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Determining the Association Between Pesticide Safety Behaviors and Health Literacy of Farmers Registered in WhatsApp Groups of Antalya Provincial Agriculture and Forest Directorate: A Descriptive-Correlational Study

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ABSTRACT

Objective: Pesticide use safety practices are essential in preventing pesticide exposure risk. Health literacy should be at a sufficient level to acquire these safety practices. This study aimed to determine the association between pesticide safety practices and health literacy of farmers registered in the WhatsApp groups of the Antalya Provincial Agriculture and Forest Directorate.

Methods: The sample of this descriptive-correlational study consisted of 221 farmers registered in Whatsapp groups belonging to five districts of Antalya. Research data were collected between March and August 2022 using an online Pesticide Safety Behaviors and Health Literacy Google form. Descriptive statistics, Multiple Linear Regression Analysis, and Pearson Correlation analysis were used to evaluate the data.

Results: There was a high positive correlation between pesticide safety behaviors and health literacy mean scores of farmers (r=.844, p<.01). According to the multiple linear regression results, the most significant variables affecting pesticide safety behavior were, respectively, training on pesticide use (β=0.426), higher levels of education (β=0.347), female gender (β=0.195), and older age (β=0.110). Health literacy was affected by higher levels of education (β=0.591), female gender (β=0.340), and employment status (β=0.088).

Conclusion: The study group showed adequate pesticide safety behaviors and health literacy levels. The most crucial factor in exhibiting safe behaviors was receiving training on pesticides. Higher levels of education level and female gender positively affected both variables. To minimize the risk of pesticide exposure for farmers., it was recommended to plan community-based participatory training interventions and raise awareness by making cross-sectoral cooperation.

Keywords: Farmworkers, pesticide exposure, health literacy, public health nursing

1. INTRODUCTION

In agriculture, pesticides are commonly used to control plant growth and prevent or eliminate harmful pests. According to the latest data from the Food and Agriculture Organization (FAO) for 2021, it is known that more than four million tons of pesticides are used in the world (1). According to the Turkish Ministry of Agriculture and Forestry Plant Protection Products Statistics for 2017, 60,020 thousand tons of pesticides are used for agricultural purposes in Türkiye. Antalya province mostly uses pesticides (2).

Pesticide use behaviors of farmers are affected by many factors, such as age (3), education level (4), risk perception (5), legal regulations, socioeconomic level (6,7), climate (8) and cultural planting practices (4), comfort (6, 7), pesticide knowledge level (5, 9). It is known that farmers are generally at a low level of education (10, 11), and a low education level is associated with low health literacy (12-14). "Health literacy" refers to a person's or community's capacity to obtain, comprehend, assess, and utilize information related to their well-being for decision-making purposes. In studies on pesticide knowledge and the behavior of farmers, it is reported that individuals are aware of the health risks of pesticides but are not adequately protected (7, 15, 16). This situation makes us think there may be a problem in individuals' behavior change and positive attitude development during evaluating and applying the acquired knowledge. Understanding farmers' pesticide use behavior is essential to protect their health and the environment. A study conducted in İzmir determined that 86.9% of the farmers used pesticides, but 59.3% did not take any protective measures (10). In a study conducted in Türkiye, farmers' knowledge and attitudes about pesticide use were

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low (17). In a systematic review that included 121 studies to reveal the personal protective equipment (PPE) and pesticide safety behaviors of farmers, the protection behaviors of the employees were insufficient (18).

Approximately 78% of the world's poorest people live in rural areas and work largely dependent on agricultural land (19, 20). Existing studies have shown that HL levels among agricultural workers and rural residents tend to be lower than in other population groups (21, 22). Farmers are vulnerable to the adverse health effects of exposure to pesticides. Studies have shown that individuals with low education/literacy have higher risks of pesticide exposure (23). The low literacy level of agricultural workers can cause difficulties in understanding and applying the risk and use signs on pesticide labels (24). It can also lead to a lack of knowledge about alternative pest management and new technologies in agriculture (25). In addition, data on agricultural and protective behavior factors related to HL among farmers in Türkiye are limited. It was aimed to investigate whether individuals' abilities to acquire, understand, apply, and evaluate health-related information would affect their likelihood of exhibiting pesticide protective behaviors. It is expected that the obtained results will guide the interventions of public health nurses. In this direction, initiatives can be planned to increase both the health literacy and pesticide safety behaviors of agricultural workers.

1.1. Research Questions

1. What was the level of safe pesticide use behaviors of farmers?
2. What variables affected farmers' pesticide safety behaviors?
3. What was the level of Health Literacy of farmers?
4. What were the variables that affected the Health Literacy levels of farmers?
5. Was there a relationship between farmers' safe pesticide use behaviors and their Health Literacy levels?

2. METHODS

2.1. Type and time of Research

This descriptive-correlational type study was conducted following the Strengthening Reporting of Observational Studies in Epidemiology (STROBE) checklist (26). Research data were collected between March and August 2022 using an online Google form.

2.2. Population and Sample

Antalya province is a region where pesticides are used intensively in many agricultural fields, especially greenhouse agriculture. In Antalya, which has eighteen districts, the highest pesticide consumption is in Kumluca, Finike, Aksu, Demre, and Serik districts. "WhatsApp" groups were established by the Antalya Provincial Directorate of Agriculture and Forestry to conduct farmer training during the Covid-19 pandemic. The groups were formed from individuals registered in the "Farmer Registration System" through District Directorates. The planned trainings cover plant production, good agricultural practices, organic farming, and pest control. The population of this study consists of 2500 farmers registered to WhatsApp groups in five districts with the highest pesticide consumption.

We used the sample determination formula to determine the number of samples needed when the universe is known. The sample size was calculated by taking the frequency of safe pesticide use behavior p=0.37, d=0.05 from the Masruri et al (27) study. It was determined that the minimum sample size to be included in the study was 290 farmers. No sampling method was used in the study, and farmers over 18 who agreed to participate were included. There are no exclusion criteria from the study. The data was sent to all individuals in the WhatsApp group list. Data collection forms were created through Google Forms, and individuals were expected to respond. A total of 211 agricultural workers participated in the study. When the targeted sample could not be reached online, the power of the study with the collected data was calculated with the G*Power program. In the post hoc correlation analysis of the relationship between pesticide safety behaviors and Health Literacy level for the statistical power of the study, the power of the study was found to be 0.97 in the 95% confidence interval (r=.844).

2.3. Data Collection

The research data were collected online with a data collection form consisting of three parts. In the first part of the questionnaire, there were 10 questions about the descriptive characteristics of individuals and how many years they had worked in agriculture, how often they applied pesticides, and whether they had received training before. The second part of the data collection form had questions about pesticide safety behaviors. The Health Literacy Scale was used in the third section of the data collection form.

2.3.1. Pesticide Safety Behaviors Questionnaire

This section was generated by researchers by the "Guidelines for Personal Protection when Handling and Applying Pesticide –Inter Code of Conduct on Pesticide Management" prepared in cooperation with the World Health Organization (WHO) and the Food and Agriculture Organization (FAO) (28). In this section, there were 20 questions to determine the behavior of farmers before, during, and after pesticide application. Four questions were about reading labels ***before pesticide application***, following directions, choosing less risky ones, and mixing by hand; 11 questions were about ***pesticide application***, whether individuals eat or drink something, use personal protective equipment, and pay attention to weather conditions; five questions were about bathing, changing clothes and washing ***after the application.*** The questions were designed in a five-point Likert type (Never=1 point), (Rarely=2 points), (Sometimes=3 points), (Often=4 points), (Always=5 points). The questions were designed in a five-point Likert type (“Never” (1 point), “Rarely” (2 points), “Sometimes” (3 points), “Often” (4 points), and “Always” (5 points). To measure the attention of farmers, some questions (14.,22.,23.,25.,28.) were formed in a negative form. These questions were reverse-coded. A maximum of 100 and a minimum of 20 points can be obtained from this part of the questionnaire. The increase in the mean score was interpreted as a good level of pesticide safety behaviors. In evaluating the measurement reliability of the data collection form, the Cronbach-alpha coefficient was calculated as 0.77. The questionnaire showed sufficient measurements.

2.3.2. Health Literacy Scale

The original Health Literacy Scale scale was 25-item, which was simplified by Toçi et al. 2013 (29) from the 47-item Health LiteracyS-E.U (Health Literacy Survey in Europe) form developed by Sorensen et al. 2013 (30). The standard deviation of the original scale was 0.95, and the internal consistency coefficients (Cronbach’s alpha) determined for the subscales vary between 0.90 and 0.94 (30). The Turkish validity and reliability of the Health Literacy scale used in this study were conducted by Bayik Temel and Aras (31). There were 25 questions on the scale. The scale consisted of access to information (5 questions), understanding information (7 questions), appraisal/evaluation (8 questions), and application/use (5 questions). The Cronbach Alpha value was 0.92. The scale was in a five-point Likert type (I have no difficulty: 5 points, I have little difficulty: 4 points, I have some difficulty: 3 points, I have many difficulties: 2 points, I am unable to do it: 1 point). The minimum score on the scale was 25, and the maximum score was 125. All items were positive.

2.4. Statistical Analysis

Researchers analyzed the research data with the IBM SPSS 20.0 program (Akdeniz University licensed). Data were shown as numbers, percentages, mean, and standard deviation. The normality curve of the data was checked before the analyses were made. The kurtosis skewness values of the total scores of both scales were found between – 1.5 and +1.5. Data showed a normal distribution.

Dependent variables, pesticide safety behaviors, and variables affecting Health Literacy were evaluated with multiple linear regression analysis. Educational level, gender, marital status, income, employment, total years of work, and previous training in pesticide safety were independent variables. Categorical independent variables were transformed into dummy variables. Gender (Female:1, Male:0), Education Level (High school and above:1, Secondary school and below:0), Income (Income Equal to expense or high:1, low:0), Employment (Working in own field: 1, wage earner, tenant/shareholder: 0), training on pesticide use (Yes:1, No:0), Marital Status (Married:1, Single:0). Pearson Correlation analysis performed to determine the correlation between Health Literacy and pesticide safety behaviors—data analyzed at a 95% confidence interval. Sample adequacy was evaluated for the analysis used in the study. For each independent variable, 10-20 data is required for multiple linear regression. The study’s sample size was sufficient for analysis (32).

2.5. Research Ethics

Ethical consent was obtained from the Akdeniz University Clinical Research Ethics Committee (Number:70904504/829, Date:21.12.2021), and informed consent was obtained from participants. The Antalya Provincial Agriculture and Forest Directorate granted institutional permission.

3. RESULTS

The mean age of the farmers was 43.99±10.91 (min.:24, max.:69), and 44% were women. Among participants, 42.5% were in secondary school or below, and 57.5% were at high school or higher education level. The income of 95% of the participants is less than and equal to their expenses. The percentage of those working in their fields is 81%, and 84.2% are married. Among participants, 59.3% had received pesticide safety training before, and the mean working year was 19±10.91. The mean score of pesticide safety behaviors was 77.45±7.61 (min:20, max:100), and the mean Health Literacy score was 90.87±12.43 (min: 25, max: 125). (Table 1)

Table 1. *Scales and sub-dimensions (n=221)*

	Min.	Max.	Mean
Pesticide Safety Behavior Score	**54**	**93**	**77.45±7.61**
Before Pesticide Practice	7	20	16.00±2.58
During Pesticide Practice	25	55	42.96±5.37
After Pesticide Practice	10	25	18.48±3.23
Health Literacy Score	**66**	**116**	**90.87±12.43**
Accessing Information	10	25	18.52±3.66
Understanding Information	15	34	25.19±4.36
Appraisal/Evaluation	18	40	30.07±4.41
Practice/Use	8	25	17.09±3.30

Multiple linear regression analysis was applied to determine the variables affecting pesticide safety behaviors. The correlation between all independent variables included in the model and pesticide safety behaviors was R=0.840. Independent variables explained 69% of the change in the mean pesticide safety behavior score (R^2 =0.692). There was a slight difference between the Adjusted R^2 =0.692 value and the R^2=0.705 value corrected for sampling error. This means that there were enough samples taken, and the margin of error in the measurements was minimal. At least one of the independent variables had a significant effect that could explain the dependent variable (F=56,031, p=.000). Significant variables affecting pesticide safety behaviors were older age (β=0.110, p=.034), female gender (β=0.195, p=.000), higher levels of education (β=0.347, p=.000), and training on pesticide use (β=0.426, p=.000). Training on pesticides was the variable that most affected the pesticide safety behavior score. Among the significant variables, a one-unit increase in the standard deviation of training on pesticides caused an increase of 0.426 units in the pesticide safety behavior score. Although not statistically significant, the increase in total working years and being single had an adverse effect on the pesticide safety behavior score (Table 2).

Table 2. *Variables affecting pesticide safety behaviors*

Variables	Beta (β)	Standard Error	*p-value*
Age	**0.110**	0.036	**.034***
Gender	**0.195**	0.641	**.000***
Education Level	**0.347**	0.936	**.000***
Income	0.014	1.359	.723
Employment	0.024	0.820	.572
Training on Pesticides	**0.426**	0.939	**.000***
Total Working Years	-0.044	0.031	.318
Marital status	-0.097	1.033	.051
R	**0.840**		
R^2	**0.705**		
Adjusted R^2	**0.692**		
F and *P* value	**56.031**		**.000***

**p<.05*

The independent variables affecting the level of Health Literacy were evaluated with multiple regression analysis. The correlation between the independent variables included in the model and Health Literacy was R=0.827. Independent variables explain 67% of the change in the mean Health Literacy score (R2 = 0.675). At least one of the independent variables had a significant effect that could explain the dependent variable (F=77,295, p=.000). Significant variables affecting the level of Health Literacy were determined as female gender (β=0.340, p=.000), higher levels of education (β=0.591, p=.000), and working in own field (β=0.088, p=.000) (Table 3).

Table 3. *Variables affecting Health Literacy*

Variables	Beta (β)	Standard Error	*p-value*
Age	0.057	0.056	.245
Gender	0.340	1.066	**.000***
Education Level	0.591	1.099	**.000***
Income	-0.041	2.258	.299
Employment	0.088	1.311	**.035***
Marital Status	-0.072	1.675	.147
R	**0.827**		
R2	**0.684**		
Adjusted R2	**0.675**		
F and *P* value	**77.295**		**.000***

*p<.001

There was a high positive correlation between pesticide safety behaviors and the Health Literacy mean scores of farmers (r=.844, p<.01). In general, there were significant relationships between the sub-dimensions of both scales. The highest correlation was between pesticide safety behaviors and the appraisal/evaluation sub-dimension (r=.780). There was a high level of relationship between pesticide safety behaviors and the sub-dimensions of appraisal/evaluation (r=.780) and understanding information (r=.702) and a moderate relationship between the sub-dimensions of practice/use (r=.630) and access to information (r=.626) (Table 4).

Table 4. *Determining the correlation between pesticide safety behaviors and sub-dimensions of the Health Literacy scale*

Scales and Sub-Dimensions		1	2	3	4	5	6	7	8	9
Pesticide Safety Behaviors (1)	r	1	.553*	.810*	.584*	**.845***	.626*	.702*	.780*	.630*
	p		**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**	**.000**
Before Pesticide Practice (2)	r		1	.150*	.207*	.447*	.339*	.343*	.449*	.316*
	p			**.025**	**.002**	**.000**	**.000**	**.000**	**.000**	**.000**
During Pesticide Practice (3)	r			1	.126	.684*	.523*	.558*	.621*	.524*
	p				.062	**.000**	**.000**	**.000**	**.000**	**.000**
After Pesticide Practice (4)	r				1	.495*	.335*	.451*	.445*	.360*
	p					**.000**	**.000**	**.000**	**.000**	**.000**
Health Literacy (5)	r					1	.768*	.857*	.874*	.751*
	p						**.000**	**.000**	**.000**	**.000**
Accessing Information (6)	r						1	.637*	.524*	.420*
	p							**.000**	**.000**	**.000**
Understanding Information (7)	r							1	.640*	.459*
	p								**.000**	**.000**
Appraisal/ Evaluation (8)	r								1	.621*
	p									**.000**
Practice/Use (9)	r									1
	p									

** p< .01*

4. DISCUSSION

It was aimed to determine the relationship between pesticide safety behaviors and health literacy of the Whatsapp group of farmers, where training and information were provided on agricultural issues such as crop cultivation, pest control, and irrigation management. The assumption is that the ability of farmers to acquire, understand, evaluate, and apply information about their health will bring safe use behaviors to protect them from the harmful effects of pesticides. The results of the study were examined under three main headings.

4.1. Farmers' Pesticide Safety Behavior Levels and Affecting Variables

The mean score was 77.45±7.61 out of 100 points for farmers' pesticide safety behaviors. This study group's pesticide safety behaviors were sufficient, unlike some studies in the literature (5, 7). We can explain this because the farmers in the WhatsApp group were in contact with the staff of the District Agriculture Directorate. Contacting agricultural professionals within the framework of programs that maintain environmental and human health, such as Integrated Pest Control and Good Agricultural Practices, led to safe behaviors. This result was in line with the increase in pesticide safety behavior in farmers trained with IPM programs in the literature (33, 34, 35, 36).

As expected, individuals who had received training in pesticide-safe behaviors also scored higher. The meta-analyses determined that education interventions significantly affected behavior change (37). As in many studies, this study's high education level brought safe pesticide applications (6,7, 36, 38). As literacy rates continue to increase and information becomes more readily available, individuals are expected to become more knowledgeable about pesticides. This study shows that their pesticide safety scores reflect the need for more farmers with low education levels to access correct information and adapt to the recommended safety guidelines.

Research results show that, similar with literacy, employees exhibited more safety behaviors as age increasesThis situation can be explained by the fact that with advancing age, individuals are more likely to be exposed to/encounter training and information activities regarding safe behaviors, as in Wang et al.'s (2017) study. (39). Another important variable that significantly affects safe pesticide use behaviors is female gender. Contrary to some, this study found that women exhibit better safety behaviors (40, 41). The reason for this may be that, unlike other agricultural countries, women in Antalya, Türkiye are actively involved in agricultural work and have responsibilities. Women in agriculture in Türkiye are in a decision-making position in many stages, such as preparing pesticides, spraying, and applying the recommended harvest time. In general, it is known that women's risk perceptions cause positive attitudes toward safety (42). Based on these results, the fact that women who actively work with pesticides are aware of the health risks and have a high-risk perception has brought about safe pesticide behaviors.

4.2. Farmers' Health Literacy Levels and Affecting Variables

The mean Health Literacy score of farmers was 90.87±12.43. The Health Literacy levels of farmers were evaluated with different measurement tools in different cultures. This situation made it difficult to compare with different studies. As in this study, the health literacy level of agricultural workers in Thailand was found to be relatively high (43). In a different study, it was found that the health literacy levels of agricultural workers in Türkiye were limited and problematic (44). It was seen that the health literacy level of agricultural workers was similar to different groups in Türkiye (31, 45, 46, 47).

As in other agricultural studies, higher education levels were expected to affect Health Literacy positively (43, 48). With advanced literacy skills, individuals' access to information, transportation, evaluation, and transportation processes becomes more accessible. In this study, unlike the Turkish Health Literacy Study, the Health Literacy level of women was higher than that of men (49). It is thought that this situation may be since men in rural areas do not care about their health-related decisions.

4.3.Farmers' Correlation of Pesticide Safety Behaviors and Health Literacy

There was a strong positive correlation between farmers' safe pesticide use behaviors and their Health Literacy levels**.** The results of the Pobhirun et al. (50) study on sweet corn farmers also supported this finding. This result was significant regarding individuals obtaining information on the harms of pesticides, their correct use, reducing exposure, understanding this information, evaluating it through functional processes, and exhibiting appropriate behavior. Especially the ability of farmers working with pesticides to read the labels on the boxes, comply with the instructions, and not enter the field within the recommended time is indirectly related to Health Literacy. Interventions to improve farmers' Health Literacy levels will also increase individuals' awareness.

5. CONCLUSION

The study results showed a strong correlation between the pesticide safety behaviors and Health Literacy levels of the farmers. In this context, the lack of sufficient information and training for agricultural workers on the use of personal protective equipment and safe practices in pesticide use should be completed. Based on these results, it is important that public health nurses regularly provide training to agricultural workers regarding pesticide safety, covering all employees. Another striking result is that social environments such as WhatsApp groups where information exchange takes place are effective in individuals exhibiting safe behaviors. In this context, public health nurses will play important roles in reaching agricultural workers, planning initiatives in cooperation with stakeholders such as Provincial/District Agriculture Directorates, and protecting and improving health. Similarly, according to the Occupational Health and Safety regulations of the Ministry of Environment and Urbanization, annual blood cholinesterase/pseudocholinesterase measurement is recommended for pesticide applicators in preventing pesticide exposure. Public health nurses will play an active role in guiding individuals to health screenings with their counseling and case management roles.

5.1. Limitations of the Research

One of the limitations of the study was that 57.5% of the individuals were at high school or higher education level, which was likely to affect the study results. Another limitation is the lack of access to those who are older and have lower levels of education. Also predicted sample size could not be reached. One disadvantage was that online research responses might be answered hastily and without much consideration.

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Drafting the manuscript: DA

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REFERENCES

[1] FAO.FAOSTAT Pesticides Use Dataset 2020. Access Date:20.02.2023. [Available from: http://www.fao.org/faostat/en/#data/RP].

[2] Turkish Ministry of Agriculture and Forestry GDoFaC. The Usage Situations of 2017 Plant Protection Products on the Basis of Provinces as Grouped (2017). [Available from: https://www.tarimorman.gov.tr/Konular/Bitki-Sagligi-Hizmetleri/Bitki-Koruma-Urunleri-Ve-Makinalari/Istatistik-Bilgileri. Access Date: 21.02.2023.

[3] Berni I, Menouni A, Ghazi El I, Duca RC, Kestemont MP, Godderis L, Jaafari SE. Understanding farmers' safety behavior regarding pesticide use in Morocco. Sustainable Production and Consumption. 2021;25:471-483. https://doi.org/10.1016/j.spc.2020.11.019

[4] Bagheri A, Emami N, Allahyari MS, Damalas CA. Pesticide handling practices, health risks, and determinants of safety behavior among Iranian apple farmers. Human and Ecological Risk Assessment: An International Journal. 2018;24(8):2209-2223. https://doi.org/10.1080/10807039.2018.1443265

[5] Jallow MFA, Awadh DG, Albaho MS, Devi VY, Thomas BM. Pesticide risk behaviors and factors influencing pesticide use among farmers in Kuwait. Science of The Total Environment. 2017;574:490-498. https://doi.org/10.1016/j.scitotenv.2016.09.085

[6] Bhandari G, Atreya K, Yang X, Fan L, Geissen V. Factors affecting pesticide safety behaviour: The perceptions of Nepalese farmers and retailers. Science of The Total Environment. 2018;631-632:1560-1571. https://doi.org/10.1016/j.scitotenv.2018.03.144

[7] Sharifzadeh MS, Abdollahzadeh G, Damalas CA, Rezaei R, Ahmadyousefi M. Determinants of pesticide safety behavior among Iranian rice farmers. Science of The Total Environment. 2019; 651: 2953-2960. https://doi.org/10.1016/j.scitotenv.2018.10.179

[8] Shammi M, Sultana A, Hasan N, Mostafizur Rahman M, Saiful Islam M, Bodrud-Doza M, Uddin K. Pesticide exposures towards health and environmental hazard in Bangladesh: A case study on farmers' perception. Journal of the Saudi Society of Agricultural Sciences. 2020;19(2):161-173. https://doi.org/10.1016/j.jssas.2018.08.005

[9] Bagheri A, Emami N, Damalas CA, Allahyari MS. Farmers' knowledge, attitudes, and perceptions of pesticide use in apple farms of northern Iran: impact on safety behavior. Environmental Science and Pollution Research International. 2019;26(9):9343-9351 https://doi.org/10.1007/s11356-019-04330-y

[10] Ergonen AT, Salacin S, Ozdemir MH. Pesticide use among greenhouse workers in Turkey. Journal of Clinical Forensic Medicine.2005;12(4):205-208. https://doi.org/10.1016/j.jcfm.2004.10.017

[11] Gün S. Pesticide Use in Turkish Greenhouses: Health and Environmental Consciousness. Polish Journal of Environmental Studies. 2009;18(4):607-615.

[12] Van der Heide I, Wang J, Droomers M, Spreeuwenberg P, Rademakers J, Uiters E. The relationship between health, education, and health literacy: Results from the Dutch Adult Literacy and Life Skills Survey. Journal of Health Communication. 2013;18(1):172-184. https://doi.org/10.1080/10810730.2013.825668

[13] Joveini H, Rohban A, Askarian P, Maheri M, Hashemian M. Health literacy and its associated demographic factors in 18-65-year-old, literate adults in Bardaskan, Iran J Educ Health Promot. 2019;8:244. https://doi.org/10.4103/jehp.jehp_26_19

[14] Sudhakar S, Aebi ME, Burant CJ, Wilson B, Wenk J, Briggs FBS, Pyatka N, Blixen C, Sajatovic M. Health literacy and education level correlates of participation and outcome in a remotely delivered epilepsy self-management program. Epilepsy & Behavior. 2020;107:107026. https://doi.org/10.1016/j.yebeh.2020.107026

[15] Gesesew HA, Woldemichael K, Massa D, Mwanri L. Farmers knowledge, attitudes, practices and health problems associated with pesticide use in Rural Irrigation Villages, Southwest Ethiopia. PloS one. 2016;11(9):0162527.

https://doi.org/10.1371/journal.pone.0162527

[16] Taghdisi MH, Amiri BB, Dehdari T, Khalili F. Knowledge and practices of safe use of pesticides among a group of farmers in Northern Iran. Int J Occup Environ Med. 2019;10(2):66-72. https://doi.org/10.15171/ijoem.2019.1479

[17] Cevik C, Ozdemir R, Ari S. Relationship between farmers' knowledge and attitudes towards pesticide use and their sociodemographic characteristics: A cross-sectional study from north-western Turkey. Roczniki Panstwowego Zakladu Higieny. 2020;71(3):341-348.
https://doi.org/10.32394/rpzh.2020.0123

[18] Sapbamrer R, Thammachai A. Factors affecting use of personal protective equipment and pesticide safety practices: A systematic review. Environ Res. 2020;185:109444.
https://doi.org/10.1016/j.envres.2020.109444

[19] Food and Agriculture Organization of the United Nations (FAO) (2024). Reduce Rural Poverty. Available at: https://www.fao.org/reduce-rural-poverty/our-work/family-farming/en/ (Accessed 15 June 2024).

[20] The World Bank (2014). For Up to 800 Million Rural Poor, a Strong World Bank Commitment to Agriculture. Available at: https://www.worldbank.org/en/news/feature/2014/11/12/for-up-to-800-million-rural-poor-a-strong-world-bank-commitment-to-agriculture. (Accessed 15 June 2024).

[21] Aljassim N, Ostini R. Health literacy in rural and urban populations: a systematic review. Patient Educ Couns. 2020;103:2142–2154
https://doi.org/10.1016/j.pec.2020.06.007

[22] Bassem R, Fahim AE, Mosaad SE, Waheed A. Occupational health literacy among agricultural workers. Egypt J Occup Med. 2023;47:33–45.
https://doi.org/10.21608/EJOM.2022.157730.1288

[23] Mueller W, Jones K, Fuhrimann S, Ahmad ZNBS, Sams C, Harding AH et al. Factors influencing occupational exposure to pyrethroids and glyphosate: An analysis of urinary biomarkers in Malaysia, Uganda and the United Kingdom. Environmental Research. 2024; 242:117651
https://doi.org/10.1016/j.envres.2023.117651

[24] Rother HA. Pesticide labels: Protecting liability or health? – Unpacking "misuse" of pesticides. Current Opinion in Environmental Science & Health. 2018;4: 10-15.
https://doi.org/10.1016/j.coesh.2018.02.004

[25] Ahmad A., Shahid M., Khalid S. Zaffar H, Naqvi T, Pervez A, Naqvi T, Bilal M, Ali MA, Abbas G, Nasim W. Residues of endosulfan in cotton growing area of Vehari, Pakistan: an assessment of knowledge and awareness of pesticide use and health risks. Environ Sci Pollut Res. 2019;26:20079–20091. https://doi.org/10.1007/s11356-018-3169-6

[26] von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP; STROBE Initiative. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. Lancet. 2007;370(9596):1453-1457.
https://doi.org/10.1016/S0140-6736(07)61602-X

[27] Masruri B, Dehdari T, Yekzamani P, Moghadasi N, Ashtarinezhad A. Assessment of knowledge and practice of pistachio farmers in terms of pistachio pesticide safety. Human and Ecological Risk Assessment: An International Journal. 2021;27:595-605. https://doi.org/10.1080/10807039.2020.1744111

[28] Food and Agriculture Organization of the United Nations & World Health Organization. Guidelines for personal protection when handling and applying pesticide: international code of conduct on pesticide management. Food and Agriculture Organization of the United Nations. Published [1 February 2020]. https://apps.who.int/iris/handle/10665/330917

[29] Toçi E, Burazeri G, Sorensen K, Jerliu N, Ramadani N, Roshi E, Brand R. Health literacy and socioeconomic characteristics among older people in Transitional Kosovo. Journal of Advances in Medicine and Medical Research. 2013;3(4):1646-1658.

[30] Sørensen K, Van den Broucke S, Pelikan JM, Fullam J, Doyle G, Slonska Z, Kondilis B, Stoffels V, Osborne RH, Brand H. Measuring health literacy in populations: Illuminating the design and development process of the European Health Literacy Survey Questionnaire (HLS-EU-Q). BMC Public Health. 2013;13:948.

[31] Bayık Temel A, Aras Z. Evaluation of validity and reliability of the Turkish Version of Health Literacy Scale. Florence Nightingale Journal of Nursing. 2017;25(2):85-94.
https://doi.org/10.17672/fnhd.94626

[32] Çokluk O. Logistic regression analysis: Concept and application. Educational Sciences: Theory and Practice.2010;10(3):1357-1407.

[33] Jørs E, Konradsen F, Huici O, Morant RC, Volk J, Lander F. Impact of training bolivian farmers on integrated pest management and diffusion of knowledge to neighboring farmers. J Agromedicine. 2016;21(2):200-208.
https://doi.org/10.1080/1059924x.2016.1143428

[34] Clausen AS, Jors E, Atuhaire A, Thomsen JF. Effect of integrated pest management training on ugandan small-scale farmers. Environmental Health Insights. 2017;11:1178630217703391. https://doi.org/10.1177/1178630217703391

[35] Maddah D, Ghach W, Abi Farraj N, Yehya M, Khatib JA, Alami NH. The first community-based intervention to promote safe pesticide use by developing knowledge, attitudes, and practices among Lebanese farmers. Human & Ecological Risk Assessment. 2020;26(10):2824-2835.
https://doi.org/10.1080/10807039.2019.1688639

[36] Galli A, Winkler MS, Doanthu T, Fuhrimann S, Huynh T, Rahn E, Stamm C, Staudacher P, Huynh TV, Loss G. Assessment of pesticide safety knowledge and practices in Vietnam: A cross-sectional study of smallholder farmers in the Mekong Delta. Journal of Occupational and Environmental Hygiene. 2022;19(9):509-523.
https://doi.org/10.1080/15459624.2022.2100403

[37] Ayaz D, Öncel S, Karadağ E. The effectiveness of educational interventions aimed at agricultural workers' knowledge, behaviour, and risk perception for reducing the risk of pesticide exposure: A systematic review and meta-analysis. Int Arch Occup Environ Health. 2022;95:1167–1178.
https://doi.org/10.1007/s00420-022-01838-8

[38] Diomedi BZ, Nauges C. Pesticide-handling practices: The case of coffee growers in Papua New Guinea. Australian Journal of Agricultural and Resource Economics. 2016;60:112–129. https://doi.org/10.1111/1467-8489.12106

[39] Wang J, Deng Y, Ma Y. Relationships between safe pesticide practice and perceived benefits and subjective norm, and the moderation role of information acquisition: Evidence from 971 Farmers in China. Int J Environ Res Public Health. 2017;14(9):962. https://doi.org/10.3390/ijerph14090962

[40] Christie ME., Van Houweling E. & Zseleczky L. Mapping gendered pest management knowledge, practices, and pesticide exposure pathways in Ghana and Mali. Agric Hum Values. 2015;32:761–775.
https://doi.org/10.1007/s10460-015-9590-2

[41] Kasner EJ, Keralis JM, Mehler L, Beckman J, Bonnar-Prado, J, Lee SJ, Diebolt-Brown B, Mulay P, Lackovic M, Waltz J, Scwartz A, Mitchell Y, Morage-McHaley S, Roisman R, Gergely R, Calvert G. Geder differences in acute pesticide-related illnesses and injuries among farmworkers in the United States, 1998–2007. American Journal of Industrial Medicine. 2012;55(7):571–583. https://doi.org/10.1002/ajim.22052

[42] Znajmiecka-Sikora M, Sałagacka M. Analysis of the relationship between psychological gender and risk perception style and attitudes towards safety in a group of women and men. International Journal of Occupational Safety and Ergonomics. 2022;28(1):364-375
https://doi.org/10.1080/10803548.2020.1760527

[43] Montgomery H., Morgan S, Srithanaviboonchai K, Ayood P, Siviroj P, Wood M. Correlates of health literacy among farmers in Northern Thailand. International Journal of Environmental Research and Public Health. 2020;17(19):7071
https://doi.org/10.3390/ijerph17197071

[44] Koç N, Adana F. Perception of Health, Health Literacy Levels of Farm Labourers and Related Factors. Journal of Public Health Nursing. 2021;3(3):171-183.
https://doi.org/10.54061/jphn.995982

[45] Bayık Temel A, Çimen Z. Kronik hastalığı olan yaşlı bireylerde sağlık okuryazarlığı, sağlık algısı ve ilişkili faktörler. Ege Üniversitesi Hemşirelik Fakültesi Dergisi. 2017;33(3):105-125. (Turkish)

[46] Kuloğlu Y, Uslu K. Geleceğin sağlık çalışanlarında sağlık okuryazarlık düzeyinin sağlık algısı üzerindeki etkisi. Doğuş Üniversitesi Dergisi. 2022;23(1):255-277.
https://doi.org/10.31671/doujournal.955317 (Turkish)

[47] Yıldızeli F, Alabaz D, Gözüyeşil E. Ebeveynlerin çocukluk çağı aşılarının kabulünün sağlık okuryazarlığı ile ilişkisi. J Pediatr Inf. 2021;15(2):91-99.
https://doi.org/10.31125/hunhemsire.966461 (Turkish)

[48] Tusun RB, Emiroğlu ON. Vegetable growers' views on pesticide use in greenhouse agriculture and evaluation of health literacy status. Journal of Samsun Health Sciences. 2022; 7(3):897-914. https://doi.org/10.47115/jshs.1161593 (Turkish)

[49] Republic of Turkey Ministry of Health General Directorate of Health Promotion. Turkish Health Literacy and Related Factors Research. 2018. [Access Date:29.02.2022].
https://sggm.saglik.gov.tr/TR,57003/turkiyenin-saglik-okuryazarligi-duzeyi-olculdu.html#. (Turkish)

[50] Pobhirun T, Pinitsoontorn S. The association between health literacy and pesticide use behaviors among sweet corn farmers in the Pak Chong district of Thailand: A cross-sectional study. F1000Research. 2019;11(8):448.
https://10.12688/f1000research.18398.2

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