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Factors Affecting the Incidence of Occupational Accidents among Farmers

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Abstract

Aim: The aim of this study was to determine the incidence of occupational accidents among farmers with an emphasis on the role of extension and education in reducing these incidents.

Methods: This study was conducted through a literature review. For this purpose, we investigated books, documents and articles related to research topics in the period of 2000 to 2017.

Findings: Various factors are effective on the incidence of occupational accidents as well as on the type, amount and severity of injuries resulting from accidents at work. Farmers and agricultural workers are not excluded from occupational accidents. The affecting factors on occupational accidents in agriculture are classified in three categories: farmers' characteristics, agricultural environment, and agriculture technologies.

Conclusion: Occurrence of incidents in agricultural occupation is inevitable. Identifying the factors affecting the incidence of accidents can help to reduce the occurrence of incidents among farmers. The agricultural extension and education according to the abilities and talents in the field of agriculture and rural society can reduce accidents and work-related risks and improve the farmers' occupational health.

Keywords: Agriculture, Occupational accidents, Factors affecting

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Introduction

Since the Creation, human beings have been struggling to fulfil their living requirements. In that in most cases, a great effort has been made in the type of their technical activities with the advancement of science and technology. These activities (performed in simple or complicated manner) are referred to either as job or work. The health of the body and the purity of the soul are ensured by virtue of work, which is, a fact, stressed in the words of Imam Ali (AS): "What makes human being smooth is working". In another Hadith, Prophet Muhammad (PBUH) holds that one who endeavors to earn his family's bread and butter is like a Mujahid who fights in the cause of God. As such, the importance of job is realized not only from the economic and material aspects, but it also embodies spiritual and ideological values [1]. There are covert and overt risks in doing jobs, some of which happen, sometimes, due to ignorance, lack of safety observance (negligence), lack of proper equipment, etc. Kurdrostami (2011) states that it is an unplanned event during a series of planned activities. In other words, accident is an event whose occurrence causes damage to property and the environment, or human loss or injuries [2]. According to the International Encyclopedia of Work, accident is an unexpected event that causes injury and harm [3].

Studies have shown that low-educated or illiterate people or those with low knowledge about how to take safety measures often cause work-related dangers. Although this was reported among educated people, the reason why they happen is impulsiveness. Hence, the major part of accidents involves some social and personal requirements, as well as the lack of observance of safety standards during work. In this regard, throughout human life spans, physicians and scientists have taken steps to promote the health of workforce. The history of social damages dates back to the fourth century BC. For example, Hippocrates, for the first time, detected the workers' lead poisoning in the fourth century BC. Moreover, Ramazzini, who is called as the father of medicine, was the first who advised physicians to ask for the patients' occupational history along with queries from them, because it is likely that there is a close connection between job and disease [1].

Importance of studying occupational accidents

Occupational accident is one of the main causes of disability. It imposes high costs on families, healthcare and other systems in the society [4]. Research shows that workplace is one of the most important fields causing accidents. Every year, 313 million non-fatal occupational injuries occur worldwide, leading

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to at least four days' absence from work. Each year, more than 350,000 people die from occupational injuries [5]. Also, in agricultural sector, according to the International Labor Organization (ILO) estimates, at least 170,000 agricultural workers are killed every year [6].

The direct and indirect costs of accidents impose millions of dollars of losses annually on employers. According to the European Agency for Safety and Health at Work (EASHW), six million job-related accidents occur in the EU states annually, resulting in a loss of 146 million hours of work. It means that approximately 6.2 to 8.3% of the EU's total domestic gross product is lost every year [7]. The estimated cost in a seven-year study in 2010 was calculated between $ 21 to $ 31 million. Most of the costs involved are indirect costs such as efficiency loss at work and at home. Fatal injuries in the first place and admissions to hospitals at the next level consist the highest direct costs [8]. About 45% of accidents cause damage to property, 30% lead to loss of time, 21% lead to medical attention, and 2.67% end with mortality [9]. The economic burden of such incidents and illnesses is considerable on individuals, companies, families and even the general community. But according to the safety experts, each incident has one or more causes. To prevent an accident, one must identify the cause of the incident. The followings are the factors that affect incidents:

Factors affecting the incidence of occupational accidents

No effect is undoubtedly without cause. As the French scientist Lavoisier contents: "Nothing comes to existence on itself unless a reason gives way to it". Disasters and accidents are born of factors whose reasons are human beings themselves or human-made tools. Henrich holds that one needs to focus on accidents and their causes in the first place in order to take preventive measures (unsafe actions and unsafe conditions), and pay less attention to the effects of accidents like damages and their immediate damages [10]. Prevention of accidents is possible with a clear understanding of key affecting factors [11]. The development of highly sophisticated technologies in various industries, particularly in risky industries, has changed the philosophy of safety from post-occurrence approach to pre-occurrence approach. The new approach is built on the recognition of root causes of accidents ahead of occurrence [12]. Accident happens typically at three levels;

1) Basic cause level: At the lowest level of causes, accidents just occur when a person or object encounters a quantity of energy or a risky substance and perceives it as if it cannot be understood in normal state. This energy or risky substance is the direct cause of accident.

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2) Direct cause level: The direct causes are usually the result of one or more unpredictable and irreversible conditions, or both. Unsafe actions or conditions are always referred to as *indirect causes*.

3) Indirect cause level: Indirect causes are often because of poor management policies, wrong management decisions or unfavorable environmental or personal factors. These causes are called *root causes* [3].

In this regard, in agriculture sector accidents and damages arising from agricultural works are a remarkable health problem worldwide [13] in the sense that agricultural safety is a central issue of agricultural productivity improvement. That is to say, with the expansion of agricultural technologies, agricultural workers will face a growing health concern, causing them to face new job sanitary and health threats in addition to former health and sanitary threats. However, even in the countries where primary health cares have been developed well, occupational sanitary cares often cease to exist in the agricultural sector [14]. Accident in the agricultural sector is defined as any unpleasant or destructive event that happens unexpectedly or by chance, and leads to injury, loss of life, asset or time, etc. [15]. In addition to long-term effect on an individual, agricultural damages affect the farmers' families and society as well [16]. Since a variety of factors contribute to occupational accidents, and to the type, level and degree of damages caused by these accidents, many studies conducted in this regard have been reviewed. Generally, factors affecting occupational accidents can be classified into three classes: farmers' characteristics, agricultural environment and agricultural technologies, and use of protective equipment.

Farmers' characteristics

Since human resources is seen as the most important yield factor in the agriculture sector, farmers' characteristics can contribute to the accidents of this sector as well as their preventive measures. In this sector, some characteristics of farmers and their roles in accidents have been investigated.

A. Demographic and personal characteristics

It has been widely accepted that human factors are influential in accidents [17]. Human factors in the occurrence of workplace accidents include lack of knowledge, lack of adequate motivation, negative attitude, wrong beliefs, unsafe behaviors, work incompetency, lack of appropriate rules and proper instructions, and enhancement of unsafe behaviors [18]. Cartiyon and Reyeshineen (2013) state that individual characteristics, decreased ability, skeletal-muscular problems and respiratory diseases were shown to make a significant

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difference to accidents and damages [19]. Farmers' resistance to change is one of the factors affecting the occurrence of accident, in that it is triggered by adverse weather conditions. This is mainly because of a strong connection with traditional agriculture and rural ideology [20].

Age is a serious factor with regard to a potential risk of damage among farmers. Since older farmers are not under any compulsion to plan for retirement, many farmers may have still desire to do certain tasks beyond their abilities [21, 22]. Older farmers are subject to accidents due to long hours of work and lack of rest [23]. However, risks of damages to older farmers may be due to their more work experiences, lower risk-taking and reduced interference with heavy manual works [24]. On the contrary, many deaths happened among young workers because of the lack of experience and insufficient attention to work [25]. A wide range of accidents happen at ages over 18 [26].

In addition to age, gender is an important factor in fatal injuries in farms [21]. Most occupational accidents have happened to men [27]. A review of 16 studies indicates that the risk of injury in men is 3.3 times higher than that in women [28]. Agricultural risks are reported to be more in men in the summer during mid-day owing to the loss of control of agricultural machineries during harvesting [29]. However, women are active labor force in the agriculture sector as they can work on farms even during pregnancy. In some cases, due to falling down and displacement, abortion occurs in farms. On the other hand, fatigue, malaria, exposure to pesticides, and the like that cause accidents and diseases are on the rise among them [30]. The low level of education is a factor of risk among farmers [31]. Studies have shown that farmers with higher education levels are less likely to sustain injuries than people with lower education levels [32]. Other individual and personal factors are also at work in this sector, which we can refer to in what follows:

Farm work mechanization has some clear advantages in terms of productivity, but its potential effects should be taken into consideration on obesity and overweight risks [21]. Overweight and obesity are among the risk factors of occupational injuries [33]. People to whom farming is a secondary job are less likely to pay attention to job safety due to lack of self-confidence and experience in farming [34]. The occurrence level of accidents among the workers previously sustained damages is more than in other workers, but their recovery can be deferred nonetheless [35]. Daytime sleepiness, job status, drinking alcohol, and smoking are factors contributing to threats among farmers [31].

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As work experience grows, accidents would fall [36]. Psychological factors including depression, stress, social support and anger are also contributing to accidents among farmers [37].

Failure to use personal protective equipment by workers, impulsiveness and carelessness, unprotected or technically broken devices, failure to procure and deliver individual equipment, failure to train workers, and the employer's failure to supervise them contribute to accidents [38]. The most common causes of accidents among farmers are to rush to work, irregularities, and not observing the original safety rules [39].

B. Economic conditions

Farmers' concerns for making household expenditures have lowered individual attention and safe behaviors during day-to-day activities. In addition, farmers are less interested in observance of safety measures and their health owing to economic problems as well as costs reduction and costs saving [40]. Inadequate economic situation is among the disastrous factors to farmers [34]. Poverty of farmers has limited the provision of protective equipment among them and has increased the risks of pesticide poisoning [41].

C. Safety training and knowledge

Worker training regarding the farm safety can play a key role in preventing work-related injuries and diseases. The lack of proper training and monitoring of the implementation of safety rules is the underlying cause of accidents [42]. Lack of knowledge about how to do a job is considered one of the important factors in causing an accident [43]. Lack of knowledge about dangers of workplace can end up with accidents in farms [44]. To protect health and achieve safety at the workplace, the transfer of these concerns requires preventive measures as a challenge and priority for the career of agricultural health [45]. Some studies have also shown that farmers not trained in the use of personal protective equipment suffer from a higher incidence of occupational accidents, injuries and illnesses [46]. Sikkaland (2012) demonstrated that Norwegian farmers are aware of dangers; however, they do not always properly handle this risk. Many farmers seem to perceive risks as natural part of their lives. Dangers are considered something they are forced to live with; on the other hand, many farmers are not well aware of the beneficial effects of safety [47].

D. Duration of agricultural activities

Time pressure due to increased seasonal workload has caused farmers and workers work longer hours during the day and more days during the week. This itself causes stress and fatigue, which is a known risk factor for

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injury [48, 49]. Long working hours are a risk factor known for damage among those who work in agriculture [49, 50].

Sleep less than 7 to 7.5 hours by day and night causes injuries on farmers [13]. Effect of sequential long shifts and the duration of rest between changes are determining risk factors in the occurrence of accidents [51]. There is a relationship between what time of day, fatigue, work pressure, and events. Prolonged work periods during the summer months have increased the health risks for farmers [52, 53]. The duration of work on the farm is associated with the severity of damage occurred, in that more accidents happen to those who work over 35 hours a week [54]. Work shifts and long working hours can reduce work performance and increase the risk of obesity. They can also bring about a wide range of chronic diseases and other accidents and injuries [55].

Farm environment

In addition to functioning as farmer's workplace, farm is considered a person's living environment, because dangers can menace his family as well as the person himself. Therefore, the environment of the farm is a dangerous environment that has an ongoing impact on the work and life of the people on the farm. Regardless of whether people are working on the farm or not [56], the lack of farm resorts for farmers and the lack of proper washing conditions have reduced the safe use of pesticides, leading to the occurrence of accidents and diseases caused by toxins [57]. In this regard, farm vehicles, irrigation systems, planting and harvesting technology, and use of pesticide are influential in accidents, which require a change in monitoring systems, governmental regulations, and the introduction of genetically modified breeding [58]. Investment in farm yield and mechanization may have positive effects on work quality and quantity as well as work safety [19]. Weather conditions affect the severity of the incident [59] as the degree of the environment temperature, humidity, wind, dust storms, precipitation and solar radiation can cause potential and significant risks on the farm environment [60].

For farmers, there are perturbing occupational factors in the farm environment, including time pressure with respect to seasonal workload and unpredictable factors, e.g. machinery failure [61]. The amount of accidents in farms where work is full time is over twice that of farms where work is part time [62]. Larger farms, doing agricultural activities alone, long-term work experience, and old working conditions are seen as accident-causing factors [19].

Failure to rest adequately when it comes to injury and adverse workplace conditions gives rise to the occurrence of life threatening accidents [63]. Farmers may not have access to

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sanitary and welfare facilities on the farm; for instance, it is possible that workers become unable to wash their hands during the day or have no access to washing machine or bathroom after work. Even if such possibilities are accessible, due to excessive workload, they have not enough time to take care of their safety [64]. Type of work on farms like tractor maintenance, livestock breeding, and the like is known as a factor creating risk to farmers [54].

Farm technologies and use of protective equipment

Negligence in maintenance and improper use of devices and equipment can cause dangers and accidents to farmers [29]. Equipment and use of machinery have a high potential for inflicting serious damages and accidents [65]. Use of unsafe and old methods, obsolete machinery or lack of appropriate tools can also cause accidents to farmers [66]. Farmers' main reasons for not using protective equipment include the lack of comfort, unpleasantness, inaccessibility to buy them or disturbance of machinery noise [67]. The rattling sound of machineries, long use of them, and lack of protective equipment use are problematic to farmers [68]. Generally, in the past, it was held that adverse environmental conditions can cause accidents; that is why little preventive measures are taken to individuals apart from some training programs using safety posters, etc. By his new ideas and thoughts about how the accidents occur and taking necessary actions for controlling them, Henrich had important role in the Safety Science [69]. Thus, as time goes by and new progresses come along in this science, safety experts have begun to conclude that human being is the main cause of accidents, and decided to direct their focus on human aspects of accident control. Therefore, they began to realize the importance of unsafe actions [70], because efforts at controlling the rate of accidents and reducing the resulting damages have shown that human performance is the main cause of accidents.

In the agricultural sector, yield of agricultural crops depends on the power and physical capacity of farmers. Thus, productivity of this sector is heavily influenced by the health of workforce. Farmers are subject to particular job risks based on the type of activity, the amount of using agriculture equipment and devices, and the amount of using pesticides. This reveals the importance of certain measures for preventing the diseases and accidents caused by work in this sector. It further highlights the role of institutions like agricultural extension and education to have a close link with farmers more than ever.

Agricultural extension and education

In the twenty-first century, agriculture

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continues to stay at the forefront of the most vital means of progress and poverty decrease as well as social and economic welfare increase. A farmer is in need of investment, energy, knowledge and sufficient skills to boost his work so that he can gain enough profit. In fact, as the main function of village, farming assumes a vital role in boosting welfare and eradicating poverty [71].

Given that agriculture is a basis of daily life sustainability and one of the main sections in support of national and local economy [72], the development of this section is crucial, which requires the application of proper tools in this regard. As one of the rural-related institutions, agricultural extension is the most important and key tool used to achieve human, agricultural and rural development [73, 74]. Agriculture extension is a kind of service or system that assists people through training practices to modify their conventional agricultural techniques and boost their yield and efficiency. Since most of the developing countries have a rural economy, the actors involved in the development of the country play a vital role [75]. Rivera & Sulaiman (2009) express it as the engine of knowledge transfer, innovation and development [76]. Monder in the reference book "Food and Agriculture Organization" believes that agricultural extension is a service or system that contributes to the improvement of cultivation and farming practices and techniques, increasing the efficiency of yield and income, and improvement of living level and social and educational standards of farmer life [77]. By adding education attribute to extension, Moscher proposed it as *extension education*. He holds that the nature of an extension process is to help farmers through informal education [78].

Importance of agricultural extension and education in reducing the accidents caused by agricultural work

Traditionally, health and sanitation were known as one of the main factors in determining quantity and quality of human capital. It is expected that health and sanitation as a part of human capital have a positive impact on productivity. In other words, the share health and sanitation of workforce is higher in yield and productivity. Physical capital per capita representing yield technique is directly linked with the efficiency of workforce. Substituting capital in the form of equipment and machineries for workers can contribute to yield increase for work/hour individual, so yield per capita of workforce and thus efficiency of workforce can increase. In addition, the amount of using yield capacities has a positive impact on the efficiency of workforce, the measurement of which is based on actual yield-to-potential

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yield ratio [79]. Promoting health through lifetime increase and decrease of working days when the workforces lose because of their own or relatives' disease can improve labor productivity and indirectly affect yield. Moreover, health promotion can increase life expectancy, thereby increasing tendency for saving among people, and hence, investment and faster economic growth [80]. Agricultural extension and education can properly play a role in reducing the accidents and dangers caused by work, considering abilities and talents offered for relationship between farmers and rural society. On the other hand, education is the main leverage of extension in relationship with farmers. The role of education in human resource improvement and promotions and its economic effect, i.e. productivity and yield increase, is undeniable [81]. Conversely, educational programs should cover all those involved in farms including managers and supervisors, migrants and temporary workers. If there is any kind of migrant, illiterate or disabled worker, a variety of training programs and new pedagogical methods should be used for them [60].

This institution should seek for promotion of farmers' occupational health and sanitation awareness level about accidents, diseases and damages caused by work. Promotion using a variety of methods can deal with farmers' training in safety and health; for instance, an agricultural extension and education program could bring success in many less developed countries like West Africa. Farmers' ability to maintain biodiversity, food security, society education, human health protection and political reforms are clear parts of the success of this program [82, 83]. On the other hand, extension educators are required to use leading theories and patterns in education when implementing their educational programs in order to achieve better result and increase the efficiency of pedagogical programs, as well as using the latest pedagogical methods and tools. Theories and models are useful in different stages of planning, implementation, and evaluation of an intervention, as they contribute to the understanding of desired sanitary behavior and explanation of its dynamics and effect of external factors on behavior, so that the most appropriate goals can be determined for programs, change practices, and assessable results [84]. In this regard, some experts believe that one of the causes of pedagogical program failure is the lack of attention to causality studies and their groundwork regardless of psychosocial models as a specific intellectual framework of educational planning [85].

Conclusion

Agriculture is the most important and essential section of satisfying human life requirements,

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and the concept of *developed world* is not feasible without agriculture. Agriculture sector is one of the main resources of employment and income generation in many countries of the world, especially in the developing countries. It is further responsible for providing security and food safety as a national target.

On the other hand, agriculture is closely linked to different aspects of the farmers' lives and their families, and their jobs continue to be passed down from generation to generation. In other words, several generations thrive on the farms, so that they no longer are able to continue working on farms. People of every age are busy working on the farm though the rate of accidents in agriculture is high. It can be said that the high rate of agricultural accidents is to some extent because of working in special conditions as in mud, snow and rain, and at high and low temperatures. In addition, it is likely that tasks entrusted to each member of family are not commensurate with their capacities and education levels in terms of safety and health, which can cause deadly events for other family members. Studies have shown that worker education on farm safety can possibly play a crucial role in preventing occupational injuries and diseases. The lack of proper training and monitoring of safety law enforcement are among the underlying and basic factors of accidents. Agricultural extension is working with rural people in order to improve their living conditions by changing their knowledge, attitudes and skills. This goal cannot be realized with neglecting the farmers' health and safety. Thus, agricultural extension and education can hold training courses and other educational activities in this regard in cooperation with other institutions like professional health unit.

Conflict of interest statement

The authors declare that they have no conflict of interest

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