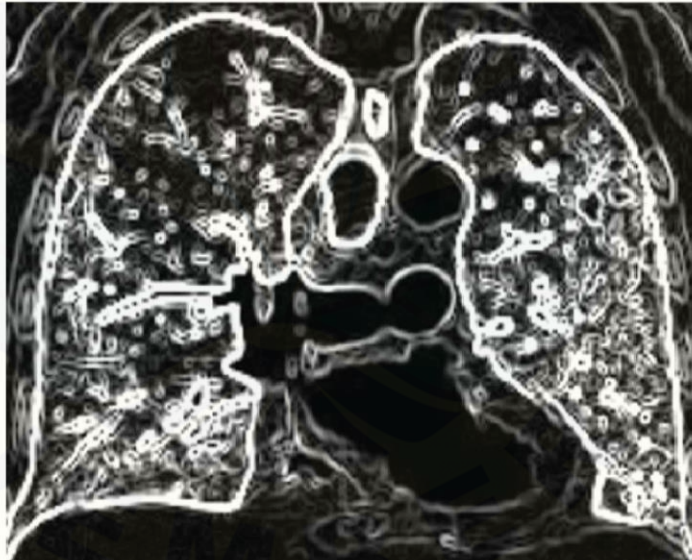
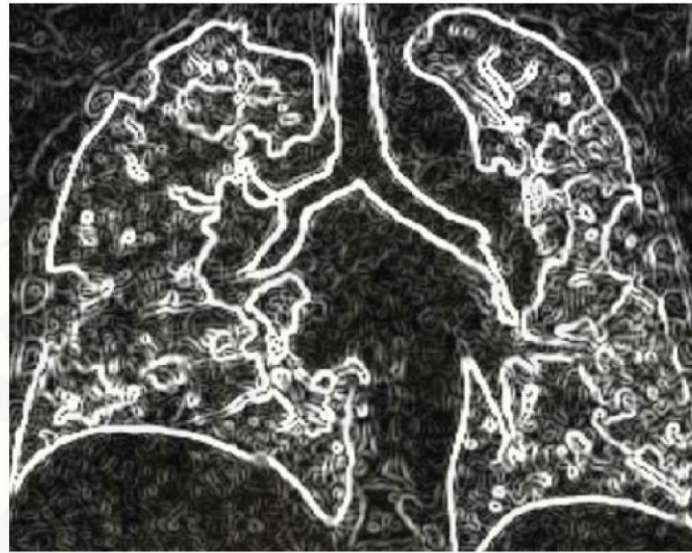





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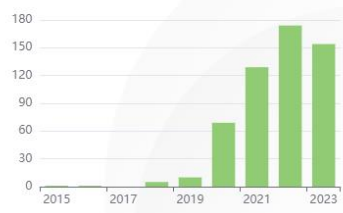
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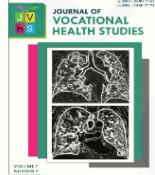
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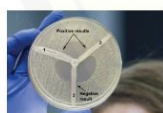
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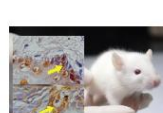
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#### Literature Study



### WHAT ARE THE CAUSES AND TYPES OF FARMER TRAUMA? A LITERATURE REVIEW

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**WHAT ARE THE CAUSES AND TYPES OF FARMERS' INJURIES? A LITERATURE REVIEW**

APA PENYEBAB DAN JENIS CIDERA PETANI? TINJAUAN LITERATUR

Arista Maisyarah<sup>1</sup>, Syaifuddin Kurnianto<sup>2</sup>, Eko Prasetya Widiyanto<sup>3</sup>

Emergency and Critical Nursing Department, University of Jember Lumajang Campus, Indonesia

Literatur Study  
Studi Literatur**A B S T R A C T**

**Background:** The application of technology in agricultural mechanization has not been able to prevent or reduce the threat of occupational health problems in farmers. It is necessary to identify the causative or triggering factors. **Purpose:** Identify the causes and types of injuries experienced by farmers. **Review:** The method used in this study was a literature review with an electronic database search through Springer Link, Science Direct, Pub-med, and Google Scholar based on the inclusion criteria respondents that were farmers who had experienced work-related trauma and there were interventions in the form of assessment of trauma events in farmers, using the method of a systematic review or analytical retrospective study or a population-based observational study or cross-sectional study, using Indonesian and English, published in 2018-2022. **Result:** The results of the literature review showed that the causes of trauma due to agriculture were agricultural machinery, hand tools/ manual agricultural tools, farm animals, wild animals, falls, ergonomic positions, and fatigue. At the same time, the types of trauma in farming accidents were soft tissue injuries, concussions, fractures, avulsions, amputations, and infections to death. **Conclusion:** Work-induced injuries directly affected farmers' lives, so it is necessary to increase knowledge in recognizing the factors causing injuries and management according to the type of injury experienced.

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Online 11 November 2023Correspondence:  
Arista MaisyarahE-mail:  
aristamaisyarah@unej.ac.id**Keywords:**  
Agriculture, Farmer, Occupational  
injuries, Trauma**A B S T R A K**

**Latar belakang:** Industri pertanian merupakan sektor yang berbahaya menyebabkan banyak kecelakaan tiap tahun. Penerapan teknologi dalam mekanisasi pertanian belum mampu mencegah atau mengurangi ancaman masalah kesehatan kerja pada petani. Penting untuk mengidentifikasi faktor penyebab atau faktor pemicu. **Tujuan:** Mengidentifikasi penyebab dan jenis cedera yang dialami oleh petani. **Telaah Pustaka:** Metode yang digunakan dalam penelitian ini adalah tinjauan pustaka dengan pencarian database elektronik melalui Springer Link, Science Direct, Pub-med, dan Google Scholar berdasarkan kriteria inklusi responden adalah petani yang pernah mengalami trauma terkait pekerjaan, dan terdapat intervensi berupa penilaian kejadian trauma pada petani, dengan menggunakan metode *systematic review* atau studi retrospektif analitik atau studi observasional berbasis populasi atau cross-sectional, menggunakan bahasa Indonesia dan Inggris, diterbitkan pada tahun 2018-2022. **Hasil:** Hasil kajian pustaka menunjukkan bahwa penyebab cedera akibat pertanian adalah mesin pertanian, perkakas tangan/alat pertanian manual, hewan ternak, hewan liar, jatuh, posisi ergonomis, dan kelelahan. Jenis cedera dalam kecelakaan pertanian adalah cedera jaringan lunak, gegar otak, patah tulang, kejang, amputasi, infeksi hingga kematian. **Kesimpulan:** Cedera akibat pekerjaan berdampak langsung pada kehidupan petani, sehingga perlu ditingkatkan pengetahuan dalam mengenali faktor-faktor penyebab cedera dan manajemen sesuai dengan jenis cedera yang dialami.

**Kata kunci:**  
Cedera pekerjaan, Pertanian,  
Petani, Trauma

## INTRODUCTION

Agriculture is one of the most dangerous sectors of the economy which accounts for many accidents and occupational diseases every year (Mucci *et al.*, 2020). The agricultural industry (including agricultural, livestock, forestry, fishing, and hunting workers) has the highest fatal occupational accident rate among all areas of work (Keller *et al.*, 2021). In the context of occupational safety and health, the term "agriculture" refers to a variety of activities, including cultivation, growth, harvesting, and key processes relating to agricultural and animal products, and livestock breeding, including aquaculture and agroforestry (Nguyen *et al.*, 2018). The most vulnerable work injuries or accidents occur due to socio-cultural factors associated with social status, ethnicity, location, language, and lack of access to health services. Health problems faced in agriculture cannot be separated from the use of technology used to cultivate agriculture (Widianto *et al.*, 2020). Although the agricultural sector has experienced rapid growth in terms of mechanization, the threat of injury persists (Vaibhav *et al.*, 2020).

Agriculture-related injuries have resulted in major injuries such as lifelong injuries and death (Viradia *et al.*, 2019). The prevalence of occupational injuries in agriculture in the last 12 months was 69%. Common injuries to farmers included (79.7%) wounds, (11.3%) stab wounds, and (7.5%) lacerations (Maisyaroh *et al.*, 2020). According to Vaibhav *et al.* (2020), it was estimated that in each year in a total study of three North Indian states, there were 5.000-10.000 deaths, 15.000-20.000 amputations and 150.000-200.000 serious injuries due to agriculture and related work.

According to Mucci *et al.* (2020), the most common causes of agricultural injuries were accidents with agricultural machinery, namely overturned tractors and all other types of machinery on the farm including grain augers, power take-offs, hay balers, corn pickers, and wheat thresher. In addition, the lack of knowledge and motivation in using PPE for farmers causes work accidents such as falling, being crushed, pinched by objects, and animal bites (Maisyaroh *et al.*, 2019). Other factors such as fatigue and serious physical strain in agriculture may cause maxillofacial trauma. Maxillofacial trauma is the most common injury to the fingers and toes followed by the back and spine (Vaibhav *et al.*, 2020).

Most farmers are aware of the negative impact of work-related injuries on health, environment (Widianto *et al.*, 2020), and economy (Parvez and Shahriar, 2018). According to Mucci *et al.* (2020), the most frequently happening injuries on body parts were hand lesions (14.2%) and upper limb lesions (85.7%). Types of lesions in the agricultural sector are usually open wounds (such as bruises, lacerations, and wounds on mangling lesions), fractures, tensions, sprains, and overused lesions. The presence of additional infection after injury such as

superficial, deep soft tissue and osteomyelitis leads to amputation. Amputation occurs in the middle of the forearm caused by the fungus *Aspergillus*. This causes muscle, tendon, and nerve injuries at the level of the forearm or elbow to develop into an infection.

Despite the high incidence of agricultural injuries, agricultural areas have a higher risk compared to other sectors. Therefore, serious measures are needed to reduce agricultural injuries affecting the agricultural workforce. This literature review is important to discover the incidence of trauma in agriculture. This study aimed to determine the relationship between agriculture and the incidence of trauma experienced by agricultural farmers.

## LITERATURE STUDY

Musculoskeletal injury or disorder is a work-related disease of the skeletal muscles with symptoms of pain, stiffness, and decreased function. This disorder can be found in farmers due to incorrect work position (ergonomic) that is not ergonomic. Musculoskeletal disorders can occur due to several agricultural activities such as carrying weights with hands or shoulders, demands for working time, long work duration, work that is too heavy with a vibrating machine (Fatejarum *et al.*, 2020).

According to Mucci *et al.* (2020), the most common causes of agricultural injuries were accidents with agricultural machinery, namely overturned tractors and all other types of machinery present in agriculture including grain augers, power take-offs, hay balers, corn pickers, and wheat thresher. In addition, the lack of knowledge and motivation for the use of PPE in farmers causes work accidents such as falling, being crushed, pinched by objects and animal bites (Maisyaroh *et al.*, 2019). This is related to a study by Ardhani *et al.* (2022) that discovered a strong relationship between OHS compliance and the risk of worker work injury in construction companies.

Most farmers are aware of the negative impact of occupational injuries on health, environment (Widianto *et al.*, 2020) and economy (Parvez and Shahriar, 2018). According to Mucci *et al.* (2020), frequently happening injuries on body parts were hand lesions (14.2%) and lesions of the upper extremities (85.7%). The most frequent types of lesions are open wounds (such as bruises, lacerations, and incisions to mangling lesions), fractures, tensions, sprains, and excessive lesions. The presence of additional infections after injuries such as superficial, deep soft tissues and osteomyelitis leads to the occurrence of amputations. Amputation occurs in the middle of the forearm caused by the fungus *Aspergillus*. This causes muscles, tendons, and nerve injuries at the forearm or elbow level to develop into infections.



**RESULT**

The present study employed a literature review method with electronic database searches through Springer Link, Science Direct, Pubmed, and Google Scholar. We searched for the literature published between 2018 - 2022 to identify the relevant literature using the keywords: "trauma" or "injuries" combined with "agriculture", "farmer", and "occupational injuries".

The research inclusion criteria in the selection of articles were international journals and national-scale journals originating from different databases, but related to research variables, namely trauma incidents to farmers, the area coverage of agriculture and plantations, articles obtained from primary sources, respondents including traumatized farmers due to work,

an intervention carried out in the form of an assessment of trauma events in farmers, the use of a systematic study method or an analytical retrospective study or a population-based or *cross-sectional* observational study, using Indonesian and English (Figure 1).

Based on literature searches, there were 476 related articles. After filtering out the titles and abstracts, 452 studies were excluded because they did not fit the inclusion criteria that the study used. The authors reviewed the full text of the remaining 24 studies for a more detailed evaluation. Of these, 14 articles failed to meet the eligibility criteria, the last screening of the article was assessed using the Critical Appraisal method which resulted in 8, and only 8 articles remained that matched the criteria so they were included in the review with a total sample of 53-2.484 can be seen in Table 1.

**Table 1.** Summary of literature review results

| No. | Author/Year          | Title  | Method   | Result   | Conclusion  |
|-----|----------------------|--|--|--|---|
| 1   | Mucci et al., 2020   | Upper Limb's Injuries in Agriculture: A Systematic Review  | Design: Systematic review<br>Sample: 53 upper limb accidents in agriculture                                | It could be seen that young male farmers were more involved, especially during the harvest season. The upper extremities and hands were often the parts of the body that suffered the most damage. The most common types of lesions were open wounds, lacerations, fractures, strains, and overuse lesions.  | The agricultural sector in terms of deaths, injuries and work-related health problems was one of the three most dangerous sectors of activity. Therefore, health promotion systems and good practices were needed to support farms, especially small ones, to develop them in terms of prevention strategies and safety management.   |
| 2   | Johnson et al., 2021 | Agricultural injuries among farmers and ranchers in the central United States during 2011 - 2015   | Design: Systematic review<br>Sample: 1.063 injuries (89% agriculture work and 11% leisure time)            | Of the 875 operators injured, 731 had one injury, 95 had two injuries, and 49 had three or more injuries. The most frequent sources of injury were livestock (22%), machinery (13%), and hand tools (12%).   | This study showed that the rate of non-fatal injury for farmers and self-employed livestock farmers was higher with the male gender, the younger age. These results reaffirmed agriculture/livestock as a hazardous occupation and emphasized the need for injury prevention, particularly related to the source of the injury and the identified risk factors.   |
| 3   | Vaibhav et al., 2020 | Maxillofacial Injuries as an Occupational Hazard of Farming in Rural and Semi-urban Population: A 3-Year Retrospective Epidemiological Study | Design: Analytical retrospective study<br>Sample: 2.484 patients suffered injuries in farm-based settings. | Out of 2,484 patients suffering injuries in an agriculture-based environment, 334 patients had maxillofacial injuries. Fracture of the condyle of the mandible together with fracture of the parasymphysis was the most common fracture configuration. Injury while working with non-motorized machinery followed by working around farms was the most common etiology factor in livestock-related trauma. | Maxillofacial injuries represented a significant percentage of injuries sustained in agriculture-related environments. Through this study, we had identified the pattern of maxillofacial injuries occurring in such an environment, and the data obtained can be used to develop various ergonomic and safety interventions in terms of machine design and handling and implementation of rigorous safety training and enforcement programs, and guidelines for minimizing maxillofacial trauma in agriculture-based settings. |

The continuation of Table 1

| No. | Author/<br>Year           | Title   | Method   | Result   | Conclusion   |
|-----|---------------------------|---|--|--|--|
| 4   | Swanton et al., 2020      | Time to definitive care among severely injured farmers compared to other work-related injuries in a Midwestern state          | Design:<br>A population-based observational study<br><br>Sample:<br>158 severe injuries were farm-related. | Seven hundred and forty-eight severe work injuries were identified; (N=158) 21% of these were related to agriculture. The overall mean time to definitive treatment was nearly one hour longer for farmers compared to other workers (2h46m vs 1h48m, p<0.05). When adjusted for confounders, farm status remained a significant predictor of delay in achieving definitive care, but only in the first hour after injury (HR = 0.44, 95% CI = 0.24 – 0.83). | Farm-related injuries account for more than 1 in every 5 severe occupational injuries that entered the Iowa trauma system. We found that severely injured farmers experienced delays in achieving definitive trauma care, even when adjusted for confounding variables such as rural. This effect was mostly pronounced in the first hour. |
| 5   | Viradia et al., 2019      | Farming Related Trauma Injuries in Southern West Virginia With a Focus on Risks, Injury Trends, and Associated Co-morbidities | Design:<br>A population-based observational study<br><br>Sample:<br>82 cases of farm-related injuries      | The total number of cases of agriculture-related injuries was 82. The most common injuries were concussion at 18% (15/82) followed by rib fractures at 17% (14/82).  | Agriculture-related injuries appeared to increase risks to the body and certain organ systems, as described in our initial data analysis. Specific comorbidities had also been documented to indicate a higher risk of injury and will require further investigation. Further research is needed to explore these underlying findings.     |
| 6   | Parvez and Shahriar, 2018 | Agricultural Farm-Related Injuries in Bangladesh and Convenient Design of Working Hand Tools                                  | Design:<br>A population-based observational study<br><br>Sample:<br>434 agricultural injuries              | There were 434 agricultural injuries. Approximately 67% of injuries of all incidents were caused by hand tools, and the remaining 33% were caused by machines or other sources.  | Hand tools accounted for 67% of total agricultural injuries in Bangladesh. The most significant injuries were cuts to the limbs, abrasions to the skin of the palms due to high pressure on the hands, tools slipping from the hands, and so on.   |
| 7   | Rabbani and Fatmi, 2018   | Incidence, patterns and associated factors for occupational injuries among agricultural workers in a developing               | Design:<br>A cross-sectional study<br><br>Sample:<br>472 occupational injuries agricultural workers        | The incidence of occupational accidents was 35.0 per 100 per year (95% CI: 28.9 - 42.7). Cuts (70%) and hand tools (71%) were the most common types and causes of injury, respectively. Most of the injuries occurred during harvesting (55%). Increasing age [AOR 1.03 (95% CI: 1.01 - 1.05)], income <6000PKR/month [AOR 2.27 (95% CI: 1.08 - 4.76)] and tractor driving [AOR 2.58 (95% CI: 1.25 -5.33)] increased risk of injury.                         | There was a high injury burden among agricultural workers in Pakistan. Large-scale studies are needed to better characterize the risk of injury and develop prevention strategies to protect agricultural workers.   |

The continuation of Table 1

| No. | Author/Year             | Title   | Method   | Result  | Conclusion  |
|-----|-------------------------|---|--|---|---|
| 8   | Kica and Rosenman, 2020 | Multisource surveillance for non-fatal work-related agricultural injuries | Design:<br>A population-based observational study<br><br>Sample:<br>1.559 non-fatal work-related farm injuries | The study identified 1,559 agricultural injury incidents. The most commonly injured body parts were the upper limbs (38.2%) and the lower limbs (23.7%). The most common types of injury were bruises (26.4%) and accounted for 44.1% and employed 42.9% of injured individuals. Injuries caused by cattle were the leading cause: 472 (31.5%) of all injuries. Dairy products accounted for 39.6% of all cases whose farm type was recorded. | Supervision of work-related non-fatal agricultural injuries is essential for the recognition and prevention of the condition. |

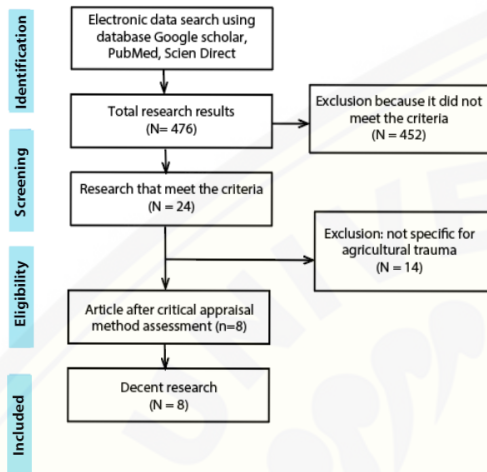


Figure 1. PRISMA flow

Research on agricultural trauma has been carried out in several developed and developing countries can be seen in Table 2. There were 5 countries namely Italy, United States of America, Pakistan, India, and Bangladesh,. The characteristics of the respondents in this study were patients with agricultural trauma. Based on Table 3, the incidence of trauma due to agriculture in the eight articles reviewed by the authors were 53 – 2.484 cases of trauma.

Table 2. Research locations

| No. | Journal                      | Country           |
|-----|------------------------------|-------------------|
| 1.  | Mucci <i>et al.</i> , 2020   | Italy             |
| 2.  | Johnson <i>et al.</i> , 2021 | The US of America |
| 3.  | Vaibhav <i>et al.</i> , 2021 | India             |
| 4.  | Swanton <i>et al.</i> , 2020 | The US of America |
| 5.  | Viradia <i>et al.</i> , 2019 | The US of America |
| 6.  | Parvez and Shahriar, 2018    | Bangladesh        |
| 7.  | Rabbani and Fatmi, 2018      | Pakistan          |
| 8.  | Kica and Rosenman, 2020      | The US of America |



**Table 3.** Agricultural trauma incidence rate

| No. | Journal                      | Occurrence rate |
|-----|------------------------------|-----------------|
| 1.  | Mucci <i>et al.</i> , 2020   | 53              |
| 2.  | Johnson <i>et al.</i> , 2021 | 1.063           |
| 3.  | Vaibhav <i>et al.</i> , 2021 | 2.484           |
| 4.  | Swanton <i>et al.</i> , 2020 | 158             |
| 5.  | Viradia <i>et al.</i> , 2019 | 82              |
| 6.  | Parvez and Shahriar, 2018    | 434             |
| 7.  | Rabbani and Fatmi, 2018      | 472             |
| 8.  | Kica and Rosenman, 2020      | 1.559           |

It is easier for the agricultural industry to have a higher risk of injury. Based on Table 4, the causes of trauma and/or injury included agricultural machines (tractor, corn husker, auger, hay baler, combine, thresher, harvester, grinder, power tiller, irrigation pump, power take-off hay baler, and corn picker), hand tools/ manual farming tools (scythe, axe, shovel, hand saw, ax, fork, digging fork, crowbar, small rake and hoe), livestock, wild animal, fall, ergonomic position, and fatigue. Based on 8 literature searches in Table 5, it was discovered that the types of trauma and/or agricultural accident injuries were soft tissue injuries, concussions, fractures, avulsions, amputations, infections and even death.

**Table 4.** Causes of agricultural trauma

| No. | Journal                      | Causes of trauma   |
|-----|------------------------------|--|
| 1.  | Mucci <i>et al.</i> , 2020   | 1. Agricultural machinery (tractors, grain augers, power take-offs, hay balers, corn pickers, grain grinders and threshers)<br>2. Hand tools (scythes, axes, shovels, hand saws and hoes)<br>3. Fall<br>4. Animals/wild beasts<br>5. Fatigue |
| 2.  | Johnson <i>et al.</i> , 2021 | 1. Farm animals<br>2. Hand tools<br>3. Agricultural machines (tractors)  |
| 3.  | Vaibhav <i>et al.</i> , 2021 | 1. Animals<br>2. Agricultural machinery (tractor, thresher, harvester, power tiller, irrigation pump)<br>3. Manual/non-motorized machines (shovel, sickle, axe, fork)<br>4. Fall   |
| 4.  | Swanton <i>et al.</i> , 2020 | 1. Animals<br>2. Agricultural machinery<br>3. Elements of nature   |
| 5.  | Viradia <i>et al.</i> , 2019 | 1. Farm animals<br>2. Agricultural equipment   |
| 6.  | Parvez and Shahriar, 2018    | 1. Agricultural machines (tractors)<br>2. Hand tools (hoe, sickle, dagger, digging fork, crowbar, and small rake)<br>3. Animal bites<br>4. Heat stroke   |
| 7.  | Rabbani and Fatmi, 2018      | 1. Strong hands<br>2. Agricultural machines (tractors)<br>3. Fall from Animals   |
| 8.  | Kica and Rosenman, 2020      | 1. Agricultural machinery (tractor, corn husker, auger, hay baler, combine)<br>2. Fall<br>3. Farm animals  |

**Table 5.** Types of agricultural trauma

| No. | Journal                      | Type of trauma  |
|-----|------------------------------|---|
| 1.  | Mucci <i>et al.</i> , 2020   | 1. Wounds (open, torn, cut, and burn)<br>2. Laceration<br>3. Contusion<br>4. Dislocation<br>5. Amputation<br>6. Stab<br>7. Skin avulsion<br>8. Fractures (open and closed)<br>9. Injuries (mutilation, soft tissue, tendon, degloving, and mangling)<br>10. Bruises<br>11. Concussion<br>12. Scratches<br>13. Sprains / sprains |
| 2.  | Johnson <i>et al.</i> , 2021 | -   |
| 3.  | Vaibhav <i>et al.</i> , 2021 | 1. Maxillofacial injury<br>2. Fractures (mandibular condyle, parasymphysis, dento-alveolar, angle and midface)<br>3. Amputation<br>4. Death<br>5. Laceration<br>6. Scratches<br>7. Sprain<br>8. Avulsion<br>9. Bruises  |
| 4.  | Swanton <i>et al.</i> , 2020 | 1. Fractures (hip and long bones)<br>2. Amputation<br>3. Injuries (brain, chest, and long bones, blunt, penetrating, and fused)   |
| 5.  | Viradia <i>et al.</i> , 2019 | 1. Fractures (ribs, pelvis, spine, lateral, distal radius, distal tibia, metatarsals)<br>2. Concussion (cerebral hematoma)<br>3. Finger amputation<br>4. Burns<br>5. Facial injuries  |
| 6.  | Parvez and Shahriar, 2018    | 1. Musculoskeletal disorders<br>2. Amputation<br>3. Infection<br>4. Wounds (legs, fingers, and deep veins)<br>5. Muscle stress  |
| 7.  | Rabbani and Fatmi, 2018      | 1. Cut wound<br>2. Fracture<br>3. Bruises<br>4. Sprain<br>5. Stab wounds<br>6. Amputation   |
| 8.  | Kica and Rosenman, 2020      | 1. Bruises<br>2. Broken bones<br>3. Laser/cut/puncture<br>4. Injuries (head, lower and upper extremities)<br>5. Abrasion<br>6. Amputation<br>7. Dislocation<br>8. Burns   |

## DISCUSSION

The review results in Table 3 showed that Italy had the lowest incidence of agricultural injuries. This is in line with Guarascio *et al.* (2019) who discovered that farming injuries tended to decrease, from 50 fatal injuries in 2013 to 28 fatalities in 2019. The results of the review were interesting to explore more about the efforts made by the Italian state; hence, it could reduce the incidence of agricultural injuries that could be applied or modified in other countries, especially Indonesia. Facchinetti *et al.* (2021) mentioned that in Italy, a *Tractor Training Certificate* (TTC) program has been introduced and regulated by the Italian occupational safety and health law, including theoretical and practical testing, allowing operators to be appropriately trained on the risks in using tractors and managing heavy equipment safely. After five years obtaining the TTC, refresher training is provided. Although it has not been able to reach all agricultural workers in Italy, the certification is expected to improve farmers' knowledge, skills, and affective behavior, thereby reduces the incidence of injuries due to human error by 25% (Ivascu and Cioca, 2019; Magagnotti *et al.*, 2020). Regulations related to occupational safety and health have been regulated in the law in each country. Still, the problem is related to the optimization of its application to be improved and emphasized as has been done by Italy, so that it has an impact on reducing the number of agricultural injuries (Vigoroso *et al.*, 2019).

Apart from TTC, Vigoroso *et al.* (2019) also reported that Italy intensively conducted safety training and visual communication through pictograms to improve workers' understanding of occupational safety and health rules contained in pictograms. In Indonesia, pictograms in the agricultural sector are rare or have yet to be applied. This can be a good input for the Indonesian agricultural sector to develop occupational safety and health pictograms in the agricultural industry based on the culture of each region. The next effort made by Italy was to increase the transfer of knowledge and experience to prevent injuries in the agricultural sector through storytelling based on scientific and technical evidence by involving relevant officers (Fubini *et al.*, 2019). As a result, 60 occupational health and safety officers wrote 53 injury stories that were collected and published on the institution's website. Twenty-two stories were selected for discussion during peer review sessions with agricultural sector workers, and preventive indications were modified as preventative solutions (Fubini *et al.*, 2019). Regular inspections by occupational safety and health officers to evaluate the quality of healthy and damaged machinery and policy support related to new farm equipment, financial assistance, age restrictions on farm equipment operators, and operator quality helped Italy reduce the incidence of injuries in the agricultural sector (Facchinetti *et al.*, 2021).

The review results in Table 4 provide information that the majority of causes of injury in the agricultural sector are the use of modern and conventional agricultural equipment, as well as attacks by agricultural animals or wild animals in agricultural areas. These findings are in line with (Weichelt and Gorucu (2019) statement that the primary source of injury in all incidents was vehicles (64%), followed by machinery (10%). In addition, the primary exposure event of the incidents was transported (61%), followed by contact with objects and equipment (18%). Additional riders were involved in 111 incidents (9.4% of all incidents). Erlani (2018) stated that, in general, the causes of accidents were caused by human factors (unsafe actions) and environmental factors (unsafe conditions). The authors assume that the emergence of these causes is related to farmers' low level of knowledge, skills, and attitudes about occupational health and safety in agricultural areas. Several assumptions underlie farmers' common knowledge, psychomotor, and attitude, including low willingness to get health and safety literacy, difficulty in reaching health and safety literacy, and less than optimal policy support related to health and safety literacy. While the relationship between health education and health literacy is widely recognized, it is rarely discussed in research and practice related to farmer safety and health. Nevertheless, increasing health and safety literacy through education has great potential to improve farmers' and their families' health, safety, and quality of life (Coman *et al.*, 2020). The higher the farmer's knowledge of safety while working, the more accidents can be avoided (Akbar *et al.*, 2022).

The review results in Table 5 provide information that the types of injuries related to agriculture included lacerations, stab wounds, fractures, amputations, skin avulsion, scratches, abrasions, burns, sprain, brain injury, bruises, dislocations, and contusions. These data follow the report of Momeni *et al.* (2020), that found out that agricultural-related injuries included symptoms related to the lower back (59.3%), followed by the knee (36.9%) and upper back (36.6%). The report was complemented by Rostamabadi *et al.* (2019) revealing that the prevalence of chronic diseases was 96.1%. The most common were *Musculoskeletal Diseases* (MSDs) and eye and neurological diseases. Almost half of the farmers (42.7%) experienced a work accident during the past 12 months, in this case, scratches and fractures were the most common injuries. Sick leave was reported by 28.2% of farmers, and of those with a history of accidents, 21.4% were hospitalized. The authors assumed that agriculture-related injuries occurred due to mechanical and inflammatory pathophysiological mechanisms. Mechanically, increased body mass led to increased strain on the spine, resulting in higher muscle tension and accelerated spinal degeneration (e.g., intervertebral disc disease). In addition to excess upper body mass causing direct compressive load on the spine, other biomechanical factors may exacerbate the load on the lumbar spine (Momeni *et al.*, 2020).



Furthermore, links between obesity and inflammation, inflammation and pain signaling, and low back pain and inflammation have been postulated. In this context, many pro- and anti-inflammatory mediators (e.g., C-reactive protein (CRP), tumor necrosis factor-alpha (TNF- $\alpha$ ), interleukin-6 (IL6), and adiponectin) that originate from or interact with adipose tissue and affect body fat and skeletal muscle have been studied (Momeni *et al.*, 2020). In addition, the authors assume that using agricultural machinery with poor conditions and not fulfilling ergonomic elements will pose a high risk of injuries such as cuts and fractures. This suggests the need for more attention from health policymakers to plan effective intervention measures to prevent, control, and treat chronic diseases in the agricultural sector.

## CONCLUSION

The relationship between agriculture and trauma and/or injury experienced by farmers is interrelated. It is easier for the agricultural industry to have a higher risk of injury. In general, the causes of agricultural injuries are agricultural machinery, hand tools, and wild animals/animals. The real impact of injury to farmers can be minimized by understanding the sources of risk and hazardous situations to reduce the health effects associated with agricultural work.

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