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Plant Protection Products and Personal Protective Use Information, Attitude, Behavior of Turkish Farmers

Özgür ÖZERDOĞAN* Sibel OYMAK Buse YÜKSEL Coşkun BAKAR
Çanakkale Onsekiz Mart University, Faculty of Medicine, Department of Public Health, Çanakkale, Turkey
(*Corresponding author e-mail: drozgurozerdogan@gmail.com)
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ABSTRACT: The aim of this work is to examine the knowledge, attitudes and behaviours of farmers about the use of plant protective products (PPPs) and personal protective equipment (PPE). This descriptive study was conducted in a village located in Çanakkale Ezine town, Marmara region of southern Turkey. The questionnaire was applied by face to face interview method. Criteria for inclusion in the research were determined as voluntary participation, being 18 years old or older and actively farming or previous active farming experience. 194 people were interviewed in the study. The data of 184 subjects were included in statistical analysis. By the study it was concluded that farmers knew the harmful effects of PPPs, but did not use adequate PPE. Total score data of PPPs behaviour were obtained from 11 questions. In further analysis, it was determined that total score data of PPPs behaviour increased with not doing livestock, knowing the harmful effects of PPPs and not experiencing discomfort after using PPPs in the last year. In order to protect human and environmental health should be undertaken multidisciplinary training on farmer-safe personal protective use and PPPs applications and the level of knowledge, attitude and behavior of farmers should be improved. Periodic monitoring of farmer health and safety may be useful.

Keywords: Plant protective products, Pesticide, Personal protective equipment, Farmer, Turkey

Türk Çiftçilerinin Bitki Koruma Ürünleri ve Kişisel Koruyucu Kullanımı Bilgi, Tutum, Davranış Durumu

ÖZ: Bu çalışmanın amacı, çiftçilerin bitki koruyucu ürünleri (BKÜ) ve kişisel koruyucu ekipman (KKE) kullanımı hakkındaki bilgi, tutum ve davranışlarını incelemektir. Bu tanımlayıcı çalışma, Türkiye'nin Güney Marmara Bölgesi'nde yer alan Çanakkale'nin Ezine İlçesi'nde bir köyde gerçekleştirilmiştir. Anket yüz yüze görüşme yöntemi ile uygulanmıştır. Araştırmaya dahil olabilme kriterleri; gönüllü olma, 18 yaş ve üzerinde olma, aktif olarak çiftçilikle uğraşma veya daha önce çiftçilikle aktif olarak uğraşmış olma olarak belirlenmiştir. Araştırmada 194 kişi ile görüşme yapılmıştır. 184 kişinin verileri istatistiksel analize dahil edilmiştir. Çalışmada, çiftçilerin BKÜ'lerin zararlı etkilerini bildiği, ancak yeterli düzeyde KKE kullanmadığı belirlenmiştir. On bir soru ile BKÜ kullanımı davranış toplam puanı elde edilmiştir. İleri analizlerde,BKÜ kullanımı davranış toplam puanının, hayvancılık yapmamak, BKÜ'lerin zararlı etkilerini bilmek ve son bir yıl içindeBKÜ'leri kullandıktan sonra bir rahatsızlık yaşamamak ile arttığı belirlenmiştir. İnsan ve çevre sağlığını korumak için, çiftçilere güvenli kişisel koruyucu kullanımı ve BKÜ uygulamaları konusunda multidisipliner eğitimler verilmeli ve çiftçilerin bilgi düzeyleri, tutum ve davranışları geliştirilmelidir. Çiftçi sağlığı ve güvenliğini düzenli olarak izlemek yararlı olabilir.

Anahtar Kelimeler: Bitki koruma ürünleri, Pestisit, Kişisel koruyucu ekipman, Çiftçi, Türkiye

INTRODUCTION

Plant protective products (PPPs) are chemical compounds used for kiling pests like insects, rodents, fungus and unwanted plants. They are potentially toxic to humans and other organisms and should be used safely and spread appropriately (WHO, 2017a). The United Nations Population Fund estimates the global population will reach 9.7 million by the year 2050 and that this population increase will occur nearly fully within developing countries. The United Nations Food and Agriculture Organization (FAO) estimated that 80% of the necessary increase in food production in developing countries will be due to yield increases and that annual yields will increase. It is expected that only 20% of new food production will come from the expansion of agricultural land. In this context, PPPs will continue to play a role in agriculture by preventing large crop losses. Additionally, if we consider the effects on humans, the threat to public health from exposure to increased levels of PPPs reaches worrying dimensions. The WHO recommends the healthy and safe use of PPPs in food production and the adoption of good agricultural practices regardless of the economic status of countries. Additionally, farmers should use the appropriate dose at the minimum level necessary for PPPs when used to protect plants (WHO, 2017b).

It is possible to produce agricultural products with the desired amount and quality by protecting these products from disease and pests. As a result, PPPs are commonly used in the agricultural sector (Ersoy et al., 2011). As the toxicity and danger of PPPs is known, developed countries have limited their use in the agricultural sector with laws; however, in developing countries these limitations are not sufficient and these products are commonly used in cultivating agricultural products (Coggon, 2002; Singh and Gupta, 2009; Salameh et al., 2004; Kuye et al., 2007). Their use in agricultural activities may cause environmental pollution by mixing with soil, water and air. Exposure of humans to PPPs via

contact, digestive or respiratory routes may result in acute and chronic intoxication with death and a broad range of side effects occurring (Altıkat et al., 2009; Samanic et al., 2005; Weng and Black,2015). Due to all of these harmful effects, PPPs use should be taken under control at all stages from the production of food material to its consumption and it is necessary to identify whether any PPPs residues are found on plants (Tiryaki et al., 2010). If PPPs are applied in a safe manner and used with appropriate equipment and personal protective equipment (PPE), human exposure to these products may be reduced to a minimum and thus the potential harmful effects of PPPs on the environment may be reduced (Damalas and Eleftherohorinos, 2011).

Especially in developing countries, farm workers do not have knowledge, attitude and behavior related to the safe use of PPPs and about PPE (Blanco-Munoz and Lacasana, 2011). Studies have shown that farmers are aware of the potential health risks of PPPs application; however, they do not use the most basic safety precautions led by protective clothing at sufficient levels or correctly (Damalas et al., 2006; Khan et al., 2010; Yassin et al., 2002; Yang et al., 2014; Weng and Black, 2015). Farmers who do not view PPPs as a health risk choose not to use PPE or clothing but are observed to consider daily clothing sufficient (Branson and Sweeney, 1991; Palis et al., 2006).

Application of PPPs in unsafe and unhealthy conditions is a global public health problem threatening the health of the farmer initially and then society and the environment. This study aims to investigate the use of PPPs and PPE among farmers living in a county located in the South Marmara region of Turkey.

MATERIAL AND METHOD

This descriptive-type epidemiologic research was completed from 22-24 August 2017 from 10:00 to 15:00 in Mahmudiye village in Ezine country in Çanakkale located in the South Marmara region of Turkey (Figure 1).

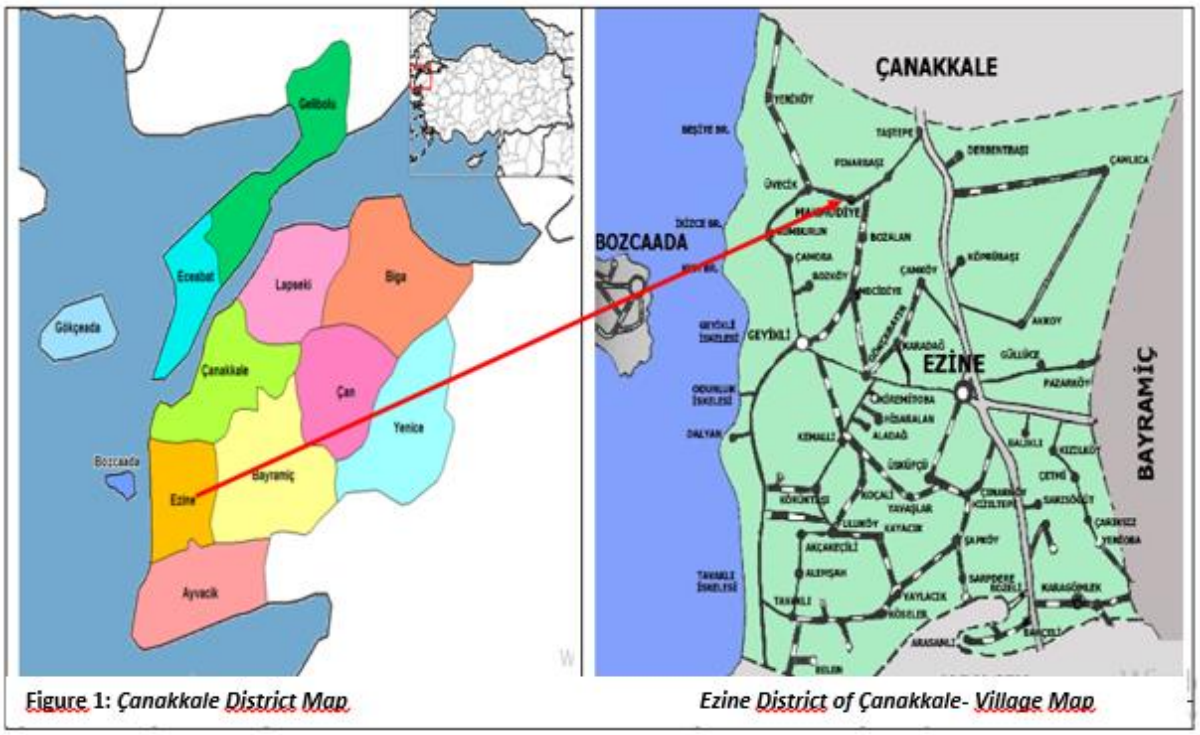

Figure 1: Çanakkale District Map — Ezine District of Çanakkale- Village Map

This study included individuals aged 18 years and older living in Mahmudiye village in Ezine country in Çanakkale province, who actively farmed or had previously engaged in farming. Sampling was not taken for the study; the target was to reach all individuals abiding by the study criteria within the study duration. During the time of the study, a total of 1521 individuals, 772 males and 749 females, resided in Mahmudiye village (TSI, 2016). During the study, 194 people were interviewed (of those interviewed 10 had not engaged in farming and did not abide by the participation criteria; thus, the data of 184 individuals were statistically analyzed). Among reasons for not participating in the study were situations such as not being in the village during the study period, not accepting to answer the survey

form, and not reaching some people during the interviewers' working period.

The research team comprised teaching staff from Çanakkale Onsekiz Mart University, Faculty of Medicine, Department of Public Health and intern doctors completing Public Health internships. Before the study, preliminary training was given to the research team in the Department of Public Health in the university and the survey form was reviewed.

Study Design

Research data were obtained by applying the survey form (to increase participation and to encourage farmers, blood pressure measurements were performed after answering the survey form; however, these measurements were not recorded). The survey form comprised 13 questions related to sociodemographic properties, and 42 questions related to knowledge levels, used habits and attitudes related to agricultural pesticides. Blood pressure measurements were completed manually after at least 20 minutes rest, with cuff placed 2-3 cm above the elbow covering 80% of the left arm. After blood pressure measurements, results were shared verbally with the farmers and not recorded.

In the preliminary preparation stages of the study, initially discussions were held with Ezine county Directorate of Food, Agriculture and Livestock and the village headman and then written permission was obtained. Ethics committee permission was obtained from Çanakkale Onsekiz Mart University Clinical Research Ethics Committee (date 06.09.2017 and decision no. 14-23). The survey form was created by the research team according to the literature. The research team provided preliminary training to the intern doctors who would apply the survey form. The training team observed a preliminary trial, identified mistakes and resolved requirements and deficiencies to standardize the program. The intern doctors applied the survey form to participants during face-to-face interviews. The application of the survey forms and blood pressure measurements were performed in Mahmudiye village headman's office, at Mahmudiye village family health center and during home visits. Inclusion criteria for the research were determined as voluntary participation, being 18 years or older, and actively farming and/or previous active farming experience. Participants who volunteered for the study were given information about the aim and method of the study by the intern doctors and verbal and written consent was obtained. The knowledge, attitude and behavior of participants in the study about PPPs and PPE use were investigated.

Data Analysis

The study data was analyzed with the SPSS 20.0 statistical program. Descriptive variables are given as number, percentage, mean, standard deviation, median, minimum and maximum values. The PPPs use behavior total points were obtained from 11 questions chosen to investigate the behavior of farmers related to the use of plant protective products (range 0-11). The 11 questions related to behavior total points are shown in Table 1.

The independent variables of gender, age, education, marital status, smoking habit, having livestock, disease requiring continuous medication use diagnosed by a doctor, duration of farming, duration of use of PPPs, knowing the names of PPPs used, knowing the harmful effects of PPPs, receiving training from an official organization about the safe use, storage conditions and protective methods for PPPs, knowing PPPs may mix with water/soil/air and experiencing discomfort after using PPPs within the last year were compared with the dependent variable of PPPs use behavior total points after normal distribution tests were performed and the Mann-Whitney U test applied. For multivariate analysis, the multiple regression test (backward method) was used. The degree of statistical significance was taken as $p<0.05$.

According to Mann-Whitney U test results, the dependent variable (PPPs use behavior total points) was identified to be related to five independent variables (age, having livestock, PPPs duration use, knowing the harmful effects of PPPs and experiencing discomfort after PPPs use within the last year). To investigate the effects of these five independent variables on the dependent variable, different modelling studies were performed with the multiple regression analysis (backward method). Age, used as a dichotomous variable in the Mann Whitney U test was used to surround the continuous variables in the regression analysis of the PPPs duration of use variables. The other independent variables were included in the multiple regression analysis by coding them as; not having livestock '1', having livestock '0'; knowing the harmful effects of PPPs '1', not knowing the harmful effects of PPPs '0'; and no discomfort after PPPs use in the last year '1', discomfort after PPPs use in the last year '0'. The three independent variables (having livestock, knowing the harmful effects of PPPs and experiencing discomfort after using PPPs in the last year) identified to affect PPPs use behavior total points with the multiple regression analysis (backward method) are presented in the model results section (Adjusted R^2=0.274, Durbin-Watson=1.493)

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Table 1. Questions and points used to determine total PPPs behavior points

Variables	Points
Do you spread agricultural pesticides by hand?	
Yes	0
No	1
Do you spread fertilizer with bare hands?	
Yes	0
No	1
When applying pesticides do you abide by the dose recommended on the box?	
Sometimes/No	0
Yes	1
Do you smoke while applying and preparing pesticides?	
Yes/Sometimes	0
No	1
Do you eat or drink anything at any time while working?	
Yes/Sometimes	0
No	1
Do you apply these pesticides while sweating a lot?	
Yes/Sometimes	0
No	1
Do you change your clothes after application?	
Sometimes/No	0
Yes	1
Do you bathe after application on the same day?	
Sometimes/No	0
Yes	1
Do you apply pesticides against the wind on a windy day?	
Yes/Sometimes	0
No	1
Do you frequently take breaks and rest while applying pesticides?	
Yes/Sometimes	0
No	1
Do you take personal protective precautions while repairing or cleaning equipment used for applications?	
No	0
Yes	1
PPPs use behavior total points	**0-11**

RESULTS

Of the 184 people comprising the study group 42.9% were female. In the whole group the mean age was 58.1±14.4 years (median: 60, Min-Max: 23-88), with mean age of males 60.2± 15.1 (median: 62, Min-max: 24-88) and mean age of females 55.3±13.0 (median: 55, Min-Max: 23-84). Of participants 51.6% were aged 60 and above. Primary school graduates accounted for 73.4% of participants, with 80.4% married and 57.1% nonsmokers. Of participants, 51.4% had been farmers for less than 30 years, with 53.4% of participants using PPPs for 20 years or more. Of farmers, 17.3% stated they had received training about the safe use, storage conditions and protective methods for PPPs from an official organization. When participants who had not received training about the safe use, storage conditions and protective methods for PPPs from an official organization were asked if they would like to receive such training, 67.9% of participants were identified to want training from an official organization. In the study group 20.8% had experienced discomfort after PPPs use within the last year (Table 2).

Table 2. Characteristics of the study group

Variables	n	%
Gender		
Female	79	42.9
Male	105	57.1
Age		
<60	89	48.4
≥60	95	51.6
Education level		
Not Literate	5	2.7
Literate	20	10.9
Primary education	135	73.4
High school	17	9.2
University	7	3.8
Marital status		
The married	148	80.4
Single	9	4.9
Widow	27	14.7
Smoking status		
Yes	55	30.3
No	104	57.1
I've used, I left	23	12.6
Farming (year)		
<30	93	51.4
≥30	88	48.6
Period of use of PPPs (year)		
Do not use	9	5.2
<20	72	41.4
≥20	93	53.4
Training by an official organization about the safe use, storage conditions and preventive methods of PPPs		
Yes	30	17.3
No	143	82.7
Request for training by an official organization about the safe use, storage conditions and preventive methods of PPPs (Asked for people who have not been trained before)		
Yes	95	67.9
No	45	32.1
Experience an discomfort after use PPPs within the last year		
Yes	35	20.8
No	133	79.2

n: Number, %: Percent, PPPs: Plant Protective Products

Of the study group 49.1% had spread PPPs with bare hands, 58.3% had spread fertilizer with bare hands, 87.6% stated they abided by dose recommendations on the PPPs boxes, while 82.7% did not smoke while preparing or applying PPPs, 81.8% did not eat or drink anything while working, 46.9% stated they applied PPPs while very sweaty, 90.9% changed their clothes after applying PPPs, 95.8% had a bath the same day after application, 67.2% did not apply PPPs against the wind on windy days, 67.5% did not take frequent breaks while using pesticides and 39.0% took PPE precautions while repairing or cleaning equipment used to apply PPPs (Table 3).

Table 3. Distribution of the PPPs use behavior total points's questions

Variables	n	%
Do you spread agricultural pesticides by hand?		
Yes	82	49.1
No	85	50.9
Do you spread fertilizer with bare hands?		
Yes	102	58.3
No	73	41.7
When applying pesticides do you abide by the dose recommended on the box?		
Yes	141	87.6
Sometimes	13	8.1
No	7	4.3
Do you smoke while applying and preparing pesticides?		
Yes	22	13.6
Sometimes	6	3.7
No	134	82.7
Do you eat or drink anything at any time while working?		
Yes	13	7.9
Sometimes	17	10.3
No	135	81.8
Do you apply these pesticides while sweating a lot?		
Yes	75	46.9
Sometimes	21	13.1
No	64	40.0
Do you change your clothes after application?		
Yes	150	90.9
Sometimes	4	2.4
No	11	6.7
Do you bathe after application on the same day?		
Yes	160	95.8
Sometimes	7	4.2
No	0	0.0
Do you apply pesticides against the wind on a windy day?		
Yes	25	15.2
Sometimes	29	17.6
No	111	67.2
Do you frequently take breaks and rest while applying pesticides?		
Yes	32	19.6
Sometimes	21	12.9
No	110	67.5
Do you take personal protective precautions while repairing or cleaning equipment used for applications?		
Yes	62	39.0
No	97	61.0

n: Number, %: Percent, PPPs: Plant Protective Products

The study group mainly cultivated wheat (27.4%), vegetables (16.8%), olives (16.4%) and barley (11.2%), in that order (Figure 2). Of participants 42.0% (n=76) had livestock. When those working with livestock were asked what product they earned money from 40.4% (n=59) said milk, 31.5% (n=46) said meat, 17.1% (n=25) said cheese, 6.2% (n=9) said eggs, 2.7% (n=4) said butter and 2.1% (n=3) said yogurt. Of the study group, 74.7% (n=127) stated they did not know the names of PPPs. PPPs were most commonly applied with tractors (70.2%) and back pumps (21.3%) (Figure 3). PPPs mixes were prepared in the field by 63.4% of participants. PPPs were most commonly stored in depots/stores (64.8%) and at home (20.5%). When participants were asked how they cleaned clothes

used when applying PPPs, 54.3% (n=94) washed them in a washing machine without mixing with other clothes, and 27.8% (n=48) washed the clothes alone by hand. Of the study group, 83.2% (n=149) knew about the harmful effects of PPPs and participants thought exposure to PPPs was mainly though the lungs/windpipe (41.4%), skin (33.6%) and esophagus/stomach/intestines (24.3%) (Figure 4). To dispose of PPPs containers, most burnt them (28.0%), some threw them in the rubbish (26.6%) and some threw them in the fields (26.1%) (Figure 5). Of the study group, 82.7% (n=143) had not received training from any official organization about the safe use, storage conditions and protective methods for PPPs. Of participants, 90.3% (n=159) stated PPPs may mix with water/soil/air. Within the last year, 20.8% of participants (n=35) had experienced discomfort after using PPPs.

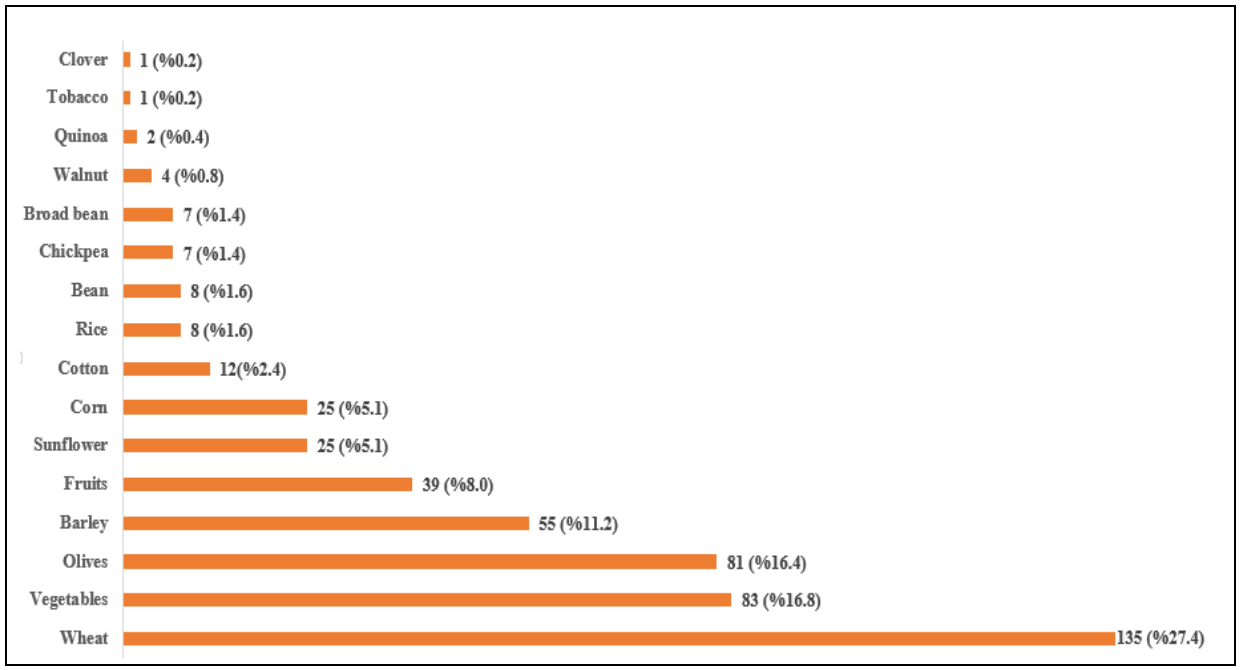

Figure 2. Agricultural products of earned money by farmers n(%), n: Number, %: Percent (more than one item were answered)

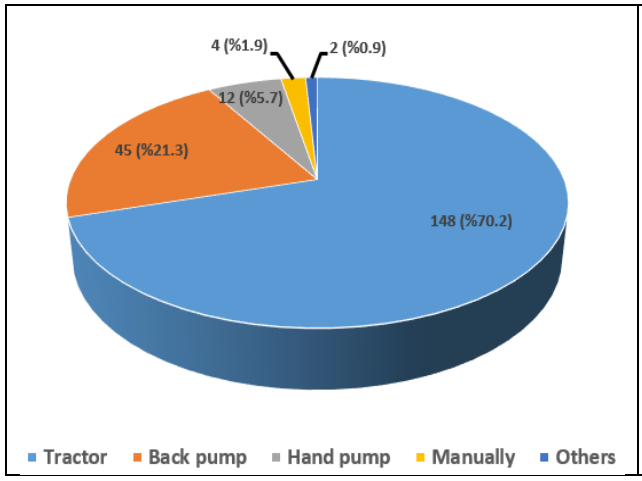

Figure 3. Way of applying PPPs n (%), n: Number, %: Percent, PPPs: Plant Protective Products (more than one item were answered)

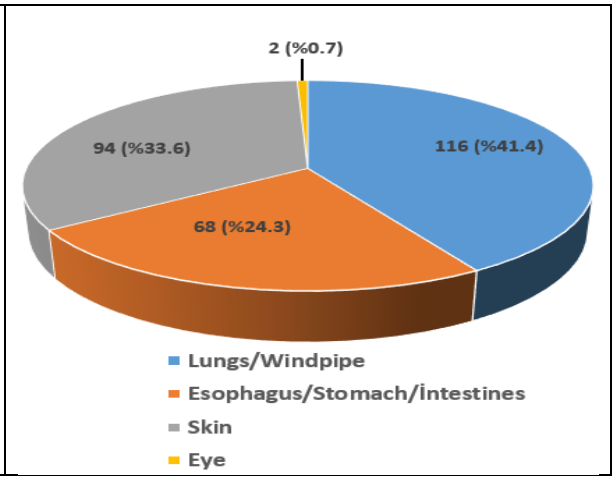

Figure 4. Study group's thought about exposure way to PPPs, n(%), n: Number, %: Percent, PPPs: Plant Prodective Products, (answered who think PPPs are harmful- more than one item were answered)

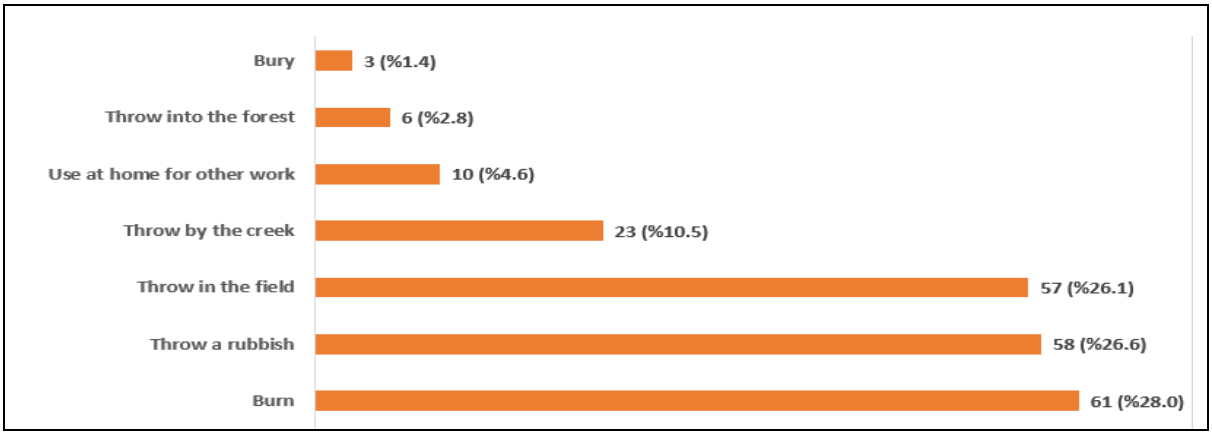

Figure 5. Way of PPPs containers's disposing, n (%), n: Number, %: Percent, PPPs: Plant Protective Products (more than one item were answered)

When the PPE use while preparing PPPs was investigated, most used trousers (61%), hat (56.1%) and gloves (44.5%). When PPE use when applying PPPs was investigated, most were identified to use trousers (63.4%), hat (57.2%) and jacket (44.1%) (Table 4).

Table 4. The PPE use while preparing and applying PPPs

Variables	Preparing		Applying	
	Yes n (%)	No n (%)	Yes n (%)	No n (%)
Gloves	73 (44.5)	91 (55.5)	70 (43.8)	90(56.2)
Protective googles	48 (29.4)	115 (70.6)	45 (28.0)	116 (72.0)
Hat	92 (56.1)	72 (43.9)	92 (57.2)	69 (42.8)
Jacket	69 (42.1)	95 (57.9)	71 (44.1)	90 (55.9)
Trousers	100 (61.0)	64 (39.0)	102 (63.4)	59 (36.6)
Bot/Long boots	42 (25.6)	122 (74.4)	43 (26.7)	118 (73.3)
Mask	38 (23.2)	126 (76.8)	42 (26.3)	118 (73.7)
Workwear	15 (9.1)	149 (90.9)	16 (9.9)	145 (90.1)

n: Number, %: Percent, PPE: Personal Protective Equipment, PPPs: Plant Protective Products

PPPs use behavior total points were calculated for 149 people who answered the 11 questions about PPPs use behavior fully and the mean PPPs use behavior total points were identified as 7.4±2.3 (median= 8, minimum-maximum= 1-11). The Mann-Whitney U test identified a statistical difference for age ($p=0.018$), having livestock ($p<0.001$), use duration of PPPs ($p=0.043$), knowing the harmful effects of PPPs ($p=0.010$) and experiencing discomfort after using PPPs in the last year ($p<0.001$) with the PPPs use behavior total points. The median PPPs use behavior points were higher for those aged 60 years and above compared to those younger than 60 years; for those who did not have livestock compared to those who did; for those who didn't use PPPs or used them for less than 20 years compared to those who used PPPs for 20 years or more; for those who knew the harmful effects of PPPs compared to those who did not; and for those who had no discomfort after using PPPs in the last year compared to those who did (Table 5).

Table 5. Comparison of sociodemographic characteristics, farming and PPPs use, PPPs information status and PPPs use behavior total points*

Variables	Mean±SD	Median (Min-Max)	p
Gender			
Female (n=55)	6.8±2.8	7.0 (1-11)	0.054
Male (n=94)	7.8±1.9	8.0 (3-11)	
Age			
<60 (n=73)	7.0±2.4	7.0 (1-11)	**0.018**
≥60 (n=76)	7.8±2.2	8.0 (2-11)	
Education status			
Primary Education/ Literate/ Not Literate (n=128)	7.4±2.4	8.0 (1-11)	0.941
High School/ University (n=21)	7.6±1.7	8.0 (4-10)	
Marital status			
Married (n=127)	7.5±2.3	8.0 (1-11)	0.378
Single/ Widow (n=22)	6.9±2.5	8.0 (2-10)	
Smoking status			
Yes/ I've used, I left (n=66)	7.6±2.2	8.0 (2-11)	0.599
No (n=82)	7.4±2.4	8.0 (1-11)	
Having livestock			
Yes (n=66)	6.7±2.3	7.0 (1-10)	**<0.001**
No (n=81)	8.0±2.2	9.0 (2-11)	
Disease condition that requires continuous medication			
Yes (n=76)	7.2±2.4	8.0 (1-11)	0.459
No (n=72)	7.6±2.2	8.0 (2-11)	
Farming (year)			
<30 (n=74)	7.4±2.1	7.5 (1-11)	0.540
≥30 (n=73)	7.4±2.6	8.0 (2-11)	
Period of use of PPPs (year)			
Do not use / <20 (n=62)	8.0±1.9	8.0 (3-11)	**0.043**
≥20 (n=85)	7.0±2.5	7.0 (1-11)	
Knowing the names of the PPPs he/ she uses			
Yes (n=40)	7.9±2.1	8.5 (3-11)	0.167
No (n=109)	7.3±2.4	8.0 (1-11)	
Knowing the harmful effects of PPPs			
Yes (n=124)	7.7±2.1	8.0 (1-11)	**0.010**
No (n=25)	6.1±2.8	5.0 (2-11)	
Training by an official organization about the safe use, storage conditions and preventive methods of PPPs			
Yes (n=29)	7.9±2.1	8.0 (4-11)	0.285
No (n=119)	7.3±2.4	8.0 (1-11)	
Knowing that PPPs contaminate water / land / air			
Yes (n=131)	7.3±2.3	8.0 (1-11)	0.120
No (n=16)	8.3±1.8	8.5 (4-11)	
Experience an discomfort after use PPPs within the last year			
Yes (n=30)	5.6±2.5	5.0 (1-10)	**<0.001**
No (n=117)	8.0±2.0	8.0 (2-11)	

*: The PPPs use behavior total points was calculated for 149 participants who answered at least 11 questions, PPPs: Plant Protective Products, n: Number, SD: Standard Deviation, Min: Minimum, Max: Maximum, p: Mann-Whitney U Test

The multiple regression analysis (backward method) was applied using the independent variables (age, duration of PPPs use, having livestock, knowing the harmful effects of PPPs and experiencing discomfort after PPPs use within the last year) estimated to be related to the dependent variable of PPPs use behavior total points on the Mann-Whitney U test. The result of different modelling studies identified a statistically significant difference between having livestock, knowing the harmful effects of PPPs and experiencing discomfort after using PPPs in the last year with the dependent variable ($p<0.05$). It was determined that not having livestock increased the PPPs use behavior total points by 1.093 points, knowing the harmful effects of PPPs increased it by 1.621 points and not experiencing discomfort after using PPPs within the last year increased it by 2.072 points (Table 6).

The multiple regression formula took the following form:

PPPs use behavior total points = 3.799 + 1.093* having livestock *(yes=0, no=1)* ***+ 1.621* knowing the harmful effects of PPPs*** *(no=0, yes=1)* ***+ 2.072* experiencing discomfort after using PPPs in the last year*** *(yes=0, no=1)*

Table 6. Examination of the risk factors related to PPPs use behavior total points of the study group with multiple regression analysis, Çanakkale, 2017*

Variables	OR	CI %95	p
Constant	3.799	2.760-4.838	<0.001
Having livestock			
Yes (0)			
No (1)	1.093	0.426-1.761	**0.001**
Knowing the harmful effects of PPPs			
No (0)			
Yes (1)	1.621	0.757-2.486	**<0.001**
Experience an discomfort after use PPPs within the last year			
Yes (0)			
No (1)	2.072	1.261-2.882	**<0.001**

*: Backward Multiple Regression Analysis, OR: Odds Ratio, CI: Confidence Interval, PPPs: Plant Protective Products, p: Statistical Significance Level

DISCUSSION

This study was done to investigate the PPPs and PPE use habits of farmers in a village in Ezine country in Çanakkale province. The study group were identified to apply PPPs in unhealthy and unsafe conditions and farmers did not pay attention to the use of PPE. The majority of farmers in our study had primary school and lower levels of education complying with the literature (Garcia et al., 2002; Sam et al., 2008). In accordance with the climatic and geographical conditions of villages on the Anatolian side of the Çanakkale straits, the majority cultivated cereals, vegetables and fruit. In our study region, the majority were identified to cultivate wheat, vegetables, olives, barley and fruit based on the climatic and geographic conditions. Our study does not include data about the variety of PPPs, as the variety among cultivated products may affect the variety, amounts and application devices for PPPs used. Very few of the farmers answering questions related to PPPs in our study group did not use any PPPs, with more than half stating they had been using PPPs for 20 years or longer.

Farmers stated the most common method used for application was a tractor and nearly half stated they had spread PPPs by hand at some period of their lives. In our study, a significant risk factor was that the majority of people had used their bare hands to spread PPPs at some point in their lives. In addition to the identification that PPPs are mainly applied with tractors, it is not known what PPE is used in terms of PPPs effects during tractor application. In the literature, products appear to vary in terms of PPPs application methods (Ntow et al., 2006; Singh and Gupta, 2009). Mistaken applications by farmers not using PPE may cause intoxication (Ntow et al., 2006; Weng and Black, 2015). In our study group, similar to the literature, more than half of participants did not use gloves while preparing PPPs and 21% were identified to have experienced at least one health problem after using PPPs within the last year (Reynolds et al., 2007). Our findings are similar to studies in developing countries, with PPPs stored in unhealthy and unsafe conditions, with labels and guidelines for use ignored, kept in depots-stores together dry food and at home (Ngowi et al., 2001; Lekei et al., 2014; Blanco-Munoz and Lacasana,

2011; Banerjee et al., 2014). In our study, depot/stores and homes were mostly used with the aim of storing PPPs. The high storage rates of PPPs at home identified is important in terms of not only farmers applying PPPs but also their families being exposed to health risks linked to PPPs. These results reveal the necessity of developing and applying protection and prevention intervention programs urgently to reduce the health and safety risks of PPPs.

Informing about PPPs safety decreases the perceived risk while increasing perceived control. Increases in control were found to be closely related to the development of safety knowledge and safe behavior (Arcury et al., 2002). In ourstudy, the majority of farmers knew about the dangers of PPPs, in accordance with the literature (Shomar et al., 2014; Damalas et al., 2006; Mohanty et al., 2013; Garcia et al., 2002; Weng and Black, 2015) and the most frequently reported exposure routes were respiratory and skin. Different to our study results, studies in the Philippines and India found the majority of farmers were not uncomfortable about the safety and health risks of exposure to PPPs (Palis et al., 2006; Singh and Gupta, 2009). Both our literature scan and study results show that farmers do not pay sufficient attention to healthy and safe PPPs application; in spite of knowing the health risks of PPPs they consider the risk unimportant due to insufficiently developed attitudes and thus do not protect against health risks. One of the most important gaps in the literature about this topic is the lack of qualitative studies. Qualitative studies will reveal situations preventing the development of attitudes to healthy and safe PPPs application and PPE use among farmers and then the necessary precautions may be taken.

Studies have shown that farmers do not abide by safety precautions after applying PPPs, and dispose of empty PPPs boxes, PPPs waste after application and other waste material in unhealthy and unsafe conditions (Plianbangchang et al., 2009; Damalas et al., 2008; Mohanty et al., 2013). A study in Greece observed that farmers repeatedly applied pesticides to the field until the PPPs tank was empty and used the remaining PPPs to apply a different product on the labels. Farmers were identified to empty PPPs wastes into fields, irrigation channels, and rivers, with some openly burning the empty containers, throwing them into public waste disposal sites or continuing to use empty containers (Damalas et al., 2008). In our study group, farmers were identified to burn waste PPPs containers, throw them in the rubbish, and leave them in fields. Additionally, it is noteworthy that some reported continuing to use them at home for other uses and this finding requires emergency intervention in terms of public health. Studies in different countries comply with our results, with the majority of farmers disposing of waste PPPs containers under inappropriate conditions, by burning or leaving them in the fields or by water courses (Mohanty et al., 2013; Yang et al., 2014).

In our study, similar to the literature, farmers appear to use insufficient PPE when preparing and applying PPPs (Shomar et al., 2014; Khan et al., 2010). However, some PPEs like trousers were used at higher rates when preparing and/or applying PPPs compared to other PPE. This result may be due to the perception of the use of trousers worn as daily clothing as PPE instead of separate work trousers when preparing and/or applying PPPs. Similar to our study results, studies have shown that though farmers are aware of the health risks of PPPs, the use of basic PPE like masks and gloves is irregular and at very low levels (Damalas et al., 2006; Khan et al., 2010; Salameh et al., 2004; Plianbangchang et al., 2009; Kuye et al., 2007; Singh and Gupta, 2009; Macfarlene et al., 2008; Mohanty et al., 2013). Another study from India identified that the most common personal protection methods used during PPPs application were closing the nose and covering the mouth with cloth and taking a bath after application (Banerjee et al., 2014).

In our study, the total points for healthy and safe PPPs use behavior were calculated with the aim of identifying how consciously farmers acted during PPPs applications. Advanced analyses found that PPPs use behavior total points were higher among those without livestock, those who know the harmful effects of PPPs and those who had not experienced any discomfort after PPPs use in the last year. According to these results, farmers knowing the harmful effects of PPPs is important; however, the majority of the study group stated they had not received any training about the safe use, storage conditions for PPPs and PPE use from an official organization. Additionally, the PPPs use behavior points were identified to be high for those who had not experienced health problems after PPPs use in the last year. This situation may be interpreted that PPPs-related health problems may be observed more rarely among those who develop healthy and safe attitudes and behavior to PPPs use. Similar to our study findings, a study in Indonesia observed that farmers using PPE clothing had fewer health problems (Sekiyama et al., 2007). In developing countries, it was found that due to reasons such as farmers frequently not receiving training about their work, not being literate or having low educational levels, not believing safety precautions are practical and considering safety material to be expensive, occupational intoxication is more commonly observed in these individuals (Sam et al., 2008).

In our study farmers reported they washed their working clothes after applying pesticides in three different ways (in order, separately in the washing machine without mixing other clothes, hand washing on their own and in a washing machine with other clothes). The study by Damalas et al. identified that farmers mainly washed their work clothes after several uses (Damalas et al., 2006). Farmers reported they required training to increase awareness about potential dangers of PPPs use, especially healthy and safe management of waste products (Damalas et al., 2008). Very few of the farmers in our study group were identified to have received "safety training" from an official organization. Studies have reported that applied safety training among farmers is necessary for the development of protective behavior (Salameh et al., 2004). Additionally, improving labelling to reduce the health risks of PPPs and reducing economic factors preventing development of safe behavior (easy access to PPE and safe application equipment, etc.) will be effective in developing protective behavior (Lekei et al., 2014). In our study, in accordance with the literature, the majority of farmers stated they wished to receive work safety and hygiene training about applying PPPs in healthy and safe conditions (Phung et al., 2013). Due to the farmers not using PPE and not being aware of safety and health risks that may occur linked to PPPs exposure, there is a need for training-intervention programs (Singh and Gupta, 2009; Mohanty et al., 2013; Banerjee et al., 2014; Palis et al., 2006; Jors et al., 2014). The importance of education increases further in regions with high intoxication especially. When training studies are not continuous or regular, farmers use of PPE has been shown to fall even though they receive training (Sam et al., 2008). According to a study from China, farmers were identified to receive information about the dangers and use of PPPs through verbal communication. It was identified that the protective precautions among farmers were insufficient and they did not use any protective equipment when applying PPPs. It was reported that it was necessary to explain the potential health and safety risks of PPPs waste during training. The same study stated the majority of farmers used illegal PPPs (Yang et al., 2014).

Our research was a descriptive-type study completed in a village linked to Ezine country in Çanakkale province. As a result, it is not possible to generalize our study results to the province. However, repetition of this study in different counties and villages in Çanakkale province where agricultural activities are intensely practiced will be effective to determine the knowledge-attitude and behavior status of farmers related to healthy and safe PPE and PPPs application. Thus, it will be easier to determine the deficiencies/errors in these elements and develop necessary policies.

Our study data were obtained by applying a survey form to farmers and participants voluntarily answered the form. As some participants did not want to answer some questions on the survey, some data were not presented due to data deficiency or some data represented numbers below the study population. The total PPPs behavior points were calculated from 11 questions and the PPPs behavior total points were calculated for participants answering all of these 11 questions fully. As a result, analyses were based on 149 separate PPPs behavior total points.

In our study group, in compliance with the literature, farmers were identified to have low incidence of PPE use. Both our study findings and the literature consider farmers to have weak compliance with PPE use. As in our study group, though farmers know the health and safety risks of PPPs, they do not usePPE when preparing or applying PPPs mixtures, have not developed positive attitudes to PPPs and PPE and this situation negatively affects behavior. There is a need for qualitative studies and training to resolve this and reveal the factors affecting attitudes and behavior of farmers to PPE use. Acceptance of risk triggers the use of PPPs under unhealthy and unsafe conditions. Individuals accepting risks use PPE and safe application methods less often (DellaValle et al., 2012). However, developing perceptions of risk control and health protection may increase the use of healthy and safe PPE and as a result the healthy and safe use of PPPs.

CONCLUSION

Though PPPs are used in lower amounts in Turkey and in Çanakkale compared to many countries, the unsafe conditions and use without attention to health risks is a common public health and environmental health problem. Our study results show that farmers do not pay attention to safe applications when using PPPs and did not fully use PPE. Repeated training about safe pesticides may increase the healthy and safe use of PPE and PPPs among farmers. With this aim, to create a multidisciplinary approach within a framework of cooperation between expert field teams and local health administrations, pilot villages may be chosen in our region and other regions. In these villages, the necessity of using PPE for health protection and how their work may affect their health will be explainedto farmers to create a health risk perception and a work health and safety culture in agriculture. Additionally, collection and removal of waste PPPs containers without harming the environment will encourage farmers. To prevent disposal of waste in

inappropriate and unhealthy conditions, systems with programs ensuring recycling or collection of unwanted environmental chemical wastes at appropriate cost may be developed regionally. Solution methods such as improving packaging systems to ensure PPPs waste products are at minimum levels may be offered. Considering the health and technical aspects of farmers' healthy and safe PPE and PPPs applications for human and environmental health, multidisciplinary cooperation will improve farmers' knowledge levels and studies to develop attitude-behavior may be completed. Auditing of these applications by local administrations may encourage and motivate farmers.

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