

*Systematic Review*

# Falls Are the Leading Cause of Injuries among Farmers—Limitations of Practicing Judo in Preventing These Incidents

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**Abstract:** Benefits related to doing martial arts go beyond health-related and constitute very useful life skills. One of them is ability to fall safely. It is an important skill since falls are a common cause of injuries. The aim of the study is knowledge regarding the burden of falls in a population of farmers. This systematic review was prepared according to PRISMA guidelines. A literature search was conducted in PubMed, Science Direct, Scopus, Springer Link, Web of Science. A total of 21 articles met eligibility criteria. The common general observation was that fall (regardless of type) caused various body injuries in populations of agriculture workers. Fall was the leading cause of injuries in only one population, and the most frequently classified second or third causes among all other listed injuries. People employed in the agriculture sector constitute an occupational group with an increased risk of injury as a result of accidental fall, which may lead to disability or even death (in extreme situations). Safe fall training would be an important addition to traditional fall prophylaxis applied on farms. The authors indicate the limitations of judo as a base of such a program, such as with superficial analysis of this issue in scientific publications. There is a need for a critical and wary approach to recommendations that are limited to prophylaxis of the effects of accidental falls that are founded on judo or other combat sports and martial arts.

**Keywords:** agriculture injuries; martial arts; safe fall programs

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## 1. Introduction

It is justified to state that physical activity is one of the universal means of restoring, sustaining, and enhancing health. This stems from observations of a multitude of negative effects of physical inactivity [1,2] and the positive effects of physical activity [3,4]. The importance of physical activity in human ontogenesis is also reflected in the WHO guidelines on physical activity, which have been determined for various age groups [5], even for children under the age of 5 [6].

In comparison to forms of physical activity such as running or resistance training, martial arts include all recommended types of exercises (aerobic, anaerobic, and strength), of which the relative contribution in particular types of training can be easily modified. There are many health-related benefits to practicing martial arts. For example, those related to Tai Chi include stress reduction, improved agility and balance, posture control, lower extremity strength, impeding a decline of the muscular-skeletal system that occurs with aging and the associated deterioration in functional capacity and an increased risk of falls

and hip fractures [7]. Practicing martial arts also has a positive influence on people's mental and social health [8].

Apart from health-related benefits, people practicing martial arts learn self-defense, how to avoid collision with an object in motion (e.g., boxing, fencing, karate, kendo, taekwondo), and safe falling (e.g., hapkido, judo, ju-jitsu, sumo, wrestling). People with such skills are less susceptible to lose their health as a consequence of unfortunate events that happen in every-day life, including assault and falls under various circumstances (at work, doing sports, during leisure time activities, etc.). Therefore, teaching these skills should be considered an important contribution to enhancing people's health capabilities, which, as a whole, constitute a life skills [9].

It may seem that ability to fall safely is more important in the case of urban rather than in rural areas. A cursory analysis of publications related to the burden of injuries in populations of agriculture workers [10–30] justifies the statement, that it is also an important public health issue in that occupational group. By extension, martial arts should be considered a serious alternative for other recommended forms of physical activity, and is favorable to health enhancement. Both health prophylaxis and broadly understood survival abilities [31,32] have been taken into account.

The authors of this publication focused on judo because it has many health-related benefits. Training based on the traditional model, Kodokan [33], focuses on the development of all the aforementioned abilities, which are the necessary elements for effective protection of the body in situations where it is endangered, it increases personal sense of safety (associated with quality of life), and increases the likelihood of surviving in situations of physical aggression. Elementary judo education encompasses safe fall exercises (ukemi waza), characteristic stepping patterns (tsugi-ashi) and executing turning movements (tai-sabaki), and sparring (randori). The first set of exercises enhances one's ability to fall safely, the second—balance control, and the third—tolerating imbalances caused by external forces. Additionally, tai-sabaki exercises, together with mastering self-defense techniques, goshin-jitsu-no-kata, enhance one's ability to avoid collisions. This is required of people wanting to obtain higher degrees of initiation (dan) and instructor qualifications.

Moreover, a very important element, from the perspective of the motor safety of people suddenly losing their balance, is the ability to provide security to a falling body purposely thrown off balance. Judoka acquires this ability in two ways: by mastering a technique of particular throws, and with free-style practice—randori. Such types of situations during collective work in agriculture are unavoidable.

If one critical stipulation was not mentioned, recommendations included in this article would have been open to question. The authors of the article would like to stress, that practicing judo on a professional level (participation in tournaments), as with many other contact sports, is associated with being at risk of suffering various body injuries [34], death or irreversible life-long disability [35].

The aim of the study is to determine knowledge about the burden of falls in a population of farmers.

## 2. Materials and Methods

This systematic review was prepared according to PRISMA guidelines (Figure 1) [36]. All authors were responsible for publication searches. A literature search was conducted in online databases, such as PubMed, Science Direct, Scopus, Springer Link, and Web of Science. The search string used was “Farmers AND Falls”. The language of the papers was restricted to English. The publications met eligibility criteria if they included information concerning at least burden of fall-related injuries. If there were also data concerning the types and frequencies of recorded injuries, and body parts, those were also taken into consideration.

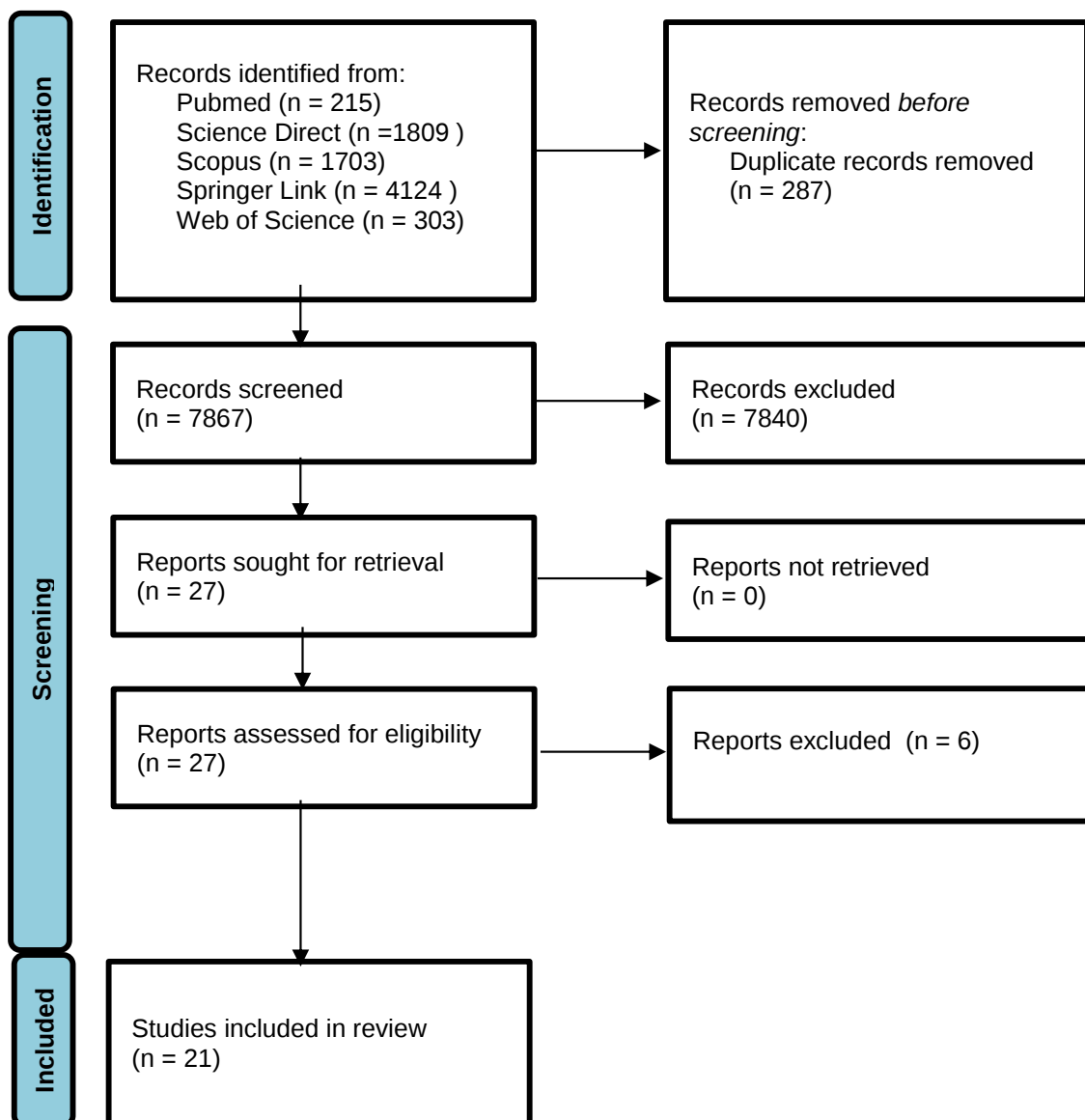


Figure 1. PRISMA flow diagram for study selection [36].

### 3. Results

The common general observation present in all the analyzed articles [10–30] was that falls (regardless of type: from the same level, height, machine or animal) caused either various bodily injuries or death (in extreme situations). Given the level of contribution to injuries, falls turned out to be leading cause of injuries (27.9%) in the Korean population [27]. According to data from the rest of the articles, this type of accident was most frequently either second or third among the most prevalent causes among all listed by researches. The authors did not provide a distribution of fall prevalence according to type or part of body injured in the majority of articles. Nevertheless, Paton et al. [21] ascertained that falls (including falls from heights, animals, machinery, and falls on the same level) were the immediate cause of 38.5% and 57% of all head and spine injuries, respectively (Table 1).

**Table 1.** Burden of fall-related injuries in various rural populations.

| Year and Author/-s          | Material                                                                                                                                                                  | Study Design                                                                                                                       | Injured Body Parts (% of Cases) and Types of Injuries (% of Cases) + B:D                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Estimated Falls Contribution (% of Causes) and Important Remarks (IR)                                                                              |
|-----------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|
| 2000<br>Xiang et al. [10]   | Farmers from 14 villages<br>Country: the People's Republic of China                                                                                                       | The interviewers with help from village leaders conducted face-to-face interviews with eligible individual farmers to collect data | <b>Body parts:</b> extremities (68.5%), multiple body parts (21.4%), trunk (5.8%), head (4.3%).<br><b>Types of injuries:</b> not specified                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Falls were the <b>second leading cause</b> of injuries (26.1%)                                                                                     |
| 2001<br>Pickett et al. [11] | Data from the Canadian Agricultural Injury Surveillance Program (CAISP) concerning persons experiencing a farm injury requiring hospitalization, April 1991 to March 1995 | Descriptive analyses characterizing farm injuries by persons involved, mechanisms, primary diagnoses, and agents of injury.        | <p><b>Body parts.</b> <i>Machinery related farm injuries (results for particular age groups: 0–14, 15–59 and 60 + respectively):</i> upper limb (29.8%, 34.1%, 27.3%), lower limb (22.2%, 20.3%, 16.7%), head (15%, 5.7%, 4.8%) trunk (8.6%, 11.1%, 18.9%). <i>Non-machinery related farm injuries:</i> upper limb (25.5%, 13.5%, 8.9%), head (22.2%, 11.7%, 9.3%), lower limb (13%, 17.6%, 22.7%), trunk (4%, 12.1%, 16.1%).</p> <p><b>Type of injuries.</b> <i>Machinery related:</i> (results for particular age groups: 0–14, 15–59 and 60 + respectively): fracture: skull/spine trunk/upper and lower limb (44.1%, 40.7%, 40.7%), open wound: head/neck/trunk/upper and lower limb (22.4%, 26.3%, 22.1%), intracranial injury, excluding those with skull fracture (10.5%, 3.4%, 2.9%), contusion with intact skin surface (5.5%, 4.5%, 6.2%), crushing injury (4.7%, 5.3%, 3.8%), internal injury of chest, pelvis, and abdomen (3.3%, 2.7%, 3.9%), certain traumatic complications and unspecified injuries (3.1%, 4.7%, 5.5%), other (2.7%, 4.2%, 7.1%), superficial injury (1.6%, 0.7%, 0.5%), dislocation (0.8%, 2.3%, 2.1%), burns (0.6%, 1.6%, 0.6%), injury to nerves and spinal cord (0.6%, 0.7%, 0.9%), injury to blood vessels (0.2%, 0.3%, 0.3%), sprains/strains of joints and adjacent muscles (0, 2.8%, 3.4%), missing (0, 0, 0.1%).</p> <p><i>Non-machinery related:</i> fracture: skull/spine trunk/upper and lower limb (39%, 36.9%, 42.5%), intracranial injury, excluding those with skull fracture (17.2%, 6.9%, 7.1%), other (12.9%, 14.4%, 14.2%), open wound: head/neck/trunk/upper and lower limb (10.8%, 10%, 5.5%), burns (6.4%, 3.9%, 3.6%), contusion with intact skin surface (4.1%, 6.2%, 7.4%), internal injury of chest, pelvis, and abdomen (2.8%, 3.1%, 3.1%), certain traumatic complications and unspecified injuries (2.6%, 4%, 4.1%), superficial injury (1.6%, 0.9%, 0.8%), dislocation (1%, 4.1%, 3.3%), sprains/strains of joints and adjacent muscles (0.9%, 7.9%, 7.6%), crushing injury (0.5%, 1%, 0.4%), injury to nerves and spinal cord (0.2%, 0.5%, 0.2%), injury to blood vessels (0, 0.3%, 0.2%), missing (0, 0.2%, 0.1%).</p> | Fall was <b>third and second leading</b> cause of machinery (fall from machine) and non-machinery related injuries (15.1% and 24.5% respectively). |

Table 1. Cont.

| Year and Author/-s           | Material                                                                                                                                                 | Study Design                                                                                                                                                                                                                                                            | Injured Body Parts (% of Cases) and Types of Injuries (% of Cases) + B:D                                                                                                                                                                                                                                                                                                          | Estimated Falls Contribution (% of Causes) and Important Remarks (IR)                                                                                                                                           |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2002<br>Solomon [12]         | Reports submitted under the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations and the Labour Force Survey<br>Country: United Kingdom | Secondary data analysis                                                                                                                                                                                                                                                 | No data                                                                                                                                                                                                                                                                                                                                                                           | Fall from height was <b>second leading cause</b> of fatal (15.8%) and <b>fourth leading cause</b> of non-fatal (13.1%) injuries<br>Fall on the same level was <b>third leading cause</b> of non-fatal (15%)     |
| 2003<br>Little et al. [13]   | 94 children (under 18) identified with an agricultural-related injury<br>Country: USA, Texas                                                             | The study included all farm-related accidents occurring between November 1994 and August 2001 (82 months) involving children 18 years or younger. This consecutive series of patients was accessed from the institutional trauma registry and reviewed retrospectively. | <b>Body parts:</b> Head (50%), upper extremity (35%), lower extremity (29%).<br><b>Types of injuries:</b> Dislocations/fractures (52%).                                                                                                                                                                                                                                           | Falls were <b>second leading cause</b> of injuries (34% of causes)                                                                                                                                              |
| 2004<br>McCurdy et al. [14]  | Principal farm operators from California<br>Country: USA                                                                                                 | Operators participated in computer-assisted telephone interview survey                                                                                                                                                                                                  | <b>Body parts:</b> trunk (38.8%), upper extremities (25%), lower extremities (21.3%), head (8.8%), multiple and system (4.4%), neck (1.9%).<br><b>Types of injuries:</b> sprains/strains (29.4%), open wound (11.8%), fractures (10.6%), contusions and superficial injuries (6.8%), dislocations (2.5%), Traumatic amputations-thumb/fingers (1.9%), foreign body in eye (3.1%). | Falls on the same level (5%), into hole (4.3%), from ladder/scaffold/stairs/steps (2.5%), from one level to the another (1.2%). These types of falls were jointly <b>third leading cause</b> of injuries (13%). |
| 2005<br>Moshiro et al. [15]  | 303 persons reported to have been injured in rural area<br>Country: Tanzania                                                                             | A two stage cluster sampling method was adopted in selecting the rural sample. In the first stage, using existing AMMP data on mortality and poverty, 6 out of 51 villages were selected to represent different levels of injury.                                       | <b>Body parts:</b> (39%) lower limb, (33%) spinal<br><b>Types of injuries:</b> fractures                                                                                                                                                                                                                                                                                          | Falls were <b>second leading cause</b> of injuries (27.4% of causes)                                                                                                                                            |
| 2007<br>Nogalski et al. [16] | Data considering patients with agriculture and forestry related injuries admitted to Emergency Department.<br>Country: Poland                            | Retrospective data analysis (descriptive and regression analysis)                                                                                                                                                                                                       | <b>Body parts:</b> spine (10.8%), lower limbs (9.7%), upper limbs (7.8%), head (5.5%), face/neck (0.8%), thorax/abdomen (0.8%).<br><b>Type of injuries:</b> no data                                                                                                                                                                                                               | Falls were <b>third leading cause</b> of injuries (18.9% of cases)                                                                                                                                              |

Table 1. Cont.

| Year and Author/-s                | Material                                                                                                          | Study Design                                                                                                                                                                                               | Injured Body Parts (% of Cases) and Types of Injuries (% of Cases) + B:D                                                                                                                                                                                                                                                       | Estimated Falls Contribution (% of Causes) and Important Remarks (IR)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2007<br>Solomon et al. [17]       | Population of men who were residing in three defined rural areas of England and Wales.<br>Country: United Kingdom | Each man was sent a postal questionnaire. Simple descriptive statistics were used to compare the relative frequency of different types of accidental injury in agricultural workers and other occupations  | <b>Body parts:</b> no data<br><b>Type of injuries:</b> fracture (28.8%), back injury (25.6%), cut needing stitches (22.4%), other (15.3%), other sprain (10.2%), head injury (7.5%), eye injury (6%), burn or scald (2.6%), amputation (2.2%), unknown (1.5%).                                                                 | Fall from high has the <b>fourth highest frequency rate</b> of accidents (3.4/1000 person-years) among agricultural employees and <b>the highest frequency rate</b> of accidents (5.3/1000 person-years) among self-employed agricultural workers.<br>Slipping, tripping or falling has <b>sixth highest frequency rate</b> of accidents (3.1/1000 person-years) among agricultural employees and <b>sixth highest frequency rate</b> of accidents (2.2/1000 person-years) among self-employed agricultural workers.<br><b>IR:</b> Both agricultural employees and self-employed agricultural workers are more vulnerable to fall from high than fall on the same level. |
| 2007<br>Sosnowska and Kostka [18] | Children aged 6–15<br>Country: Poland                                                                             | The analysis has been made on the basis of information collected from the Farmers' Insurance Fund                                                                                                          | <b>Body parts and type of injuries:</b> Limbs (76.8%) including: fractures (30.7%), dislocations (26.7%), finger crushes (5.4%), fingers cutting-off (4.0%), wounds and gashes (9.8%); trunk harms (20.5%) including: collar-bone fractures, shoulder-blade fractures, burns, bites by animals, bruises; head injuries (2.7%). | Falls and slips (while lifting or carrying materials, equipment, tools) and falling from high altitudes (stairs/ladder/trailers/tractors/bicycles/carriages/trees, fencing, etc.) were <b>first</b> (47.2%); and <b>second</b> (22.9%) <b>leading causes</b> of injuries respectively.<br>In general, falls were <b>leading cause of injuries</b> (70.1%).                                                                                                                                                                                                                                                                                                               |
| 2012<br>Taattola et al. [19]      | Self-employed full-time farmers<br>Country: Finland                                                               | Telephone interviews were carried out by the computer-assisted telephone interview unit of the Finnish Institute of Occupational Health                                                                    | No data                                                                                                                                                                                                                                                                                                                        | Falling or slipping was <b>one of the most common types of incidents</b> resulting in injuries                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 2013<br>Pfortmueller et al. [20]  | Out of 390,000, a total of 815 patients were eligible for the study<br>Country: Switzerland                       | Our retrospective cohort study comprised adult ( $\geq 16$ years) patients admitted to our emergency department (ED) between 1 January 2000 and 31 December 2011 in relation to an accident in agriculture | <b>Body parts:</b> Upper extremities (45.2%), head/neck (21.5%), lower extremities (18.9%), chest (13.6%), spine (11.2%), external (6.6%), abdomen (6%).<br><b>Type of injuries:</b> no data                                                                                                                                   | Fall were <b>second cause of injuries</b> (30.1%)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |

Table 1. Cont.

| Year and Author/-s             | Material                                                                                                                                                                                                                       | Study Design                                                                                                                                                                                                                                                                     | Injured Body Parts (% of Cases) and Types of Injuries (% of Cases) + B:D                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Estimated Falls Contribution (% of Causes) and Important Remarks (IR)                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2014<br>Paton et al. [21]      | Data from the Canadian Centre for Agricultural Health and Safety's Saskatchewan Farm Injury Surveillance Database<br>Country: Canada                                                                                           | The basic data was enhanced by a systematic review of the hospital charts. Regional health records personnel verified the information contained in the discharge records and added information about the injury events to standard de-identified abstraction forms.              | <b>Body parts:</b> Head and spine including: lumbar spine (55.3%), thoracic (25%), cervical (14.9%), sacrum (2.6%).<br><b>Type of injuries:</b> head: concussions (36.2%), fractures (33.3%), intracranial injury of unspecified nature (24.9%), intracranial hemorrhages following injury (4.1%), cerebral lacerations and contusions (1.5%); spine: fractures of the vertebral column (87.7%), spinal cord (7.0%), vertebral dislocation without fracture and/or intervertebral disc rupture (5.3%)                                                                                                                                                                                                                                                 | Falls (including: falls from heights, animals, machinery and falls on the same level) were the <b>immediate cause</b> of 38.5% and 57% of all head and spine injuries respectively<br>Contribution different types of fall resulting in spine injuries: fall from height (29%) or from animal (13%), fall from machine (12%); fall from same level (3%).                                                                                                                                         |
| 2015<br>Baksh et al. [22]      | Small-scale commercial-oriented vegetable farmers from ten of the most populated agricultural areas<br>Country: Trinidad                                                                                                       | Survey was conducted. This study employed a convenience sampling strategy to recruit its participants. The first farmer met was interviewed, followed by every third farmer working in the field at the time of data collection until ten farmers were successfully interviewed. | no data                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | The 33% of farmers reported experiencing fall while working within the last year.                                                                                                                                                                                                                                                                                                                                                                                                                |
| 2015<br>Missikpode et al. [23] | 2005<br>63 persons<br>2006<br>86 persons<br>2007<br>94 persons<br>2008<br>147 persons<br>2009<br>174 persons<br>2010<br>149 persons<br>2011<br>159 persons<br>2012<br>176 persons<br>2013<br>176 persons<br>Country: USA, Iowa | Using Iowa Trauma Registry data collected by the Iowa Department of Public Health, we examined trends in non-fatal agricultural injuries reported by acute care hospitals accredited as Level I, II, and III Trauma Care Facilities from 2005 to 2013.                           | <b>Type of injuries and body parts:</b><br>2005<br>fracture (43.3%), head injury (20%), dislocation/sprain (No data)<br>2006<br>fracture (41.8%), head injury (8.8%), dislocation/sprain (No data)<br>2007<br>fracture (29.2%), head injury (18.0%), dislocation/sprain (6.7%)<br>2008<br>fracture (39.0%), head injury (13.0%), dislocation/sprain (5.5%)<br>2009<br>fracture (40.5%), head injury (12.4%), dislocation/sprain (7.2%)<br>2010<br>fracture (47.6%), head injury (9.0%), dislocation/sprain (4.1%)<br>2011<br>fracture (41.4%), head injury (14.7%), dislocation/sprain (5.7%)<br>2012<br>fracture (44.3%), head injury (18.0%), dislocation/sprain (3.6%)<br>2013<br>fracture (47.4%), head injury (11.0%), dislocation/sprain (8.1%) | 2005<br>Fall were second cause of injuries (24.6%)<br>2006<br>Fall were second cause of injuries (18.3%)<br>2007<br>Fall were second cause of injuries (20.5%)<br>2008<br>Fall were second cause of injuries (21.4%)<br>2009<br>Fall were second cause of injuries (24.1%)<br>2010<br>Fall were second cause of injuries (18.5%)<br>2011<br>Fall were first cause of injuries (24.4%)<br>2012<br>Fall were first cause of injuries (20.5%)<br>2013<br>Fall were second cause of injuries (15.9%) |

Table 1. Cont.

| Year and Author/-s              | Material                                                                                                                                           | Study Design                                                                                                                                                               | Injured Body Parts (% of Cases) and Types of Injuries (% of Cases) + B:D                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Estimated Falls Contribution (% of Causes) and Important Remarks (IR)                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2015<br>Momose and Suenaga [24] | Information concerning farmers' compensation injury claims<br>Country: Japan                                                                       | Secondary data analysis: agricultural injuries were identified using the International Classification of External Causes of Injury). The Statistical Analysis              | <p><b>Body parts</b></p> <p>Men (results for populations 20–64 and 65–89 respectively): hand/wrist (25.3% and 21.5%), lower extremity (19.1% and 17.3%), ankle/toe (11.2% and 10.4%), shoulder/chest (10.4% and 15.1%), head/face (9.4% and 10.1%), lumbar region (7.8% and 10.7%), upper extremity (9.9% and 9%), others (6.8% and 5.9%)</p> <p>Women (results for populations 20–64 and 65–89 respectively): hand/wrist (26.5% and 20.3%), lower extremity (21.2% and 24.4%), upper extremity (12.2% and 12.7%), ankle/toe (12.2% and 8.6%), head/face (11.1% and 4.9%), shoulder/chest (8.5% and 10.3%), lumbar region (4.2% and 14.2%), others (4.2% and 4.5%)</p> <p><b>Types of injuries:</b></p> <p>Men (results for populations 20–64 and 65–89 respectively): others (28.7% and 23%), fracture (23.5% and 28.1%), cut wound (17% and 12.6%), bruises (11.8% and 14.5%), contusions (11% and 15.9%), sprain (8.1% and 5.8%),</p> <p>women (results for populations 20–64 and 65–89 respectively): others (24.3% and 16.6%), fracture (32.8% and 44.8%), bruises (12.2% and 14.2%), cut wound (11.1% and 8.2%), contusions (11.6% and 9.7%), sprain (7.9% and 6.6%)</p> | <p>Given nonfatal agricultural injuries, related to machinery fall/slip caused (population age: 20–64): 6.1% (men) and 5.9% (women) of injuries; fall from the machine: 7.6% (men) and 5.9% (women). Population age 65–89: fall/slip—10.4% (men) and 22% (woman); fall from the machine 6.8% (men) and 7.3% (woman).</p> <p><b>IR:</b> Population aged 65–89 is <b>more vulnerable</b> to fall/slip and fall from the machine (only women) than population aged 20–64.</p> |
| 2016<br>Cakabay et al. [25]     | Data considering the farmers who have come to emergency service unit as a result of maxillofacial trauma between 2010 and 2012.<br>Country: Turkey | Demographic findings, trauma etiologies, seasonal variables of trauma, and maxillofacial fracture area distribution have been analyzed                                     | <p><b>Body parts:</b> head</p> <p><b>Type of injuries:</b> Skull and frontal bone, nasoethmoid complex, nasal fractures, orbital floor, mandibula fracture, zygoma fractures, maxilla fracture.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <p>Falling from haystacks and falling from motorized and nonmotorized agricultural vehicles and tools have <b>fourth</b> (9.59%) and <b>fifth</b> (7.53%) <b>position</b> in ranking of 6 (predetermined) etiological categories.</p> <p><b>IR:</b> In general (both types are combined) fall has <b>second position</b> (17.12%).</p>                                                                                                                                     |
| 2016<br>Kim H et al. [26]       | 277 injury cases were identified, of which 68 were contacted<br>Country: Korea                                                                     | Subjects for this study were chosen from the injury insurance claim database of the Mutual Aid Insurance of the Nation Agricultural Cooperation Federation (NACF) of Korea | No data                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Fall were <b>first cause of injuries</b> (27.9%)                                                                                                                                                                                                                                                                                                                                                                                                                           |

Table 1. Cont.

| Year and Author/-s             | Material                                                                                                                                                              | Study Design                                                                                                                                                                                                                            | Injured Body Parts (% of Cases) and Types of Injuries (% of Cases) + B:D                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Estimated Falls Contribution (% of Causes) and Important Remarks (IR)                                                                                                                                                                                                                             |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2017<br>Abdulkarim et al. [27] | 144 agricultural-related injuries<br>Country: Ireland                                                                                                                 | Every presentation to the Accident and Emergency Department at the Midlands Regional Hospital from the 1.01.2013 to 31.12.2013 was assessed retrospectively to determine if an injury had been sustained in an agricultural environment | <b>Body parts:</b> upper limb, lower limb, trunk, spine<br><b>Type of injuries:</b> fractures, dislocation                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Falls more than 3 feet were <b>third leading cause of injuries</b> (10% of causes)                                                                                                                                                                                                                |
| 2017<br>Berney et al. [28]     | 31 patients who suffered traumatic spinal injuries on farms<br>Country: Ireland                                                                                       | Retrospective study. Patients who suffered traumatic spinal injuries on farms and underwent treatment were identified using the Hospital In-Patient Enquiry (HIPE) system.                                                              | <b>Body parts:</b> spinal cord injuries<br><b>Type of injuries:</b> Concerning spinal injuries alone, 81% suffered fractures at a single level and 6 patients (19%) had non-contiguous spinal injuries including one patient with injuries at 3 sites in the spine                                                                                                                                                                                                                                                                                                                                                  | Falls were <b>fourth leading cause of injuries</b> (16% of cases)                                                                                                                                                                                                                                 |
| 2019<br>Kaustell et al. [29]   | Data concerning injuries and occupational diseases to people working on Finnish fish farms acquired from the Finnish Workers' Compensation Centre<br>Country: Finland | Secondary data analysis                                                                                                                                                                                                                 | <b>Body parts:</b> Hand/finger (24.9%), leg from hip to ankle (19.2%), arm from shoulder to wrist (16.2%), back/spine (9.5%), eye (8.2%), head excluding eyes (6.7%), foot and toes (5.6%), other, e.g., internal organ injury (4.1%), neck and body excluding back (3.6%), multiple body parts (2.1%)<br><b>Type of injuries:</b> Dislocations, sprains and strains (35%) wounds and superficial injuries (29.4%), concussion and internal injuries (17.6%), bone fractures (9.0%), other (e.g., poisoning, suffocation) (4.3%), not known (2%), burns, scalds and frostbites (1.8%), traumatic amputations (0.8%) | Slipping, stumbling, and falling were <b>the leading cause of injuries</b> (36.5% of them)<br><b>IR:</b> Given contact modes of injuries, horizontal or vertical impact (the victim is in motion) and struck by/collision with object in motion caused 36.8% and 10.4% of injuries, respectively. |
| 2020<br>Sheehan et al. [30]    | 430 patients where the incident location was farm<br>Country: Ireland                                                                                                 | Data were gathered from the National Office of Clinical Audit Major Trauma Audit (MTA) 2014 to 2016. Patients were included and excluded based on Trauma Audit and Research Network(TARN) inclusion criteria.                           | <b>Body parts:</b> The most common body area injured was limbs, followed by chest, spine and head injuries<br><b>Type of injuries:</b> fractures, dislocation                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Falls less than 2 m were <b>second leading cause of injuries</b> (26.7% of causes)<br>Falls more than 2 m were <b>third leading cause of injuries</b> (25.6% of causes)                                                                                                                           |

#### 4. Discussion

Results of the analysis clearly indicate that the causes of falls among people employed in the farming sector differ from the types of falls that are characteristic of judo. Authors of numerous reports pointed out a fall from height as a cause of death. For instance, “Fall from height was second leading cause of fatal (15.8%) and fourth leading cause of non-fatal (13.1%) injuries” [12]. As height varies (animals, machinery etc.) and circumstances are also manifold.

A considerable number of falls in judo can also be qualified as a fall from height, in a certain sense, especially throwing techniques like *koshi-waza* (hip throwing techniques) or *te waza* (hand throwing techniques). A judo practitioner will potentially experience the highest fall during *kata guruma* (shoulder wheel)—from *tori*’s shoulders (*tori* is a person who applies a technique in judo training) [33]. This particular throw is rarely used effectively during tournaments (in the cases it is performed, as the thrower needs to greatly lower their center of gravity). During formal practice of judo throws, the aspects of sport ethics and mutual responsibility play a large role (partners take on the role of *tori* in turn as they become responsible for providing security for their partner’s falling body—*uke*’s body).

There is a lack of deeper analysis of the limitations of judo as a method of preventing body injuries resulting from falls [37,38]. The observation made by Arkkukangas et al. [38] that “interventions aiming at reducing both the risk of falls and mitigating fall-related injuries through teaching safe falling techniques are still sparsely investigated” is only partially true. The authors performed a very superficial analysis of available papers. They did not mention original and applicable cognitive achievements of a group of Polish scientists and practitioners, cooperating with Roman M. Kalina, which has been available in the global scientific space since 2018 [39].

The so-called Polish school of safe fall originates from the 1970s. It draws on the physical theory of “soft fall” from 1972 [40], which received additional elements in 2015 [41]. In the meantime, several articles appeared in Polish regional journals. They incorporate methodological essentials for a complementarily developed system of prophylaxis of body injuries resulting from falls (inspired by judo philosophy and practice). Its simplified methodological synthesis is an academic script “Combat sports propaedeutics—basics of judo”, published in 2003 (it includes specific motor diagnostic tool: test of making safe falls) [42]. The theoretical and methodological basis of teaching lower-extremity amputees safe falling appeared in the same year [43]. This set of articles provided universal methodological criteria of the assessment of any safe fall training program based on martial arts. They allowed for a precise indication of deficiencies of recommendations concerning the usage of martial arts in fall prophylaxis. For example, limited adaptability of movement and methods and patterns in particular martial arts [31,32,44].

Research conducted on healthy individuals confirmed both the high accuracy of the test of making safe falls and that anyone can learn safe fall techniques (regardless of gender, age, and type of body build) [45]. Clinical research proved the effectiveness of both programs for people with disabilities, the one dedicated for people after amputations of limbs [46] as well as the one focusing on visually impaired and blind patients [47]. Furthermore, the program proved effective for obese people [48], patients with mental impairment, participating for several months in special cognitive-behavioral therapy [49].

At the base of those empirically verified adaptive benefits, there is an attractiveness with respect to proactively therapeutic programs, combining a selection of judo exercises, safe fall, and collision avoidance techniques, providing fun forms of martial arts [50]. The programs have great influence on motor and mental functioning of the participants and incorporate simple non-apparatus diagnostic tests [51]. Along with motor competences in the area of safe falls, and reduced susceptibility to body injuries during a fall, the aforementioned training programs provide further benefits, including the unique ability to diagnose and reduce aggressiveness [52,53]. The broadly indicated multivariate benefits of the programs are one part of the still-improving concept described as innovative agonol-

ogy [32,44,54,55]. Still, the most convincing arguments supporting the effectiveness of programs dedicated to safe falls came from participants. On completion of the experiment, over 95% of the surveyed students were convinced that teaching safe fall techniques to healthy participants, and those from increased risk groups, made sense and none of the students denied it. In addition, upon completion of the clinical experiment, all the amputees, and over 83% of the visually impaired patients were of the same opinion; one response from a visually impaired patient (16%) read: “I don’t know” and none of the respondents denied the importance of teaching safe fall techniques [56].

On the basis of the evidence for the complementary influence of the innovative methods, the conclusion offered by Arkkukangas et al. [38] seems exaggerated. It was suggested that, as verified by the authors, a 10-week judo-based exercise program may be a novel way of addressing fall-related injuries. At the same time, it is not surprising that: “The Judo4Balance programme had no impact on fall-related self-efficacy in this study sample of active adults”.

## 5. Conclusions

People employed in the farming sector are at increased risk of disability as a result of accidental falls. Since traditional fall prophylaxis is estimated to be efficient only in 30–40% of cases [57], safe fall training should be recommended as it is an important additional element in this occupational group. It should be adjusted to a person’s age, physical and mental capabilities, general health, character of work, as well as training site. Despite their brief presentation, the postulates and benefits of the programs presented within the paper clearly indicate a need for a critical and wary approach to recommendations limited to prophylaxis of the effects of accidental falls founded on judo, or other combat sports and martial arts [58].

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