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OCCUPATIONAL HEALTH AND SAFETY AWARENESS AND WORK ACCIDENTS AMONG AGRICULTURAL PRODUCTION WORKERS IN TÜRKİYE

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ABSTRACT

The agricultural sector is widely recognized as one of the most hazardous industries due to the high incidence of occupational accidents and work-related illnesses. This study was conducted within the context of Türkiye, and the findings reflect the national conditions of the agricultural sector in the country. This study aims to assess the occupational health and safety (OHS) awareness levels of agricultural production workers, including farmers and laborers, and to examine the relationship between this awareness and experiences of workplace accidents. Following ethics committee approval, data were collected from 390 voluntary participants across different regions of Türkiye using a structured questionnaire. While the minimum required sample size was calculated as 384, a slightly larger sample was used to increase statistical reliability. The population size was determined based on 2024 data from the Turkish Statistical Institute (TURKSTAT). The questionnaire included multiple-choice and Likert-scale items covering demographics, OHS awareness, safety practices, and accident history. Data analysis was conducted using SPSS, employing descriptive statistics, independent samples t-tests, chi-square tests, and correlation analysis. The findings revealed that although most participants considered themselves knowledgeable about OHS, gaps remained in personal protective equipment use and training participation. Statistically significant relationships were found between education level, safety awareness, and accident frequency. Seasonal workers were identified as having particularly limited access to OHS services. This study emphasizes the urgent need for more inclusive safety training, stronger enforcement of safety standards, and the development of targeted policies in the agricultural sector. The results also contribute to the broader goal of improving working conditions in line with the United Nations Sustainable Development Goals (SDGs), particularly those addressing health, decent work, innovation, and sustainable production.

Keywords: Agricultural labor, Occupational health, Occupational safety awareness, Workplace accidents.

1 INTRODUCTION

The agricultural sector is considered one of the most hazardous industries in both developed and developing countries in terms of occupational accidents and work-related illnesses [1,2]. Agricultural production workers often operate in open environments, under adverse climatic conditions, and with limited technical resources. This increases the likelihood of exposure to physical, chemical, biological, and ergonomic risk factors. Reports by the World Health Organization (WHO) and the International Labour Organization (ILO) have also emphasized that agriculture remains one of the most neglected sectors in terms of occupational health and safety [3].

The relationship between OHS awareness and workplace accidents in the agricultural sector is influenced by multiple factors, including the promotion of a safety culture, education levels, the use of personal protective equipment (PPE), and professional experience [4]. However, research has shown that a significant proportion of farmers and agricultural workers lack adequate knowledge about safety measures and exhibit low levels of awareness regarding occupational health [5].

A significant portion of agricultural workers are individual entrepreneurs or temporary laborers, which makes it difficult to implement and maintain consistent OHS practices and widespread training programs. However, studies have shown that individuals who receive OHS training are less likely to experience work-related accidents and are more likely to use protective equipment [5, 6]. Many agricultural workers live in rural areas, where education levels and OHS awareness are often limited. Particularly among older farmers, knowledge and approaches to agricultural safety tend to be more traditional, which negatively affects risk perception and the adoption of preventive behaviors [7]. This situation decreases the preventability of accidents and influences the safety culture of younger generations.

In the context of Türkiye, the widespread prevalence of informal employment in agriculture not only increases the frequency of occupational accidents but also hinders the accurate collection of data. While self-reported data introduces subjectivity, it complements the limited official records available in agriculture. Furthermore, when the technological inadequacies of agricultural machinery are combined with user errors, the risk of accidents escalates [8]. The regional distribution of tractor-related accidents and their correlation with mechanization levels should be considered critical variables when designing sectoral safety

policies. Tractor rollovers, contact with moving parts, and exposure to agricultural chemicals are among the priority areas requiring immediate safety interventions.

In recent years, the importance of ergonomics and workplace organization in agricultural production has gained increased attention. The adaptation of lean production principles, such as the 5S methodology, to agricultural operations can help reduce work-related accidents and enhance productivity [9]. Likewise, environmental arrangements play a significant role in preventing ergonomic risks [10]. Deficiencies in ergonomic design not only led to physical discomfort but also trigger psychosocial risks, reducing motivation and increasing accident rates due to inattention.

The discrepancy between media reports and official statistics indicates that work-related accidents in agriculture are underreported. Öz et al. [11] found that although tractor accidents are frequently covered in the media, they are not adequately reflected in official data, making data-driven policy development more difficult. In this regard, improving the consistency of OHS-related statistics is essential for developing effective national safety strategies and enhancing public awareness.

The integration of technological innovations into OHS practices is also of increasing importance. For example, AI-powered systems have been developed to monitor the use of personal protective equipment, thereby enhancing safety in production environments [12]. Such systems, developed for agricultural machinery manufacturing facilities, serve as models for future digital safety solutions that can be applied in field settings.

Strengthening OHS practices in the agricultural sector not only yields individual and sectoral benefits but also supports global sustainability objectives. The United Nations Sustainable Development Goals [13] prioritize ensuring safe and healthy working conditions, promoting sustainable production, and supporting the integration of innovative technologies—goals that are directly aligned with the present study. The study particularly overlaps with SDG 3 (Good Health and Well-being), SDG 8 (Decent Work and Economic Growth), SDG 9 (Industry, Innovation and Infrastructure), and SDG 12 (Responsible Consumption and Production) (Table 1).

Accordingly, the main aim of this study is to determine the level of OHS awareness among individuals working in agricultural production and to explore the relationship between their awareness and experiences of occupational accidents. Additionally, the study investigates

associations between variables such as the use of protective equipment, prior OHS training, and the frequency of occupational accidents to evaluate the current state of the sector.

Table 1. Alignment of the Study with the United Nations SDGs.

SDG No	Goal Title	Explanation of Alignment
3	Good Health and Well-being	Reducing occupational accidents and ensuring safe working environments align with this goal.
8	Decent Work and Economic Growth	Safe agricultural employment environments enhance productivity and contribute to economic growth.
9	Industry, Innovation and Infrastructure	Developing OHS practices with artificial intelligence and technological solutions supports this goal.
12	Responsible Consumption and Production	Safe and healthy working conditions are essential for sustainable agricultural production.

2 MATERIAL AND METHOD

The observed changes in the number of farmers and agricultural workers in Türkiye between 2015 and 2024 served as a basis for determining the sampling framework of this study, as detailed in Table 2 [14].

Table 2. Number of Farmers and Agricultural Workers in Türkiye (2015–2024).

Year	Total Number of Registered Farmers	Female Farmers	Male Farmers	Number of Agricultural Workers (in millions)
2015	2197319	286481	1849294	5,20
2016	2212000	290000	1862000	5,10
2017	2225000	295000	1870000	5,00
2018	2240000	298500	1881500	4,90
2019	2255000	300000	1900000	4,80
2020	2270000	302000	1920000	4,70
2021	2290000	303500	1946500	4,60
2022	2305000	304500	1970500	4,50
2023	2320000	305000	1995000	4,40
2024	2335000	305527	2002745	4,30

Source: Turkish Statistical Institute (TURKSTAT), Ministry of Labor and Social Security, and related reports

2.1 Sample Size Calculation and Data Collection Process

This research is a descriptive study based on a quantitative research method. The target population consists of farmers and agricultural workers operating in various agricultural regions

of Türkiye. The sample size was calculated as 384 participants with a 95% confidence level and a 5% margin of error. However, data were collected from 390 participants, thereby increasing the reliability of the study in terms of sampling adequacy (Equation 1).

The sample size for this study was determined using the following formula:

$$n = \frac{N Z^2 p q}{(N - 1) d^2 + Z^2 p q} \times 100 \quad (1)$$

where:

N = Population size (4.3 million individuals), based on the 2024 agricultural workforce data provided in Table 2 and derived from TÜİK's Household Labour Force Survey (2023 Q4)¹.

Z = Z-value for a 95% confidence level (1.96)

p = Estimated proportion of the population (0.5)

q = 1 - p (0.5)

d = Margin of error (0.05 for ±5%)

Using this formula, the minimum sample size was calculated as follows:
95% confidence level, ±5% margin of error → 384 participants

In practice, data were collected from a total of 390 participants, which exceeded the required sample size and thus improved the reliability of the analysis.

A structured questionnaire was used as the primary data collection tool in the study. The questionnaire consisted of three main sections: the first section collected participants' demographic information (gender, age, education level, years of work experience, etc.); the second section included Likert-scale statements designed to assess participants' occupational health and safety (OHS) awareness levels; and the third section comprised items related to participants' work accident experiences and safety practices, such as the use of personal protective equipment (PPE).

The questionnaire was developed based on a literature review and its content validity was confirmed by expert opinion. Data were collected online using a voluntary participation approach. SPSS version 25.0 was used for the statistical analysis of the data. Descriptive

¹ The fourth quarter (Q4) of 2023 refers to October–December. The data were obtained from the Turkish Statistical Institute's Household Labour Force Survey, which reflects seasonally adjusted national employment statistics

statistics were used, as well as inferential analyses including independent samples t-tests, chi-square tests, and Pearson correlation analysis. In particular, the study examined whether there was a statistically significant relationship between OHS awareness and accident experience, as well as variables such as PPE usage and prior safety training.

This research was approved by the Ethics Committee of Kırşehir Ahi Evran University in 2025, and all participants voluntarily provided informed consent. The research was conducted in accordance with ethical principles and relevant regulatory guidelines.

3 RESULTS AND DISCUSSION

3.1 Demographic Profile of the Participants

This section presents the distribution of 390 individuals participating in the study based on their age, gender, educational background, experience in the agricultural sector, type of work, and field of activity. Of the participants, 39.3% are between the ages of 18–30, 37.7% are between 31–45, and 23% are between 46–60 years old. Regarding gender, 73.8% are male and 26.2% are female. In terms of education level, 63.9% have a university degree or higher, while 27.9% are high school graduates.

Among the participants, 42.6% operate their own agricultural enterprise, while 47.5% work in family-owned agricultural businesses. Only 6.6% identified themselves as agricultural laborers, and 3.3% as seasonal agricultural workers. A total of 31.1% of participants have worked in the agricultural sector for 11–20 years, and 29.5% for 6–10 years.

In terms of agricultural activity fields, 78.7% of respondents are involved in crop production, 44.3% in animal husbandry, and 42.6% in the use of agricultural machinery. The most frequently used agricultural machines were identified as tractors (88.5%), pesticide sprayers (70.5%), fertilizer spreaders (55.7%), and sowing machines (49.2%). Additionally, 9.8% of participants reported having experienced a previous agricultural work accident, and 23% reported suffering from an occupational disease.

While these findings reflect participants' self-reported experiences, it is important to note that such data may involve subjectivity. However, in the context of Türkiye - where underreporting of occupational accidents in agriculture is common, particularly among informal and seasonal workers - self-reported data help to capture incidents that are often omitted from official records. This limitation has been acknowledged, and the need to complement self-reported results with institutional data in future studies is emphasized.

These findings related to participant profiles are further evaluated in connection with occupational health and safety (OHS) awareness levels and safety practices discussed in subsequent sections of this study.

3.2 Occupational Health and Safety Awareness Level

This section presents the findings related to participants' awareness levels regarding occupational health and safety (OHS). This part of the questionnaire consists of 10 statements evaluating the participants' knowledge of OHS and their attitudes toward safe agricultural practices. Respondents rated each statement using a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) (Table 3).

Overall, it was observed that the level of OHS awareness among participants was high. For instance, 50.8% of the respondents strongly agreed and 34.4% agreed with the statement “Most agricultural work accidents can be prevented.” Similarly, there was a high level of agreement with the statements “I believe that receiving occupational safety training is beneficial in agriculture” and “Long working hours increase the risk of work accidents in agriculture.”

A total of 63.9% of participants strongly agreed with the statement “I follow occupational safety rules when operating agricultural machinery.” Responses to statements such as “I take necessary precautions against rollover risks while driving tractors” and “I pay attention to ergonomic postures during agricultural work” also indicated that participants adopt safe working behaviors.

Table 3. Mean Scores Related to Participants' OHS Awareness (1–5 Likert Scale).

Statement	Mean Score
Most agricultural work accidents can be prevented.	4.40
I follow occupational safety rules when operating agricultural machinery.	4.50
I use personal protective equipment when applying pesticides and fertilizers.	3.80
I believe that receiving occupational safety training is beneficial in agriculture.	4.60
Long working hours increase the risk of work accidents.	4.60
I take precautions against rollover risks when operating a tractor.	4.50
Smoking in agricultural work areas poses a safety risk.	3.80
I pay attention to ergonomic postures while working.	4.30
I read and follow label instructions when using agricultural chemicals.	4.40

However, lower average scores were noted for statements like “I use personal protective equipment when applying pesticides and fertilizers” and “Smoking in agricultural work areas poses a safety risk,” suggesting a need for increased awareness in these areas.

Above are the mean scores and response distributions for each statement related to OHS awareness (Table 3).

3.3 Agricultural Safety Practices and Training Status

This section focuses on participants’ behaviors related to occupational safety practices in the agricultural sector, their experiences with safety training, and the accessibility of occupational health services for seasonal workers. According to the data obtained, 78.7% of participants stated that they perform regular maintenance on agricultural machinery before use. While 19.7% reported that they rarely perform maintenance, 1.6% indicated that they never do.

Only 42.6% of the participants reported having previously received occupational health and safety (OHS) training. However, 90.2% believed that more OHS training should be provided in the agricultural sector. This finding suggests a significant gap in practical training, despite the high level of awareness observed.

Regarding the provision of OHS services for seasonal workers, 75.4% of respondents stated that adequate safety services are not provided to these individuals. This finding highlights the vulnerabilities caused by insecure and temporary employment in agriculture.

These findings are supported by visual figures (see Figures 1–4). The figures are presented below and illustrate the distribution of participants' responses regarding machinery maintenance, OHS training, perceived need for additional training, and safety access for seasonal workers.

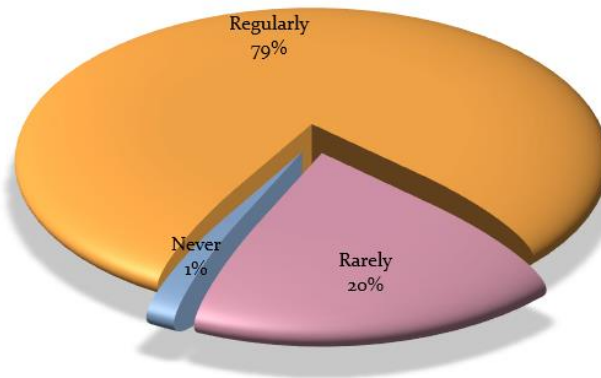


Figure 1. Frequency of Machinery Maintenance Practices.

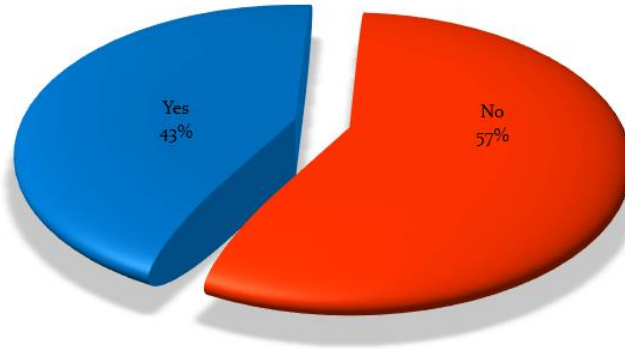


Figure 2. Participants Who Have Received OHS Training.

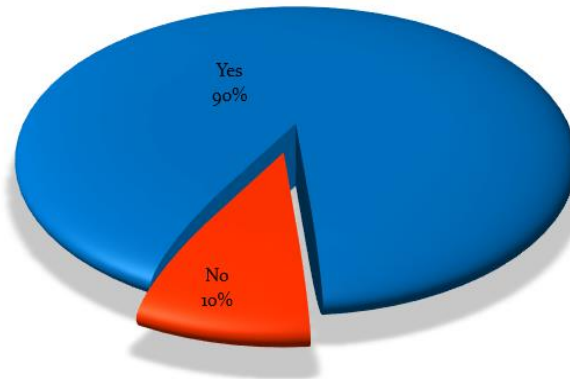


Figure 3. Participants Supporting Increased OHS Training in Agriculture.

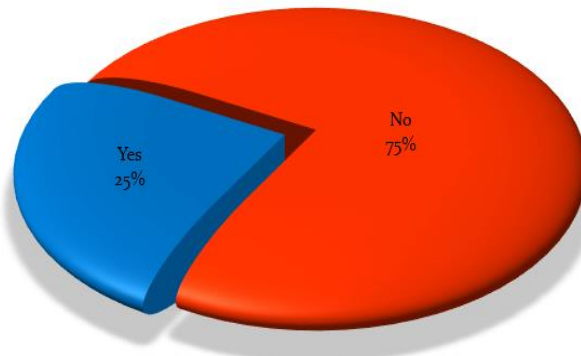


Figure 4. Availability of OHS Services for Seasonal Workers.

Moreover, statistical analysis indicates that participants who received training displayed higher levels of OHS awareness and safer work practices, with this difference confirmed as statistically significant through the chi-square test.

4 CONCLUSION AND SUGGESTIONS

This study aimed to examine the relationship between occupational health and safety (OHS) awareness and work-related accidents among individuals employed in agricultural production, including both farmers and agricultural workers. The findings revealed a generally high level of awareness among participants regarding occupational safety, particularly in relation to safe machinery use, the perceived necessity of safety training, and awareness of common agricultural risks.

The use of descriptive statistics and inferential tests, including chi-square analyses, t-tests, and correlation analysis, demonstrated statistically significant associations between prior OHS training and improved safety behavior. Participants who had received safety training exhibited significantly higher levels of OHS awareness ($p < 0.05$), and were more likely to engage in safe practices, such as using machinery responsibly and recognizing occupational hazards. For instance, 42.6% of participants had received prior OHS training, while 90.2% emphasized the need for more extensive and regular OHS education across the sector.

While high levels of OHS awareness were observed among participants, the study also examined whether this awareness was associated with safer behaviors. Statistical analyses, including chi-square tests, indicated that individuals with higher awareness scores were significantly more likely to engage in protective practices, such as wearing PPE and performing regular machinery maintenance. These findings suggest that increased awareness may positively influence safety behavior, supporting the need for awareness-based interventions in the agricultural sector.

One limitation of this study is that the ergonomic posture item was based on participants' self-perception rather than expert observation. While this subjective approach limits biomechanical accuracy, it still offers meaningful insights into perceived ergonomic risks. Future studies should consider integrating objective ergonomic assessments to complement self-reported data and strengthen the reliability of findings.

Despite these encouraging levels of awareness, critical gaps were identified—particularly in the use of personal protective equipment (PPE), which showed lower average agreement scores. Moreover, 75.4% of participants indicated that seasonal agricultural workers lacked sufficient access to occupational safety services. These results align with previous studies emphasizing the importance of safety education in changing behavior [6] and addressing systemic inequalities in agricultural safety [15].

The visual data presented in Figures 1–4 provided strong support for these quantitative results, clearly demonstrating trends in training status, perceived need for safety measures, and deficiencies in protective strategies for vulnerable worker groups. These findings are consistent with the literature, which has highlighted the role of safety perception and education in injury prevention [1, 3].

In conclusion, strengthening institutional mechanisms for OHS education, increasing access to PPE, and targeting seasonal laborer safety are essential. Future studies should explore the long-term effectiveness of localized training programs and investigate how ergonomic risks influence occupational injury rates, as shown in recent national research [9, 11].

Furthermore, although this study identified general patterns in training, equipment use, and maintenance behavior, it did not verify the technical accuracy of maintenance practices or explore the institutional context of safety training. Self-reported data may not always reflect real-world outcomes. Future research should aim to cross-validate these findings using official accident records and investigate how training quality, access to resources, and systemic barriers influence the actual implementation of safe practices in agriculture [16].

Although participants were asked whether they had previously received occupational health and safety (OHS) training, the source or provider of that training was not specified in the questionnaire. Future research should consider including detailed items regarding the institutional origin, frequency, and content of safety training in order to better assess its impact and quality [17].

In addition to the general trends identified in this study, further research is needed to explore the underlying causes of limited training access, non-use of protective equipment, and long working hours. Qualitative approaches such as root cause analysis or the 5-Why method could provide deeper insights into institutional, cultural, or economic barriers that affect safety behavior. Future studies adopting a mixed-methods design would be particularly valuable in uncovering these systemic issues and informing more targeted OHS interventions in the agricultural sector. Structured approaches such as the 5-Why method are consistent with the broader framework of organizational safety culture development, which emphasizes a systematic understanding of failure mechanisms and information flows within organizations [18].

These insights offer a foundation for designing context-specific safety interventions and suggest that institutional commitment and cultural transformation are key to sustainable improvements in agricultural OHS.

Policymakers, researchers, and agricultural stakeholders must collaboratively work to reduce accident rates and improve working conditions, particularly for disadvantaged groups in the sector. These efforts will not only support national safety priorities but also advance progress toward the United Nations Sustainable Development Goals (SDGs), specifically Goal 8 (Decent Work and Economic Growth) and Goal 3 (Good Health and Well-Being).

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Conflict of Interest Statement

The author declares that there is no conflict of interest regarding the publication of this article.

Statement of Research and Publication Ethics

The study is complied with research and publication ethics.

Artificial Intelligence (AI) Contribution Statement

Artificial intelligence (AI) tools were used solely for the purpose of language translation (from Turkish to English). All content, including the original ideas, data analysis, and figure generation, was entirely created by the author.

Ethics committee approval

This study was approved by the Ethics Committee of Kırşehir Ahi Evran University (Approval Number: E-32905094-204.01.07-00000737826, Date: 2025). All participants gave informed consent prior to participating in the study.

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