



Research in

AGRICULTURE, LIVESTOCK and FISHERIES

ISSN : P-2409-0603, E-2409-9325

An Open Access Peer-Reviewed International Journal

Article Code: 435/2024/RALF
Article Type: Research Article

Res. Agric. Livest. Fish.
Vol. 11, No. 1, April 2024: 25-33.

CONSUMER AWARENESS AND PERCEPTIONS OF PESTICIDE RESIDUES IN VEGETABLES IN BANGLADESH

Md. Akhtarul Alam*

Department of Agricultural and Applied Statistics, Faculty of Agricultural Economics and Rural Sociology, Bangladesh Agricultural University, Mymensingh-2202, Bangladesh.

*Corresponding author: Md. Akhtarul Alam; E-mail: akhtarbau@gmail.com

ARTICLE INFO

Received
03 April, 2024
Revised
27 April, 2024
Accepted
28 April, 2024
Online
May, 2024

Key words:

Awareness
Perceptions
Pesticide
Residues
Vegetables

ABSTRACT

Vegetables are heavily sprayed and prone to retaining residues. The Department of Agriculture Extension (DAE), Bangladesh has set up some projects to disseminate technologies among the farmers to reduce pesticide residues. Farmers are motivated to produce pesticide-free vegetables using vermin compost and other organic fertilizers. The study investigates consumers' awareness and perceptions of pesticide residues in vegetables. A survey was conducted at the local market in Mymensingh, Gazipur, and Dhaka city. In total, 200 sample respondents were collected. Data were analyzed using descriptive methods. There was a substantial heterogeneity in preferences across consumers. The consumers were aware of the health risks associated with vegetables produced using pesticides and chemical fertilizers. More than 60 percent of respondents thought that vegetables are usually contaminated at the farm or production level using excessive pesticides. Most of the consumers knew the effects of pesticide-borne health risks and suggested to ban some pesticides and monitoring the use of others. Consumers considered pesticide residue-free vegetables as being safer, healthy, no harmful effects, better taste, more nutritive value, and good for the environment, and would like to pay a premium for those products. Media particularly television and newspapers can play an important role in creating awareness about food safety among the producers and consumers. Government programmes on food safety should be channeled through television and newspapers where the majority of the people get their information. Policy measures should include creating awareness concerning the relevance of production, and consumption through effective marketing strategies and educational awareness.

To cite this article: Alam M. A., 2024. Consumer awareness and perceptions of pesticide residues in vegetables in Bangladesh. Res. Agric. Livest. Fish. 11(1): 25-33.

DOI: <https://doi.org/10.3329/ralf.v11i1.72975>



Copy right © 2024. The Authors. Published by: Agro Aid Foundation

This is an open access article licensed under the terms of the Creative Commons Attribution 4.0 International License



www.agroaid-bd.org/ralf, E-mail: editor.ralf@gmail.com

INTRODUCTION

In Bangladesh, vegetables are considered as high-value crops and over a decade the production has increased more than doubled, which making the country one of the fastest-growing producers in the world (Ahmad, 2017). About 142 types of home-grown and exotic vegetables are grown in Bangladesh with the output reaching 14.34 million tons from 0.8 million hectares of land in 2016–2017 (Ahmad, 2017). Vegetables are rich sources of essential vitamins such as A, C, riboflavin, and minerals such as calcium and iron, and also contributes to the intake of essential nutrients from other foods by making them more delicious (Rahman et al. 2020). The average per capita daily vegetable intake is 167.30 gram per day (HIES, 2016), which is below the recommended intake 250 gram per day by FAO.

In Bangladesh, farmers have been producing vegetables by following the traditional cultivation methods using unwise chemical fertilizers and pesticides to protect plants, buds and crops from harmful pests and increase the production. Vegetables are particularly heavily sprayed and prone to retaining residue. Most of the farmers use insecticides, herbicides, fungicides, acaricides and rodenticides in the vegetable field in the form of granules, liquid and powder. The use of pesticides has rapidly increased to 37187 metric tons in 2018 from 15632 metric tons in 2000 (BBS, 2018). About 90 percent farmers used pesticides unnecessarily, indiscriminately and excessively due to lack of knowledge and awareness of proper pesticides uses (Miah et al. 2014). However, heavy pesticide usage has created several problems such as farmer ill health, pesticide contamination of water and soil, and pesticide residue in food products has emerged food safety issue (Posri et al, 2006). Excessive use of pesticide can cause a variety of human health problems for both farmers and consumers. Most of the health impacts from chronic exposure are cancers, reproductive and endocrine disruption, neurological damage, and immune system dysfunction (Miah et al. 2014; Sanborn M et al. 2004). In addition, consumers are affected by various types of food-borne diseases associated with pesticide contamination. Vegetables such as tomatoes, country beans, cabbage, cauliflower and cucumber may receive higher doses of pesticides (Ali et al. 2002; Miah et al. 2014). As a consequence, pesticide residues remain in the vegetables though not reported how much active material could be existed in vegetables even after they are washed and cooked (Kabir et al. 2008; Miah et al. 2014). Moreover, most of the chronic diseases e.g., cancer, heart attack etc. are the result of long-term consumption of pesticide contaminated foods. Therefore, quality food, water and environment should be given the necessary attention to ensure healthy life style and also to achieve the Sustainable Development Goals (SDGs) (Hawkes and Ruel, 2006).

Therefore, a range of public and private sector scheme have emerged in response to increase consumers and producers concerns about food safety. The Department of Agriculture Extension (DAE), Ministry of Agriculture, Bangladesh has set up some project to disseminate technologies among the producers to reduce pesticide residues in vegetables. A Grassroots Technical Cooperation Project named “SENSE (Support to establish a new society of BOP farmers by using the power of ICT)” by using power of ICT funded by the Japan International Cooperation Agency (JICA) was implemented in five districts namely Chandpur, Gazipur, Jessore, Tangail and Narshingdi during 2014 to 2017 aimed to generating income of farmers by producing chemical free vegetables (Ahmed et al. 2017). Hence, number of farmers are motivated to cultivate pesticide free vegetables using vermin-compost and other organic fertilizers. Despite the importance of this growing food production method and markets, there is little information about consumer awareness and preferences for those pesticide free products. However, previous studies have found that consumers in different countries have preferred and willingness-to-pay (WTP) for pesticide free fresh vegetables and fruits (Bayramoglu and Goktolga, 2009; C. Bernard and J. Bernard, 2010; Posri et al. 2006; Owusu and Anifori, 2013; Shafie and Rennie, 2012; Sriwaranun et al. 2013). Therefore, the study is an attempt to investigate consumers’ awareness and perceptions of pesticide residues in vegetables.

METHODOLOGY

Sample and Data

A survey was conducted in the vegetable market. Data were collected using a questionnaire through direct personal interview method. Prior to conducting the survey, a focus group discussion was conducted with consumers, farmers and extension workers, to collect information, opinions and suggestions about the pesticide residues. The questionnaire included the socio-economic characteristics, household consumption pattern, consumer awareness, attitudes and preferences for pesticide residues in vegetables.

The study was conducted in the pre-urban and urban area of three cities namely Dhaka, Gazipur and Mymensingh in Bangladesh. Dhaka is the capital city of Bangladesh and represent a heterogeneous group of people from different religions and socio-economic conditions regarding their income and food consumption behavior. Gazipur is also a Metropolitan city near to Dhaka and heterogeneous group of people live in the city. Mymensingh is a medium sized divisional city in Bangladesh. In total, 200 household respondents were interviewed for the study. The overall sample is representative based on age and household size, while national average household size is 4.06 (HIES, 2016).

Analytical Method

The data collected from the survey were scrutinized, classified, edited and cleaned. The responses of the respondents that recorded in the questionnaire were transferred into a Microsoft excel sheet for further analysis. Descriptive methods were applied to evaluate the consumer awareness and perceptions. Descriptive technique is a well-known and widely used technique to show the results because it is simple, convenient and very easy to understand. Various descriptive statistical measures (i.e., sum, average, percentages, ratios, standard deviation etc.) were employed to examine the objectives. Socioeconomic characteristics of the respondent consumers, food consumption and vegetables consumption behavior, consumer perceptions, knowledge and awareness were measured. The data were analyzed using STATA software.

RESULTS AND DISCUSSION

Socio-economic and demographic characteristics of the respondents

Table 1. Socio-economic and demographic characteristics of the sample respondents

Variable	Definition	Parentage (%)	Mean	Std. deviation
Age	Age of participants (years)		39.28	11.75
Gender	Male	87		
	Female	13		
Education	Primary/elementary	38	7.65	4.86
	Secondary	43		
	Higher secondary	5		
	College/University	14		
Occupation	Govt. Service	9		
	Private Service	27		
	Business	37		
	Full time paid workers	5		
	Other	21		
Monthly income	0.000- 20000 BDT	33.50	28860	17619.88
	20000-50000 BDT	52.50		
	>50000 BDT	14.00		
Monthly expenditure			19213	9379.47
Monthly expenditure on food			9350	4086.99
Monthly expenditure on non-food			9396	6263
Household member			4.25	2.02

BDT means currency in Bangladesh

Table 1 represents the demographic and socio-economic characteristics of the respondent consumers. The respondent age ranged from 20 to 70 years, with an average of 39 years. About 87 percent of the respondents were male and 13 percent were female. The average level of education was 7.65 years of which 43 percent have secondary level of education. The average monthly household income was BDT 28860. About 53 percent respondents were the average monthly income with ranged from BDT 20000 to 50000, and 14 percent were more than BDT 50000. Average monthly household expenditure on food consumption was BDT 9350, which is about 49 percent of their monthly household expenditure. Average number of household member was 4.25 person. About 39 percent of the households have children less than five years, and 30 percent households have more 60 years old family member.

Occupation is an important socio-economic variable which has significant impact on an individual's awareness and perceptions. The result shows that a greater proportion of the respondents (96%) interviewed were employed (Figure 1). About 37 percent respondents were engaged in business and 27 percent were in private job, and rest of them were involved government service, full time paid worker and others (Table 1). This implies, most of the households have constant source of monthly income and hence, they have the possibility to offer higher premiums for safe food products particularly for pesticide free vegetable products.

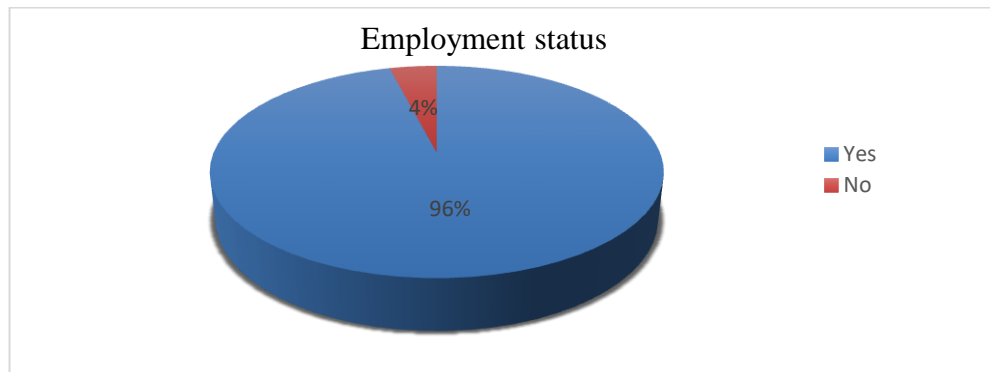


Figure 1. Employment status of the respondents

Consumer awareness and perceptions for food safety and vegetables contamination

Consumer awareness about the possible presence of pesticide and chemical residues, and associated health risks in vegetables is important for reducing the exposure (Ssemugabo et al. 2023).

Table 2. Consumer awareness on vegetable/vegetables safety issues

Statement	Options	Frequency	Percentage (%)
Have you heard about diseases caused by contaminated vegetables?	Yes	95	47.50
	No	105	52.50
Where/how did you hear about it?	Radio	2	2.11
	Newspapers	7	7.37
	Television	71	74.74
	Through friends/family members	15	15.79

The result shows that most of the consumers were very much aware for the health concerns caused by contaminated vegetables sold in the market. Consumers were also asked as to whether they heard/knew about diseases caused by vegetables, about 48 percent of consumers responded positively while rest of the respondents answered negatively. The finding is similar with the study conducted by Yahaya (2011) in Ghana, who found that, consumers were concerned with food safety as their WTP was affected by food safety concerns. Consumers were also asked how they heard or read about the diseases caused by contaminated vegetables, and the responses were through the radio, television, newspapers, through friends and family members. The results reveal that 74 percent of consumers' who responded positively that they heard it through the television, while 15.79 percent said that they heard about the diseases through friends and family. This implies that the electronic media particularly television has great importance to create awareness about food safety issues among the consumers. Therefore, most of the educational and sensitization programmes by mandated government institutions on food safety and the need for additional premiums (WTP) to obtain pesticide free products should be channeled through television, form where a large percentage of people gets their information.

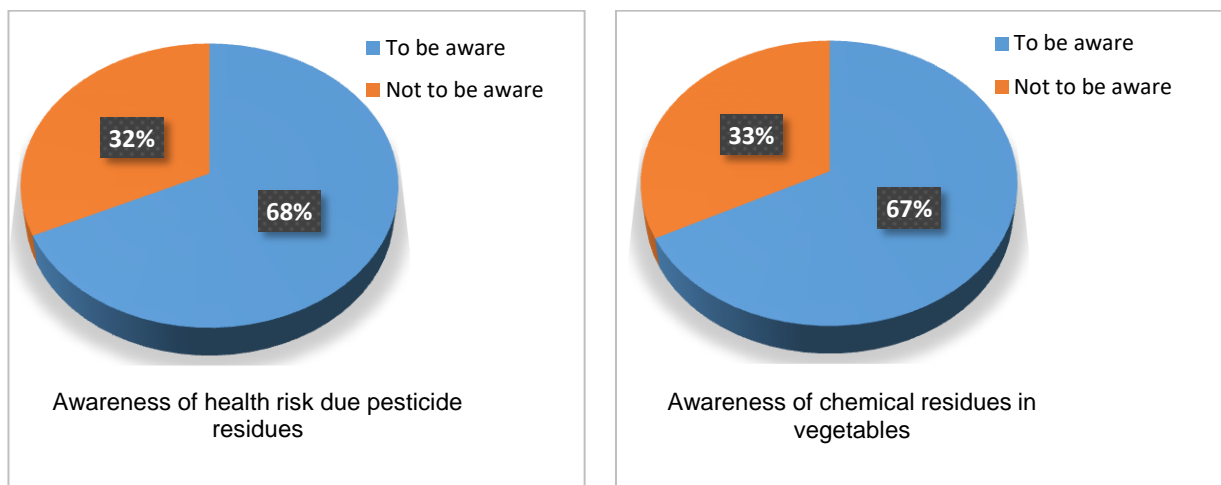


Figure 2. Consumer awareness on residual effect of pesticide and chemicals used in vegetables

The consumers were also asked for their responses on awareness for residues of pesticide and chemicals. About 68 percent consumers responded that they were conscious of health risk due to pesticides residuals, and 67.50 percent consumers answered that they were conscious about health risk due to residues of chemical in vegetables (Figure 2). This implying that majority of the consumers are aware about the residual effects of pesticide and chemical used in the vegetable production process.

Table 3. Perceptions on contamination of vegetables in food chain

Statement	Options	Frequency	%
In vegetable food chain where do you think vegetables get contaminated?	Farm/production level	129	64.50
	During transportation	28	14.00
	At the market level	40	20.00
	Consumer-kitchen level	3	1.50
Causes of contamination	Water used	12	9.30
	Pesticides use	114	88.37
	Poor handling	2	1.55
	Others	1	0.78

It is very important for consumers to know how the vegetables are contaminated, and at what stage in value chain. Therefore, the consumers were asked for their opinion at the stage of the vegetable food chain where they got contaminated. Table 3 shows that about 65 percent respondents thought that vegetables were usually contaminated at farm or production level. About 20 percent of the respondents were of the view that vegetables were contaminated at the market level while 14 percent thought that vegetables were contaminated during transportation. Consumers were also asked about the causes of contamination of vegetables. Most of the consumers' (88%) were opinioned that vegetables were contaminated by using pesticides in production and storage level. Only 9 percent consumers thought that vegetables were contaminated by using polluted water in the field. The results indicating that the consumers attributed the cause of contamination by the water used and the pesticides use at the farm level and indicating the potentialities of pesticides free organic vegetables production.

Consumer perceptions of health risk from pesticide residues and use in vegetables

Consumers were asked whether in their opinion to the use of pesticide in the vegetables can cause health risk. The results show that about 69 percent consumer perceived pesticide residues in vegetables as high risk for human borne diseases, which indicating that consumers are concern about pesticide residues (Table 4).

Table 4. Consumer perception about different source risk for health

Risk sources	No risk (%)	Low risk (%)	Medium risk (%)	High risk (%)
Pesticide residues	1.00	4.50	26.00	68.50
Foods in high cholesterol	3.00	8.50	38.00	50.50
Foods in high fat	4.00	8.50	24.50	63.00
Foods in high salt	11.00	11.50	35.50	42.00
Foods in high sugar	11.00	12.00	25.00	52.00

More than 50 percent respondents perceived that food contains with high cholesterol and high sugar causes high risk for health. Foods contain with high fat also can cause health risk (63 %) and foods in high sugar also causes high health risk (52 %). About 49 percent respondents suggested to ban pesticides whereas around 50 percent suggested to ban some pesticides and monitoring the use of others. This implies that consumers are like to purchase pesticide free vegetables and can offer premium for that. Respondents were also asked on their knowledge of pesticide borne health risk. About 87 percent consumers were known the effect of pesticide borne health risk (Table 5). This indicating that consumers are aware about the residual effect of pesticides used in vegetables and aware of their health when it from the foods they consume, particularly vegetables. This finding is similar to studies conducted by Yahaya 2011 in Ghana who found consumers were concerned with food safety as their WTP was affected by food safety issues.

Table 5. Consumer perceptions about the use of pesticide in vegetables

Statement	Options	Frequency	%
An opinion statement concerning the use of pesticides on vegetables: consumer's suggestion to -	Ban pesticide	98	49.00
	Ban some pesticide and monitoring use of others	99	49.50
	Increase testing and certification	3	1.00
	To do nothing	1	0.50
Knowledge of pesticide borne health risk	One or more effect known	173	86.50
	No information	27	13.50

Consumer perceptions for pesticide residues free vegetables

The study also evaluated consumers knowledge on different characteristics of pesticide free product such as being safer, healthy, no harmful effect, better taste, more nutritive value, and good for environment. The results reveal that the mean score for safe and healthy were 4.57 and 4.45 receptively, whereas others characteristics also more than 3.90, indicating consumers have high level of perception and knowledge about pesticide residues free vegetables (Table 6). This finding is similar in line with the findings of Hayati et al. (2017).

Table 6. Consumer perceptions on pesticide free vegetables

Statement	%					Mean Score*
	Very low	Low	Medium	High	Very high	
Safe	-	2.00	13.00	11.00	74.00	4.57
Healthy	0.50	3.00	14.00	16.00	66.50	4.45
No harmful effect	1.01	4.02	15.08	25.63	54.27	4.28
Tasty	-	8.50	25.00	24.50	42.00	4.00
Nutritive value	1.50	9.50	23.50	23.50	42.00	3.90
Good for environment	0.50	7.50	27.50	22.50	42.00	3.98

*Five-point scale with 5 = very high and 1 = very low

The study was also evaluated consumers perceptions for premium for pesticide free vegetables product. The results show that most of the respondents (91%) would be willing to pay a premium for pesticide free vegetables and only 7 percent were not willing to pay premium.

Table 7. Consumers responses to WTP for pesticide residue free vegetables

WTP	Frequency	%
Not willing pay	14	7.00
Willingness to pay less than 5 percent premium	56	28.00
Willingness to pay more than 6 to10 percent premium	83	41.50
Willingness to pay more than 11 to15 percent premium	28	14.00
Willingness to pay more than 16 to 20 percent premium	13	6.50
Willingness to pay more than 20 percent premium	6	3.00

About 28 percent consumers would be willing to pay a premium less than 5 percent, and 41.50 percent would be willing to pay a price premium between 6 to 10 percent, and 14 percent would be willing to pay a price premium between 11 to 15 percent (Table 7). This implying that consumers are willing to pay less than 10 percent premium for pesticide free vegetable products.

CONCLUSION

This study investigated consumers' preferences, awareness, knowledge and perceptions for pesticide residue free vegetables. The consumers are aware of the health risks associated with the vegetables produced using pesticide and chemical fertilizers. Majority of the consumers were known the effect of pesticide borne health risk and suggested to ban some pesticides and monitoring the use of others. Consumers were considered pesticide residue free product as being safer, healthy, no harmful effect, better taste, more nutritive value, and good for environment, and would like to pay a premium for those products. This is good news for the farmers who are motivated to produce organic vegetables without using pesticides and chemical fertilizers. Policy related to the benefit associated with the vegetables production without pesticides is highly recommended. Governments, different organizations and stakeholders could formulate policies that would promote the consumption of pesticide free vegetables in Bangladesh. Policy measures should include creating awareness concerning the relevance of production, consumption through effective marketing strategies and educational awareness. The results have important marketing implications for vegetable growers, wholesalers, and retailers.

COMPETING INTEREST

The author(s) declared no potential conflicts of interest with respect to the research.

ACKNOWLEDGEMENT

The author gratefully acknowledges the Bangladesh University Grant Commission (UGC) for funding this research project.

REFERENCES

1. Ahmad R, 2017. Vegetables output grows fast. The Daily Star. <https://www.thedailystar.net/frontpage/veg-outputgrows-fast-1343068>. Retrieved 31 May 2019.
2. Ahmed M, Ozaki A, Choudhury D K, Ogata K, Ito S, Miyajima I, Ahmed A, Okayasu T and Al Amin N, 2017. Chemical free vegetable cultivation and outcomes in winter season in Bangladesh: A case study on BOP farmers in five districts. *Journal of the Faculty of Agriculture, Kyushu University*, 62(1): 255–262.
3. Ali S M K, Rahman M M and Hossain A M M M, 2002. Pesticide use and male fertility in Bangladesh, in Ahmed M F. et. al, (Eds), *Bangladesh Environment 2002*, (Bangladesh Paribesh Andolon (BAPA), Vol-1.
4. Bayramoglu, Z. and Goktolga, Z. G. (2009) Consumer Willingness to Pay for Pesticide Free Tomatoes in Turkey. 1st International Symposium on Sustainable Development, June 9-10 2009, Sarajevo.
5. BBS, 2018. Yearbook of Agricultural Statistics. Bangladesh Bureau of Statistics, Dhaka, Bangladesh.
6. Bernard J C and Bernard D J, 2010. Comparing Parts with the Whole: Willingness to Pay for Pesticide-Free, Non-GM, and Organic Potatoes and Sweet Corn. *Journal of Agricultural and Resource Economics*, 35(3): 457-475.
7. Hawkes C and Ruel M, 2006. Understanding the links between agriculture and health. Washington, DC: International Food Policy Research Institute. Available from: <http://www.ifpri.org/2020/focus/focus13/focus13.pdf>
8. Hayati, B., Haghjou, M. and Pishbahar, E. (2017) Effecting factors on consumers' willingness to pay a premium for pesticide-free fruit and vegetables in Iran. *MOJ Food Process Technol*, 4(5): 137–145.
9. HIES (2016) Household Income and Expenditure Survey. Bangladesh Bureau of Statistics, Dhaka, Bangladesh.
10. Kabir KH, Rahman M A, Ahmed M S, Prodhan M D H and Akon M W, 2008. Pesticide analytical research at BARI related to quality, residue and maximum residue limit, in Chowdhury, MKA et al. (Eds), *Proceedings of Workshop on Maximum Residue Limits of Pesticides in Agricultural Commodities and Food in Bangladesh*, Bangladesh Agricultural
11. Miah S J Hoque A, Paul D A and Rahman D A, 2014. Unsafe Use of Pesticide and Its Impact on Health of Farmers: A Case Study in Burichong Upazila, Bangladesh. *IOSR Journal of Environmental Science, Toxicology and Food Technology*, 8(1): 57–67.
12. Owusu V and Aniforib M O, 2013. Consumer Willingness to Pay a Premium for Organic Fruit and Vegetable in Ghana. *International Food and Agribusiness Management Review*, 16(1): 67-86.
13. Posri W, Shankar B and Chadbunchachai S, 2006. Consumer Attitudes Towards and Willingness to Pay for Pesticide Residue Limit Compliant “Safe” Vegetables in Northeast Thailand. Doi:10.1300/J047v19n01_05.
14. Rahman M M, Zhou D, Barua S, Farid M S and Tahira K T, 2020. Challenges of value chain actors for vegetable production and marketing in North-East Bangladesh. *GeoJournal*, <https://doi.org/10.1007/s10708-020-10170-y>
15. Sanborn M, Cole D, Sanin LH and Bassil K L, 2004. Systematic Review of Pesticide Human Health Effects, Toronto: Ontario College of Family Physicians Toronto, 2004. Available from: https://www.researchgate.net/publication/277291279_Systematic_Review_of_Pesticide_Human_Health_Effects.

16. Ssemugabo C, Bradman A, Ssempebwa J C and Guwatudde D, 2023. Consumer Awareness and Health Risk Perceptions of Pesticide Residues in Fruits and Vegetables in Kampala Metropolitan Area in Uganda. *Environmental Health Insights*, 17: 1-8.
17. Shafiea F A and Rennie D, 2012. Consumer Perceptions towards Organic Food. *Procedia - Social and Behavioral Sciences*, 49: 360 – 367.
18. Sriwaranun Y, C Gan, C Lee, M and Cohen D, 2013. Consumers' willingness to pay for organic products in Thailand. *Faculty of Commerce Working Paper no.4*, ISBN: 978-0-86476-326-6.
19. Yahaya I, 2011. *Measuring Consumers' Willingness to Pay for Safer Vegetables in Urban and Peri-Urban Ghana*. MSc. Dissertation, Department of Agricultural Economics, Agribusiness and Extension, Kwame Nkrumah University.
20. Yahaya I, Yamoah FA and Adams F, 2015. Consumer motivation and willingness to pay for "safer" vegetables in Ghana. *British Food Journal*, 117(3): 1043-1065