





Injury as a Threat To Health, Experiences of Falling From Trees in Farmers: A Qualitative Study

Zahra Zobdeh¹⁽¹⁾, Saeid Bashirian²⁽¹⁾, Salman Khazaei³⁽¹⁾, Maryam Afshari²¹⁽¹⁾, Ensiyeh Jenabi⁴⁽¹⁾, Hamid Shokoohi⁵⁽¹⁾, Mehran Biglari⁶⁽¹⁾, Behzad Gholamaliee⁶

¹Department of Nursing, School of Nursing and Midwifery, Hamadan University of Medical Sciences, Hamadan, Iran ²Social Determinants of Health Research Center and Department of Public Health, School of Public Health, Hamadan University of Medical Sciences, Hamadan, Iran

³Research Center for Health Sciences, Hamadan university of Medical Sciences, Hamadan, Iran

⁴Pediatric Developmental Disorders Research Center, Hamadan University of Medical Sciences, Hamadan, Iran

⁵Department of Emergency Medicine, George Washington University, Washington, DC, USA

⁶Tuyserkan Health Center, Hamadan University of Medical Sciences, Hamadan, Iran

Abstract

Background: Falling is a significant cause of occupational injuries and fatalities among farmers, and falling from trees is one of the most common causes of injury resulting in a high number of visits to health centers. Despite this, there is limited evidence on the factors associated with falling from walnut trees. Therefore, this study aimed to identify the factors that contribute to falling from walnut trees from the perspective of farmers and farmworkers.

Methods: This qualitative study was conducted using conventional content analysis. Data were collected through semi-structured interviews with 20 farmers and farmworkers who had experienced falling from walnut trees as recorded in the National Accidents Record Program from September to October 2017 in Tuyserkan county, Iran. Participants were selected through purposive sampling. Moreover, data rigor was ensured through participant and external checks. All interviews were recorded and analyzed using content analysis methods.

Results: Data analysis led to the extraction of six themes, including psychological factors, physical factors, behavioral and habitual factors, economic factors, factors related to walnut trees, and atmospheric agents, along with 18 subthemes for behavioral, human, and environmental factors.

Conclusion: The findings of this study suggest that with appropriate interventions and training, farmers and farmworkers can be guided and assisted so as to prevent the occurrence of falling from walnut trees. In addition to educational interventions, health promotion measures such as providing safety equipment and insurance coverage can be essential in reducing injuries. **Keywords:** Injury, Falling, Walnut tree, Farmers, Farmworkers, Qualitative study

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Introduction

The agricultural industry is a crucial sector globally, providing food and employment for a significant number of farmers and farmworkers (1). However, agriculture has traditionally been one of the most dangerous occupations, with high rates of death, injury, and illness among farmers and farmworkers (2). Both fatal and non-fatal injury rates are high among farmers, who often work under hazardous conditions, particularly in low-income countries, leading to injury and death (3). Farmers are at risk of injury as agricultural work involves multiple tasks and positions (4), which can result in various health problems, including harm, falls, pesticide poisoning, and respiratory, musculoskeletal, skin, and infectious diseases (5).

Falls are a significant cause of occupational injury and mortality among farmers, leading to serious but preventable public health problems (6). A review of studies on agricultural injury in North America revealed that 25% of injuries are due to falling (7). The height of the fall, the landing surface, and the body position during the fall are the factors that determine the severity of an injury. The spinal cord, brain, and extremities are the most commonly injured organs (8).

The type of farm and exposure to specific agents of injury, particularly falls, among farmers and agricultural workers have been well documented (9). Falling from walnut trees is one of the leading causes of morbidity and mortality among farmers in Tuyserkan county (10). Walnut trees are found throughout the county and are economically significant. Falling from trees, including walnut trees, is one of the most common causes of injury in the county, resulting in a large number of visits to health centers. The walnut tree has a very slippery surface



and can grow up to 10-25 meters in height, making it particularly hazardous. The traditional techniques used to harvest walnuts are also risky. Farmers and farmworkers may lose their balance and fall from a considerable distance when climbing the trees. Falling from the upper parts of walnut trees is a significant problem for farmers due to worm-eaten branches, unpruned trees, and the recklessness of some workers during walnut harvesting. Despite the risks, the high price of walnut in local markets motivates farmers to accept these hazards.

Overall, farmers and farmworkers are working under unsafe conditions, particularly in low- and middleincome countries, leading to injuries and deaths. Most farmers are informal sector workers, and farming is a household-owned rather than a company-owned business in Iran. Given the importance and sensitivity of this issue as one of the challenges facing the national health system and the lack of appropriate scientific information about health issues related to falling from walnut trees, further research in this area is necessary. Using qualitative research can provide a deeper understanding of farmers' perspectives and experiences, and can lead to new insights into the causes and factors of falling from trees. Additionally, in some cases, phenomena such as falls cannot be investigated using statistical methods due to their complexity and uncontrollability, making qualitative research the best solution for studying this phenomenon. Qualitative research can also enable a more accurate interpretation of data and lead to the discovery of more details and reasons for falls among farmers. Therefore, the use of qualitative research methods to investigate falls can lead to valuable new knowledge and insights in this area. Furthermore, since there is limited evidence on the factors associated with falling from walnut trees among farmers and farmworkers, this study was conducted to identify the factors that contribute to falling from walnut trees from the perspective of farmers and farmworkers.

Methods

This qualitative study was conducted from August to September 2017 using conventional content analysis in Tuyserkan county, located in Hamadan province in western Iran. Tuyserkan county with a harvest level of 54 thousand hectares is a major county for walnut production in Iran (11).

Purposive sampling was employed to select participants who had been admitted to the hospital for injuries due to falling from walnut trees during the walnut harvesting season. The sampling included both outpatients and inpatients who had received remedial measures, and maximum variation sampling was used to increase the generalizability of the results. Firstly, a list of eligible farmers who had fallen from walnut trees as recorded in the National Accidents Record Program from September to October 2017 was obtained. Then, these farmers were contacted, and those who expressed interest in participating were included in the study.

Semi-structured interviews were conducted to obtain answers to predetermined questions and provide opportunities for participants to recount their experiences related to the research topic. The interviews were conducted in a private room at the health centers, and the interview time was scheduled based on the participants' convenience. A brief explanation of the study objectives was provided to 20 farmers and farmworkers who had fallen from walnut trees during the walnut harvesting season. Sampling and interviews continued until data saturation was achieved. The questions were directed towards factors that affect falls, including behavioral, human, and environmental factors. The questions were: "What do you think are the behavioral and human factors that contribute to falling from walnut trees?" and "What environmental factors do you think contribute to falling from walnut trees?" Initially, the causes of the fall were explored during the interviews, but as the interviews progressed, more detailed questions were raised based on the participants' responses and the simultaneous analysis of the data. The interviewers provided a conclusion using the statements of the interviewees. The participants were asked if there were any ambiguities that required further elaboration. All interviews were conducted individually and face-to-face, with the necessary tools such as notebooks, voice recorders, and other equipment available. The interviews lasted from 40 to 45 minutes each.

The procedure of the study, confidentiality of information, aim of the study, and the right to withdraw from the study were explained to the participants, and they signed a written consent form if they agreed to participate.

The Graneheim and Lundman's approach was utilized to analyze the data (12). After each interview, the notes were reviewed and transcribed using word processing software. Primary codes were assigned to meaning units by both researchers, and data rigor was confirmed by the participant and external checks. In the next stage, codes were compared and similarities and differences were identified to extract concepts and induce integration in related topics. Themes were then extracted, and the key topics of the study were obtained by reviewing both codes and themes (12). To validate the major and minor subjects extracted by both researchers, the data were separately re-evaluated by the two researchers. They analyzed the data, categories, and subcategories, and the research team reached a consensus.

Results

Baseline characteristics

All participants in the study were men (100%), and most of them were illiterate (35%). Among all cases, the majority

were married (85%), and 30% of them were under the age of 30. Moreover, 65% were farmers, and 50% had more than 10 years of experience in climbing walnut trees. The majority of the participants (70%) had a low monthly income. Table 1 displays the demographic characteristics of the participants.

Categories and subcategories

The data analysis led to the identification of six main categories related to behavioral, human, and environmental factors. The themes for behavioral and human factors included: 1) psychological factors; 2) physical factors; and 3) behavioral and habitual factors. The themes for environmental factors included: 4) economic factors; 5) factors related to walnut trees; and 6) atmospheric agents. Table 2 presents these categories in detail.

The subcategories for psychological factors included distraction and confusion, lack of fear of falling, irresponsibility and negligence, and anger. The majority of farmers and farmworkers pointed to distraction and confusion. For example, a 70-year-old man stated, *"Before falling, I was distracted by some family problems"* (Participant 1). Furthermore, some farmers and farmworkers reported that they did not fear falling and believed that they would never fall from the tree.

 Table 1. Demographical characteristics of the participants (n=20)

Characteristics		Number	Percent
Marital status	Married	17	85
	Single	2	10
	Divorced or widowed	1	5
Level of education	Illiteracy	7	35
	Elementary school	5	25
	Middle school	4	20
	High school	2	10
	College	2	10
Age (y)	< 30	10	50
	30-49	5	25
	50-69	3	15
	≥ 70	2	10
Occupation	Farmer	13	65
	Farmworker	7	35
Experience climbing the walnut tree (y)	≤10	10	50
	11-20	5	25
	21-30	2	10
	31-40	2	10
	≥41	1	5
Monthly income	Excellent	0	0
	Good	2	10
	Moderate	4	20
	Poor	14	70

For instance, a 25-year-old man stated, "*I did not fear falling from the tree*" (Participant 6). Irresponsibility and negligence were also identified as reasons for falling. A 28-year-old man stated, "*Due to negligence, one of my legs slipped and I fell*" (Participant 10). In some cases, farmers reported falling from the tree due to anger. For example, a 29-year-old man stated, "*I was angry with my neighbor and I fell*" (Participant 11).

The subcategories for physical factors included excessive fatigue, aging, high weight, and lack of balance. Participants reported that one of the reasons for their fall was excessive fatigue. For instance, a 58-year-old man stated, "*I was so tired and I should not have climbed the tree*" (Participant 15). Participants also mentioned that aging, high weight, and lack of balance were contributing factors to falling. A 49-year-old man stated, "*Sometimes, obesity and aging can be the reasons for the fall*" (Participant 3).

The subcategories for behavioral and habitual factors included inexperience, not using safety equipment, not having the habit of using safety equipment, hurrying to finish the task, and lack of training for using safety equipment and adopting protective behaviors. Most participants expressed that they were inexperienced in this job, which could have a negative impact on falling from the walnut tree. For instance, a 35-year-old man stated, *"Sometimes I think that I'm so unskilled and inexperienced*

 $\ensuremath{\text{Table}}\xspace$ 2. Categories and sub-categories of behavioral, human and environmental factors

Categories	Subcategories		
Psychological factors	Distraction and confusion		
	Lack of fear of falling		
	Irresponsibility and negligence		
	Anger		
Physical factors	Excessive fatigue		
	Aging		
	High weight		
	The lack of balance		
Behavioral and habitual factors	Inexperience		
	Lack of use of safety equipment		
	Lack of having the habit of using safety equipment		
	Hurry to finish the task		
	Lack of training in the use of safety equipment and protective behaviors		
Economic factors	Not having money to buy safety and new equipment		
Factors related to walnut trees	Thin, dry, rotten and long branches of walnut trees		
	The disease of the walnut trees		
Atmospheric agents	Rainfall		
	Windy weather or hot air		

to climb the walnut tree. I need to acquire more skills" (Participant 8). The majority of the participants reported that they did not use protective equipment. A 69-yearold man stated, "I did not have safety equipment, so I did not use it and I fell" (Participant 4). Besides, most farmers complained that the protective equipment was cumbersome and that they were not accustomed to using it. A 22-year-old man expressed, "Climbing the tree with safety equipment slows me down" (Participant 9). Some farmers and farmworkers reported that they were in a hurry to finish the task and were not cautious. A 24-yearold man stated, "I had to finish harvesting a walnut garden very soon, so I hurried and fell from the tree" (Participant 1). Furthermore, most farmers and farmworkers reported that they had not received training on using safety equipment and taking protective measures. A 26-yearold man stated, "I have never received any training on preventing falls from the walnut tree" (Participant 18).

The subcategory for economic factors included not having money to buy safety and new equipment. Most participants reported that they lacked the funds to buy safety equipment and had to rely on worn-out safety equipment. Economic problems were identified as the most significant barriers to buying and using safety equipment. A 71-year-old man stated, "I *do not have enough money to buy equipment*" (Participant 12). A 58-year-old man also mentioned, "When you cannot buy new equipment, you have to use old tools" (Participant 15).

The subcategories for factors related to walnut trees included thin, dry, rotten, and long branches of walnut trees, as well as the disease of the walnut trees. In recent years, a disease has affected some walnut trees in the area, causing their branches to gradually dry out. Additionally, due to the high density of walnut trees, they are tall and have fragile branches, which increase the risk of falling. A 27-year-old man stated, *"I would not have fallen from the tree if I had cut the dry and tall branches of the walnut trees*" (Participant 2).

The subcategories for atmospheric agents included rainfall, windy weather, and hot air. Participants reported that bad weather conditions were a factor in their falling from the walnut tree. They suggested avoiding climbing trees during bad weather conditions. A 42-year-old man stated, *"The wind was blowing, and I climbed the tree, but I regretted doing it"* (Participant 7).

Discussion

Occupational injury rates among farmers are high, and many prevention programs and laws have been introduced as injury control strategies in this field. However, the effectiveness of many of these strategies in reducing injuries is still unknown, as it is based on identifying important factors. The present study was conducted to enrich our understanding of the factors affecting falling from walnut trees among farmers and farm workers. This study is one of the few that examines the factors affecting falling from walnut trees in all countries.

According to the FAO report in 2011, Iran is the secondlargest producer of walnuts, with an annual production of 485 000 tons, representing 14.2% of the world market (13). It is challenging to estimate the exact number of people at risk of falling from walnut trees. Indeed, falling from trees is a common cause of fall-related injuries (14-16), and the main cause of falling from trees in Iran is the gathering method. Since the lives of most of the population depend on fruit trees, falling from trees is a significant occupational hazard in Iran.

The findings of this study revealed that psychological and physical factors were significant contributors to falling from the walnut tree, which is consistent with the results of a previous study (17). A study in 2017 identified psychological and cognitive factors that caused falls among the elderly. It was shown that farmers and farmworkers who have experienced health problems are more susceptible to falling from the trees (15). Similar to another study (16), the results of this study demonstrated that falling from walnut trees affected aging individuals who climbed the trees to harvest. Aging males who climb trees may be less cautious and more likely to have chronic diseases that affect their balance and physical condition due to their age. In addition, pollution with leopard moth pesticides in walnut trees can create a superficially healthy and thick but hollow branch that may break under the weight of the human body (16). Psychological factors such as anger and fatigue can also cause a loss of focus and increase the risk of falling.

Behavioral factors were also found to be a significant contributor to falls from walnut trees. Training has been shown to reduce fall risk in other studies (18,19), and researchers have found that the incidence of injuries is lower among farmers who participated in any type of safety training program (20). Farmers have acknowledged that taking preventive measures regarding falls from trees can ensure their safety and reduce costs imposed on owners and their families. It is recommended that health centers provide continuous education and health promotion interventions for farmers and agricultural workers, especially as the walnut harvest season approaches each year, to prevent and reduce falls from walnut trees. These interventions should be conducted by healthcare professionals.

Similar to another study in Iran (16), breaking branches was the main reason for falls in participants. Aging and diseases were the main causes of falling from other fruit trees (21). Pests of walnut trees cause cavities in the branches, making them fragile and prone to breaking under the weight of the human body (22). To prevent slipping and sliding, it is recommended to wear appropriate shoes and avoid climbing trees during rainfall (23). Similar to another study, the results of this study demonstrated that economic factors are a significant contributor to falls (24). This study showed that the most common reason for the lack of access to healthcare was the lack of money. Moreover, the time of day and weather conditions may also affect the risk of falling from trees. Climbing trees after rainfall may be risky, and walnut trees can be slippery when exposed to hot sun (25). High air temperatures during this time can increase the probability of falling, and the relationship between high air temperatures and occupational injuries has been previously established (23). Work-related fatigue and hypotension may also play a role (19).

Overall, agriculture has traditionally been one of the most hazardous occupations for farmers and farmworkers, and agricultural injuries are reported globally, especially in low- and middle-income countries. Falls are the most common form of non-fatal occupational injuries (26).

The results of this study should be considered in the context of its strengths. This research was the only qualitative study conducted on falls from walnut trees among farmers and farmworkers. However, the major limitation of this study was that many participants were too busy with gardening, which may have influenced the interviews. As a result, the researchers had to contact people multiple times and persuade them to participate in the study.

Conclusion

The results of this study showed that there are significant factors contributing to falls among farmers and farmworkers from walnut trees. In addition to educational interventions, health promotion interventions such as providing safety equipment and insuring people to reduce injuries are essential. Providing personal protective equipment by the Agricultural Jahad Organization at an affordable price to farmers and agricultural workers during walnut harvesting can also be effective. Occupational health specialists can use the research results to plan for preventive measures and interventions to reduce fallrelated injuries in this population.

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Authors' Contribution

Conceptualization: Maryam Afshari. Data curation: Maryam Afshari. Formal analysis: Maryam Afshari. Investigation: Zahra Zobdeh. Methodology: Maryam Afshari. Project administration: Saeid Bashirian. Resources: Zahra Zobdeh, Saeid Bashirian. Software: Ensiyeh Jenabi. Validation: Maryam Afshari, Mehran Biglari, Behzad Gholamaliee. Visualization: Zahra Zobdeh, Hamid Shokoohi. Writing-original draft: Maryam Afshari, Saeid Bashirian. Writing-review & editing: Maryam Afshari, Salman Khazaei.

Competing Interests

No potential conflict of interest was reported by the authors.

Ethical Approval

The study was approved by the Ethics Committee of Hamadan University of Medical Sciences with the ethics code IR.UMSHA. REC.1397, 266.

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