International Journal of Agricultural Management and Development
Available online on: www.oiccpress.com/ijamad
ISSN: 2159-5852 (Print)
ISSN:2159-5860 (Online)

Original article *DOI: 10.71877/ijamad.2024.8280*

Identifying and Assessing Occupational Safety Risks among Grape Growers in Northwest of Iran

Mojtaba Sookhtanlou [a,*] and Zahra Khoshnodifar [b]

Received: 10 Jun 2022
Accepted: 28 Aug 2023

Keywords:
Occupational Safety, risk assessment, grape growers, productivity, meshginshahr County

ABSTRACT

Occupational safety risk management in agricultural and horticultural activities is profound for preserving safety, increasing productivity, and enhancing yields. So, this research focused on identifying and assessing different occupational risks among grape growers. The statistical population (N=2145) was composed of grape growers in northwest of Iran (Meshginshahr County in Ardabil province). The sample (n=325), whose size was determined by Bartlett et al.'s (2001) table, was taken from the regions of Lahrud (222 people), Arjaq (58 people), and Fakhrabad (45 people) by the multi-stage randomization technique. The indices for measuring occupational risks were identified by the Delphi technique (37 skillful grape growers), and the occupational safety risks were assessed by the 3D method of risk assessment presented by Melbourne University. According to the results, most respondents (31.38%) were at a high occupational risk level. The most important occupational risks included incidents when working with manual and mechanical tools, incidents when working with chemical pesticides, and ergonomic problems. Also, the most effective variables in distinguishing the respondents included perceived severity (0.554), response cost (0.553), and self-efficacy (0.509). Developing compulsory safety regulations on the necessity of using protective covering on mechanical garden tools, providing supportive subsidies to procure safety equipment, and holding technical training courses about occupational safety and ergonomic principles will effectively mitigate occupational safety risks of grape growers.

[a] *Associate Professor, University of Mohaghegh Ardabili, Ardabil, Iran.*
[b] *Assistant professor, Agricultural and Natural Resources Research and Education Center of Markazi Province, Arak, Iran; and assistant professor, University of Saravan, Saravan, Iran.*

** Corresponding author's email: m.sookhtanlo@uma.ac.ir*

INTRODUCTION

Agricultural and horticultural activities are regarded as high-risk occupations in the world based on the mortality rate and health issues of crop producers and labor (Asamani, 2022; Tabibi et al., 2018). Occupational hazards in the agricultural and horticultural sectors are an important factor determining job performance in this sector, which can be responsible for the tendency to quit the job, lower productivity, and lower commitment to produce healthier crops with higher quality at the workplace (Fapojuwo et al., 2021). In the modern era, workers in the agricultural and horticultural sectors are still facing more risks, including chemical, physical, ergonomic, and psycho-social risks (Tabibi et al., 2018), so those who work in the agricultural sector will inevitably encounter various occupational injuries and diseases (Natt et al., 2021). Compared to other professions, workers in the agricultural and horticultural sectors are sometimes exposed to twice as many occupational safety risks. On the other hand, it is impossible to fully control the environmental and external variables that influence agricultural and horticultural activities, unlike other professions. So, occupational hazards are more abundant in this sector.

Improving safety and reducing risky conditions in crop production sites have human and normative origins and depend on the behavioural management of producers in line with occupational health and safety. As such, the likelihood of occupational hazards can be reduced by mitigating various safety risks (Moradhaseli et al., 2020). It should be noted that attending to occupational safety and managing occupational risks will, in turn, influence the productivity and efficiency of human resources (Olaoye & Ojebiyi, 2021). In this context, the Protection Motivation Theory (PMT) is one of the best theories for predicting preventive behaviours aimed at coping with hazard risks. PMT explores how preventive protection behaviours are formed from two dimensions: threat appraisal and coping appraisal appraisal (Bijani et al., 2022). The threat appraisal is composed of three components, including perceived susceptibility or vulnerability (personal perception of resilience to the risk) (Mohsenipouya et al., 2021), perceived severity (perception about the intensity of side-effects or likely damages of a negative event) (Neisi et al., 2020), and rewards received (rewards that the person receives for doing something wrong or avoiding the recommended behaviour) (Bijani et al., 2022). The coping appraisal is, in turn, composed of three components, including self-efficacy (the person's belief in his or her ability to take a measure and achieve a certain goal regarding threat avoidance) (Roozbahani et al., 2020), response cost (perceived costs related to adaptation to the threat) (Suess et al., 2024), and response efficacy (the belief in the effectiveness of measures to mitigate the threat) (Badsar & Karami, 2021).

Yazdanpanah et al. (2020) emphasized the significant effect of response efficacy, perceived severity, and self-efficacy on protection intention and behaviour. Wang et al. (2018) pointed to the role of perceived vulnerability and severity, self-efficacy, and response efficacy in protection intention and behaviour. According to Bijani et al. (2022) and Roozbahani et al. (2020), the variables of perceived severity and self-efficacy influenced protection behaviour although the former did not find the effect of response costs, response efficacy, and rewards significant on protection behaviour. In Suess et al.'s (2024) research, the variable of response cost was very effective in protective safety behaviours. Ataei et al. (2022) found that self-efficacy was the only variable influencing farmers' protection behaviour significantly.

Schulte et al. (2012) defined occupational hazards as short-term or long-term injuries and side effects related to unsafe environments at the workplace. The major factors threatening safety and health at the workplace (occupational health) are divided into three broad categories – physical components (physical and ergonomic injuries), general health components, and psychological components (Shin and Jeong, 2022; Olaoye and Ojebiyi, 2021; Denge and Rakhudu; 2022). The most com-

mon occupational damages in farmer families are musculoskeletal pains (Benos et al., 2020). Ergonomic occupational risks include important hazards for the workers in the agricultural sector that are caused by environmental factors (mainly working in cold or hot environments, noise, vibration, and exposure to chemicals) (Tambe et al., 2019). Not only the ergonomic or environmental risk factors but also farmers' psychological factors are of significance in efforts to prevent safety risks in agricultural activities (Arabian et al., 2020; Kaewdok et al., 2020). Some researchers have emphasized the effects of issues relating to calmness (or depression) or stress as psychological factors in agricultural and horticultural occupational hazards (Shin & Jeong, 2022).

Regarding the types of occupational risks, one can refer to the results of Fapojuwo et al. (2021) according to which the most important occupational risks among farm and orchard workers include falling from a height, slipping, ergonomic risks (like backache), side effects of pesticide and chemical fertilizers, cutting, and the side effects of using various manual and mechanical machinery. Likewise, Bhattarai et al. (2016) reported that the most important injuries among farmers and gardeners in Nepal included cutting, injuries caused by burrowing, and the cuttings of skin. In their research, manual machinery was the main cause of occupational injuries. The next ranks were slipping during work, sharp tools, animal attacks, and falling from a height. Majdabadi et al. (2022) revealed that physical, chemical, and mechanical risks during planting and harvesting activities were the most abundant occupational risks that farmers were exposed to at work. However, in a study on farmers in the north of Iran, Sharifirad et al. (2022) found that the most common side effects and occupational injuries were related to ergonomics (e.g., backache) and the issues related to general health (hypertension).

In a study on paddy farmers, Asamani (2022) also reported that cutting, ergonomic issues (e.g., backache), and general health issues were the most common occupational injuries and side effects. Similarly, Tabibi et al. (2018) and Shin and Jeong (2022) found that the most common diseases among workers in the agricultural sector were musculoskeletal disorders (MSD) or ergonomic problems. However, Fragar et al. (2005) emphasized the important role of agricultural and horticultural implements (especially tractors and trailers) on severe occupational injuries and found that working with machinery in gardens was the most important factor causing occupational incidents. Jacobset et al. (2009) and Houshyar and Kim (2018) stressed the important role of the correct use of implements and machinery and the correct ergonomic methods at work in reducing occupational injuries among farmers and gardeners.

In Iran, there is no precise and up-to-date information on occupational injuries and occupational safety risks in the agricultural and horticultural sectors because most people in this sector have no work insurance and the causes of occupational injuries in this sector have not been recorded in an organized way. Also, most programs to cope with work incidents in the horticultural sector focus on post-accident treatment rather than on prevention. Admitting that agricultural and horticultural activities have high-risk factors in job security versus the other counterpart jobs, it can be claimed that identifying and evaluating the risk of occupational hazards in these professions is a fundamental step in improving their safety level (Ran et al., 2023). So, given the nature of gardening and grape cultivation and its risky activities in northwest of Iran, the present study aimed to identify and assessing the occupational safety risks among grape growers in Meshginshahr County (Ardabil province) and specify what occupational safety risks are most influential on the occurrence of occupational injuries. Therefore, the following are the specific objectives of the research:

i. Identifying the most important occupational safety risks among grape growers;

ii. Determining the level of exposure, likelihood and consequences of occupational safety risks among grape growers;

iii. Determining the levels and rating of the

identified occupational safety risks; and

iv. Determining the variables distinguishing the risk levels of grape growers against their occupational hazards.

METODOLOGY

The grape (Vitis vinifera L.) is one of the major horticultural crops in northwest of Iran where it is mostly (about 95%) cultivated in Meshginshahr County (Ardabil province). The grape produced in this County has unique taste, color, and brittleness because the region has a specific climate and geography where vineyards are located at elevations of over 1500 meters from sea level, its garden soils have high silica content, and there is a significant difference between the day and night temperature. The most important grape cultivar in this region is of the seedless raisin type. The research was an applied study in goal, a quantitative-qualitative study in type, a field study in the control over variables, and a descriptive-correlational study in the data collection method. The statistical population was composed of all grape growers in Meshginshahr County (N = 2145). The sample whose size was determined at 325 by Bartlett et al.'s (2001) table, was taken by multi-stage randomization. The rural districts of Lahrud (the Lahrud region) and Qarah Su (the Fakhrabad and Arjaq regions) were selected from Meshghinshar County in northwest of Iran. This district accounts for 95 percent of the grape cultivation area in the province. Finally, the participants were randomly sampled from the target regions of Lahrud, Fakhrabad, and Arjaq at sizes of 222, 58, and 45 people in proportion to their grape grower populations, respectively.

The Delphi technique was adopted to identify the indices for assessing the grape growers' occupational risks in the studied regions and determine their risk levels. The expert panel included 37 skillful local grape growers in the study site (based on the data provided by Agricultural Jihad Organization of Ardabil province and Meshginshahr County). The final indices of risk assessment were determined through three steps of referring to the experts (identifying initial indices, reaching a consensus on the indices and their weights, and determining the final indices) and were used in the next phase of the research. The diagnosis analysis method based on the Wilkes Lambda method was employed to account for the variables distinguishing the four groups of grape growers at different risk levels (including 1 = low, 2 = moderate, 3 = high, 4 = very high). There are various theories about protective safety behaviours at work. Based on the nature of this research about the occupational and health risks and the literature review (Yazdanpanah et al., 2020; Wang et al., 2018; Bijani et al., 2022; Roozbahani et al., 2020; Ataei et al., 2022; Suess et al., 2024), the variables of PMT were also used, in addition to the personal variables, as the basis for comparing the respondent groups.

The occupational risks of the grape growers were assessed by the 3D method of Melbourne University's risk assessment. The rationale for the adoption of this method was the risk level of occupational hazards (to provide actual preventive solutions to better safeguard the respondents' health), the transparency in results, and the acquisition of more precise information on the details of the respondents' occupational risks than other risk assessment methods. The 3D method of risk assessment provided by Melbourne University is a modern tool of risk assessment and management that gives a systemic insight into risks, errors, and shortcomings and emphasizes occupational hazards and their risk levels more than other risk assessment methods (Dehghani et al., 2020; OECD, 2018). According to Table 1, the assessment by this method is based on three dimensions: exposure to risk, the likelihood of the occurrence of risk aftermaths, and the consequences of the risk. The final rating for each risk (to determine the risk level) is calculated by multiplying the ratings determined for the three dimensions. The risk levels for the respondents are also classified into four levels: extreme or explicit risk (a total rating of >20), high risk (a rating of 10-20), moderate risk (a rating of 3-10), and low risk (a rating of <3) (Dehghani et al., 2020).

Table 1
The Dimensions of Exposure, Likelihood (Mean Annual), and Consequences.

Exposure	Rank	Likelihood	Rank	Consequence	Rank
Continuous	10	Almost definite	1	Disaster	20
Recurrent	6	Likely	0.6	Main	10
Occasionally	3	Possible	0.3	Moderate	5
Sporadic	2	Unlikely	0.1	Weak	2
Rarely	1	Rarely	0.05	Slightly	1

Survey instrument

The research instrument was a structured questionnaire composed of three sections. Section 1 was related to the grape growers' demographics, including age (year), educational level, average annual income (million IRR), experience in vineyard work (year), garden size (ha), and alike. Section 2 asked about the history of attending educational courses (in hours) and recorded data on the use of pesticides and fertilizers at the vineyard and the type and rate of personal protective equipment use. Section 3 encompassed variables related to the protection motivation model, as well as items related to the status of occupational safety risk indices. Data were collected by a questionnaire and interview with the grape growers. The content validity of the research instrument was evaluated by a panel of professors at University of Mohaghegh Ardabili and experts at the Agricultural Jihad Organization and Occupational Health Centers of Ardabil province. Their corrective opinions were applied through several steps. The items that would measure the research variables were developed as an organized set of statements with a certain order and equal weights on Likert's scales (from very low to very much on a range of 1-5 or from completely disagree to completely agree on a range of 1-5). The other items were presented as open, dichotomous, or multi-dimensional questions as per the goals. Table 2 describes the main variables.

Table 2
The Description and Reliability of the Main Research Variables.

Variables	Number of items	Cronbach's alpha	Examples of items
The amount of use of personal protective equipment	8	0.71	– "Using gloves while working with tools", "Using boots", "Using a mask or cloth while spraying pesticides or fertilizers" and...
Perceived severity	7	0.79	– "It is imperative to pay attention to the side effects related to the non-observance of safety in the viticulture activity.", "The side effects of carelessness in the horticulture activity will be more serious than other activities." and...
Perceived vulnerability	6	0.77	– "Possible incidents during horticultural work will definitely occur for me", "The injuries and side effects of occupational safety risks in horticultural work will be significant for me." and...
Perceived rewards	7	0.74	– "By reducing safety risks, I feel more capable of doing my job ctivities.", "My job performance increases significantly by being trained in more safety and technical skills in working with gardening tools", and...

Table 2
Continued

Response cost	7	0.80	– "The supply and use of personal protective equipment and measures to reduce occupational safety risks in viticulture are expensive for me.", "It is, in my opinion, time-consuming to take measures to reduce safety risks.", and…
Attitude	7	0.73	– "Occupational risk management helps to maintain more health and increase efficiency and performance.", "Maximum reduction of occupational safety risks is a basic principle for the permanence and stability of income and jobs.", and…
Response efficacy	6	0.72	– "By improving the management of occupational risks, I will ultimately gain more financial savings.", "Providing personal protective equipment and using safety instructions will increase peace of mind at work.", and…
Intention	6	0.81	– "In the future, I intend to use more safety methods in my job.", "I plan to prepare and use more suitable personal protective equipment for working with gardening tools and spraying pesticides.", and…
Self-efficacy	6	0.70	– "By acquiring more skills, I can reduce occupational safety risks more than before.", "Using guidelines for reducing occupational risks is not so complicated and laborious for me.", and…

RESULTS AND DISCUSSION

Based on the results, the mean age of the respondents among the skillful grape growers (the Delphi method) was 41.78 years, and they had been formally educated for, on average, 14.31 years. Most skillful grape growers (40.36%) had 10-15 years of experience in viticulture with a mean of 10.54 years. The mean yield of most skillful grape growers was 26.85 t/ha. The mean annual revenue of the respondents was 274.16 million IRR, and the mean garden size was 2.14 ha. Regarding the other variables, the mean annual off-farm revenue was 12.68 million IRR, the number of garden machinery pieces owned was 2.86 (mostly horticultural trailer), the extent of using protective equipment was 2.13 items, and the history of attending occupational safety-related educational courses was 5.41 hours. Among the sample of grape growers (the research sample), the mean age of the respondents was 43.92 years with the highest frequency (34.3%) for the age range of 45-55 years. They had been educated for, on average, 10.30 years. Most respondents (39.1%) had 12-18 years of experience in viticulture with a mean of 15.22 years. The mean yield of most farmers (51.6%) was 14.92 t/ha. Most respondents had an annual revenue of 173-240 million IRR (59.8%) and a garden size of 2 ha or smaller (42.6%). The mean family size was 4.09 people, the mean annual off-farm revenue was 101.550 million IRR, the number of garden machinery pieces owned was 1.95 (mostly horticultural trailer), the extent of using protective equipment was 1.54 items, and the history of attending occupational safety-related educational courses was 1.91 hours. Most respondents in this research owned less than 2 ha of vineyard.

According to Table 3, the highest likelihood of risk occurrence is related to the risks of slipping, bumping with objects, incidents caused

by moving objects and tools, working with manual and mechanical tools, side effects of working with pesticides and chemical fertilizers, insect bites, stress, and other psychological issues, ergonomic issues, and general health. The highest rate of annual exposure is related to slipping and incidents while working with manual and mechanical tools. However, the highest possible consequences of occupational risks are related to the incidents while working with machinery and the side effects of working with chemical pesticides. This is often caused by soil moisture, the lack of skill in using instruments, especially machinery, and the fact that the operators of manual or mechanical instruments feel no need for the use of protective equipment (such as suitable boots and clothes, thick gloves, goggles, and safety coverings in mechanical instruments).

Based on the criteria of risk levels and the total risk rank in Figure 1, the four safety risks of working with mechanical tools (total rank: 100), incidents during working with manual tools (total rank: 50), side effects of the application of chemical pesticides, and ergonomic problems (backache, sore legs, sore hands, ...) (total l rank: 30) were at the extreme risk level. On the other hand, the six safety risks identified at the high-risk level included slipping (total rank: 20), the throw of stones, wood, and brushwood (when working with garden tools) (total rank: 18), sunburn, heatstroke, or frostbite (total rank: 18), incidents when handling objects and machinery (total rank: 15), insect bites (total rank: 12), and general health issues (fever, headache, digestive issues, ...) (total rank: 12). Also, the three risks of bumping branches and objects (total rank: 4), accidents during fires (total rank: 4.5), and stress and other psychological issues (total rank: 4) were among the moderate risks, and the five risks of falling with a height (total rank: 0.5), the falling of branches and objects (total rank: 1.2), the side effects of working with chemical fertilizers (total rank: 1.2), attacks by animals (total rank: 3), and depression (total rank: 0.05) were at the low risk level. The main cause of most safety risks for grape growers is carelessness, fatigue, and the non-use of safety tools.

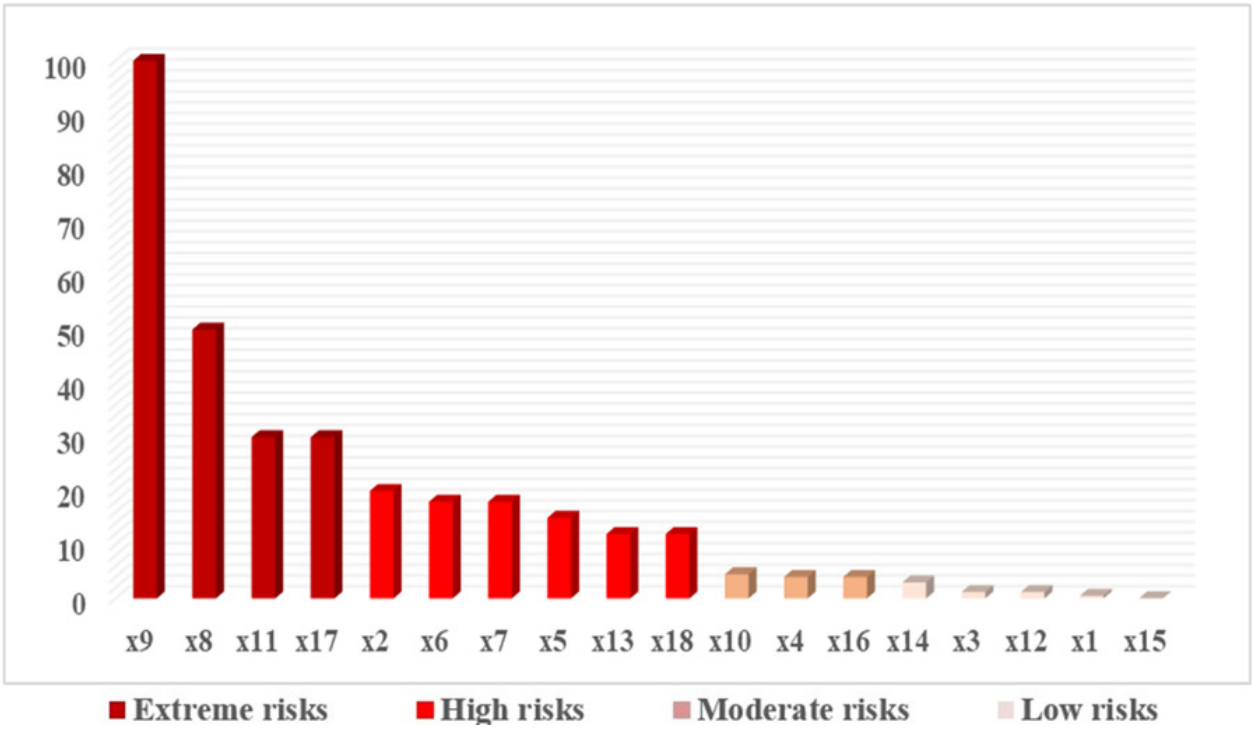

Figure 4. Determination of Occupational Risk Levels.

Table 3
Various Risks and the Rating of Occupational Risk Types.

Risk Types	Dominant Cause (% of respondents)	Exposure (Rank)	Likelihood (Rank)	Consequence (Rank)	Total Rank
X1. Falling from a height	Carelessness and fatigue (64.6%)	Rarely (1)	Unlikely (0.1)	Moderate (5)	0.5
X2. Slipping	Humidity and land slope (89.8%)	Continuous (10)	Almost definite (1)	Weak (2)	20
X3. Fall of branches and objects	Wind (61.2%)	Sporadic (2)	Possible (0.3)	Weak (2)	1.2
X4. Bumping branches and objects	Carelessness and fatigue (82.8%)	Sporadic (2)	Almost definite (1)	Weak (2)	4
X5. Accidents caused by moving objects and tools	Non-observance of standard handling procedures (69.2%)	Occasionally (3)	Almost definite (1)	Moderate (5)	15
X6. Throwing stones and wood particles (while working with gardening tools)	Non-use of personal protective equipment in gardening tools (71.5%)	Recurrent (6)	Likely (0.6)	Moderate (5)	18
X7. Sunburn, heatstroke, or frostbite	Non-use of safety clothing and helmets (89.6%)	Recurrent (6)	Likely (0.6)	Moderate (5)	18
X8. Accidents when working with manual tools	Non-use of gloves and safe clothing (91.5%)	Continuous (10)	Almost definite (1)	Moderate (5)	50
X9. Accidents when working with mechanical tools	Lack of Sufficient skill and precision (86.8%)	Continuous (10)	Almost definite (1)	Main (10)	100
X10. Incidents related to fire	Human errors (65.9%)	Occasionally (3)	Possible (0.3)	Moderate (5)	4.5
X11. Side effects of working with chemical pesticides	Non-use of proper personal protective equipment (87.4%)	Occasionally (3)	Almost definite (1)	Main (10)	30
X12. Side effects of working with chemical fertilizers	Non-use of proper personal protective equipment (79.7%)	Sporadic (2)	Possible (0.3)	Weak (2)	1.2
X13. Insect bites	Non-use of proper safety protection (83.6%)	Recurrent (6)	Almost definite (1)	Weak (2)	12
X14. Animal attack	Non-use of suitable protection for the garden and carelessness (67.1%)	Sporadic (2)	Possible (0.3)	Moderate (5)	3
X15. Depression	Loneliness (60.3%)	Rarely (1)	Rarely (0.05)	Slightly (1)	0.05
X16. Stress and other psychological problems	Climatic conditions and damage to the crop (62.2%)	Sporadic (2)	Almost definite (1)	Weak (2)	4
X17. Ergonomic problems (backache, sore legs, sore hands, etc.)	Lack of attention to safe physical activity at work (85.2%)	Recurrent (6)	Almost definite (1)	Moderate (5)	30
X18. General health problems (fever, headache, digestive problems, etc.)	Non-obsevance of health tips (77.6%)	Recurrent (6)	Almost definite (1)	Weak (2)	12

Determining risk levels based on the total risk rank **(**Dehghani et al., 2020**):**

1. Extreme risk (A): A > 20; 2. High risk (B): 10 > B ≥ 20; 3. Moderate risk (C): 3 > B ≥ 10; 4. Low risk (D): D ≤ 3

According to Table 4, the highest frequency of the respondents (31.38%) was related to the high-risk level, whereas the respondents with the low risk level were the least abundant (21.23%). Risks at the extreme level show the critical conditions in the planning and management of safety behaviors of grape growers and call for urgent measures to resolve or mitigate the risk level.

Table 4
The Frequency of Various Levels of Occupational Safety Risks Identified.

Risk level	Risk range	Frequency	Percent	Cumulative percent
A. Extreme	A > 20	71	21.85	21.85
B. High	10 > B ≥ 20	102	31.38	53.23
C. Moderate	3 > B ≥ 10	83	25.54	78.77
D. Low	D ≤ 3	69	21.23	100
Sum	-	325	100	-

The respondents were classified into four groups (1= low, 2= moderate, 3= high, and 4= extreme) regarding the risk level. According to the results of Wilkes Lambda for the function fitting (0.268; P< 0.01), the first diagnostic function could optimally distinguish the four groups of the respondents. Also, the canonical correlation, variance percentage, and χ^2 were estimated at 0.773, 76.3, and 406.190 at the 1 percent significance level, showing the function's acceptable differentiation. According to Table 5, a total of 14 variables (including demographic characteristics, the amount of use of personal protective equipment, and the component of the protection motivation model) were included in the analysis. All variables, except for age and experience in viticulture, were significant at the 1percent and 5 percent levels (the variables of yield and garden size) in distinguishing the four groups of the respondents. According to the results of the structure matrix, the most influential variables in distinguishing the four groups of the respondents were, in terms of importance, perceived severity (0.554), response cost (0.553), and self-efficacy (0.509). Also, the analysis showed that the total accuracy of the prediction of the respondent groups was estimated at 63.8 percent. This finding is consistent with the results of Neisi et al. (2020), Yazdanpanah et al. (2020), Wang et al. (2018), Suess et al. (2024), and inconsistent with the results of Bijani et al. (2022) (about the variables of response cost and self-efficacy) and Ataei et al. (2022) (about the variables of perceived severity and response cost).

Table 5
Result of the Diagnosis Analyses (Canonical Discriminant Function Coefficients).

Independent variables	Wilks' Lambda	F	p-value	Canonical coefficients	Structure matrix
Age	0.847	18.876	0.438	0.331	0.010
Education	0.894**	12.416	0.000	-0.247	0.300
Experience in viticulture	0.878	14.535	0.320	0.011	-0.013
Yield (ha)	0.973*	2.925	0.034	-0.116	0.155
Garden size	0.789*	8.723	0.019	-0.162	0.194
Average annual income	0.653**	55.509	0.000	0.669	-0.201
The amount of use of personal protective equipment	0.654**	55.496	0.000	0.480	0.312
Perceived severity	0.932**	7.623	0.000	-0.049	0.554
Perceived vulnerability	0.943**	6.287	0.000	-0.196	-0.185
Perceived rewards	0.859**	17.236	0.000	-0.233	-0.197
Response cost	0.711**	42.477	0.000	0.123	0.553
Response efficacy	0.821**	22.810	0.000	0.080	-0.281

Continued					
Self-efficacy	0.893**	12.533	0.000	0.010	0.509
Intention	0.954**	5.011	0.002	0.169	0.342

Eigen value = 1.482; Canonical correlation = 0.773; Wilks' Lambda = 0.268 and Sig.: 0.000; Chi-square: 406.190 and df: 39; % of Variance = 76.3

a. 63.8% of original grouped cases correctly classified.

**Significant at $p<0.01$; *significant at $p<0.05$.

CONCLUSIONS

This research aimed to identify and analyse various occupational safety risks of grape growers in northwest of Iran (Meshginshahr County, Ardabil province). Obviously, grape growers' protective behaviour is influenced by various factors and this research was confined to demographic factors and the components of the protection motivation model among the respondents. Based on the results, most respondents (31.38%) were at the severe occupational safety risk level, so the need for developing plans to reduce occupational risks is at a critical level, necessitating urgent measures for, at least, the safety risks at higher severity levels.

Among the occupational safety risks, grape growers have always been faced with slipping and accidents when working with manual and mechanical tools. In other words, these safety risks have been more recurrent than the other risks. Based on the overall risk rating, the most dangerous occupational safety risks among the grape growers were accidents when working with mechanical tools, accidents when working with manual tools, side effects of working with chemical pesticides, and ergonomic problems, respectively. It seems that there is a deep knowledge and skill gap among grape growers (with different occupation safety risk levels) in how to use mechanical and manual tools, how to work with chemical pesticides, and what ergonomic practices to be taken care of at work. In fact, most grape growers feel a lower perceived need and severity for adhering to safety principles and gaining more skill and knowledge about working with tools. Regarding manual and mechanical tools, it is therefore recommended to plan for developing a guideline for making the installation of safety coverings compulsory. Also, safety and educational posters in native languages must be provided by equipment manufacturers, assemblers, and retailers in order to partially improve occupational safety. Clearly, safety can significantly be improved by holding educational courses by local and governmental institutions as to how to use mechanical and manual tools that are widely used in grape culture, why safety precautions must be observed when using and handling chemical pesticides, why personal protective equipment must be used, and what the sound way of physical activities is in gardens in the studied regions.

Other findings revealed that perceived severity, response cost, and self-efficacy were the most effective variables in distinguishing the respondents based on their occupational safety risk levels. In this regard, it is recommended to increase grape growers' awareness and perceived severity of the importance of observing safety points and enhancing their occupational skills by making plans in mass media and using brochures, flyers, and posters about the implications of occupational safety risks. They must also be provided with low-interest loans in the context of safety improvement and development programs, and their access must be facilitated to technical support as per the regular visits of technical and safety experts from the vineyards in order to improve their production and safety activities.

Since self-efficacy was found to be a principal component in grape growers' sound encounter with safety behaviours, it seems that identifying and introducing role model farmers who adhere to safety regulations and holding visits from selected vineyards of the region to increase the technical and safety skills of grape growers can play a significant role in enhancing their motivation to improve their occupational safety behaviour. In this respect, the safety risks of grape growers can effectively be reduced by enacting

regulations about issuing technical competency to grape growers to procure mechanical tools, including support subsidies in the programs for procuring personal protective equipment and holding technical training courses about how to work with mechanical tools and the sound principles of ergonomics at work.

ACKNOWLEDGMENT

The authors of the article would like to thank the vice-chancellor for research and technology in University of Mohaghegh Ardabili (Ardabil province, Iran) for the financial support in the form of a research project (No. 1401/D/9/20281). They also express their gratitude to all the participants in this study.

CONFLICTS OF INTEREST

The authors have no relevant financial or non-financial interests to disclose.

AUTHORS' CONTRIBUTIONS

The authors contributed to the development of different section of the paper.

REFERENCES

Arabian, A., Omidi, L., Bakhshi, E., Ghanbari, A., Torabinassaj, E., & Zakerian S.A. (2020). Assessment of occupational safety, health, and ergonomics issues in agriculture in some cities of Iran. *Work*, *65*, 89–96

Asamani, J.A., Ismaila, H., Okoroafor, S.C., Frimpong, K.A., Oduro-Mensah, E., Chebere, M., Ahmat, A., Nabyonga-Orem, J., Christmals C.D., Nyoni J., & Kuma-Aboagye, P. (2022). Cost analysis of health workforce investments for COVID-19 response in Ghana. *BMJ Global Health*, *7*, e008941.

Ataei, P., Karimi, H., Moradhaseli, S., & Babaei, M. H. (2022). Analysis of farmers' environmental sustainability behavior: the use of norm activation theory (a sample from Iran). *Arabian Journal of Geosciences*, *15*(9), 1-13.

Badsar, M., & Karami, R. (2021). Understanding farmers' response to renewable energy: an application of Protection Motivation Theory. *Journal of Agricultural Science and Technology*, *23* (5), 987-1000.

Bartlett, J.E., Kotrlik, J.W., & Higgins, C. C. (2001). Organizational research: determining appropriation sample size in survey research. *Information Technology, Learning, and Performance Journal*, *19*, 43–50.

Benos, L., Tsaopoulos, D., & Bochtis, D. (2020). A Review on Ergonomics in Agriculture. Part I: Manual Operations. *Applied Sciences*, *10*, 1905.

Bhattarai, D., Singh, S.B., & Baral, D. (2016). Work-related injuries among farmers: a cross-sectional study from rural Nepal. *Journal of Occupational Medicine and Toxicology*, *11*, 48.

Bijani, M., Mohammadi-Mehr, S., & Shiri, N. (2022). Towards rural women's pro-environmental behaviors: Application of protection motivation theory. *Global Ecology and Conservation*, *39*, e02303.

Dehghani, Z., Tajik, R., & Zare R. (2020). The Relationship between occupational stress and job-related risks in the steel industry. *Journal of Arak University of Medical Sciences*, *23* (1), 60-71.

Denge, T. & Rakhudu, M., (2022). Perceptions of nurses on occupational health hazards and safety practices in Ditsobotla public hospitals in North West province. *Curationis*, *45*(1), a2220.

Fapojuwo, O., Ajayi, M.T., Okubena, B.A., Adebayo, O.A. & Fapojuwo, T.O. (2021). Occupational hazards prevalence and agricultural workers' job performance of agricultural organisations in Oyo State, Nigeria. *Interdisciplinary Journal of Humanities and Social Sciences*, *2*(1), 130.

Fragar, L.J, Pollock, K., & Morton, C. (2005). Occupational health & safety risk in the horticulture industries publication No. 05/049; Project No. US-121A. Printed by Union Offset Printing, Canberra. Available at:<chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://aghealth.sydney.edu.au/wp-content/uploads/ 2019/05/horticulture.pdf>

Houshyar, E., & Kim, I. (2018). Understanding

musculoskeletal disorders among Iranian apple harvesting laborers: Ergonomic and stop watch time studies. *International Journal of Industrial Ergonomics*, *67*, 32-40.

Jacobs, D.J., Gross, M.D., & Tapsell, LC. (2009). Food synergy: an operational concept for understanding nutrition. *American Society for Clinical Nutrition*, *89* (5), 1543S-1548S.

Kaewdok, T., Sirisawasd, S., & Taptagaporn, S. (2020). Agricultural risk factors related musculoskeletal disorders among older farmers in Pathum Thani province, *Thailand. Journal of Agromedicine*, *26*, 185–192.

Majdabadi, H.A., Khadri, B., Pirposhteh, E.A., Nouri, M., Dolatabadi, Z.A., & Kassiri, N. (2022). Relationship between the status of occupational health management and job satisfaction among farmers: A health promotion approach. *Journal of Education and Health Promotion*, *11*, 390.

Mohsenipouya, H., Jannati, Y., Majlessi, F., & Mousavi Nasab, N. (2021). The Role of Self-Efficacy in Perceived Sensitivity and Severity to COVID-19 Preventive Behaviors. *Journal of Mazandaran University of Medical Sciences*, *30* (194), 134-139.

Moradhaseli, S., Farhadian, H., Colosio, C., Abbasi, E. & Ghofranipour, F. (2020). Development of psychometric properties of farmers' occupational health behavior questionnaire for Iranian farmers. *Journal of agro medicine*, *1*, 1-7.

Natt, A.P., Kaur, R., Singh, A., & Singh, P. (2021). Agrarian population's occupational health risks and after effects. *Examines Phy Med Rehab*, *3*(2), 000559.

Neisi, M., Bijani, M.E., Abbasi, H., Mahmoudi, H., & Azadi, H. (2020). Analyzing farmers' drought risk management behavior: Evidence from Iran. *Journal of Hydrology*, 590, 125243.

OECD. (2018). Considerations for Assessing the Risks of Combined Exposure to Multiple Chemicals, Series on Testing and Assessment No. 296, Environment, Health and Safety Division, Environment Directorate. Available at: <chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.oecd.org/chemicalsafety/risk-assessment/considerations-for-assessing-the-risks-of-combined-exposure-to-multiple-chemicals.pdf>

Olaoye, O.J., & Ojebiyi, W.G. (2021). Occupational Health Hazards Associated with Nigerian Fisheries. In K. Palaniappan, & P. McCauley (Eds.), Occupational Wellbeing. Intech Open. Doi: 10.5772/intechopen.94205

Ran L., Hu-Chen, L., Hua, S., & Xiuzhu, G. (2023). Occupational health and safety risk assessment: A systematic literature review of models, methods, and applications. *Safety Science*, *160*, 106050.

Roozbahani, A., Behzadi, P., & Massah Bavani, A. (2020). Analysis of performance criteria and sustainability index in urban stormwater systems under the impacts of climate change. *Journal of Cleaner Production*, *271*, 122727.

Schulte, P.A., Pandalai, S., & Wulsin, V., (2012). Interaction of occupational and personal risk factors in workforce health and safety. *American Journal of Public Health*, *102*(3), 434-448.

Sharifirad, M., Poursaeed, A., Lashgarara, F., & Mirdamadi, S.M. (2022). Risk factors for musculoskeletal problems in paddy field workers in northern Iran: A community-based study. *Journal of Research in Medical Sciences*, *27*, 77.

Shin, D.S., & Jeong, B.Y. (2022). Older female farmers and modeling of occupational hazards, wellbeing, and sleep-related problems on musculoskeletal pains. *International Journal of Environmental Research and Public Health*, *19*, 7274.

Suess, C., Maddock J. E., Palma, M., Youssef, O., & Kyle, G. (2024). An application of protection motivation theory to understand the influence of fear-appeal media on stated donations for coral reef restoration. *Tourism Management*, *100*, 104797.

Tabibi, R., Tarahomi, S., Ebrahimi, S.M., Valipour, A. A., Ghorbani-Kalkhajeh, S., Tajzadeh, S., Panahi, D., Soltani, S., Dzhsupov, K.O., & Sokooti, M. (2018). Basic occupational health services for agricultural workers in the south of Iran. *Ann Glob Health*, *84*(3),

465-469.

Tambe, A.B., Mbanga, B.M.R. & Nzefa, D.L. (2019). Pesticide usage and occupational hazards among farmers working in small-scale tomato farms in Cameroon. *Journal of the Egyptian Public Health Association*, *94* (20), 1-9.

Wang, J., Chu, M., & Ma, Y. (2018). Measuring rice farmer's pesticide overuse practice and the determinants: A statistical analysis based on data collected in Jiangsu and Anhui Provinces of China. *Sustainability*, *1*, 103, 677.

Yazdanpanah, M., Abadi, B., Komendantova, N., Zobeidi, T., & Sieber, S. (2020). Some at risk for COVID-19 Are reluctant to take precautions, but others Are Not: A case from rural in Southern Iran. *Public Health*, *8*, 562-300.

How to cite this article:
Sookhtanlou, M. & Khoshnodifar, Z. (2024). Identifying and assessing occupational safety risks among grape growers in northwest of Iran. *International Journal of Agricultural Management and Development, 14*(2), 203-215. **DOI:** 10.71877/ijamad.2024.8280