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Predictors of Safety Behavior Among Jiroft-City Greenhouse Spray Workers Based on Protection Motivation Theory in 2016

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Abstract

Background: In recent decades, unsafe use of pesticides has caused different cancers in human beings as well as damages to environment and organisms.
Objectives: The present study aimed to determine the predictors of safety behavior among greenhouses spray workers in Jiroft city based on Protection Motivation Theory (PMT).
Methods: This cross-sectional study with descriptive-correlation approach was conducted in 2016 on 229 greenhouse spray workers in Jiroft city selected via proportional stratified random sampling using a researcher-made questionnaire. The questionnaire consisted of demographic variables and PMT constructs such as perceived vulnerability, perceived severity, costs, rewards, fear, self-efficacy, response-efficacy, and protection motivation, as well as safety behaviors.
Results: All workers were male in the age range of 19 to 72 years, most of whom (47.6%) had previously been poisoned by pesticides. The mean scores of all the PMT constructs were in range of 50% to 75% except for perceived rewards that its mean score was between 75% and 100%. There was a significant correlation between response-efficacy and all the constructs at $P < 0.01$, except for the perceived rewards that was significant at $P < 0.05$. Moreover, a significant correlation was found between all the constructs other than perceived rewards and fear ($P < 0.01$). The predicted amount of spray workers' preventive behaviors by protection motivation theory constructs was 41% and the role of perceived vulnerability ($\beta = 0.310$), perceived severity ($\beta = 0.303$), self-efficacy ($\beta = 0.166$), and response-efficacy ($\beta = 0.140$) was greater than the role of other constructs.
Conclusions: Concerning predictive power of protection motivation theory constructs for safety behaviors related to spray workers' health and due to the important role of perceived vulnerability, perceived severity, self-efficacy, and response-efficacy, educational interventions are necessary for training protective principles to prevent health problems resulted from exposure to pesticides in workers.

Keywords: Safety, Behaviors, Workers, Theory, Greenhouse

1. Background

In the past decades, the application of pesticides has increased in developing countries due to high demands for foods (1) and the requirement to control plant pests. However, such substances have adverse effects on useful organisms as well as on human beings and environment (2).

Unsafe use of pesticides may lead to different types of cancer (3), congenital defects, impairment of central nervous system, respiratory diseases, skin diseases, endocrine system (4), weakness of body immune system (2), infertility (5), increase of chronic diseases, congenital disorders (6), delayed puberty in girls (7), intoxication (8), psychological adverse effects on the aspects of farmers lives such as quality of life, depression, anxiety, and stress (5), as well as increase of mortality rate in agricultural workers and their family members especially among children (9).

Greenhouses are closed spaces established with the aim of providing a proper physical environment for plants' life and growth (10). In addition to the risks of agriculture, greenhouse workers are exposed to a large amount of toxins such as pesticides due to greenhouses' special conditions including closed space and high moisture that result in easy growth of fungi and pests, use of different pesticides with high concentrations, and storage of large amount of different pesticides (11). Therefore, the above mentioned problems are more severe in greenhouse workers than other farmers.

Morbidity and mortality resulted from intoxication and diseases caused by exposure to such pesticidal toxins have increased in developing countries especially in Asia due to more access to pesticides as well as their low cost. (12-14).

Yousefi (2008) reported that 3.2% of pesticides used in Iran are extremely dangerous, 11.8% are extremely toxic, and 24.7% of them are potentially dangerous (15).

In the study conducted by national institute of occupational safety and health (NIOSH), it was reported that the amount of intoxication was 39.9 times higher in agricultural workers than workers in other jobs and industries in the USA (intoxication of agricultural workers is 53.6% while it is 1.4% in non-agricultural workers) (3). Since the health of both farmers and agricultural crops are of great importance, attention should be paid to farmers' welfare and health status to reach sustainable development in agricultural sector. Some actions should be taken to protect farmers against job detrimental factors since pesticides cannot function selectively to be only effective on target pests (14). Concerning considerable differences in the toxic effects of each pesticide in terms of toxicity degree, the way the toxin enters the body, specific features of each pesticide, and personal factors (6), it is crucial to take some approaches to prevent the incidence of such effects. The behavioral approaches to protection against pesticides include a wide range of behaviors which can be divided into three general dimensions: using safety equipment, avoiding risks that endanger pesticide users, and consideration of protective and health factors. Therefore, consideration of each dimension can protect workers, environment, greenhouse products, and others against the important potential risks (16).

Wrong beliefs can cause severe damages and affect individuals' protective capacity for protecting themselves against risks. Therefore, it is necessary to study protective capacity of individuals in face of different risk factors. It is especially important to prevent detrimental effects of toxic substances. Therefore, workers' knowledge and perception about dangers must be actualized and corrected by educational activities, because the most important subject for workers in increasing the protective capacity is health education. To achieve this goal, protection motivation theory (PMT) was applied in this study (17). Due to the variables of perception (such as perceived vulnerability, severity, etc.) and other personal or environmental factors, the amount of risk-taking or risk-avoiding is different in individuals who are at risk of pesticides. Therefore, it is necessary to investigate workers' protective capacity and safety behaviors before taking any educational action (18). For this purpose, PMT has been applied in the present study.

PMT was developed by Rogers in 1975 to describe behavioral and attitudinal processes taken by people when facing perceived reality or health threat (19). PMT describes factors that play important roles in individuals' motivation for doing or not doing a sanitary behavior (20).

PMT suggests that environmental and personal factors provide an opportunity for the emergence of a behavior that may potentially threaten individual's welfare. Perceived threat is the start of threat and coping assessments. Threat assessment includes four factors: internal rewards, external rewards, perceived severity, and perceived vulnerability, whereas coping assessment consists of three factors of self-efficacy, response-efficacy, and response cost. These two assessments are taken by individuals to do something intentionally with different degrees of protection or risk which is called protection motivation (21). So far, PMT has been used in different areas of study such as breast cancer (20), wireless security at home (22), preventive behaviors from infectious diseases in poultry keepers (23), skin cancer in farmers (24, 25), drought (26), schistosomiasis (27), reductive behaviors of flood (28), risk of fire in deserts (29), etc. With respect to the mentioned ideas and by paying attention to the importance of PMT in the investigation of workers' protective capacity and perception, as well as the fact that up to this time (to the best of our knowledge), no study has been conducted to examine PMT in greenhouse workers, and also since Jiroft is an important region for agricultural products cultivation, especially greenhouse products, therefore, the current study was conducted to examine predictors of safety behavior in workers of Jiroft greenhouses based on PMT in 2016.

2. Methods

2.1. Research Setting

Jiroft city has a population of about 311000, with more than 6000 industrial, semi industrial, and non-industrial greenhouses (especially in central parts and Esmaili district).

The city has three types of climate: moderate, cold, and dry, as well as warm and humid. This city which is located in the south of Kerman province is one of the important agricultural regions of Iran. Due to its weather conditions, different types of agricultural kitchen-garden crops are cultivated in the greenhouses of the city, which are mostly cultivated in warm and humid regions during autumn, winter, and spring. The income of most people is based on agriculture.

2.2. Selection of Participants in the Study

This cross sectional study with a descriptive-correlation approach aimed to study the safety behavior predictors of greenhouse workers in Jiroft based on PMT in 2016. Inclusion criteria for workers included at least two years of work experience in greenhouse, one-year experience of working with pesticides in the greenhouse, and living in the village where they were working. Workers who had not ever participated in spraying pesticides and were not living in the village were excluded from the study. According to a pilot study conducted on 30 members of the target population and the sample size formula of $n = Z^2S^2/d^2$, z = 1.96, s = 10, and d = 1.3, 228 participants were supposed to enter the study. However, in order to consider dropout, 250 participants entered the study, among whom 21 were excluded because of not having one or more inclusion criteria, or missing many items in filling out their questionnaires. If the missing data were very partial, the researchers made contact with the respondent by the written phone number on the questionnaire and completed the questionnaires (occurred in 8 cases). Proportional stratified random sampling was used to select 10 health-treatment centers as strata where greenhouse cultivation was implemented. Some greenhouses were chosen from each stratum in order to reach the favorable size. One person from each greenhouse participated in the study, which made a total number of 229 participants. Then, the aim of the study was explained to the workers by well-trained researcher assistants to selected participants.

2.3. Ethical Considerations

The objectives of the study were explained to the volunteer workers. They were ensured about confidentiality of information, and were asked to complete the informed consent. In addition, the present research was approved by the ethics committee of Yazd University of Medical Sciences with the ethical code: R.SSU.SPH.REC.1394.60.

2.4. Information Collection Instrument

A researcher-made questionnaire (including two parts) was employed to collect data. The first part consisted of demographic information (8 items) and the second part included questions related to PMT constructs (38 items). A 5-point Likert scale was used ranging from completely agree to completely disagree (completely agree = 5, Agree = 4, No idea = 3, Disagree = 2, and completely disagree = 1). The subscales included Perceived vulnerability (6 items) with total score of 6 - 30 on items such as "I also may be poisoned because of exposure to greenhouse spray", Perceived severity (5 items) with total score of 5 - 25 on items such as "Poisoning with chemical toxic substances can cause severe damage or death", Perceived costs (5 items) with total score of 5 - 25 on items such as "It is difficult for me to use personal protective equipment regularly in greenhouse", Perceived rewards (4 items) with total score of 4 - 20 on items such as "I am happier when working in greenhouse without safety equipment", Fear (5 items) with total score of 5 - 25 on items such as "I am terrified when thinking about cancer caused by long exposure to toxins", Self-efficacy (7 items) with total score of 7 - 35 on items such as "I can protect myself from events resulted from exposure to toxins in the greenhouse", Response-efficacy (5 items) with total score of 5 - 25 on items such as "Safe measures in greenhouse may reduce treatment costs", Protection motivation (1 item) with total score of 1 - 5 on items such as "Have you ever thought about actions to protect yourself against danger of pesticides?". Safety behaviors (totally 30 items with total score of 30 - 150) comprised three dimensions including Using personal protective equipment (8 items, total score of 8 - 40) on items such as "I use mask before spraying", Avoiding risks that endanger users of toxic substances (10 items with total score of 10 - 50) on items such as "I avoid breathing pesticides due to their dangerous and toxic content", and Consideration of protective-sanitary principles (12 items with total score of 12 - 60) on items such as "I pay attention to danger signs and notifications on labels of pesticides before spraying". In all the subscales, negative questions were scored inversely.

Scores of PMT constructs and behavior were classified into three levels: good (scores between 75% and 100%), moderate (scores between 50% and 75%), and poor (scores lower than 50%). Median scores higher than 22.5 were evaluated as good for perceived vulnerability, moderate when between 15 and 22.5, and poor while scores were lower than 15. Median scores higher than 18.75 were evaluated as good for perceived severity, moderate with scores between 12.5 and 18.75, and poor with scores lower than 12.5. Median scores lower than 12.5 were accounted as good for perceived costs, moderate with scores between 12.5 and 18.75, and poor with scores higher than 18.75. Median scores lower than 10 were also accounted as good for perceived rewards, moderate with scores in the range of 10 - 15, and poor for scores higher than 15. Median scores higher than 18.75 were perceived as good for fear, moderate with scores between 12.5 and 18.75, and poor with scores lower than 12.5. Median scores higher than 26.5 were assumed good for self-efficacy, scores from 17.5 to 26.5 were moderate, and the scores lower than 17.5 were poor. Median scores higher than 18.75 were evaluated as good for response-efficacy, scores in the range of 12.5 - 18.75 were moderate, and scores lower than 12.5 were poor. Median scores higher than 3.75 were accounted as good for protection motivation, scores from 2.5 to 3.75 were moderate, and scores lower than 2.5 were poor. Mean scores higher than 112.5 were evaluated as good for safety behaviors, scores between 75 and 112.5 as moderate, and scores lower than 75 were poor.

The employed questionnaire was validated by measuring content validity indices (CVI and CVR) and using opinions of a panel of experts (8 persons in fields of health education and promotion, phytopathology, occupational health, and medical toxicology). Cronbach's alpha was also applied to measure questionnaire's reliability. Alpha value was over 0.62 for all the constructs of protection motivation and behavior.

2.5. Statistical Analysis

Data were analyzed using application of descriptive statistical tests for demographic variables and PMT constructs' scores in SPSS V. 24 software. According to One-Sample Kolmogorov-Smirnov Test (to check the normality assumption of variables), all the PMT constructs had abnormal distribution (P value < 0.05), while safety behaviors had normal distribution (P value > 0.05). Therefore, Spearman correlation tests were used to measure the correlation among the constructs as well as between demographic quantitative variables and the constructs. Mann-Whitney U and Kruskal-Wallis tests were conducted to measure the relationship between qualitative demographic variable and the constructs of the theory. Path analysis was accomplished by using AMOS V. 24 software to determine safety behaviors' predictors by the theoretical constructs. The significance level in the present study was set at P value < 0.05

3. Results

All participants of the current study were male workers. Their mean age was 36.88 $\pm$ 11.24 and most of them were 26 to 40 years old (52.8%). Most participants were married (86.5%) and illiterate (41.5%); 41.9% of the participants had diploma degree while 16.6% had associate or higher degrees. Most workers (65.5%) stated that their income is lower than 10 million Rials per month. In terms of work experience, 57.2% of the participants had work experience of lower than 5 years and 61.6% had work experience of lower than 2 years. Out of all the participants, 11.8% stated that they do not spray more than 30 times a year; 21% stated that they spray between 11 - 20 times, 20.5% reported 21 - 30 times, and 46.7% indicated more than 30 times of spray per year. Furthermore, 47.6% of the participants stated that they have the history of poisoning due to exposure to toxic substances (Table 1).

The scores of all the PMT constructs and safety behaviors were moderate (between 50% - 75% of the obtainable score) (Table 2).

The workers' score on the use of personal protective equipment was poor (lower than 50% of the obtainable score) while their score for preventing risks that endanger pesticide users' health was good (above 75% of the obtainable score). The scores of safety observance and health principles were moderate (between 50% - 75% of the obtainable score) (Table 3).

There was a significant correlation between safety behaviors and all the PMT constructs including perceived vulnerability, perceived severity, costs, fear, self-efficacy, except for perceived rewards, and also between response-efficacy and all the PMT constructs at $P < 0.01$, except for perceived rewards which was significant at $P < 0.05$ (Table 4).

There was a significant correlation between age and the mean scores of perceived vulnerability ($r = 0.142$, $P = 0.032$), perceived severity ($r = 0.155$, $P = 0.019$), response costs ($r = -0.132$, $P = 0.046$), and behavior ($r = 0.130$, $P = 0.050$). A significant correlation was also found between education level, protection motivation ($r = 0.145$, $P = 0.028$), protection motivation ($r = 0.158$, $P = 0.016$) and behavior ($r = 0.214$, $P = 0.001$). Also, monthly income and the constructs of protection motivation theory did not have any significant correlation with each other. There was a significant correlation between work experience in greenhouse and perceived vulnerability ($r = 0.151$, $P = 0.022$), perceived severity ($r = 0.195$, $P = 0.003$), response-efficacy ($r = 0.160$, $P = 0.015$), and behavior ($r = 0.190$, $P = 0.004$). Duration of spraying was also significantly correlated with perceived vulnerability ($r = 0.209$, $P < 0.001$), perceived severity ($r = 0.324$, $P < 0.001$), fear ($r = 0.154$, $P = 0.020$), response efficacy ($r = 0.159$, $P = 0.016$), protection motivation ($r = 0.181$, $P = 0.006$), and behavior ($r = 0.145$, $P = 0.028$). Moreover, there was a significant correlation between the number of sprays and perceived vulnerability ($r = 0.310$, $P < 0.001$), perceived severity ($r = 0.359$, $P < 0.001$), fear ($r = 0.187$, $P = 0.005$), response-efficacy ($r = 0.187$, $P = 0.005$), self-efficacy ($r = 0.199$, $P = 0.002$), response costs ($r = -0.213$, $P = 0.001$), protection motivation ($r = 0.388$, $P < 0.001$), and behavior ($r = 0.264$, $P < 0.001$).

However, no significant relationship was observed between marital status and constructs of the theory ($P > 0.05$). On the other hand, there was a significant relationship between intoxication history and perceived vulnerability ($P < 0.001$), perceived severity ($P < 0.001$), self-efficacy ($P = 0.009$), response efficacy ($P = 0.027$), protection motivation ($P < 0.001$), and behavior ($P < 0.001$).

Perceived vulnerability, perceived severity, self-efficacy, and protection motivation had direct effects on safety behaviors (Table 5).

According to Table 6, statistical indicators of adjusted model show a reasonable adjustment.

According to the regression analysis, the predicted amount of workers' preventive behaviors was 41% by pro-

Table 1. Participants' Relative Distribution Based on Demographic Variables

Variable	No. (%)	Variable		No. (%)
Age				
Under 25	33 (14.4)	Monthly income	less than 20 million Rials	150 (65.5)
26-40	121 (52.8)		Above 20 million Rials	79 (34.5)
41-60	67 (29.3)	Work experience	less than two years	131 (57.2)
Above 60	8 (3.5)		Above two years	98 (42.8)
Marital status				
Married	198 (86.5)	Spraying history	less than one year	141 (68.6)
Single	25 (10.9)		More than one year	88 (31.4)
Widowed	5 (2.2)	Times of spraying in cultivation season	less than 10 times	27 (11.8)
Divorced	1 (0.4)		11 - 20 times	48 (21)
Education level				
Illiterate	95 (41.5)		20 - 30 times	47 (20.5)
Diploma and lower	96 (41.9)		Above 30 times	107 (46.7)
Associate	23 (10)	History of poisoning by pesticides	Yes	120 (52.4)
Bachelor	15 (6.6)		No	109 (47.6)

Table 2 . Median, Interquartile Range, Range of Obtainable Score Mean, Standard Deviation, and Obtainable Score Range, for Protection Motivation, and Safety Behaviors Reported by Workers

Construct	Median (IQR[a])	Q1 and Q3	Range of Obtainable Score
Perceived vulnerability	18 (11.50)	12, 24	6 - 30
Perceived severity	17 (8)	12, 20	5 - 25
Perceived rewards	10 (4)	8, 12	4 - 20
Response costs	13 (7)	10, 17	5 - 25
Fear	18 (4)	16, 20	5 - 25
Self-efficacy	27 (9.50)	20, 30	7 - 35
Response efficacy	14 (8)	10, 18	5 - 25
Protection motivation	4 (2)	2, 4	1 - 5
Safety behaviors[b]	Mean ± SD	-	30 - 150
	101.24 ± 10.07		

[a]The interquartile range (for non-normal data).
[b]Normal distribution.

tection motivation theory. The role of perceived vulnerability ($\beta = 0.310$), perceived severity ($\beta = 0.303$), self-efficacy (β = 0.166), response-efficacy (β = 0.140), and protection motivation was more than the role of other constructs (Figure 1).

4. Discussion

The present study aimed to determine the predictors of safety behaviors among greenhouse spraying workers in Jiroft city based on PMT.

According to the achieved results, the mean scores of the constructs were moderate while perceived rewards gave good scores. However, the mean scores of safety behaviors regarding pesticides were poor in the dimension of personal protective equipment. The score of avoiding risks that endanger pesticides' users was good while the score of consideration of protective and sanitary principles was moderate. These results suggest that although the total mean score of safety behaviors was moderate, most spraying workers did not use personal protective equipment, as the most important factor in avoiding pesticides' potential hazards (30). Also, the points outlined in protective and sanitary principles that are very essential for health of workers, environment, greenhouse products, and further actions in this regard include: paying attention to risk alarms and signs as well as recommendations written on pesticides' labels and brochures, cautious collection and correct destruction of pesticides' empty boxes and not using them for other purposes, immediate referral in case of intoxication, and not spilling pesticides' residual in water streams or greenhouse surroundings. Among avoiding risks that endanger pesticides' users, we can point to behaviors such as checking sprayers' leakage, avoiding to breathe pesticides, and avoiding to eat, drink,

Table 3. Median, Interquartile Range, and Range of Obtainable Score for Dimensions of Safety Behaviors Reported by Workers

Construct	Median and IQR	Q1 and Q3[a]	Range of Obtainable Score
Use of personal protective equipment	20 (8.50)	14, 22.50	8 - 40
Preventing risks that endanger pesticide users' health	46 (5)	43 48	12 - 60
Observance of safety and health principles	37 (6)	34, 40	10 - 50

[a] Quarter 1, 2, and 3 (or percentile 25, 50 and 75).

Table 4. Correlation Matrix Between the Constructs Under Study in Participants (N = 229)

Constructs	Perceived Vulnerability	Perceived Severity	Response Costs	Perceived Rewards	Fear	Self-Efficacy	Response Efficacy	Protection Motivation	Safety Behaviors
Perceived vulnerability	1								
Perceived severity	0.854[a]	1							
Response costs	-0.333[a]	-0.309[a]	1						
Perceived rewards	-0.055	0.003	0.130[b]	1					
Fear	0.279[a]	0.362[a]	-0.193[a]	0.095	1				
Self-efficacy	0.323[a]	0.381[a]	-0.168[b]	0.035	0.253[a]	1			
Response efficacy	0.587[a]	0.538[a]	-0.418[a]	0.155[b]	0.250[a]	0.261[a]	1		
Protection motivation	0.475[a]	0.486[a]	-0.194[a]	0.007	0.214[a]	0.199[a]	0.286[a]	1	
Safety behaviors	0.578[a]	0.599[a]	-0.178[a]	-0.033	0.227[a]	0.330[a]	0.265[a]	0.367[a]	1

[a] P value < 0.01.
[b] P value < 0.05.

Table 5. Direct and Indirect Effects of Variables on Safety Behaviors of Spray Workers

Variables	Standardized Direct Effects	Standardized Indirect Effects	Total Effects
Perceived vulnerability	0.310	0.021	0.330
Perceived severity	0.303	0.293	0.596
Perceived rewards	-	-0.035	-0.035
Response costs	-	-0.108	-0.108
Fear	-	0.003	0.003
Self-efficacy	0.166	0.169	0.336
Response efficacy	-0.140	-	-0.141
Protection motivation	0.075	-	0.075

Table 6. Statistical Indicators of Adjusted Model

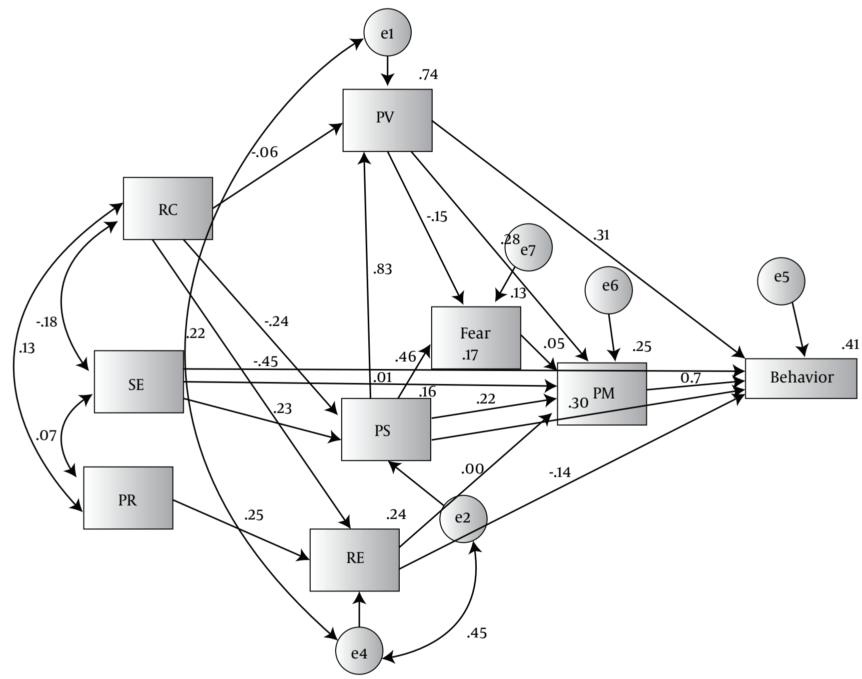
RMSEA	NFI	IFI	GFI	CFI	CMIN	DF	CMIN/DF	P value	χ^2
0.075	0.962	0.978	0.973	0.978	29/841	13	1.268	0.006	29.481

smoke, or touch eyes, nose, and mouth with hands during spraying that were considered relatively good by workers probably due to their high vulnerability and severity about such behaviors.

In the study conducted by Eghilinezhad, personal protective equipment and consideration of productive and sanitary principles were not favorable (31). However, in the study conducted by Recena, although more than 90% of workers believed that spraying was detrimental for human health, lower than 20% of them actually used personal protective equipment when using pesticides (32).

Therefore, according to the results, it is necessary to increase vulnerability, severity, fear, self-efficacy, and response-efficacy among spraying workers in all dimen-

Figure 1. Modified Model for Safety Behaviors of Spray Workers



PM, Protection Motivation; PV, Perceived Vulnerability; PS, Perceived Severity; RC, Response Costs; SE, Self Efficacy; PR, Perceived Rewards.

sions of safety behaviors. Thus, lower rewards and response costs are perceived by workers and therefore, their motivation increases, which in turn can result in the consideration of protective-safety behaviors against pesticides. In the present study, the PMT constructs, except perceived rewards, had a significant correlation with safety behaviors in application of pesticides. Results of a study conducted by Babazadeh (24) on rewards are not consistent with the results achieved by the present study although they are consistent regarding other constructs.

In the study conducted by Suklim (33), vulnerability and severity had significant correlations with farmers' safety behaviors when working with pesticides.

Della Valle indicated that the likelihood of using personal protective equipment was lower in high-risk taking farmers (with lower perceived vulnerability and severity) than other farmers (18).

In the study carried out by Jallow, it was stated that risk perception of farmers had no positive effect on using pesticides (34).

In the Palis' study, participant's interpreted diseases resulted from exposure to pesticides as inability of doing routines and believed that pesticides were not dangerous for them (low perceived vulnerability) because they thought that they were safe against the effects of pesticides. They believed that pesticides are medications for plants rather than toxic substances; they also thought that pesticides exposure was possible only via respiration and digestion rather than skin. Such imageries consequently cause insufficient protection against pesticides (35). In the study conducted by Quandt, workers were worried about severe effects of exposure to pesticides and had insufficient knowledge about the long-term effects of low-dose pesticides. They believed that some people were inherently more sensitive to pesticide exposure (36).

In the present study, the mean scores of PMT constructs and safety behaviors were moderate while perceived rewards gave good scores.

Therefore, safety behaviors against pesticides are important and any mistake will hurt spraying workers as well as others. Also, it is crucial to know farmers' beliefs about pesticides' risks and their misuse predictors; thus, these factors must be taken into account to correct farmers' protective behaviors and safer application of pesticides (34). Thus, it is necessary to study the role of other variables in the formation of protection motivation and safety behaviors against pesticides in educational planning based on PMT constructs and safety behaviors.

In the current study, there were significant correlations between age and the mean scores of perceived vulnerability, severity, and behaviors. This may be due to that perceived vulnerability and severity are higher in older workers because of their experience about unpleasant events such as intoxication resulted from exposure to pesticides. Consequently, such workers consider safety behaviors while working with pesticides compared to younger workers with less experience. This result is inconsistent with the findings of a study conducted by Khan (37) on farmers who were not working in greenhouses and presumably were less exposed to intoxication and pesticides' effects in long-term. Participants of the mentioned study may believe that events and diseases' symptoms were parts of their job; thus, older workers were reluctant to change their status and to consider protective behaviors against toxins. In the study conducted by Ibrahim (23), there was a significant relationship between workers' age and preventive behaviors.

In the present study, there was a significant correlation between education, protection motivation, and behavior. It was found that education may increase workers' general knowledge and analytic power for better understanding of pesticides' detrimental effects, using personal protective equipment, and avoiding risks that endanger users of pesticides. Suklim and Khan reported a significant relationship between education and protective behaviors of farmers against pesticides (33, 37). There was no significant relationship between income, protection motivation, and behavior in the current study, while in the study of Khan, income had a negative relationship with risk perception (37). This may be because spraying workers in our study were paid daily, but this result is likely reversed for greenhouse keepers among whom reduction or increase of crop yields can affect income directly.

It was also found that workers who were poisoned by pesticides had high levels of perceived vulnerability, perceived severity, self-efficacy, response-efficacy, and protection motivation; they also considered most behaviors related to toxins' exposure risks. Khan observed a positive significant correlation between the experience of unpleasant events due to pesticides and protective behaviors (37).

As it was true about age, people with longer work experience in greenhouse (who are expected also to be older) had done more sprays in the cultivation season and perceived the importance of safety behaviors due to their experiences. As a result, their levels of PMT constructs and safety behaviors were higher than those of workers with low work experience in greenhouse or low number of sprays in the cultivation season. Afshari showed that there was a significant correlation between agricultural experience and mean score of perceived severity (38). This idea can be used in training safety behaviors to farmers and workers, i.e., experienced workers give recommendations to other workers.

In the study conducted by Raksanam, in spite of high perceived severity regarding detrimental effects of pesticides, there were numerous high risk behaviors especially in the application of improper safety equipment. Although it is important to use safety equipment, non-standard safety equipment can be a factor that causes workers feel protected against pesticides but such protection is not obtained practically (39).

In the present study, perceived vulnerability, severity, self-efficacy, and response-efficacy were the most important predictors of safety behaviors in spraying workers when using pesticides. In the study carried out by Raksanan, perceived severity was the most important predictor (39). Due to immediate, tangible, and observable effects of exposure to pesticides (acute intoxication), it can be concluded that perceived vulnerability and severity of pesticides' exposure effects are the most important factors in the meeting safety behaviors at the time of mixing, loading in sprayers, and spraying.

Our results indicated that vulnerability, severity, self-efficacy, response-efficacy, and protection motivation predicted significantly 41% of spray workers' safety behaviors when using pesticides. The results of vulnerability and self-efficacy in the present study were consistent with those mentioned by Babazadeh in which perceived vulnerability, rewards, self-efficacy, and perceived response costs predicted significantly 42.2% of preventive behavior of skin cancer in farmers (24). The difference between these studies may be because farmers did not well perceive vulnerability and severity of skin cancer since it is a more abstract concept than intoxication due to pesticides; thus, their perceived response costs was higher when using safety equipment and other protective measures against sunlight. Furthermore, poor and moderate signs of sun radiation on their skins can rarely increase their perceived severity. In the study conducted by Bay, self-efficacy and motivation were the most important predictors of farmers' behavior when using pesticides (4). In the study carried out by Keshavarz, response-efficacy, perceived severity, and vulnerability, as well as self-efficacy predicted high percentages of farmers' environmental behaviors' variance about drought (26). The most important predictor of farmers' behavior on drought was response-efficacy. In the study of Yazdanpanah, perceived severity and self-efficacy were the most important predictors of farmers' intention for consideration of safety behaviors against pesticides (40). One of the weak points of the present study was the lack of questions about important and serious diseases and accidents (except for having history of poisoning by pesticides). Workers' self-report of safety behaviors was another constraint of the present study. However, use of well-trained researcher assistants for data collection was one of the strengths of the current study.

4.1. Conclusion

According to the obtained results, variables of perceived severity, perceived vulnerability, self-efficacy, response-efficacy, education, intoxication due to exposure to pesticides, work experience in greenhouses, and number of spraying in the greenhouse are important and effective factors on the compliance of greenhouse spray workers with safety behaviors. Therefore, by conducting educational interventions and by taking into account the mentioned recommendations, helpful interventions can be designed and implemented to promote safety behaviors among spray workers. Increasing knowledge of greenhouse workers about disadvantages of pesticides through correct educational methods and contents can increase workers' perceived vulnerability and severity, self-efficacy, as well as response-efficacy; it also can reduce perceived rewards and costs, increase protection motivation, and promote safety behaviors against toxins. Therefore, it is helpful to express the risks of exposure to pesticides, importance of protective equipment against pesticides, and the significance of meeting protective-sanitary principles (the way toxins enter the body, effects of pesticides on environment and greenhouse crops) by using group discussion, question and answer, practical education of small behaviors, videos, and role modeling methods.

Intervention studies based on PMT as well as other models and theories are recommended to evaluate the effect of educational/non-educational interventions on the promotion of greenhouse workers' safety behaviors. Moreover, different models should be compared to find the most effective theories in this field.

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Footnote

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