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Effecting factors on consumers' willingness to pay a premium for pesticide-free fruit and vegetables in Iran

Abstract

The aim of this study is to investigate factors affecting consumers' willingness to pay premium prices for the pesticide-free fruit and vegetables in Marand city. A Contingent valuation survey of 394 respondents was conducted during 2010. An Ordered Logit regression model was applied to determine factors affecting consumers' willingness to pay for pesticide-free fruit and vegetables. The survey results show that only 3 percent of the respondents would not be willing to pay a premium; while about 64 percent of them would be willing to a premium between 5 and 20 percent and about 33 percent would be willing to pay more than 20 percent premium for pesticide-free fruit and vegetables. Results have revealed that factors like individual's income, environmental and health concerns besides a wholesome diet, safer shopping criteria, moreover consumer's awareness significantly increase their willingness to pay a premium for pesticide-free fruit and vegetables. Results indicate that more than 50 percent of the consumers mentioned "the nonexistence of certifications and labels", "lack of supply" while 20 percent claimed higher prices of these products as their most important problem in their purchasing process of pesticide-free fruit and vegetables. In this regards, farmers' encouragement for producing these products, appropriate advertising, and increasing awareness of consumers are suggested.

Keywords: contingent valuation method, Iran, ordered logit model, price premium, pesticide-free fruit and vegetables

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Abbreviations: CVM, contingent valuation method; PFFV, pesticide-free fruit and vegetables;

Introduction

Among the chemicals used for crop production, pesticides leave undeniable effects on the health of consumers, producers and the environment and they take most concerns between various food contaminants. Pesticides are called to a group of chemicals which destroy or control the population of various pests. Several laboratory and epidemiological studies revealed that direct relationship between pesticides' application and incidence of diseases such as allergies, food poisoning and some types of cancer. Pesticides not only kill soil microorganisms, and leave residues on food products, but they also disrupt the natural ecosystem of the farm and break apart the food chain.[1,2]

An evaluation of pesticides distributed in Iran over the past two decades shows that during the period of 1990-2010 an annual average of 28,038 tons of chemical pesticides distributed and the highest level of pesticides distributed during this period amounted to 53,964 tons in 1993.[3] Also the distribution of pesticides after 2000 always was below the 20-year average; still according to experts it indicates an upper standard dosage.[2] In the province of East Azerbaijan the usage of pesticides presents a growth rate of 16 percent during 2008-2012 periods. Producers lack of knowledge about proper application of pesticides (considering the currency period), and unpleasant taste of food stuffs as a result, concerns consumers in the recent years. Despite these concerns, public awareness of the harmful effects of accumulated toxins absorbed by the body through the chemical residuals in the food products still is low. Since restriction of pesticides and chemical fertilizers are needed to move toward healthier food products, it is necessary to increase consumers and producer's awareness about the effects of chemicals' application in agriculture and on environment due to moving toward production of safer food stuffs.[4]

Nevertheless in Iran there has been no sufficient movement of planning and policy making to produce safer food products. As a result, farmers have been deprived from advantages of higher incomes of selling safer products in the inner and outer markets, besides the society has been deprived from a healthier diet and a better environment. However, due to suitable weather and environmental condition, also abundance of labor force in the country, producing safer food products in Iran is easier and more economic comparing other countries.[4]

Considering this fact that pesticide-free fruit and vegetables (PFFV) has not been produced comprehensively in any part of country and their production is still at a preliminary stage, this study concentrates on preparation for the marketing of these products and it examines consumers' attitude and information towards them. The first step toward addressing and producing such products is identification of the consumers, effective factors on their decision and power of predicting their actions in the market. One of the most striking features of the pesticide-free fruit and vegetables is their price premium comparing the conventional ones. The results from such studies could reveal the reasons of buying such foods by a group of consumers with higher prices and denying them by other group. It also would determine what

kind of characteristic would increase consumer's utility and result in buying such food stuffs and what other features would restrict consumer's willingness[5,6] to pay for such products.

Considering the importance of this subject in recent years, researchers have done several studies in this field and tried to obtain consumers' WTP a premium for safer food products. Some studies have searched consumer's WTP for organic food.[7–15] Some other studies concentrated on consumers' attitude and WTP towards local food product.[16–18] Some researchers investigated about consumers' WTP for pesticide-free fresh products.[19–25]

The results from literature review have shown extended range of effective factors on consumers' WTP for healthier foods. Nevertheless, in all of them, consumers would be willing to pay a premium for these safer food products. The effective factors on consumers WTP a premium for healthier food comparing conventional ones which have been obtained from literature are presented in the Figure 1. It shows that factors like consumers' concerns about food safety in shopping, healthy habits, perception of pesticides' risk on human health and environment, together with their friendly attitudes toward environment and comprehension of PFFV's characteristics, have positive effect on WTP. While high premiums, lack of information about such products and absence of proper certification for them, that erodes consumer's trust, result in consumer's negative attitude towards safer food products. To elicit consumers' WTP most of these studies have used methods like CVM, Choice Experiment or conjoint analysis.

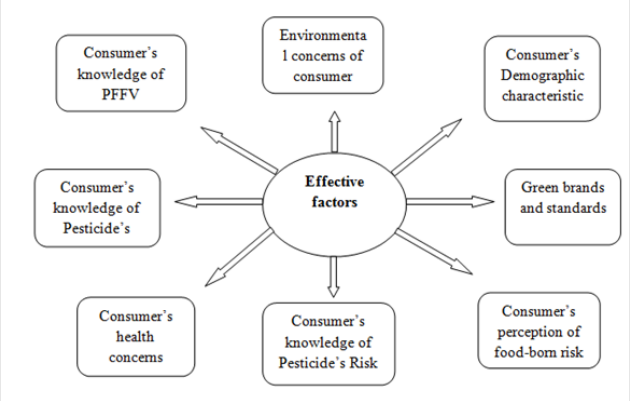

Figure 1 Effective factors on consumer's WTP obtained from literature.

Even though there is no organized market for healthier food products in Iran, but evidences have shown that there is a rising willing among Iranians for such food stuffs.[26–28] Therefore, this study aimed to investigate factors affecting consumer's potential WTP for pesticide-free fruit and vegetables (PFFV) in Marand City of East Azerbaijan Province, which is one of important cities and markets in the area. This study could be an essential marketing study for such food products. To elicit data, a contingent valuation survey was conducted among 394 families of the city.

Materials and methods

Conceptual Framework

Evidence indicates that pesticide-free fruit and vegetables (PFFV) are non-market goods in Iran; since they still do not have proper diffusion system and consumers mostly are not able to distinguish between them from the regular ones. This is because of deprivation of certification procedure and inadequate knowledge of such products. Nevertheless, many consumers look for food safety and are willing to pay higher prices for pesticide free fruit and vegetables, because such products augment their utility levels and reduce health risks, simultaneously. However, they are not able to confirm food safety before purchase. As Boccaletti et al.[22] had reached to the same results for Italy. Different economic approaches are used to evaluate non-market goods. One of them is contingent valuation method (CVM).

Contingent valuation is a survey-based economic technique for the valuation of such goods, which is used to measure aspects like higher health, quality, and taste, or reduced risks in food products. Typically the survey asks how much money people would be willing to pay (or willing to accept) to use of (or be compensated for the loss of) safer food products feature, such as environmental benefits. Indeed, CVM permits a direct estimation of WTP by means of different elicitation techniques.[22] Consumers simply indicate their WTP without purchasing the hypothetical product. The most important part in applying CVM is to choose appropriate survey and elicitation methods to reach the most accurate data. Various survey methods are possible to collection of data. In-person interviews are usually held to produce the highest-quality WTP data, although Telephone and Mail surveys are applied in a number of researches. There are various techniques for eliciting consumers' WTP, such as, dichotomous-choice format. An alternative method is to present a number of possible WTP values on a card to the respondent, called "payment card". Then respondent would choose nearest quantity to his WTP between others written on the card. Since a payment card is simple, and it lightens an unaware respondent's picking options by giving him a range of predesigned price premiums, it is an appropriate approach in these studies.[22] According to previous statements, in this study In-person interviews besides a payment card format were applied to investigate factors effecting consumer's WTP for PFFV.

Regression Model

Because of discrete nature and ordered rank of the dependent variable (namely WTP), an Ordered Logit regression model was applied which is the most appropriate choice regarding these subjects.[29] The model is set up around a latent regression that could be shown as below:

$$Y^* = X'\beta + \varepsilon \quad (1)$$

The aim of model estimation was to measure the impact of the most relevant explanatory factors on consumer WTP a premium for PFFV.

The ultimate model, proposed to explain the dependence of WTP on explanatory variables, is specified below:

$$WTP_i = \beta_0 + \beta_1.INC_i + \beta_2.Age_i + \beta_3.FDIM_i + \beta_4.PFPC_i + \beta_5.PC_i + \beta_6.\text{Health}_i + \beta_7.\text{ENV} + \beta_8.Frisk + \beta_9.Sshop + \beta_{10}.EDU_i + \beta_{11}.Gender_i + \beta_{12}.Matri_i + \beta_{13}.Aged_i + \beta_{14}.Infant_i + \beta_{15}.DSS_i + U_i \quad (2)$$

It should be noted that the interaction terms between variables did not show significant effects and were excluded from further analysis. The Limdep 7.0 econometric software[30] was applied to estimate the regression. Model significance was verified by computing the Chi-square (x^2) statistic, calculated from the restricted and unrestricted log-likelihood function:

$$x^2 = (-2) \times Log - likelihood\ ratio$$

It should be added that model 2's variables are presented in the following section.

Survey Design

In this study, after taking a small pre-test from 50persons, a CV survey was designed and conducted among 394 families of Marand city through some in-person interviews during 2010 in Marand city's families. Survey's main target was to gather data on individual's WTP, besides some relevant explanatory variables, such as: demographic, attitudinal and assessment information about respondents and their household that, from the other similar studies, are believed to influence consumers' purchasing behavior.

In the first section, information was collected on consumers' attitudes. The first question was asked to calculate individual's knowledge of PFFV characteristics (knowledge of PFFV Index), such as: being safer, no agrochemicals threat, better taste, more nutritive value, being in consonance with the environment. The second question tried to elicit consumers' perception of pesticides' risk on human health and environment (PC). In both questions, consumers were asked to evaluate some statements applying a five-level Likert item (Table 1).

Table 1 Variable definition of WTP model for pesticide free fruit and vegetables

Respondent's willingness to pay premium for PFFV	
WTP	0=Not Willing to Pay
	1=Willingness to pay less than 5 percent premium
	2=Willingness to pay 6 to 10 percent premium
	3=Willingness to pay 11 to 15 percent premium
	4=Willingness to pay 16 to 20 percent premium
	5=Willingness to pay more than 20 percent premium
INC	Monthly income of respondent (RLs)
Age	Age of respondent (years)
FDIM	Family dimension (person)
Respondent's knowledge of PFFV Index (Likert scales of 7 speeches)	
PFPC	1=very low
	2=low
	3=average
	4=high
	5=very high
Respondent's knowledge of Pesticides Risk on human and environmental health Index (Likert scales of 9 speeches)	
PC	1=very low
	2=low
	3=average
	4=high
	5=very high
Health index showing consumer's concerns about healthy life and healthy habits (Likert scales of 11 speeches)	
Health	1=Strongly disagree
	2=Disagree
	3=Neither agree nor disagree
	4=Agree
	5=Strongly agree

Respondent's Friendly attitude for environment Index (Likert scales of 5 speeches):

ENV	1=Strongly disagree 2=Disagree 3=Neither agree nor disagree 4=Agree 5=Strongly agree

An index showing consumer's safer shopping criteria in buying fruit and vegetables (Likert scales of 4 speeches)

Sshop	1=Extremely unimportant 2=Unimportant 3=Neither important nor unimportant 4=Important 5=Extremely important

Respondent's food-born risk perception index (Likert scales of 4 speeches)

Frisk	5=very dangerous 4=dangerous 3=undedicated 2=fairly harmless 1=harmless

Education of respondent (Ordinal Variable)

EDU	1=Illiterate 2= Primary School 3= Junior high school 4= Senior high school 5= Associated Diploma (AD) 6= BSc 7=MSc 8=PhD

Gender of respondent (Dummy variable)

Gender	1=Female 0=Male

Matrimony of respondent (Dummy variable)

MATRI	1=Married 0=Single

Seniors in the household (Dummy variable)

Aged	1= Existence 0= Nonexistence

Children younger than 10 years old in the household (Dummy variable)

INFNT	1= Existence 0= Nonexistence

People with special disease in the household (Dummy variable)

DSS	1= Existence 0= Nonexistence

The third question was concerning safety features in shopping. It tried to valuate individual's solicitude about healthy shopping criteria in buying fruit and vegetables such as: having some caries, or not being in the same or too big sizes which show the natural nature of products (which we call: Index of safe shopping). This question was constructed using Likert's scale, which had different items in order to evaluate individual's emphasis about our objective criteria in the matter. Complete way of measuring variables has shown on the Table 1.

The fourth question was about individuals' friendly attitude toward environment (friendly environmental attitude index). The question was consisted of some speeches to measure consumers' friendly attitudes with respect to environment, such as ignoring some utilities for safeguarding it, going for sustainable methods and their tendency for organic farming to save environment.

The fifth question was to evaluate respondents food-born risk perception (food-born risk index). They were asked about four dangerous-called food components: Cholesterol, Fat, Salt and Sugar. The sixth question tried to evaluate respondents' concerns about their personal health in their daily life (health index), like regular exercises, drinking a healthy amount of water, routine check up and etc. This question was Likert scales too, which contained some items to appraise individual's concern about the criteria. Second part of questionnaire was designed to elicit some demographic characteristics of respondents, such as: individuals' age, family dimension, monthly income, education, gender and matrimony. Moreover, respondents were asked if they had seniors, younger than 10-year old, infants or people with special disease in their family. The third part was to determine consumer's WTP a premium for PFFV. Respondents were asked about the price premium they would be willing to pay to use PFFV instead of conventional ones (Table 1). Last part was appraisal evaluation that meant to assess consumers' attitude by getting some extra information about their most important problems in consumption of these products.

Results and discussion

Descriptive results

According to WTP sample distribution, most respondents (97percent) would be willing to pay a premium for pesticide-free fruit and vegetables, whereas 19 percent would be willing to pay a premium between 11 to15, and 33 percent would be willing to pay a price premium higher than 20 percent of the regular prices (Table 2).

Descriptive statistics of independent variables are shown in Table 3. Some of them are scale variables (INC, Age, FDIM), some are ordinal (Indices: Sshop, ENV, PFPC, PC, Frisk, and EDU) and the others are nominal (Gender, MATRI, Aged, INFNT, DSS).

Most of the respondents were males, and married; 25 percent of them had seniors in their family; 45 percent had children younger than 10years old, and 11 percent had people with special disease in their household. The average consumer was 39years old, with an average monthly income of 6020000RLs (about 2000 USD), and 3.8 numbers of family dimension.

Results revealed that the mean of "health ", "safe shopping criteria" and "friendly environmental attitude" indices are 3.7, 3.67 and 3.86 respectively, which have shown their moderate importance among respondents. Results also indicate mediate "knowledge of PFFV" and "perception of pesticides' risk" among sample consumers (with the averages of 3.4 and 3.9 respectively, for the indices). Moreover, consumers had an acceptable perception of food-born risk (with average of 3.8 for the index). Descriptive results also have shown that consumers' mode of education was 4.8 (i.e. Diploma). Finally, the results for two appraisal evaluations (open statements) show that consumers' most important problems in purchasing PFFV were: nonexistence of certification and labels (56 percent), lack of supply (49 percent) and deficiency of advertisement (39 percent).

Inferential results

The ordered logit model assumes that the distance between each category of the outcome is proportional. In practice, violating this assumption may or may not alter the substantive conclusions. According to test whether this is the case, a Brant test[31] had been used to test whether the proportional odds (i.e., parallel lines) assumption holds. The results showed an insignificant test statistic, which provides the evidence of existence of parallel regression assumption. Therefore the ordered logit model had been chosen as final model. After estimation of many regression models, and removal of non-significant variables, the results from the final estimated Ordered-Logit model are presented in Table 4. The Chi-square (x^2) statistics, significant at the 1% level, indicates satisfactory explanatory power of estimated model. The scaled R^2 of about 58 percent indicates overall ability of the model to provide accurate prediction for WTP. From 15 estimated parameters, 8 were significant. Variable EDU did not show a significant relationship with WTP. Age also had not relevant effect on consumers' potential WTP for PFFV.

Positive sign on the INC coefficient indicates that consumers with higher income are more likely to be willing to pay a premium for PFFV. This can be considered a logical conclusion of consumer purchase pattern caused by rise of purchasing power, which is confirmed by similar studies.[11,32,33] Results revealed that consumers with higher care of safe shopping criteria are more likely to pay higher prices for PFFV. Furthermore, those with friendly attitudes with respect to environment and more concerns about their health would be willing to pay higher prices for these products; some other researchers are evidentiary to this.[11,34,35] Table 4 shows that respondents' knowledge of PFFV characteristics and perception of pesticides risk have a significant effect on their higher WTP for these goods.[28,32] Positive sign on the Frisk coefficient indicates that those with higher perception of food-born risks would be willing to pay higher prices for PFFV. Results divulge a significantly positive relationship between having seniors in the family and higher premiums in buying pesticide free fruit and vegetables. We could say those respondents' concerns about their health and friendly attitudes towards environment, as well as perception of pesticides risk are three most important factors affecting their WTP for PFFV.

For non-linear models (this study for example) the impact of a change in particular explanatory variable on WTP, could be described with marginal effects of independent variables. The marginal effects of a specific variable across the six categories must sum to zero. The explanation of the marginal effects for non-binary variables is simple. It means that if all other factors stay fixed, one unit change in the explanatory variable would result in an increase or decrease in the predicted probability equal to the degree of marginal effect.

Nevertheless, for a binary variable the marginal effect explains the change in the predicted probability based on whether the respondent falls into the specific category or not. Briefly the marginal effects indicate the change in the predicted probability for different classes of WTP with respect to an average consumer, for a particular variable. Table 5 shows the marginal effects for all explanatory variables in six WTP classes.

The marginal effects of INC are negative for the first four classes of WTP (i.e. for the "not willing to pay"; "willingness to pay less than 5 percent", "willingness to pay 6 to 10 percent" and "willingness to pay 11 to 15 percent" premium), whereas it is positive for the two next classes. It means that as the income increases, the probability of being "Willing to Pay between 16-20 percent" and "willing to pay more than 20 percent" premium price increases, while the probability of the first four mentioned classes of WTP, declines. Therefore, persons with higher incomes are, in all likelihood, consumers who would pay a higher price for PFFV. The sizes of marginal effects are small for INC variable. It could be because of consumers' assumption of these products; for lower classes of WTP they are considered to be "Luxurious goods", whereas the two higher classes of WTP regard them as "necessary goods". Yet, it should be mentioned that people with higher income, would pay a higher premium for these products.

Table 2 Distribution of WTP responses among households of Marand city

WTP category	Frequency	Proportion
Not Willing to Pay	10	3
Willingness to pay less than 5 percent premium	53	13
Willingness to pay 6 to 10 percent premium	42	11
Willingness to pay 11 to 15 percent premium	74	19
Willingness to pay 16 to 20percent premium	84	21
Willingness to pay more than 20 percent premium	131	33

Table 3 Descriptive statistics of independent variables

Variable name	Mean*	SD	Min	Max
INC	6020000	2355000	700000	30000000
Age	39	10.4	20	70
FDIM	3.8	3.7	1	10
PFPC	3.4	1.2	1	5
PC	3.9	0.88	1	5
Health	3.7	0.85	1	5
ENV	3.86	0.93	1	5
Sshop	3.67	1.04	1	5
Frisk	3.8	0.83	1	5
EDU	4.8	1.39	1	8
Gender	1	0.6	0	1
Matri	1	0.8	0	1
Aged	0	0.4	0	1
Infant	0	0.2	0	1
DSS	0	0.1	0	1

*For the Binary Variables, the Mode of the variable is shown instead of its mean.

The marginal effects of PFPC, PC, SShop, ENV, Health and Frisk, following the same pattern, are positive for the "willingness to pay 16-20 percent" and "willingness to pay more than 20 percent" premium classes of WTP, while they are negative for the four other classes. Meaning as consumers knowledge[36] of PFFV increase, besides if their perception of pesticides risk augments, moreover respondents' attention for healthy shopping criteria increases; also their friendly attitudes toward environment and their concerns about their personal health rise; and finally if persons perception about food-born risks augments, those with WTP more than 15 percent premium, would be willing to pay higher prices PFFV. Also it could be mentioned that people with higher scales for these indices, falls into higher categories of WTP, while people with lower scales of knowledge[36] about PFFV and degraded perception of pesticides' risk indices, those with less friendly attitudes regarding environment, consumers with less concerns about their own health and safer shopping habits, besides respondent with lower concerns about food-born risks, in any case, are consumers who would pay a lower price or wouldn't pay a premium for these products. Finally, the marginal effects for the Aged dummy variable indicate that consumers who have seniors in their

families are more likely to be willing to pay higher premium price for pesticide free fruit and vegetables (i.e. more than 15 percent), and are less likely to be willing to pay no or small premium (i.e. less than 15 percent). It indicates that such consumers are more likely to fall into two high classes of WTP.

Table 4 Result of estimation of ordered logit model

Variable	Estimated coefficient	Standard error	Z-ratio
Constant	-9.90***	0.81	-12.12
INC	0.66*	40101	1.64
PFPC	0.002***	0.0006	3.23
PC	0.26***	0.09	2.93
Health	0.60***	0.21	2.87
ENV	0.81***	0.16	5.18
Sshop	1.25***	0.18	7.3
Frisk	0.42**	0.19	2.27
Aged	0.61**	0.32	1.92

Log likelihood: -329.01, $R_s^2 = 0.58$, χ^2 :611.8***

***: P<0.01, **: P<0.05, *: P<0.1, ns: non-significant.

Table 5 Marginal effects from the estimated ordered logit model

Variable	WTP=0	WTP<5	6≤WTP≤10	11≤WTP≤15	16≤WTP≤20	WTP≥20
INC	0	0	0	-0.0001	0.0001	0
PFPC	0	-0.003	-0.0046	-0.097	0.11	0.038
PC	0	-0.002	-0.042	-0.09	0.1	0.035
Health	0	-0.007	-0.114	-0.24	0.267	0.094
ENV	0	-0.004	-0.069	-0.145	0.161	0.057
Sshop	0	-0.004	-0.063	-0.132	0.147	0.052
Frisk	0	-0.004	-0.067	-0. 141	0.157	0.055
Aged	0	-0.003	-0.045	-0.123	0.12	0.051

Conclusion

The descriptive results revealed that 97 percent of respondents would be willing to pay a premium for pesticide free fruit and vegetables, besides 51 percent would be willing to pay between 6 to 20 percent more than the regular prices; while 33 percent declared to be willing to pay more than 20 percent premium price for PFFV comparing conventional ones. Most of the respondents (56 percent) declared "nonexistence of certification", and almost half of them claimed "lack of supply" as their most important problems in purchase of PFFV. Also deficiency of advertisement is another important problem mentioned by consumers. This indicates a potent national market for PFFV. Regarding these results, also region's potentials for organic and safer cultivation, also the regression model's results, some of following suggestion are presented.

Just like the other new technologies, farming without pesticides needs governmental assist such as financial aids, green subsides and giving loans to the producers. Moreover official helps to the farmers must be concentrated to targeted products, and helping these crops through national markets. Besides trying to make proper standards and labels for these goods, could be another step in this issue. Considering consumers' concern about food-born risks (such as sugar and salt), and its meaningful link to their WTP, making an appropriate packing system which contains material analysis, and setting a proper advertisement system with respect to PFFV, could be suggested. Moreover, holding programs in all of educational ranks for all age groups, and trying to augment society's awareness towards safer food (such as PFFV) characteristics can be of use in culture domination for consumption of safer food products in the society. Since such food products, normally have a price premium, governmental helps to extend the consumption section such as subsides which in these case have positive external effect on society's health could be suggested. Also, making a proper marketing system for safer products to reduce marketing margins would help consumers to reach these products with mild prices, and broad the consumption level of such stuffs.

Finally since this study shows a significant link between consumers' environmental tendencies and also their knowledge of PFFV and pesticides' risks, assisting NGO's formation concerning environment,

organic agriculture, sustainable development, and related subjects, along with encouraging them to do activities for develop society's awareness of organic agriculture's advantages, also disadvantages of conventional planting system, could be suggested. Because the philosophy and nature of such organizations is to raise these kinds of information in the society or do activities like that. Along with them, governmental activities, like relevant TV programs, or advertisement billboards in appropriate sites or distributing awareness brochures in public areas to increase society's knowledge and awareness could be another useful step in culture building of safer consumption habits.

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Conflict of interest

The author declares no conflict of interest.

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