

Injuries at World and European judo tournaments in 2010-2012

Authors' Contribution:

- A Study Design
- B Data Collection
- C Statistical Analysis
- D Manuscript Preparation
- E Funds Collection

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Abstract

Background and Study Aim:

In Olympic judo, athletes are not allowed to kick, punch, or strike, or use any equipment or weapons. The athlete must subdue the opponent only by gripping the uniform and using techniques to lift and throw the competitor or pin them down to the mat. The purpose of the research is to know about type of injuries judo athletes during the European and World Judo Championships respectively, from 2010 to 2012 and evaluates the differences between men and women.

Material and Methods:

The study investigates the incidence and type of injuries of 3,408 and 3,860 athletes at 16 European and 9 World Judo Championships respectively, from 2010 to 2012 and evaluates the differences between men and women.

Results:

Bleeding and excoriation or wounds were the most frequent injuries accounted for 3.82% and 3.96% of total injuries for men and women respectively. There was no statistically significant difference in overall injury incidence between World and European tournaments (6% vs 8%, $p = 0.57$) and between European cadets, junior and senior tournaments (4% vs 6% vs 6%, $p = 0.51$ and $p = 1.000$). The overall injury rate was significantly higher in the veteran tournaments when compared to the other European tournaments (17% vs 4%, $p = 0.002$; 17% vs 6%, $p = 0.01$).

Conclusions:

The study additionally shows that international judo competitions are associated with a low overall injury incidence. The risk of injury is greater and statistically significant in the veterans judo athletes group. Therefore, it is necessary to modify the regulations in this rival group.

Key words:

individual technique • kata • movement sequence • tokui-waza • randori

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Conflict of interest:

Authors have declared that no competing interest exists

Ethical approval:

The study was conducted according to the guidelines of the Declaration of Helsinki and approved by the Ethics Committee of Regional Medical Board in Krakow (approval No. 287/KBL/OIL/2020)

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Technique – *noun* a way of performing an action [29].

Waza – a technique or movement which is based on a standard form and is used to challenge and defeat the opponent [30].

Tokui-waza – “favourite” or “best” technique. It’s the throw that fits naturally to athlete body type.

Individual technique – synonym of tokui-waza.

Kata – predetermined and choreographed physical exercises, which together with free exercises (*randori*), lectures (*kōgi*) and discussions (*mondō*) form the four critical pillars of Kodōkan jūdō education [31].

Randori – sparring in judo in which both participants practice attacking and defending [30].

Movement sequence – the combination of fundamental movement skills and movement elements to enable the body and/or objects to move in response to a stimulus [32].

INTRODUCTION

Judo is one of the most popular martial arts, with more than 20 million practitioners around the world judo for the world. In Olympic judo, athletes are not allowed to kick, punch, or strike, or use any equipment or weapons. The athlete must subdue the opponent only by gripping the dress and using techniques to lift and throw the competitor or pin them down to the mat. Judo training involves technique training (*kata*), which are prearranged movements, with the purpose of controlled, perfect execution of each movement sequence and applying it to the individual techniques of each judoka (*randori*) [1]. Therefore in judo the fighting environment will where there are constant changes of actions with applications of different movement structure. The ability to be at the right time, in the right position, to optimize an attack or defence strategy, then improving the effectiveness of the adopted tactical sequence is of primary importance [2]. The more the athlete trains and competes, the more they are exposed, to more and different types of injuries.

Better motor preparation of the athletes enhances the application of more powerful movements, which may broaden and increase the types of injuries [3-5]. The frequency and number of injuries as well as the significance of the injury influences further training and the resulting competitions [6]. Therefore, one of the most important issues in judo training and first of all in competition the application of a well balanced approach to training technique and motor preparation, combined with combat strategy. This allows an efficient strength and power capacity and coordination skills to increase the effectiveness of the motor performance. Recent injury analysis studies in judo were done [7, 8].

In turn in this study, the authors present the proportions of damage to parts of the body in relation to the type of judo athletes [9].

Although judo promotes the health status by enhancing the strength, agility, speed, dynamic and static balance, power, and endurance of the

athletes [10], the participation in a such physically demanding sport can result in increased risk of injury. A judo match starts with the two opponents facing each other standing (*tachi waza*), but it can end up with the opponents on the mat (fighting in horizontal posture, *ne waza*).

The knowledge of the type and mechanism of injuries and their incidence plays a critical role to develop effective strategies to prevent such injuries [8]. Although several studies have been performed to investigate the epidemiology of injuries in martial arts [11-19], there is a lack of epidemiologic studies assessing injuries in judo athletes. Some authors performed surveys on severe judo related head and neck injuries [20-22], but, to our knowledge, no comprehensive epidemiologic studies of judo injuries among international competitions have been performed.

This prospective study assessed the incidence, type, and mechanism of injuries at European and World Judo Championships from 2010 to 2012, to compare the results achieved in different tournaments, and to evaluate differences between men and women. In our opinion, this period provides the most valuable information from the review of judo injuries in the longer term 2005-2020 [19].

The purpose of the research is to knowledge about type of injuries judo athletes during the European and World Judo Championships respectively, from 2010 to 2012 and evaluates the differences between men and women. We hypothesised that the injury incidence and characteristics would not differ between European and World Championships, and between men and women.

MATERIAL AND METHODS

Study design and sample

The study design followed the consensus on definitions and data collection procedures for studies of judo injuries outlined by The European Judo Union Medical Committee [23].



European Judo Union

Injury - Technical Form Videotagging V9.14

Sex 01 Female 02 Male

Code from the scoreboard* _____

*(= Mat N°, Weight category, Round N°, national Olympic codes of White and Blue)

example: M1-57-Round1-SUI/POL (all information on the scoreboard)

MINOR INJURY <input type="checkbox"/> Minor (check the box)		<table border="1"> <thead> <tr> <th>Injury Type</th> <th>Tissue involved</th> </tr> </thead> <tbody> <tr><td>03 Fracture</td><td>04 Skin</td></tr> <tr><td>04 Distension</td><td>04 Bone</td></tr> <tr><td>05 Luxatio</td><td>05 Cartilage</td></tr> <tr><td>06 Contusio</td><td>06 Ligament</td></tr> <tr><td>07 Commotio</td><td>07 Nerve/brain</td></tr> <tr><td>08 -</td><td>08 Muscle</td></tr> <tr><td>09 Rupture</td><td>11 Cornea</td></tr> <tr><td>10 -</td><td>12 Tympanum</td></tr> <tr><td>11 -</td><td>13 Joint</td></tr> <tr><td>12 Strangulation</td><td></td></tr> </tbody> </table>	Injury Type	Tissue involved	03 Fracture	04 Skin	04 Distension	04 Bone	05 Luxatio	05 Cartilage	06 Contusio	06 Ligament	07 Commotio	07 Nerve/brain	08 -	08 Muscle	09 Rupture	11 Cornea	10 -	12 Tympanum	11 -	13 Joint	12 Strangulation	
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11 -	13 Joint																							
12 Strangulation																								
MAJOR INJURY																								
LEVEL 1 given by Match analysis	Anatomical Localisation																							
FACE	03 Skull																							
	04 Face																							
	05 Eye																							
	06 Ear																							
	07 Nose																							
NECK	08 Mouth																							
	09 Neck																							
	10 Throat																							
UPPER EXTREMITY	11 Clavicle/AC																							
	12 Shoulder/Humerus																							
	13 Elbow joint																							
	14 Forearm																							
	15 Wrist																							
	16 Hand and finger																							
TRUNK	17 Thorax																							
	18 Back																							
	19 Abdomen																							
	20 Pelvis																							
	21 Genitals																							
	22 Inguinal																							
LOWER EXTREMITY	23 Femur																							
	24 Knee																							
	25 Leg																							
	26 Ankle																							
	27 Foot																							
Fight timing:	first half / last half																							
Technique:	last minute / golden score Tori / Uke :																							

Hospital	Side of Lesion
1 yes	03 Left
2 no	04 Right
Injured Athlete	05 Midline
1 Tori	Visit Number
2 Uke	01 First
On Tatami	02 Second
1 yes*	03 Third
2 no°	Continues the fight
* on tatami or immediately after the fight	01 yes
no during fight	02 no
° no during fight	

Event: _____

Diagnosis: _____

How to use:

Each medical doctor going to the mat hat to fill this sheet, including the national team doctors

1. please note the gender and the code* of the athlete on the top of the sheet
2. in case of small skin scratches, small nose bleedings, small nail lesions, ... only circle B Minor Injury and go to the Event line. Only fill the Diagnosis line in case of need.
3. in case of injury, please circle one number in front of the adequate item in each box, go to the Event line and to the Diagnosis line

Many thanks for your collaboration

Figure 1. Injury report form used for the data collection [24].

The purpose and the design of the study were explained to the coaches and physicians of all the participating teams. After consent was obtained, the coaches and physicians informed the athletes. The participation of the athletes was voluntary, and all signed a written informed consent. All athletes participating in the index tournaments were included in the study. To be included in the study, athletes had to carry out at least one fight in the tournament.

Sixteen World Championships (6 men and 10 women) from 2010 to 2012 and nine European Championships including men and women (3 cadets, 2 juniors, 2 seniors and 2 veterans) from 2010 to 2012 were followed prospectively.

In the period from 2010 to 2012, six Male World Championships (1,438 athletes) and ten Women World Championships (1,970 athletes) were held. In addition, nine European Championships were followed: three cadets tournaments (705 boys and 522 girls), two junior tournaments (466 men and 332 women), two senior tournaments (439 men and 282 women) and two veteran tournaments (1,006 men and 108 women).

Injury collection

In each tournament, the Mat Side physicians took care of injured athletes, and compiled injury reports during the competition. When indicated, the player was referred to the designated local hospital, as per Local Organizing Committee recommendation, for further management, including imaging studies and/ or injection and/or surgery.

For each injury, the form included: anatomical location and type of injury, tissue involved, ability of the player to continue the fight, where the examination was performed (on or out of the competition mat), and whether the player was transported to the local hospital (Figure 1). At the end of the competition, reports were submitted by e-mail or fax to the research centre. At the research centre, injuries were recorded by one experienced specialist in orthopaedic sports medicine and one orthopaedic trainee.

Statistical analysis

All statistical analyses were performed with SPSS for Mac, version 19.0. Pearson's Chi-squared test 'exact' based on Monte Carlo simulation was used to compare the incidence of injury in different tournaments, and to evaluate differences between men and women. The injury rate was

calculated as follows: [(number of events during a specified period)/(total athlete-exposures at risk during a specified period)] × 1000. Athlete-exposure (AE) was calculated as the number of athletes participating in the index tournament where they are exposed to the risk of developing an injury. A $p < 0.05$ was considered significant.

RESULTS

The injury data per injury type and tournament type are presented in no statistically significant differences were found between men and women during the World Championships in terms of injury incidence (5% vs 6% respectively, $p = 0.75$) and injury rates (Table 1). During the European tournaments (cadet, junior, senior and veterans) no statistically significant differences were found between men and women in terms of overall incidence of injuries and injury rates. Table 2. The raw data are presented in supplementary tables S1 to S7 (online).

During the World Championships, athletes were able to continue the fight in 86% and 80% of instances in males and women respectively ($p = 0.25$), and only in 3% and 4% of cases ($p = 0.7$), respectively, the injured player required evacuation to hospital (Table S6). The number of athletes evacuated to hospital was slightly higher during the European Tournaments than during the World Championships, with 17% and 13% respectively for male and female cadets, 10% and 9% respectively for male and female juniors, 17% and 14% respectively for male and female seniors, and 5% and 7% respectively for male and female veterans (Table S7). Male and female juniors had most trouble continuing the fight (only 61% and 32%, respectively). Bleeding was the most frequent type of injury in both genders at all tournaments (Tables 1 and 2). There was no significant difference between men and women in the types of injuries incurred.

The comparison between World and European tournaments showed no statistically significant difference in terms of overall incidence of injuries (6% vs 8% respectively, $p = 0.57$). The comparison of the different categories of European tournaments showed no statistically significant difference in terms of overall incidence of injuries between cadet, junior and senior tournaments (4% vs 6% vs 6% respectively, $p = 0.51$ and $p = 1.000$). In contrast, the overall incidence of

Table 1. Injury rates per type and tournament.

Tournament	Type of Injury	Injury Rate Per 1000 Ae	Athlete Exposure
Men World Cup 2010-2012	other	13.2	1,438
	bleeding	38.2	1,438
Women World Cup 2010-2012	other	20.3	1,970
	bleeding	39.6	1,970
Males European Cadets Tournaments 2010-2012	other	17.0	705
	bleeding	27.0	705
Females European Cadets Tournaments 2010-2012	other	13.4	522
	bleeding	15.3	522
Males European Junior Tournaments from 2010-2012	other	30.0	466
	bleeding	30.0	466
Females European Junior Tournaments from 2010-2012	other	45.2	332
	bleeding	21.1	332
Males European Senior Tournaments 2010-2012	other	22.8	439
	bleeding	45.6	439
Females European Senior Tournaments 2010-2012	other	17.7	282
	bleeding	31.9	282
Males European Veteran Tournaments 2010-2012	other	98.4	1,006
	bleeding	74.6	1,006
Females European Veteran Tournaments 2010-2012	other	83.3	108
	bleeding	46.3	108

* [(Number of events per type of injury during a specified period)/(athlete exposures during a specified period) * 1,000].

** Other type of injuries except bleeding refers to Fracture, Sprain, Dislocation, Contusion, Commotion, Contact lens, Bandage & Strangulation.

Table 2. Type of injuries in Men and Women World and European Championships. The absolute numbers and (percentages) of injuries are given.

Tournament type	Gender & p value	Type of injury									Total
		Fracture	Sprain	Dislocation	Contusion	Commotio	Bleeding	Contact lens	Bandage	Strangulation	
World Championships	Male		7 (9.5)	2 (2.7)	5 (6.8)	0 (0)	55 (74.3)	1 (1.4)	3 (4.1)	1 (1.4)	74 (100)
	Female		19 (16.1)	4 (3.4)	10 (8.5)	0 (0)	78 (66.1)	0 (0)	0 (0)	7 (5.9)	118 (100)
	p value		0.26	0.7	0.78		0.69	0.31	0.04*	0.04*	0.75
Cadet	Male	2 (6.5)	2 (6.5)	0 (0)	7 (22.6)	0 (0)	19 (61.3)	0 (0)	0 (0)	1 (3.2)	31 (100)
	Female	0 (0)	2 (13.3)	2 (13.3)	1 (6.7)	0 (0)	8 (53.3)	0 (0)	0 (0)	2 (13.3)	15 (100)
	p value	0.01*	0.09	0.0002***	0.0002***		0.19			0.04*	0.71
Junior	Male		5 (17.9)	2 (7.1)	6 (21.4)	1 (3.6)	14 (50)	0 (0)	0 (0)	0 (0)	28 (100)
	Female		10 (45.5)	2 (9.1)	1 (4.5)	0 (0)	7 (31.8)	0 (0)	0 (0)	2 (9.1)	22 (100)
	p value		0.001***	0.6	0.001***	0.04*	0.009**			0.002**	0.77
Senior	Male	1 (3.3)	5 (16.7)	3 (10)	1 (3.3)	0 (0)	20 (66.7)	0 (0)	0 (0)	0 (0)	30 (100)
	Female	0 (0)	2 (14.3)	0 (0)	1 (7.1)	0 (0)	9 (64.3)	0 (0)	2 (14.3)	0 (0)	14 (100)
	p value	0.08	0.55	0.001***	0.19		0.76		0.001***		0.55
Veteran	Male	7 (4)	42 (24.1)	5 (2.9)	44 (25.3)	0 (0)	75 (43.1)	1 (0.6)	0 (0)	0 (0)	174 (100)
	Female	0 (0)	3 (21.4)	0 (0)	6 (42.9)	0 (0)	5 (35.7)	0 (0)	0 (0)	0 (0)	14 (100)
	p value	0.04*	0.61	0.08	0.007**		0.31	0.31			0.42

*p<0.05; ** p<0.01; ***p<0.01

injuries was significantly higher in the veteran tournaments compared to the other European tournaments (17% vs 4%, $p = 0.002$; 17% vs 6%, $p = 0.01$). At almost all tournaments the number of bleeding events exceeded the number of all other injuries, except at the European Veteran Tournaments and Women Junior European Tournament (Table 2). The percent incident rate in relation to the total athlete exposures was 3.82% for bleeding and only 1.32% for all other injuries in Men World Championships 2010-2012 (Table 1 and Table 2).

DISCUSSION

This study shows no statistically significant difference in terms of overall incidence of injuries between World and European tournaments. Moreover, among the different categories of European tournaments, a similar overall injury incidence was found in cadet, junior and senior tournaments. In contrast, veteran tournaments showed a significantly higher injury incidence. Finally, no statistically significant difference was found between men and women in terms of overall incidence of injuries in both World and European competitions.

Several studies investigated the epidemiology of injury in martial arts. The total injury rates for elite men taekwondo player range from 21 to 139 per 1,000 AE, and from 25 to 105 per 1,000 AE for elite women [25]. Children under 10 years have a significantly lower overall injury rate compared with older age athletes [15]. Compared with studies on other martial arts [12, 14, 15, 25], our findings showed that judo is safer than, for example, taekwondo and karate.

Nose bleeding, excoriations and wound injury rates per 1,000 AE were significantly higher when compared with all other injury and present the biggest proportion of all injuries (Table 2). Nose bleeds and excoriations require medical assistance on the mat, the reason why they had classified them as a separate category.

The major strength of the study is that 16 World Championships and nine European Championships were followed prospectively over a period of three consecutive years, allowing us to include a large sample of athletes in the study. Furthermore, the Mat Side physicians of each tournament examined each injured athlete and immediately compiled the injury reports. This optimized procedure for data

collection and provided accurate reporting and a comprehensive picture of the injury pattern during international judo athletes. To our knowledge, this is the first epidemiologic study on judo injuries during international tournaments, with separate data for men and women.

In the latest review of works dedicated to judo recommendations for people with intellectual disabilities, the authors focus solely on the health benefits of judo training. Fair tables issues that require attention to the risk of damage in judo practice [26, 27]. Thus, the aviation response is to focus on modern methods of teaching safe falls [28].

LIMITATIONS

The data were collected during a relatively long period of time. We acknowledge that there is a missing information as far as concerns the data on the outcome of these injuries, their management and the final diagnosis. Another limitation of the study is that we were not able to collect data on individual exposure and injuries during training. Thus, our data refer only to injuries sustained during competition. Moreover, we did not record overuse injuries that caused no symptoms during the tournament. Another major limitation is that the report was performed by the field physician without any consultation with the team physician: therefore, we were not able to follow up on the injuries and cannot provide any data on return to sport or the severity of the injury in terms of time loss. Further studies should be conducted on individual exposure and injuries during both training and competitions, providing a more complete picture of the type and mechanism of injuries. Moreover, overuse injuries should be taken into account as well, because they can also affect the performance of athletes during competitions. The improvement of knowledge on injuries in judo can lead to develop effective training programs and/or changes rules to reduce the risk of injuries

CONCLUSIONS

International judo competitions are associated with low overall injury incidence. Injury incidence and characteristics do not differ between European and World Championships, and between men and women. However, in European tournaments the risk of injury is greater and statistically

significant in the veterans judo athletes group. Therefore, it is necessary to modify the regulations in this rival group.

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