DBDC was 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 impact 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 ($B_l < B_i$) was presented [17].

The procedure was thus repeated by varying the amount of WTP until they refused to pay more, at which point the resultant amount was taken as their WTP. If the respondents were not willing to pay any amount in addition to the price 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) was dichotomous in nature. The variable took the value of 1, if the respondent was

ready to pay for pesticide-free vegetables, and took the value zero, if he was reluctant to pay for them.

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

WTP = β_0 + β_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.

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 were middle aged, having better educational qualification and income level.

The socio-economic status of the consumers is summarised in Table 2.

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

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 of pesticide use in vegetables and the presence of pesticide residues 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 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 the future.

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 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 Rs. 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. Similar association between annual income and WTP were also observed by Poornima [18], Posri et al [19], Rani et al [20] and Gundala and Singh [21]. Low-income households may not have the sufficient resources to buy organic or pesticide-free produce, so a substantial connection between income and its consumption was not so surprising [22]. Whereas education was positively and significantly influencing the WTP at the 1 per cent level. The results were in conformity with the findings of Coulibaly et al [13], Nandi et al [23] and Rani et al [20]. Whereas a negative relationship between education and WTP decision was observed by Misra et al [9], Govindasamy and Italia [24] and and Boccaletti and Nardella [11]. The positive association obtained in the current study could be due to increased media exposure and reports of health risks, resulting in a better appreciation of the risks and their resultant health outcomes by the consumers with better and higher education levels [19].

The awareness on presence of pesticide residues was positively influencing the WTP behaviour at 5 per cent level. Govindasamy et al [25], Coulibaly et al [13] and Owusu and Anifori [26] also reached at a similar conclusion that the awareness of pesticide residues in vegetables were significantly influencing the WTP decision. The consumers who were aware of the presence of residues could be more concerned about the impact this may create. Whereas 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, had a higher annual income, and were well educated were willing to pay a premium for the pesticide-free vegetables.

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

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

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*

4. CONCLUSION

The study was an attempt to assess the willingness to pay behaviour and awareness regarding pesticide residues among vegetable consumers in the Palakkad district of Kerala for pesticide-free vegetables. Along with this, the factors that 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 the respondents expressed their concern over the harmful effect of these residues on health. 54 of them (67.5%) responded positively and were willing to pay for pesticide-free vegetables.

The influence of variables on WTP was studied by fitting a logit model. 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 and 40 per kg of vegetables, which implies that the producers have a greater scope for producing and marketing 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 production practices and the resultant decrease in yield can be offset by extracting the potential WTP from prospective consumers.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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