

GARDENERS' ATTITUDES AND SAFETY BEHAVIORS REGARDING AGRICULTURAL PESTICIDES

By

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Abstract

Introduction: Gardening and agriculture in Egypt relies extensively on pesticides to enhance crop yield and quality. However, little is known about the attitudes and behaviors of Egyptian gardeners towards agricultural pesticides. **Aim of Work:** To assess the knowledge and awareness of gardeners about the hazards of pesticide use and explore their attitudes and safety behaviors towards pesticide. **Materials and Methods:** A cross-sectional survey has been done through convenience sample of 48 gardeners from Cairo and Giza governorates in Egypt. Data was collected using a structured questionnaire consisting of four sections: demographic information, any present complaints (as skin irritation, chest pain, nausea.... etc), knowledge and awareness of pesticide hazards, attitudes towards pesticide use, and safety practices when applying pesticides. **Results:** The majority of gardeners had above primary school education and was married. Prevalence of pesticides use among gardeners was 93.8%, with 75% of them purchased pesticides from private retailers and only 45.8% of gardeners had received previous training on pesticides application. Regarding attitudes towards pesticide use, 56.3 % of gardeners relied on their experience when selecting active ingredients and only 75% of them read and followed instructions on pesticide containers. While 68.8 % of gardeners chose the right time and weather for pesticide application, just 56.3 % could discriminate forbidden pesticides. Regarding perceived risks, a significant proportion of gardeners did not associate pesticide use with environmental problems or human illnesses. Common health effects reported by gardeners included skin irritation, chest pain, and nausea. Safety behaviors detected showed that 54.2 % of gardeners didn't use proper personal protective equipment during pesticide spraying and 75 % didn't store or dispose empty containers appropriately. **Conclusion and Recommendations:** The present study highlights knowledge gaps, attitudes, and unsafe behaviors among Egyptian gardeners regarding pesticide use. Findings suggest a need for targeted education and training programs to enhance awareness of pesticide hazards and promote safe practices among gardeners in Egypt **Keywords:** Gardeners, Attitudes, Safety, Agricultural, Pesticides and Egypt

Introduction

Egyptian agriculture has been growing over the years and directly employs about 24 million persons. According to the Food and Agriculture Organization of the United Nations, Egypt is the largest consumer of pesticides in Africa, using over 40,000 tons of pesticides annually (FAO, 2021).

Gardening in Egypt is a broad occupation that involves a wide range of tasks in community parks, private and commercial properties. They confront wide variety of chemical hazards as they rely heavily on pesticides, which raise concerns about the potential negative impacts on human health and the environment (Abdel-Shafy and Mansour, 2016).

Studies have shown that pesticide use can lead to acute and chronic health effects on farmers' health as skin irritation, blurred vision, headache, cancer, neurological and reproductive disorders (Pathak et al., 2022; Pedroso et al., 2022 and WHO and FAO, 2023). Moreover, pesticide use can contaminate soil, water, and air, leading to environmental pollution and posing a significant threat to public health (Rad et al., 2022 and

European Environmental Agency, 2023).

Attitudes and behaviors of gardeners towards pesticide use have been explored in previous studies that pesticide use were dependent on several factors such as age, education, income and training (Imane et al., 2021; MUYESAIER et al., 2021; Sabran and Abas, 2021 and Mastewal et al., 2022). For instance, previous studies reported that farmers who had lower levels of education and income were less likely to use personal protective equipment (PPE) when applying pesticides. Moreover, farmers who never received any training on pesticide use were more likely to use pesticides inappropriately (Sapbamrer and Thammachai, 2020 and Migheli, 2021).

Similar to other developing countries, the pesticide sector is very poorly regulated in Egypt; in 2018, manufacturers of pesticides in the European Union export 82,000 tons of banned pesticides with over half of them would go to developing countries including Egypt (European Union, 2021).

Despite regulations of restricting banned pesticides by The Egyptian

Agricultural Pesticide Committee, about 20% of pesticides circulated in the Egyptian market are thought to be illegal through private sector that raise the importance of enhancing Egyptian gardeners' ability to discriminate and safely handle pesticides (Agricultural Pesticide Committee, 2017). However, little is known about the attitudes and behaviors of Egyptian gardeners towards agricultural pesticides.

Aim of Work

To assess the knowledge and awareness of gardeners about the hazards of pesticide use and explore their attitudes and safety behaviors towards pesticide.

Materials and Methods

Study design: This study was a cross-sectional survey.

Place and duration of the study: data was collected from gardeners in Cairo and Giza governorates, Egypt during the duration from April to June 2023.

Study Sample and Sampling method: Using PASS 15 Program for sample size calculation, setting confidence interval at 95% and margin of error at 10%, it is estimated that sample size is at least 45 gardeners

was needed to detect an expected prevalence of positive attitude among gardeners toward safe pesticide use of about 87.1% (Tariku et al., 2022). The study used a convenience sampling method to select gardeners who were willing to participate in the study.

Study Methods:

-Data collection and Survey instrument: The study used a structured questionnaire to collect data from the participants. The questionnaire consisted of four sections: (1) demographic information and personal complaints, (2) knowledge and awareness of the hazards of pesticide use, (3) attitudes towards pesticide use, and (4) safety practices when applying pesticides.

Consent

Informed consent was taken from participants as they were provided with information at the start of the questionnaire about the aim of the study and confirmed that their sharing is not obligatory.

Ethical approval

Approval of the Research Ethical Committee of the Faculty of Medicine, Ain Shams University was obtained (FWA 000017585) (FMASU R195/2023).

Data Management

Data of valid questionnaire was revised, coded, tabulated and introduced to a PC using Statistical package for Social Science (SPSS 22 for windows). Data cleaning and

checking for quality of data and data entry was performed. Data was presented and suitable analysis was done (frequency, percentage and chi-square). A value of $p \leq 0.05$ was considered significant.

Results

Table 1: Demographic characteristics and prevalence of pesticides use among the studied gardeners.

Characteristics of the studied gardeners		No (%)
Governorates	Cairo	27 (56.3)
	Giza	21 (43.8)
Educational level	Read and write	2 (4.2)
	Primary	11 (22.9)
	Preparatory school	12 (25.0)
	Secondary	13 (27.1)
	College	10 (20.8)
Marital status	married	48 (100.0)
Land tenure system	Freehold	21 (43.8)
	Lease	27 (56.3)
Living close to agricultural land		21 (43.8)
Prevalence of pesticides use		45 (93.8)
Previous training on pesticides		22 (45.8)
Pesticides retailers	Governmental	9 (18.8)
	Private	36 (75.0)
	Both	3 (6.3)

The study included 48 gardeners from Cairo and Giza governorates. The participants' socio-demographic characteristics revealed that most of them were above primary school education (72.9 %) and they were all married. Nearly half of them (43.8%) were freehold and living close to their agricultural land. There was a high prevalence rate of pesticides use among the studied gardeners (93.8 %) with only 45.8 % had received a previous training on pesticides application. The majority of gardeners reported that they bought pesticides from private retailers (75%) (Table 1).

Table 2: Different perceptions and environmental risks related to pesticide use.

	Perceptions	No (%)
Select active ingredient based on my experience	Agree	27 (56.3)
	Disagree	18 (37.5)
	Neutral	3 (6.3)
I read and follow the instructions on the container	Agree	36 (75.0)
	Disagree	9 (18.8)
	Neutral	3 (6.3)
I choose the right time for pesticide application	Agree	33 (68.8)
	Disagree	15 (31.3)
I check the weather before applying pesticide	Agree	30 (62.5)
	Disagree	18 (37.5)
I can discriminate forbidden pesticide	Agree	27 (56.3)
	Disagree	21 (3.8)
I think that pesticide use in agriculture could cause environmental problem	Agree	30 (62.5)
	Disagree	15 (31.3)
	Neutral	3 (6.3)
I think that water pollution is related to pesticides	Agree	26 (54.2)
	Disagree	22 (45.8)
I think that pesticides are very harmful to agricultural products	Agree	16 (33.3)
	Disagree	26 (54.2)
	Neutral	6 (12.5)
I respect the recommended dose of pesticide	Agree	38 (79.2)
	Disagree	10 (20.8)
I wear proper personal protective equipment during spraying pesticide	Agree	22 (45.8)
	Disagree	26 (54.2)
I store pesticides in a separate room after purchase or use	Agree	12 (25.0)
	Disagree	36 (75.0)
I don't throw or burn empty containers	Agree	12 (25.0)
	Disagree	36 (75.0)
I don't eat and drink during pesticide handling	Agree	33 (68.8)
	Disagree	15 (31.3)
I take a shower after handling pesticide	Agree	30 (62.5)
	Disagree	18 (37.5)
I believe and collaborate with a goals of low chemical input agriculture to limit the use of pesticide	Agree	18 (37.5)
	Disagree	30 (62.5)

Regarding perceptions toward pesticide use, nearly half of studied gardeners (56.3%) agreed that they selected active ingredient based on their experience with only 75% of them read and followed the instructions on the container. Two thirds of gardeners agreed that they choose the right time and weather for pesticide application. However, only 56.3% approved that they can discriminate forbidden pesticide. Regarding perceived environmental risks toward pesticide use, only 62.5% of gardeners granted that pesticide use in agriculture could cause environmental problems and 54.2% thought that water pollution is related to pesticides. Also the study revealed that nearly one third of gardeners disagreed that pesticides were associated to human illnesses. (Table 2)

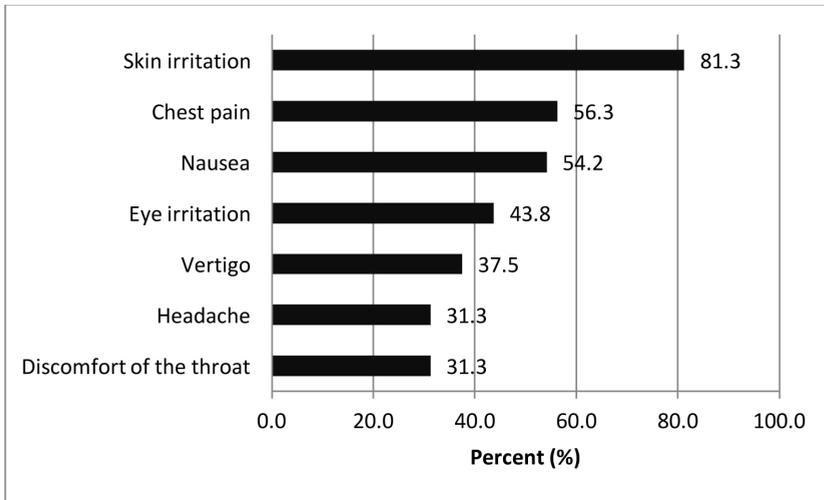


Figure (1) Health risks related to pesticide.

Figure 1 showed that (81.3%) reported skin irritation as a consequence of pesticide followed by chest pain and nausea (56.3% and 54.2% respectively). The least reported manifestations were throat discomfort, headache and vertigo (31.3%, 31.3% and 37.5% respectively).

Table 3: Safety behaviors toward pesticide use among the studied gardeners.

Safety behaviors		No (%)
I respect the recommended dose of pesticide	Agree	38 (79.2)
	Disagree	10 (20.8)
I wear proper personal protective equipment during spraying pesticide	Agree	22 (45.8)
	Disagree	26 (54.2)
I store pesticides in a separate room after purchase or use	Agree	12 (25.0)
	Disagree	36 (75.0)
I don't throw or burn empty containers	Agree	12 (25.0)
	Disagree	36 (75.0)
I don't eat and drink during pesticide handling	Agree	33 (68.8)
	Disagree	15 (31.3)
I take a shower after handling pesticide	Agree	30 (62.5)
	Disagree	18 (37.5)
I believe and collaborate with goals of low chemical input agriculture to limit the use of pesticide	Agree	18 (37.5)
	Disagree	30 (62.5)

Regarding safety behaviors toward pesticide use, table 3 showed that 79.2% of gardeners agreed that they respect the recommended dose of pesticide with only 45.8 % of them wear proper personal protective equipment during spraying pesticide. Majority of them (75%) reported that they didn't store pesticides in a separate room after purchase or use and didn't throw or burn empty containers. Additionally, nearly two thirds of gardeners agreed that do not eat and drink during pesticide handling and they took a shower after handling pesticide. Only 37.5% of gardeners believed and collaborate with goals of low chemical input agriculture to limit the use of pesticide.

Table 4: Comparisons of gardeners' characteristics, perception and safety behaviors in relation to training on pesticides.

Gardeners' characteristics, perception and safety behaviors		Training on pesticides		p value
		NO (No=26) No (%)	Yes (No =22) No (%)	
Educational Level	Read and write	2 (7.7%)	0	<0.00*
	Primary	7 (26.9%)	4 (18.2%)	
	Preparatory school	5 (19.2%)	7 (31.8%)	
	Secondary	12 (46.2%)	1 (4.5%)	
	College	0 (0.0%)	10 (45.5%)	
Land tenure system	Freehold	7 (26.9%)	14 (63.6%)	0.019*
	Lease	19 (73.1%)	8 (36.4%)	
I select active ingredient based on my experience	Agree	7 (26.9%)	20 (90.9%)	<0.001*
	Disagree	16 (61.5%)	2 (9.1%)	
	Neutral	3 (11.5%)	0	
I read and follow the instructions on the container	Agree	16 (61.5%)	20 (90.9%)	0.052
	Disagree	7 (26.9%)	2 (9.1%)	
	Neutral	3 (11.5%)	0	
I choose the right time for pesticide	Agree	50.0%)13	20 (90.9%)	0.002*
	Disagree	13 (50.0%)	2 (9.1%)	
I can discriminate forbidden pesticide	Agree	9 (34.6%)	18 (81.8%)	<0.001*
	Disagree	17 (65.4%)	4 (18.2%)	
I think that pesticide use in agriculture could cause environmental problems	Agree	12 (46.2%)	18 (81.8%)	0.036*
	Disagree	46.2%)12	3 (13.6%)	
	Neutral	2 (7.7%)	1 (4.5%)	
I think that water pollution is related to pesticides	Agree	9 (34.6%)	17 (77.3%)	0.003*
	Disagree	17 (65.4%)	5 (22.7%)	
I think that pesticides are associated to human illnesses	Agree	11 (42.3%)	22 (100.0%)	<0.001*
	Disagree	15 (57.7%)	0	
I wear proper personal protective equipment during spraying pesticide	Agree	7 (26.9%)	15 (68.2%)	0.004*
	Disagree	19 (73.1%)	7 (31.8%)	
I store pesticides in a separate room after purchase or use	Agree	3 (11.5%)	9 (40.9%)	0.019*
	Disagree	23 (88.5%)	13 (59.1%)	

I don't eat and drink during pesticide handling	Agree	14 (53.8%)	19 (86.4%)	0.015*
	Disagree	12 (46.2%)	3 (13.6%)	
I take a shower after handling pesticide	Agree	14 (53.8%)	16 (72.7%)	0.178
	Disagree	12 (46.2%)	6 (27.3%)	
I don't throw or burn empty containers	Agree	3 (11.5%)	9 (40.9%)	0.003*
	Disagree	23 (88.5%)	13 (59.1%)	
I respecting the date before harvest after last pesticide spray	Agree	17 (65.4%)	19 (86.4%)	0.003*
	Disagree	9 (34.6%)	3 (13.6%)	
I believe and collaborate with a goals of low chemical input agriculture to limit the use of pesticide	Agree	20 (76.9%)	10 (45.5%)	0.025*
	Disagree	6 (23.1%)	12 (54.5%)	

*: Statistically significant at p- value <0.05

Table 4 showed that gardeners that received previous training on pesticide's use were significantly had college education and most of them were free holding their land (p value; <0.001 and 0.019 respectively). About 90.0% of them can select pesticides based on their experience (p<0.001), and could choose the right time for pesticide application (p=0.002). About 81% of the same group reported that they can discriminate forbidden pesticide (p <0.001) and agreed that pesticide use in agriculture could cause environmental problems (p=0.036). Also 77.3% thought that water pollution was related to pesticides application (p=0.003). Moreover all of them considered that human illnesses was related to pesticides uses (p<0.001). Regarding comparison of safety behaviors of pesticides use, 68.2% who received training use proper personal protective equipment during spraying (p=0.004);40.9% established that they stored pesticides in a separate room after purchased or used and didn't throw or burn empty containers (p=0.019 and p=0.003 respectively); 68.4% agreed that they don't eat or drink during pesticide handling (p=0.015); 45.5% believed and collaborated with a goals of low chemical input agriculture to limit the use of pesticide (p=0.025).

Discussion

The current study highlighted important findings related to the attitudes and safety behaviors of Egyptian gardeners regarding agricultural pesticides' use. The high prevalence of pesticide use among the studied gardeners (93.8%) (Table 1) was slightly higher than previous studies done in Egypt in 2006 that reported a prevalence of 81.3% among farmers that indicate an increased trend for pesticides use (Olurominiyi, 2006) and in other developing countries (Jaga and Dharmani, 2003). Lack of training on pesticide use among the majority of participants (54.2%) may contribute to unsafe pesticide practices (Table 1), which is a common issue in developing countries as was mentioned by Okoffo et al. 2016 in their study on pesticides exposure by cocoa farmers in Ghana and Mastewal et al., 2022 on their study on pesticide use ,knowledge, attitude, and practices associated factors among workers in North West, Ethiopia.

Many of the studied gardeners rely on their own experience when selecting active ingredients for pesticide use (Table 2), which may

not always be effective or safe, as not all pesticides are suitable for all crops and pests (Andrew et al., 2016). It is alarming that only 56.3% of gardeners admitted that they can discriminate forbidden pesticides (Table 2), as the use of banned or restricted pesticides is a serious issue in developing countries, where these products are still be available in the market as was mentioned by Islam et al., 2022 on their work on the assessment of farmers' health risk due to pesticide uses at selected areas of Bogura district; Bangladesh .

The studied gardeners reported some health manifestations due to pesticide exposure, particularly skin irritation, nausea and chest pain (Figure 1), which is consistent with the previous study done by Mwabulambo et al., 2018, in Arusha region , Tanzania; that revealed high frequency of skin irritation, headache and nausea among farmers during applying pesticide. This underscored the need for proper personal protective equipment and safe handling practices to reduce the risk of pesticide exposure and related health effects (Okoffo et al., 2016).

The present study also highlighted

the importance of training on pesticide use, as gardeners who received training were more knowledgeable about pesticide selection, application, and health and environmental risks associated with pesticide use (Table 4). This finding is consistent with the previous study by Christos and Spyridon, 2017, that showed the effectiveness of training programs in improving knowledge and safety practices among farmers. However, it is of great concern and attention that less than half of the studied gardeners who received training stored pesticides properly and did not throw or burn empty containers (Table 4), as improper storage and disposal of pesticides can cause serious health and environmental risks (Christos and Ilias, 2011, and Mubushar et al., 2019)

Study limitation: The study used a convenience sampling method to select participants, which may introduce sampling bias and limit the generalization of the findings. Also, a larger sample size from multiple governorates in Egypt would have provided more robust and representative results.

Conclusion

The present study revealed high prevalence of pesticide use among gardeners in Cairo and Giza governorates. However, only a minority of gardeners had received previous training on pesticide use, indicating a potential gap in knowledge and awareness. A significant number of gardeners did not adhere to safe behaviors on application of pesticides like wearing proper personal protective equipment and storage practices for pesticides. Gardeners who had received previous training demonstrated better knowledge, attitudes, and safety behaviors compared to those without training. They showed a higher capacity to select appropriate pesticides, choose the right time for application, and identify forbidden pesticides.

Recommendations

The current study highlighted the need for training and education programs for Egyptian gardeners regarding safe pesticide use practices, proper storage and disposal of pesticides, health and environmental risks associated with pesticides. These programs should be tailored to the needs of the target population

and delivered through appropriate channels, such as extension services or community-based organizations. It is essential to raise awareness among gardeners regarding the importance of safe pesticide practices to protect their health, the environment, and the sustainability of agriculture.

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Conflict of interest

All authors have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper

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