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Consumer Willingness to Pay for Pesticides-Free Fruits and Vegetables (A Case Study of Bhaktapur District)

Deepak Ghimire
Lecturer, Department of Economics, Reliance International Academy, Kathmandu
deeghimire58@gmail.com

Kapil Khadka
Department of Economics, The Times International College, Kathmandu
kapilkhadka1985@gmail.com

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Abstract
Since it has been proven that pesticides free products are helpful to prevent several health hazards. The demand for organic products is increasing all over the world. Thus, this study was conducted with the objective of identifying the factors influencing the consumers' willingness to pay for pesticide-free products in Bhaktapur districts of Nepal. 123 data were collected from four municipalities of Bhaktapur district ((Suryabinayak municipality, Madhyapur Thimi municipality, Bhaktapur municipality and Changu Narayan municipality). Logistic regression was applied for the analysis of data. The result of logistic regression reveals that gender, age awareness about the presence of residue in vegetables and awareness about the problem of health from pesticide-free products significantly influence the willingness to pay for pesticide-free fruits and vegetables. Therefore, it is recommended that accessible outlets, reasonable price, and awareness programs on pesticide-free products will encourage local farmers and benefits consumers.
Keywords: Contingent Valuation, Pesticide-free fruits and vegetables, premium price, Willingness to pay

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Introduction

Consumers are aware of food safety risks concerning real or perceived quality threats has undergone a remarkable expansion in organic agriculture (Henson, 1996). Traditional farming, which is still present in high hills and mountains tends to be organic or chemical-free by default due to century-aged production patterns and methods (Gauchanet al., 2020; Bhatta and Doppler, 2011). However, the Use of pesticides is growing very sharply; either naturally or chemically synthesized compounds are used to control a variety of pests. These chemical compounds are used in a variety of sectors like food, forestry, agriculture and aquaculture (Pathak et al., 2022). They include insecticides, herbicides, nematicides, fungicides, molluscicides, rodenticides, plant growth regulators, and other compounds (Zhan et al., 2020; Bhatt et al., 2021a; Zhang et al., 2021).

The pesticide used in Nepal was 0.35 kg/ha, in 2018 (FAOSTAT, 2021). However, a much higher rate (1600 g/ha) is used in commercial vegetable farming at Sarlahi, Kavre, Makwanpur, Dhading and some other districts of Terai region (Panthi , 2018). The import of pesticides was 56 mt. in 1997 to 635 Mt. in 2018 (Prasain, 2023). Globally, total pesticides utilize in agriculture remained stable in 2020 at 2.7 million tons (mt) of active ingredients. The worldwide application of pesticides per area of crop-land is 1.8 kg/ha. On per-capita and per-value of agricultural farming basis, pesticide weight was 0.69 kg/1000 I$ and 0.37 kg/person, respectively. Total pesticide trade reached approximately 7.2 mt of formulated products in 2020, with a value of USD 41.1 billion (FAOSTAT, 2021).

There is an increasing demand for various types of pesticide-free or pesticide-safe agricultural and food products in recent decades (Aswathy& Thomas, 2019). Organic farming is a form of agricultural production practice where chemicals are not used on crops from sowing to storing and reaching the final consumption (Hong, 2018). It is an environment-friendly production method that aims to protect human health and improve bio-diversity and preserve fertility (Behera et. al., 2012); (Koocheki, 2004). Though, conventional agriculture has gained the power of providing food to the majority of the world's population. While pesticides free farming on the other side is environmentally and human-health-friendly farming that avoids the use of such hazardous chemicals which are harmful to humans, plants, animals and the ecosystem. (Khan, & Jan, 2018). Food crops contaminated with pesticides and metal pollutants can be toxic to the human body (Faisal et al., 2019).

Therefore, this paper aims to access consumers' awareness of pesticide-free products, health risks, and diseases caused by pesticides fruits and vegetables. Meantime, the factors influencing consumer willingness to pay premium price for pesticide-free fruits and vegetables.

Literature Review

Khan et al., (2018) analyze factors influencing the consumption decision of pesticide-free fruits (PFF) and estimate the willingness to pay (WTP) price premium for PFF in Pakistan. A contingent valuation survey of 200 households was conducted using face-to-face interviews and payment card methods. Results suggested that 93.5% of respondents were WTP higher prices for PFF. Remarkably, around 35% of respondents were WTP 16–20% higher prices and 24% of respondents were WTP 6–10% higher prices for PFF than the existing conventional price. In addition, ordered logit regression suggested demographic and socio-economic variables such as age, education, income, household size and awareness of health benefits are significantly associated with higher WTP for PFF.

Owusu & Owusu (2013) analyze the willingness of consumers to pay a premium for organic watermelon and lettuce using contingent valuation data from urban Kumasi in Ghana. The determinant's effects of the consumer willingness to pay the premium price are estimated with a bi-variate tobit model. The empirical findings indicate that in addition to socioeconomic characteristics, product freshness and cleanness tend to have positive effects on consumers' willingness to pay premium for organic watermelon compared to conventional watermelon. Whereas product size has a negative influence on consumers' willingness to pay premium for organic lettuce, less insect damage to vegetables tends to have a positive effect. The study estimates the willingness to pay premium for organic watermelon/lettuce compared to conventional watermelon/lettuce. The estimated mean consumers' willingness to pay premium for 1 kilogram of organic watermelon is GH¢0.5554 (US$ 0.4575) and that of organic lettuce is GH¢1.2579 (US$1.0361).

Nandi et al., (2017) investigate consumers' willingness to pay (WTP) for organic fruits and vegetables and relevant factors affecting consumers' WTP. The contingent valuation method was selected to estimate WTP. Empirical data was drawn from a 250-consumer survey conducted in Bangalore. A binomial logistic regression model was applied to obtain the value of WTP and determine the factors influencing it. The results indicated that around 90% of the consumers were willing-to-pay a premium price to acquire better-quality fruits and vegetables. More than 87% of the consumers respond on high prices, less availability, narrow range, and irregular supply are the major barriers for them to buy such products. Furthermore, firms involved in the organic foods business may also see benefits when drawing information to calibrate marketing strategies.

Piyasiri, & Ariyawardana, (2002) identifies the factors influence the additional willingness to pay for organic vegetables. The research was conducted in three supermarkets (Cargills, Dhanasiri and Royal Garden Mall). 30 respondents were randomly selected from each supermarket. Results reveal that most of the consumers are aware of organic products due to their past consumption. Further, the majority of the consumers respond to price as an imperative factor for their organic consumption and suggest supplying products at easily accessible outlets

with quality certification. The results revealed that socio-demographic factors, income level, environmental awareness and education significantly influence the willingness to pay for organic vegetables. Based on the study, consumers' awareness effectively advances the demand for organic products and the high potential to introduce organic products at supermarkets in Kandy.

Haghjou et al., (2013) investigate factors affecting consumers' willingness to pay premium prices for organic food in Tabriz, Iran. Ordered logit regression model was applied to obtain the value of willingness to pay and determine the affecting factors. The survey result illustrates 95 % of the respondents were willing to pay premium price; while 10 % were willing-to-pay more than 35 % premium price. Results revealed the factors such as individual income, family size, environmental concerns and nutritious diet, general criteria of shopping, and consumers' awareness of product features significantly increased consumers' willingness to pay a premium price. Similarly, married respondents and females were willing-to-pay a higher premium. Children younger than 10 years old, elderly, or family members with acute diseases were significantly willing-to-pay a higher premium price. More than 80 % of the consumers mentioned the "absence of certifications and organic labels", "lack of advertisement", and "higher prices" as a barrier in purchasing organic food products.

Sharma, M. & Pudasaini, A. (2021) investigates the factors affecting consumers' potential willingness to pay premium prices for organic food in Nepal. The research applied public opinion analysis based on the conducted surveys and the statistical inference method. The data were analyzed using Pearson's chi-square test which revealed that men were more willing than women to select local organic foods due to their disbelief in conventional foods. This survey shows that 9.55 % of respondents are not willing to pay premium price, whereas 91.45 % are willing- to-pay a certain %age for organic foods. Results revealed that factors like personal disposable income, original product price, consumers' lifestyle, self-congruity, etc. affects consumers' feelings to paying a premium price. Moreover, health consciousness, environmental concerns and food safety awareness increase the willingness to purchase organic foods. However, high prices, irregular supply, and insufficient information on health benefits have negatively influenced consumer's willingness to pay premium price.

Shrestha & Baral (2019) studied the awareness and willingness to pay for organic products and socio-economic factors affecting willingness to pay for organic goods. A total of 200 respondents were selected as the sample population. 85.5 % of respondents have general awareness on organic products, among which 53 % have well better information on organic products and their significance. Out of ten socioeconomic variables, only seven variables were found as a determinant of willingness to pay premium price for organic agricultural products. The result showed that income level and health consciousness are the two important determinants.

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Methodology

Sample section and Questionnaires

To determine the consumer's actual choice to purchase and pay a premium price for pesticides free fruits and vegetables, a sample of 123 fruit and vegetable buyers are randomly selected from 4 municipalities (Suryabinayak, Madhyapur Thimi, Bhaktapur, Changu Narayan) of Bhaktapur district. Data were collected with a formal questionnaire which consists of two sections. First, personal information consists of basic information of the respondent, whereas research-based information consists of awareness on pesticide-free vegetables, problems of health diseases caused by pesticide-free fruits and vegetables, past consumption of pesticide-free fruits or vegetables, pesticides fruits and vegetables led diseases in family members, willingness to pay premium price and premium % that a consumer is willing-to-pay for pesticides free fruits and vegetables.

Theoretical Framework of Contingent Valuation Method

We apply the Contingent Valuation (CV) approach to evaluate the consumers' response in the absence of a real purchasing situation. The CV approach allows a direct estimation of WTP employing different (direct) elicitation techniques (Boccaletti & Moro, 2000). This study is a survey-based method where respondents are directly asked questions regarding how much they would be willing to pay for perceived benefits from goods or services in a hypothetical market (Bhattari, 2019; Nandi et al., 2016).

Empirical Estimation of WTP by using Logit model

Hayati, et. al,(2017) used logit regression model to know the WTP for pesticides free fruits and vegetables. The logit regression model is specified as $Y_i^* = B_0 + \sum_{i=1}^{n} B_i X_i + U_i$ where Y_i^* is willingness to pay for *i*th individual, B_0 is the intercept, X_i is a vector of explanatory regression variables (representing the demographic factors, and Research based questions), B_i is a vector of parameters to be estimated of different X_i and U_i is the zero-mean error term.$Y_i = 1$ When $Y^* > 0$ otherwise $Y_i = 0(X_{ij})$

The probability that $Y = 1$ can be expressed as $P = \frac{1}{1+e^{-(B_0+B_1X)}}$..... equation (1)

The probability that $Y = 0$ can be expressed as $1 - P = \frac{1}{1+exp^{(B_0+B_1x)}}$..... equation (2)

From equation (1) and (2) we get $\left[\frac{p_i}{1-p_i}\right] = exp(B_1 + B_2)$

Taking log on both side the logit model is presented as $log\left[\frac{p_i}{1-p_i}\right] = B_0 + \sum_{j=1}^{n} B_2 X_{ij}$

Now, $Y^* = log\left[\frac{p_i}{1-p_i}\right] = B_0 + B_1X_1 + B_2X_2 + \cdots \ldots B_9X_9$

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Results and Discussion

Demographic Characters of the Respondent

The socioeconomic characteristics of the respondents are presented in the below-mentioned table. Among 123 respondents from various locations of Bhaktapur districts, 64% are male and the remaining 36 % are female. The mean age of respondents is 36.79 with the range from 16 to 70 years and the standard deviation stands at 12.09. The average education of the respondent stands at 2.57 which indicates that the average education of the respondent is between higher secondary level to bachelor level. The average household of the family is 4.87 and the variance is 1.59. The minimum number of household members is 1 and the maximum is 11. Similarly, the average household member with children is 0.50. This means, 50% of respondents have children less than 10 years old. The common health disease (sugar, pressure, uric acid, gastro-intestinal disease etc.) are found to be in 51% of the respondent family members.

Table 1:- Demographic Characteristics

Variable	Mean	Std. Dev	Min	Max
Gender of respondent 1=male, 0=female	0.64	0.48	0	1
Age of respondent	36.79	12.09	70	16
Household size	4.87	1.59	1	11
Household with children (less than 10)	0.50	0.49	0	1
Family members with Disease 0=No 1=Yes	0.51	0.50	0	1
Monthly Income	42642	28359	10000	300000
Monthly fruits & Vegetable expenditure	8608	6645	60000	2000
Permanent address 1=consumer within Kathmandu, 0= otherwise	0.33	0.81	0	1

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Knowledge on current fruits and vegetable available in the market

Q. Do you think the fruits and vegetables found in the market are pesticide-free products?

In response to the question, among total respondents of 123; 86 % of respondents don't believe that the fruits and vegetables found in the market are pesticides free products. Whereas, 7% of respondents believe that the products found in the market were pesticides- free. And, 7% of respondents are unaware of whether the available fruits and vegetables are pesticide-free or not.

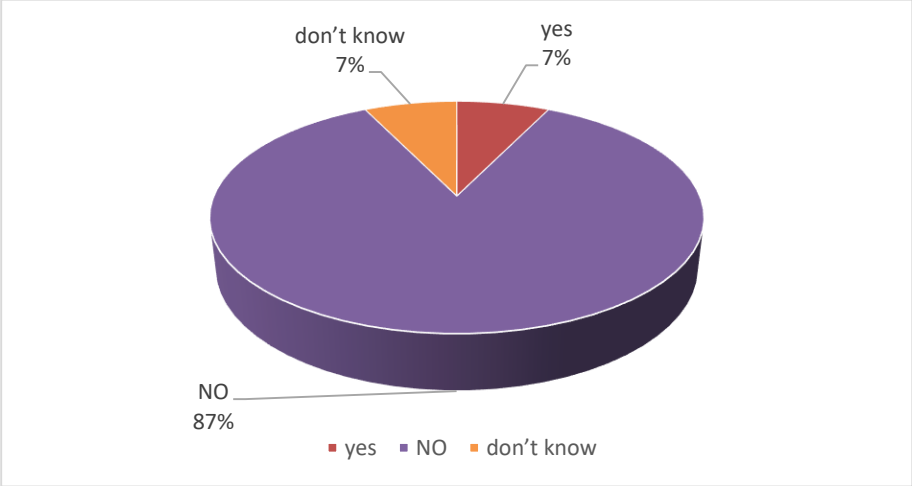

Figure 1 : Knowledge on current fruits and vegetable available in the market

Meantime, respondents were asked another question (i.e. *Do they know any special places where pesticides free fruits and vegetables are produced and sold inside Kathmandu Valley?)*, among the respondents, 26% of respondents know the places where non-pesticides fruits and vegetables are produced or sales. However, 53% believe that pesticides free fruits and vegetables cannot be found in Kathmandu valley. Likewise, 21% believed that pesticides free fruits and vegetables can only be produced in backyard kitchen gardens.

Table 2: Aware of pesticides-free fruits and vegetables availability

Availability of pesticides free product	26%
Non availability of pesticides free product	53%
Pesticides free product can only produced in Kitchen garden	21%

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Awareness about the problem of health diseases caused by pesticides fruits and vegetable

Q. Do you know the problem of health disease caused by pesticides fruits and vegetables?

Among the respondents, 91% are aware of health issues and diseases caused by pesticides used fruits and vegetables. Whereas, 9% are unaware of health issues and diseases caused by such fruits and vegetables.

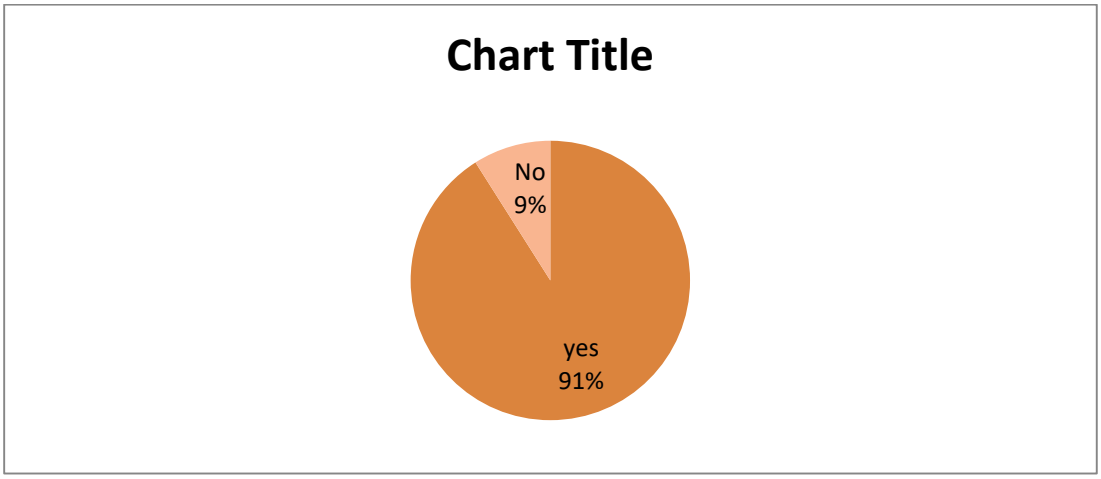

Figure 2: Awareness about the problem of health diseases caused by pesticides fruits and vegetable

Consumer perception about the taste of Pesticides free fruits and vegetables products.

Q. Do you think organic vegetable taste better than pesticide fruits and vegetables?

Among the respondents, 52% respondents believe that pesticide-free vegetable tastes better than pesticide vegetables. In contrary, 21% found no difference on the taste of organic and traditional vegetables. However, 27 % have no experience with taste difference.

Distribution of responses by willingness to pay

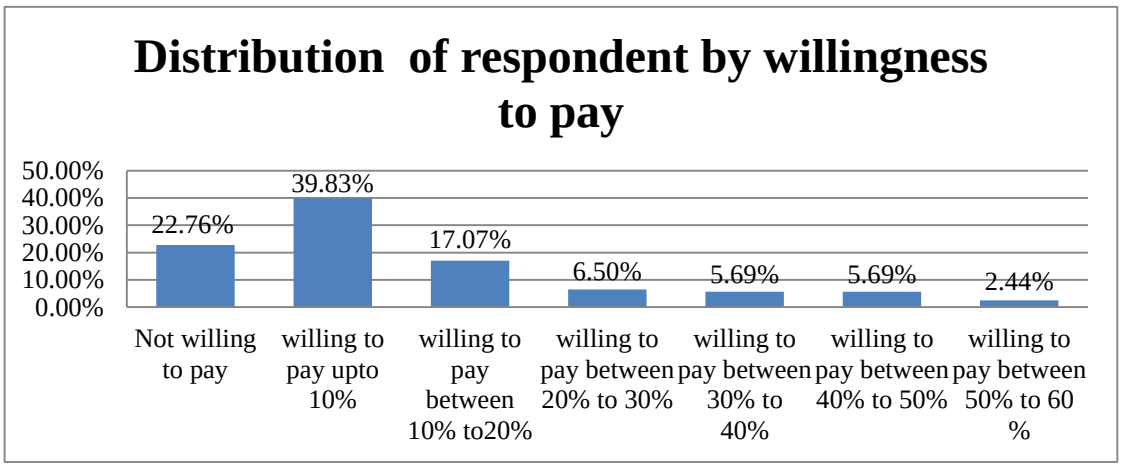

Figure 3: Distribution of responses by willingness to pay

Among the respondents, 22.76 percent are not WTP and the remaining 77.24 percent are WTP. If we categorized WTP then 39.83 percent are willing to pay upto 10percent. 17.07 percent are

willing to pay between 10 to 20 percent. However, WTP between 20 to 30 percent, 30 to 40 percent, 40 to 50 percent and 50 to 60 percent is less than 10 percent.

Result of logistic Regression Result (logit model)

Logistic regression analysis examines the influence of dependent variables (demographic and research-based questions) on WTP. The pseudo-R-Squared is 0.24 which suggests that the overall ability of the model to yield correct predictions is 24% and the p-value is 0.00 which shows that there is significant relation between predictor variables and the response variables. The regression results for WTP are shown in the table below.

Table 3: Result of logistic Regression Result (logit model)

Table:- Result of ordered logit Regression analysis

Variable	Coefficient	Std.Error	Z-Statistic	Probability
Gender	1.32	0.59	2.24	0.02
Age	0.05	0.02	1.96	0.05
Household Size	-0.23	0.19	-1.24	0.22
Children in a family (less than 1o years)	-1.52	0.55	-1.09	0.12
Income of family	1.1e-05	1.3e-0.5	0.88	0.38
Monthly vegetable expenditure	-9.7e-05	6.0e-05	-1.61	0.11
Permanent Address	-0.59	0.55	-1.09	0.28
Family members with special disease	0.42	0.57	1.09	0.27
Taste	0.62	0.57	1.09	0.28
Awareness about present of residue in vegetable	1.78	0.80	2.22	0.03
awareness about the problem of health from pesticides food product	0.81	0.45	1.80	0.07
Previous Suffering	-0.71	0.43	-1.62	0.11
Previous consumption	-0.37	0.49	-0.76	0.45
C	3.51	2.28	1.54	0.12

Gender shows a positive and significant relationship with WTP. The result shows that male respondents are more likely to pay premium for pesticide-free product in comparison to female respondent. The finding is similar to Shrestha & Baral (2019) and opposite to Boccaletti& Nardella (2000), Similarly, age also shows a positive and significant relationship with WTP at a 5% level of significance. This indicates that elder age groups are more likely willing-to-pay

higher price for pesticide-free products than younger age groups. The finding is similar to Nohara, (2022) and Muhammad, Fathelrahman, & Ullah,(2015).

In research-based questions, awareness of pesticide residue in vegetables shows a positive and significant relationship with WTP at a 5% level of significance. This finding is similar to Bhattarai, (2019); khan, (2019); Nouhoheflin, Coulibaly, Cherry; Al-Hassan & Adegbola (2005). Furthermore, awareness about the impact of pesticides used product is positive and significant at 10% level of significance. This show a person who is aware of the health problem caused by pesticides vegetables is likely to pay more for pesticide-free fruits and vegetables. The finding is opposite with Boccaletti, S., & Nardella, M. (2000) which shows there are insignificant relations.

However, household size, no. of children, income level, monthly expenditure on fruit and vegetable, permanent (home) address, family members with special diseases, taste, previous suffering and previous consumption show an insignificant relationship with WTP.

Conclusion

The awareness and demand for pesticides free fruits and vegetables seem increasing around the world due to health risks and diseases. The study proves that a larger number of consumers are willing-to-pay premium price for pesticide-free fruits and vegetables; 86 % of the population doesn't believe that the current fruits and vegetables are pesticide-free products. However, 91 % of the respondents are aware of the health risks and diseases caused by pesticides used in fruits and vegetables. The study also shows that more than 50 % of the respondent's family members are suffering from special types of diseases like sugar, blood pressure, uric acid, cholesterol, gastrointestinal diseases etc. Similarly, 52 % of the respondents believe that pesticides free are tastier than pesticides used in fruits and vegetables. Logit regression results in revels that gender, age, awareness of the presence of pesticide residues, and awareness about the problem of health risks and diseases are influencing factors for WTP. Therefore, it is recommended that accessible outlets, reasonable price and awareness programs on pesticide-free products will encourage local farmers and benefits consumers.

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