

The Prevalence of Dermal and Respiratory Symptoms among Greenhouse Agricultural Workers: A Surveillance Study

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Abstract

BACKGROUND/AIMS: This study was conducted to examine the prevalence of dermal and respiratory symptoms among workers in greenhouse agriculture.

MATERIAL AND METHODS: This cross-sectional study was conducted with 529 greenhouse workers in a district center between March and September 2020. The data collection form was developed by researchers to collect the research data. Descriptive statistics and logistic regression analysis were used in the analysis.

RESULTS: 41.8% of the participants stated that they used gloves and 25.8% of them used masks while working, but 7.0% of them reported that they did not use any personal protective equipment. It was found that working for 8 h or more per day was associated with respiratory distress, itching-rashing on skin, and nose-eye problems, while working for 25 days or more per month was associated with respiratory distress and cough complaints ($p < 0.05$). Working in the tasks of seed sowing, pesticide application/spraying, and grafting was found to be associated with wheezing, coughing, itching-rashing on skin, and nose-eye problems ($p < 0.05$). Those who did not wear protective equipment suffered from wheezing, and those who did not use a mask had bronchitis, cough, wheezing, itching-rashing on skin, and nose-eye problems ($p < 0.05$).

CONCLUSION: Working conditions, a type of work done in greenhouse agriculture, and failure to use personal protective equipment increase the prevalence of dermal and respiratory symptoms.

Keywords: Greenhouse agriculture, skin, respiratory, symptoms, surveillance

INTRODUCTION

Greenhouse agriculture gains intensity in the Mediterranean Region in our country. While the control of chemicals used in greenhouse agriculture was mostly up to the producer's choice in previous years, the usage dosage, prevalence, and interval of chemicals have been implemented under the principles determined by the ministry and strict

supervision control in recent years. Chemical drugs used on the crop to obtain efficient and good quality crops and to offer them to buyers can cause various health problems among greenhouse agricultural workers. Since the primary exposure is through the respiration and skin, these areas are the most affected areas of the body.¹ When the data on health problems of workers in greenhouse agriculture was analyzed, it was seen that pesticides triggered the inflammatory response and caused

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reactions by changing the esterase level in the cell membrane of immunocytes.^{2,3} In a study on the health problems of women working in agriculture, it was found that the dermal diseases, asthma and other respiratory problems were common among them and their children,⁴ and that the chemicals used in agriculture suppressed the immune system and increased the susceptibility to allergic reactions^{5,6} and that the risk of autoimmune diseases such as rheumatoid arthritis, systemic lupus erythematosus could increase.^{7,8} Similarly, it was shown in the studies that exposure to pesticides reduced cholinesterase levels^{9,10} and caused neurological and respiratory symptoms and skin reactions, and that low cholinesterase levels increased the asthma-related pulmonary inflammation.¹¹

The most obvious effects of greenhouse cultivation on workers are asthma, allergic alveolitis, and dermatitis. Although the most common way of pesticide exposure is the skin,¹²⁻¹⁴ especially the hand and face areas are affected.¹⁵ Pesticides can be absorbed directly through the skin due to their physicochemical properties. Clothing that does not completely cover the body or has a permeable structure also leads to exposure through the skin. Since pesticides also contain respirable components,¹⁶ the second most frequent way of exposure is the respiratory tract. After pesticide application, which is generally done indoors by spraying, the lack of ventilation and high temperature and humidity as well as failure to use protective equipment increase the level of exposure.^{17,18} Furthermore, it is recommended not to apply pesticides when the ambient temperature is above 30 °C.¹⁷ In studies examining the respiratory functions of greenhouse workers, it was reported that chronic cough, respiratory distress, rhinitis, bronchial hyperreactivity, and asthma-related symptoms were seen at a high rate^{16,19-22} and that even non-occupational exposure caused respiratory problems.²³

Public health nurses and their field studies have a great role in determining the health problems in the community and the prevalence and level of health problems developing among the working people. In this context, one of the important tasks of public health nursing is surveillance. Greenhouse agriculture is the main source of income for the people of the district in the region where the study was conducted and its use is high. Due to the observation of dermal and respiratory symptoms among those working in this field, the study was planned to examine the dermal and respiratory problems of those working in greenhouse agriculture. The following research questions were sought:

1. What are the working conditions of the workers in the greenhouse (daily and monthly working hours, work they do, use of personal protective equipment, ...)?
2. Did workers experience skin and respiratory problems while working in the greenhouse?
3. Do working conditions impact skin and respiratory symptoms?

MATERIALS AND METHODS

Population and Sample

This cross-sectional study was conducted with individuals working in greenhouse agriculture in a district center between March and September 2020. The population of the research consists of 3210 people (Kumluca District Directorate of Agriculture, 2019 data) located

in the Kumluca district center and registered as working in greenhouse agriculture. The sample of the research consists of people working in greenhouse agriculture over the age of 18 living in the district center and accepting to participate in the study. It was aimed to include at least 344 workers in greenhouse agriculture according to the calculation of the number of sample whose population was known, and the study was completed with 529 people who could be reached. When the square of 0.30 is taken as 0.09 as the medium effect size for the zeroth order correlation coefficient (R^2),²⁴ it is seen that the sample size has 90% power at 95% confidence interval (post-hoc) (G*Power 3.1.9).

Data Collection and Tools

The data of this study, which is a field study, was collected by face-to-face interview in the greenhouses where individuals worked (data collection was suspended upon starting the pandemic process and the data collection continued when the normalization process started. In this process, in accordance with the coronavirus measures, absolute attention was paid to social distance, use of masks, and hygiene. The workers' breaks and lunch times were preferred as the data collection time. A data collection form developed by the researchers in line with the literature was used to collect research data.^{9,25} Before the main data of the study were collected, a preliminary study was conducted with 17 people and the comprehensibility of the questions was examined.

Data Collection Form: It consists of three parts as sociodemographic characteristics, professional characteristics, and health status and 24 questions (Professional questions: "At what age did you start working in the greenhouse?", "How many hours do you work in the greenhouse per day?", "How many days do you work in the greenhouse monthly?", "What work do you do in the greenhouse?", "What protective equipment do you use while working in the greenhouse?", "What do you do with the emptied boxes of pesticides?", "What do you think causes your health problems?" Health-related questions: "Have you experienced/are you experiencing any of the problems of respiratory distress, bronchitis, cough, wheezing, itching/rashing on hands/face, or itching, watering, pain on nose/eyes?", "Did your health problem begin after you started working in the greenhouse?", "Does working in the greenhouse increase the severity of your health problem?", "Do other people with whom you work in the same place have similar diseases/problems?", "Do your complaints decrease when you do not work in the greenhouse?"). In the literature review conducted within the scope of the research subject, a standardized measurement tool related to dermal symptoms was not found, and a respiratory questionnaire about respiratory problems was obtained (Saint George Respiratory Questionnaire). When the scope and content of the questionnaire were examined, it was seen that it was mostly aimed at patients with COPD, and therefore it could not be used as a data collection tool in this study.

The data collection form used in the study was examined by three academicians, other than researchers, who were experts in public health nursing, before the study in terms of content validity, and the results were examined using the Davis technique. In the Davis technique, expert opinions are analyzed as follows: a) appropriate, b) needs minor revision, c) needs major revision, d) not appropriate The Content Validity Index (CVI) is obtained by dividing the sum of A and B in all expert forms by the total number of experts. If the CVI is greater than 80%, the question is sufficient in terms of content validity.²⁶ The average CVI score of the form was found to be 98.1%.

Ethical Approval

Informed consent was obtained from the participants. The study was conducted in accordance with the Declaration of Helsinki principles (revised in Brazil in 2013). The approval of the Akdeniz University Faculty of Medicine Clinical Research Ethics Committee was obtained to conduct the study (approval number: KAEK-282).

Statistical Analysis

The data were evaluated in the Statistical Package for Social Science 25.0 (IBM Corp.; Armonk, NY, USA) program, and descriptive statistics and logistic regression analysis were used in the analysis of the data. The cases where the type 1 error level is below 5% was considered as statistical significance.

RESULTS

A total of 529 people working in greenhouse agriculture participated in the study. 51.0% of the participants were women, 44.2% were primary school graduates, and the average age is 36.03 ± 14.03 . More than half of the participants (54.3%) are working in their family/own business and their monthly income is averagely 569.67 ± 397.54 dollars. 25.5% of the participants said they smoked and 19.1% said they drank alcohol.

The average age for the participants to start working in the greenhouse was found as 16.86 ± 7.62 , the number of working days per month as 21.48 ± 7.75 and the number of working hours per day as 7.75 ± 1.99 . It was observed that they mostly worked in April (11.6%), May (11.9%), and June (11.2%) in the greenhouse and were mostly engaged in harvesting/gathering crops (22.9%), pesticide application (19.4%), and weeding (19.3%). 41.8% of the participants stated that they used gloves and 25.8% of them used masks while working, but 7.0% of them reported that they did not use any personal protective equipment. It was seen that the reasons for the failure to use protective materials included the unavailability of such materials (39.3%), and considering them uncomfortable (23.2%) and unnecessary (23.2%). It was determined that the emptied pesticide boxes were mostly thrown into garbage bins on the streets (34.0%) and sent for recycling (31.6%). 6.6% of the participants reported that they wore the clothes used while working in the greenhouse also in their daily life and 53.5% of them consumed food and beverages in the greenhouse (Table 1).

Information on the health problems experienced by the participants in the study is given in Figure 1, and the problems of itching, rashing, swelling, etc. one hands/face (open areas of the body) were found to be experienced the most by a 48.8% rate. It is followed by nose or eye problems (itching, watering, burning, pain, etc.) with a 45.7% rate, cough with a 39.1% rate, and wheezing/shortness of breath with a 22.1% rate (Figure 1). The participants stated that dermal problems were mostly caused by contact with products (38.9%) and respiratory problems were due to dust/dirt (31.9%), while both dermal and respiratory problems were reported to result from pesticides (21.4%), chemical fertilizers (19.3%) and hot working environment (17.0%) (Figure 2).

In the logistic regression analysis, working for 8 h or more per day was found to be associated with respiratory distress [odd ratio: (OR): 2.04, $p=0.02$], itching-rashing on skin (OR: 15.27, $p=0.01$) and nose-eye problems (OR: 5.93, $p=0.003$), while working for 25 days or more per

Table 1. Certain professional characteristics of participants (n=529)

Characteristics	Min.-Max.	M \pm SD
Age to start working in greenhouse	7-55	16.86 \pm 7.62
The number of working hours in greenhouse per day	2-12	7.75 \pm 1.99
The number of working days in greenhouse per month	3-30	21.48 \pm 7.75
	n	%
Working months in greenhouse (n=2343)*		
Winter (December-January-February)	584	25.0
Spring (March-April-May)	740	31.6
Summer (June -July -August)	534	22.8
Autumn (September-October-November)	485	20.8
Type of work in greenhouse		
Family business/own business	287	54.3
Land tenure/annual renting	77	14.6
Seasonal worker	44	8.3
Daily wage	88	16.6
Partner	33	6.2
Works in greenhouse (n=1907)*		
Seed sowing	272	14.3
Weeding	369	19.3
Pesticide application/spraying	370	19.4
Grafting	154	8.1
Harvesting/gathering crop	437	22.9
Product packaging	237	12.4
Other (uprooting, irrigation)	68	3.6
Protective equipment used during work (n=1033)†		
I do not use personal protective equipment	72	7.0
Apron	100	9.7
Boots	87	8.4
Gloves	432	41.8
Mask	266	25.8
Safety goggles	56	5.4
All	20	1.9
Reason for not using protective equipment (n=328)†		
The unavailability of equipment	129	39.3
Considering them uncomfortable	76	23.2
I do not think they are protective	21	6.4
Considering them unnecessary	76	23.2
Considering them expensive	26	7.9
Emptied boxes of pesticides		
I leave them in the greenhouse where I work	30	5.7
I throw them into the garbage bins on the streets	180	34.0
I bury them in the ground	16	3.0
I send them for recycling	167	31.6
I burn them in fire	91	17.2
I wash them and use for other purposes	34	6.4
I sell them for scrap	11	2.1
Wearing work clothes in daily life		
Yes	35	6.6
No	494	93.4
Food consumption in greenhouse		
Yes	283	53.5
No	246	46.5

*Multiple options were checked. Min.: Minimum, Max.: Maximum, SD: Standard deviation.

month was found to be associated with respiratory distress (OR: 0.27, p=0.04) and cough complaints (OR: 6.80, p=0.02) (Table 2).

In the multivariate analysis examining the relationship between the type of work done in greenhouse agriculture and health problems, the seed sowing work was found to be associated with respiratory distress (OR: 1.69, p=0.01), wheezing (OR: 1.71, p=0.01), itching-rashing on skin (OR: 2.93, p=0.001) and nose-eye problems (OR: 2.15, p=0.001). Pesticide application/spraying was found to be associated with bronchitis (OR: 8.04, p=0.04) and nose-eye problems (OR: 1.66, p=0.02), while grafting was found to be associated with cough (OR: 0.62, p=0.02), itching-rashing on skin (OR: 0.34, p=0.001) and nose-eye problems (OR: 0.29, p=0.001). Considering the relationship between the use of personal protective equipment and health problems, it was discovered that wheezing (OR: 0.32, p=0.005) was experienced by those not wearing protective equipment; and bronchitis (OR: 0.48, p=0.03), cough (OR: 0.48, p=0.001), wheezing (OR: 0.50, p=0.005), itching-rashing on skin (OR: 0.42, p=0.001) and nose-eye problems

(OR: 0.51, p=0.001) were experienced by those not wearing mask (Table 3).

Forty-four point eight percent of the individuals participating in the study stated that their health problems occurred after they started working in the greenhouse, and 42.3% of them reported an increase in the severity of their problems while working in the greenhouse, and 39.1% of them said similar health problems were seen among other people working in the same place, and 45.9% had a decrease in their complaints on the days when they did not work in the greenhouse.

DISCUSSION

The results of this study report the dermal and respiratory symptoms experienced by those working in greenhouse agriculture and the variables associated with them. It is seen that the average age at which the participants started working in greenhouse agriculture is less than 18 years. Workers work in greenhouse agriculture approximately 3/4 of the month and 1/3 of the day. Similarly, in a study, the age of starting to work in greenhouse agriculture was found to be 15.5.¹ In this study, some participants reported a much earlier age to start greenhouse agriculture as family business. Greenhouse agriculture is one of the most dangerous lines of business for child labour.²⁷ In cases where greenhouse agriculture is done as a family business, the child may be exposed to this environment at a very early age, including infancy, and chemical exposure may predispose to respiratory and dermal symptoms.

It was seen that the participants mostly worked in the greenhouse in spring and early summer, and they mostly did the work of gathering crops, applying pesticides, and weeding. About half of the participants stated that they used gloves and one quarter of them used masks while working, but some of them reported that they did not use any personal protective equipment. It was seen that the failure to use protective materials resulted from the unavailability of such materials and considered them uncomfortable and unnecessary. The application interval of pesticides varies seasonally. While pesticides are applied at the lowest rate in May-June, the highest usage is in October-November.⁹ In a study conducted with agricultural workers, it was stated that female and male workers working in the greenhouse used gloves the most, and when they did not, they were not provided with them, and they could not use personal protective equipment because of their high cost.²⁵ Huyen et al.²⁸ found that all workers used masks and could not use other equipment (gloves, boots, goggles...) due to their insufficiency. The fact that protective equipment is considered uncomfortable and unnecessary by the workers besides the reasons of high cost and unavailability of them indicates a lack of awareness among the workers. Creating this awareness and raising the awareness of workers about the use of equipment should be one of the priority initiatives in terms of agricultural health.

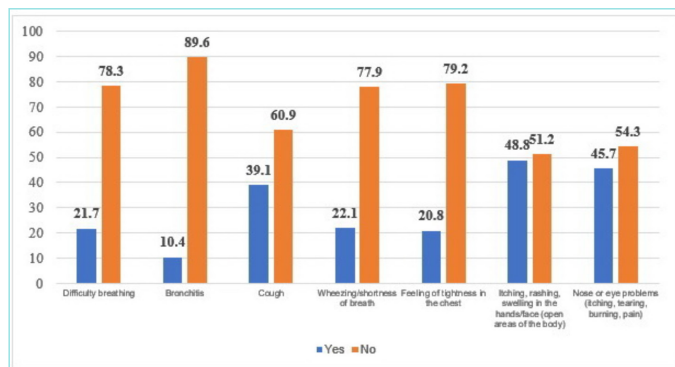


Figure 1. Health problems experienced by the participants.

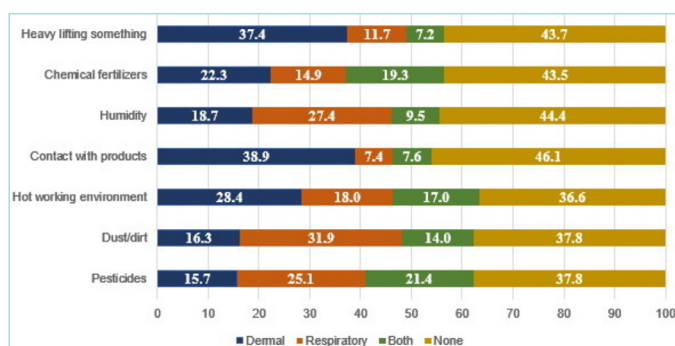


Figure 2. Factors that cause health problems for the participants dermal and respiratory tract.

Table 2. Logistic regression analysis for the relationship between working time and health problems in greenhouse agriculture (n=529)

Variables	Odds' ratios, (95% GA)				p*
	Respiratory distress	Cough	Itching-rashing	Nose-eye problems	
The number of working hours in greenhouse per day	2.04 (0.40-14.60) ^a		15.27 (1.71-26.48) ^b	5.93 (1.83-19.20) ^c	0.023 ^a 0.015 ^b 0.003 ^c
The number of working days in greenhouse per month	0.27 (0.04-1.71) ^x	6.80 (1.23-34.48) ^y			0.044 ^x 0.028 ^y

*p<0.05, ^a8 hours, ^b<10 hours, ^c>25-30 days, for the monthly working day variable, the reference category has been changed to "last".

Table 3. Logistic regression analysis for the relationship between work type and equipment usage and health problems in greenhouse agriculture (n=529)

Variables	Odds' ratios (95% GA)						p*
	Respiratory distress	Bronchitis	Cough	Wheezing	Itching-rashing	Nose-eye problems	
Seed sowing	1.69 (1.11-2.58) ^a			1.71 (1.09-2.68) ^b	2.93 (1.97-4.37) ^c	2.15 (1.45-3.19) ^d	0.015 ^a 0.019 ^b 0.000 ^c 0.000 ^d
Pesticide application/ spraying		8.04 (2.36-27.40) ^a				1.66 (1.07-2.57) ^b	0.044 ^a 0.022 ^b
Grafting			0.62 (0.41-0.95) ^a		0.34 (0.21-0.54) ^b	0.29 (0.18-0.46) ^c	0.028 ^a 0.000 ^b 0.000 ^c
Personal protective equipment (PPE)** not used		0.31 (0.09-1.02) ^a		0.32 (0.14-0.71) ^b			0.054 ^a 0.005 ^b
Mask		0.48 (0.24-0.93) ^a	0.48 (0.32-0.72) ^b	0.50 (0.31-0.80) ^c	0.42 (0.28-0.63) ^d	0.51 (0.34-0.76) ^e	0.030 ^a 0.000 ^b 0.005 ^c 0.000 ^d 0.001 ^e

*p<0.05, **Personal Protective Equipment, ^{a,b,c,d,e}No, for variables with an OR value less than 1, the reference category is changed to "last".

It was determined in the study that the emptied pesticide boxes were mostly thrown into garbage bins on the streets and sent for recycling. Similarly, in a study, it was revealed that the majority of the workers threw the emptied pesticide boxes in the nearby garbage bins, and 20% of them dumped them anywhere.²⁸ In the same study, when workers were asked about the reasons for their behavior, they stated that the municipal garbage container was too far from the agricultural areas and it was difficult and time consuming to transport the emptied boxes there.²⁸ Nowadays, when waste management and plastic waste recycling have become extremely important, it is seen that these plastic wastes containing chemical residues are unconsciously left to nature and there is a serious lack of awareness among agricultural workers.

A low percentage of the participants stated that they wore the clothes used while working in the greenhouse in their daily life, and more than half of them consumed food and beverages in the greenhouse. Avoiding the use of the same clothes is very important in terms of preventing the contamination of other family members and preventing secondary exposure. Mouth is one of the ways of taking pesticides into the body, and it makes us think that the participants of the research are either unaware of or insensitive about the harmful effects of consuming food and beverage in the greenhouse to human health.

In the research, itching, rashing, swelling, etc. on hands/face (open areas of the body) were found to be experienced the most by the participants. It is followed by nose or eye problems (itching, watering, burning, pain, etc.) with a 45.7% rate, cough with a 39.1% rate, and wheezing/shortness of breath with a 22.1% rate. In a study conducted with farmers, it was reported that symptoms such as allergies, nasal congestion, and wheezing were observed frequently after the use of pesticides.²⁹ In one study, it was reported that pesticides used in agriculture can be absorbed by eyes in amounts that can cause serious or even fatal disease.³⁰ Granular pesticides can pose a special danger to the eyes depending on the size and weight of the particles.³¹ If pesticides are applied with electrical equipment, the granules can bounce off vegetation or other

surfaces at high speed, causing serious eye damage.³² Eye protection is also needed when measuring or mixing concentrated or highly toxic pesticides. Protective face shields or goggles should be worn when spraying pesticides or to prevent eye contact with powders.

In the study, the workers think that dermal problems are mostly caused by contact with products and respiratory problems are due to dust/dirt, while both dermal and respiratory problems are reported to result from pesticides, chemical fertilizers, and a hot working environment. Pesticide exposure was reported to be commonly associated with eye irritation, skin infection/rashing, and dry throat.³³ Fungicides, a type of pesticide, have been reported to cause high rates of irritation and dermal sensitivity on the skin and mucous membranes.³⁴ In a study, a significant difference was found in terms of dermal symptoms between the hand by which pesticide was applied and other parts of the body.³⁵ In some of the current literature information, it was determined that agricultural workers had asthma,³⁶ chronic obstructive pulmonary disease^{37,38} and pulmonary hypersensitivity.³⁹ In studies performed with workers working in flower cultivation in greenhouses, respiratory symptoms were also reported to be common.⁴⁰⁻⁴² Inhalation of pesticide aerosols or vapors can directly damage the airways or interact with irritant receptors in the airway mucosa, resulting in the release of chemical mediators that trigger neurogenic inflammation.²⁰ Huyen et al.²⁸ reported that dermal symptoms were common among farmers due to their constant contact with pesticides. Entering into the greenhouse with daily clothes and using them while working, although at a low rate, and failure to clean hands and face sufficiently after working in the greenhouse may make workers sensitive in terms of dermal and eye diseases.

In the study, daily and monthly working time was found to be associated with dermal and respiratory symptoms. Similarly, a study conducted in Spain found a positive correlation between working time in the greenhouse and rhinitis.⁴³ Quansah et al.¹⁹ discovered in their research that the prevalence of chronic cough and wheezing was higher among

agricultural workers who applied pesticides more than 30 days a year. The length of the working period (hours and days) seems to trigger dermal and respiratory symptoms by increasing the time of exposure to chemical agents in the greenhouse.

In the study, it was determined that the tasks of seed sowing, pesticide application/spraying, and grafting in the greenhouse were associated with dermal and respiratory symptoms. A research performed in China reported that pesticide exposure was mostly seen among workers engaged in sowing, plant growing, and pesticide application.⁴⁴ Another study found that respiratory and dermal symptoms were mostly seen in female workers engaged in cutting and weeding tasks. In the same study, it was discovered that the prevalence of respiratory symptoms was high among male workers engaged in pesticide spraying.²⁵ Research conducted with female agricultural workers in Africa revealed that pesticide spraying had a positive relationship with ocular-nasal symptoms.⁴⁵ The biological mechanism by which some pesticides cause respiratory symptoms and asthma is not fully understood. Exposure to high concentrations of pesticides is thought to cause excessive mucus secretion and contraction of the smooth muscle of the respiratory tract, resulting in shortness of breath, wheezing, and cough.⁴⁶

The study revealed that those not using any protective equipment suffered from wheezing and those not wearing masks experienced bronchitis, coughing, wheezing, itching-rashing on skin, and nose-eye problems. Personal protective equipment is an important approach to reducing respiratory exposure in agricultural activities.⁴⁷ One study reported that a large proportion of pesticide poisonings were caused by the failure to use personal protective equipment.⁴⁸ While many workers are unaware of the risks associated with pesticide use, the lack of training and equipment to safely use pesticides increases health risk.⁴⁹ It has been reported that workers must use hand, head, eye, foot, ear and respiratory protectors that are defined as appropriate personal protective equipment while working with pesticides to prevent their exposure to the harmful effects of pesticides, and that skin exposure to pesticides can be prevented by 98% with the proper use of these protective materials.⁵⁰ The use of protective equipment among agricultural workers may vary by years and region. In a study, it was found that 93% of workers used protective equipment during pesticide applications and this use was preferred mostly by young men,⁵¹ while Esehie and Ibiyato¹² discovered that the use of personal protective equipment by greenhouse workers was insufficient. The research performed in our country revealed that the rate of using personal protective equipment during pesticide applications varied between 13-41%.^{40,52,53} The awareness of the use of personal protective equipment and the risks of pesticides varies by age and gender.^{54,55} Reviewing the literature, the high rate of occupational diseases and health problems among agricultural workers shows that personal protection is inadequate or faulty, and those applying pesticides have insufficient knowledge about storage, application, and disposal of these products.⁵⁶⁻⁵⁸

Approximately half of the participants in the study stated that their health problems occurred after they started working in the greenhouse, that their problems increased while working in the greenhouse, and that similar health problems were also seen among other people working in the same place, and that their complaints decreased on the days not when they did not work in the greenhouse. These findings

suggest that the working environment triggers health problems among workers. The data by the Turkish Statistical Institute show that 18.2% of total employment is in the agricultural sector.⁵⁹ The results of this study are important to guide workers rendering services in agricultural activities, to elaborate plans for raising social awareness, and to form a basis for the steps to be taken in this regard.

Study Limitations

The beginning of the pandemic process created a limitation in terms of data collection. Because people with respiratory problems are thought to be not working in the greenhouse due to the risk of contracting coronavirus during the pandemic and normalization process, these people may not have been reached during the data collection process. Also, the findings obtained from the study are limited to the sample of the research.

CONCLUSION

In conclusion, factors such as working conditions, type of work done in greenhouse agriculture, and failure to use personal protective equipment increase the prevalence of dermal and respiratory symptoms among workers. Greenhouse agriculture should be paid attention because it is a common line of business in our country and the main source of income for a large part of the society, and hence improvements should be made in working environments.

- Public health professionals should provide training on the use of personal protective equipment and the impact of pesticides on human health, environmental health, and the future to the workers; and training on the health effects of working conditions to the employers and agricultural companies; and training on the use of personal protective equipment to the pesticide vendors.
- Working times can be standardized at the directorate or ministerial level rather than individual decisions.
- Measures to reduce exposure to chemical and biological hazards should be considered. Scientific research covering exposure measurements and objective health examinations should be conducted among greenhouse agricultural workers.
- Encouraging and guiding agricultural workers to use biological agents to eradicate pests and plant diseases will help minimize worker exposure to pesticides, reduce negative impacts on the environment and save production costs.
- The use of machines in the application of pesticides can reduce the direct contact of workers with these pesticides. Machines can also reduce spraying time, labor and production costs.

MAIN POINTS

- Working for 8 h or more per day and working for 25 days or more per month were associated with skin and respiratory problems.
- The type of work done in greenhouse agriculture increases the prevalence of dermal and respiratory symptoms among workers.
- Failure to use personal protective equipment increases the prevalence of dermal and respiratory symptoms among workers.

ETHICS

Ethics Committee Approval: The approval of the Akdeniz University Faculty of Medicine Clinical Research Ethics Committee was obtained to conduct the study (approval number: KAEK-282).

Informed Consent: Informed consent was obtained from the participants.

Peer-review: Externally and internally peer-reviewed.

Authorship Contributions

Concept: D.A., A.S., Design: D.A., A.S., Data Collection and/or Processing: D.A., A.S., Analysis and/or Interpretation: D.A., A.S., Literature Search: D.A., A.S., Writing: D.A., A.S.

DISCLOSURES

Conflict of Interest: No conflict of interest was declared by the authors.

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