



Profile of injury in Iranian elite Taekwondo athletes

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Article Info	Abstract
<p>Original Article</p> <p>Article history: Received: 20 July 2021 Revised: 10 August 2021 Accepted: 01 October 2021 Published online: 01 December 2021</p> <p>Keywords: elite, injury, prevention program, sport injury, Taekwondo.</p>	<p>Background: Taekwondo is a traditional Iranian martial art currently practiced in over 206 countries around the world.</p> <p>Aim: The present study aims to provide fundamental information on injuries in Iranian elite Taekwondo athletes.</p> <p>Materials and Methods: A total of 200 Iran Taekwondo national team athletes (means±standard deviations: Age: 28.8±10.7 years, Height: 175.7±9.2 cm, Weight: 69±14.7 kg) participated in this retrospective study. The data was collected based on the injury surveillance system during 2021. The questionnaire included personal information and Taekwondo-related injuries information. Data was illustrated using descriptive methods and was analyzed using the Chi-Square test ($P<0.05$).</p> <p>Results: The overall injury occurred during training was more than competition ($P<0.05$). The occurrence of acute injury was higher than chronic ($P<0.05$), and the most prevalent types of injuries were strain, rupture, and muscle spasm. The number of injuries that occurred in the lower extremity was higher than in other parts ($P<0.05$), and the knee was the most vulnerable joint ($P<0.05$). The most important cause of injuries was fatigue ($P<0.05$). The non-contact injury was the most significant injury mechanism ($P<0.05$). The severity of injury in Iranian elite Taekwondo athletes was high ($P<0.05$).</p> <p>Conclusion: It can be concluded that injuries during training were more than competition, acute injury was more than chronic, strain was the most common type of injury, and the most vulnerable joint was the knee. Fatigue was the leading cause of injuries in elite Taekwondo athletes. So, in designing an injury prevention program, these factors should be considered.</p>

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1. Introduction

Participation in physical activity and sport, as well as having a healthy lifestyle, are essential for individuals across various societies and age demographics [1]. Participating in physical activity has been shown to have a multitude of health benefits [1, 2]. However, it should also be noted that engaging in competitive sports such as martial arts may increase the risk of injury [3, 4].

Taekwondo is a globally popular martial art known for its high-contact nature that demands agility, swift adaptation, and fast movement direction. Consequently, the types of injuries arising from Taekwondo tend to vary greatly [4, 5]. Epidemiological studies have reported a significant occurrence of injuries among Taekwondo athletes during competitions [6]. The injury rate in Taekwondo appears to be higher than that of Karate [5].

Since injury rates are influenced by various factors, including age, sex, and type of event, it is recommended that epidemiological studies be conducted to collect data that can effectively inform strategies for preventing future injuries [7]. The identification of Taekwondo injuries information such as injured anatomical sites, injury types, causes, and mechanisms of injury; as well as the severity of injuries is deemed imperative.

The results of Taekwondo studies indicated that designing an injury prevention program in Taekwondo can be effective in many aspects [4, 8]. According to recent research conducted in Sri Lanka, the incidence of injuries in Taekwondo was found to be higher than in other countries. Consequently, it has been recommended that a comprehensive injury prevention program aimed at referees and players be developed and implemented to effectively

mitigate the high rate of injuries in this sport [9].

The results of a recent investigation into the world junior championship definitively revealed that the foot and toes, as well as the face and upper limbs, were identified as susceptible anatomical regions to injury among participants in this age group. The most common types of injuries observed were contusions, sprains, lacerations, and fractures. Furthermore, player-to-player contact was found to be the prevailing mechanism of injury in this particular context [10].

A study conducted on elite Korean Taekwondo athletes found that the foot and ankle were the most commonly affected anatomical sites of injury. In terms of the mechanism of injury, sprain and contact with other athletes were found to be the predominant causes [11].

The implementation of an injury prevention program aimed at reducing sports injuries has been deemed essential [12]. Such a program can be developed by identifying the type, mechanism, and causes of injuries. While there have been documented epidemiological studies on Taekwondo injuries conducted globally [4], reliable information regarding the injury profile of Iranian elite Taekwondo athletes remains scarce. In this study, we aimed to provide fundamental information on injuries in Iranian elite Taekwondo athletes.

2. Materials and Methods

2.1. Participation

A total of 200 Iranian elite Taekwondo athletes (means \pm standard deviations: Age: 28.8 ± 10.7 years, Height: 175.7 ± 9.2 cm, Weight: 69 ± 14.7 kg) voluntarily participated in this study. All participants provided written informed consent in compliance with Isfahan University the

ethics identification number is IR.UI.REC.1400.108.

2.2. Study procedure

From January to December 2021, the injury surveillance system [13] was used to extract epidemiological data for all athletes. They recorded the necessary items, and data was collected.

2.3. Instrument

Information regarding athletic injuries during the year 2021 was gathered using an injury report form sourced from the Injury Surveillance System (ISS) [13]. Notably, the aforementioned form was also employed in a previous study conducted in Korea [11].

The questionnaire comprised two parts, one about general information, including personal information such as age, height, weight, history, and years of experience; and second part was about training and competition information related to Taekwondo, and also when and where the injury occurred, type of injury, site of the injury, sports-specific items, injury mechanism, and time loss due to the injury.

The injury was defined as any sports complaint that occurred in a competition or training, required medical attention, and causes the player to lose the opportunity to participate in training or competition. The causes of injury include internal and

external risk factors. Moreover, they are a part of the variable factors and conditions before causing injury that might be put together to provide a sufficient reason for causing injury [2].

The severity or time loss injury refers to the number of days in which athletes had lost the opportunity to participate in training or competition due to injury. Severity was reported as minor (1–7 days), which was subdivided into slight (0 days), minimal (1–3 days), mild (4–7 days), moderately severe (8–28 days), and serious (>28 days) [14].

2.4. Statistical analysis

Data was illustrated using descriptive methods and was analyzed using the Chi-Square test ($P < 0.05$). The SPSS version 20 was used.

3. Results

3.1. Injury during training and competition

In Iranian elite Taekwondo athletes, the overall injuries that occurred during training (72.1%) were more than in competition (27.9%), and a significant difference was observed ($\chi^2 = 74.57$, $P = 0.00$), so the incidence of injury in training was about 28% higher than in competition. Moreover, the most frequent round in which injuries occurred was the second round in the competition (59.8%), and this difference was statistically significant ($\chi^2 = 39.94$, $P = 0.00$; Table 1).

Table 1. Injuries during training and competition and in different rounds of competition

	N	%	IRC	N	%
Training injuries	276	72.1	-	-	-
Competition injuries	107	27.9	Round 1	11	10.3
			Round 2	64	59.8
			Round 3	32	29.9
Total	383	100	Total	107	100

N: number; IRC: injuries in different rounds of competition

3.2. Injury location

According to this study, there was a significant difference in anatomical sites of injuries in elite Taekwondo athletes, which were statistically significant ($\chi^2= 427.97, P=0.00$). So, the incidence of injuries in the lower extremity (69.2%) was more than in other parts of the body. Also, the highest number of injuries occurred in the knee (27.2%), followed by the foot and ankle (14.4%) and groin (12.9%) in the lower extremity (Table 2), which was statistically significant ($\chi^2= 129.48, P=0.00$).

Table 2. Anatomical sites of injuries

Anatomical sites		N	%
Head and neck		9	2.3
Trunk		28	7.3
Upper extremity	Hand and wrist	30	7.8
	Fingers	7	1.8
	Forehand	9	2.3
	Elbow	13	3.4
	Arm	7	1.8
	Shoulder	15	3.9
Lower extremity	Pelvic	24	6.3
	Groin	49	12.9
	Knee	104	27.2
	Shin	22	5.7
	Foot and ankle	55	14.4
	Toes	11	2.9
Total		383	100

N: number

Moreover, the highest number of injuries in the upper extremity occurred in the hand and wrist, the difference was statistically significant ($\chi^2= 28.11, P=0.00$).

3.3. Injury type

According to this study, the number of acute injuries (N= 236, 61.6%) in Iranian elite Taekwondo athletes was about 23% higher than the chronic injuries (N= 147, 38.4%). Also, this difference was statistically significant ($\chi^2= 26.68, P=0.00$). This study also showed that the most common type of

injury was strain (15.4%), followed by rupture (12.5 %) and muscle spasm (9.9 %). Also, the difference was statistically significant ($\chi^2= 200.28, P=0.00$), so the strain occurrence was higher than other injuries (Table 3).

Table 3. Types of injuries

Types of injury	N	%
Strain	59	15.4
Rupture	48	12.5
Muscle spasm	38	9.9
Ligament ailment	37	9.8
Dislocation	36	9.4
Contusion	31	8.1
Fracture	26	6.8
Joint sinusitis	21	5.6
Sprain	18	4.7
Abrasion	18	4.7
Cartilage damage	15	3.9
Disc injury	12	3.1
exhaustion	10	2.6
Nerve injury	4	1
Capsulitis	4	1
Concussion grade1	4	1
Concussion grade 2	2	0.5
Total	383	100

N: number

3.4. Injury mechanism

According to the results, the most critical injury mechanism in Iranian elite Taekwondo athletes was non-contact (Table 4). Also, the difference was statistically significant ($\chi^2=7.89, P=0.005$), so the incidence of non-contact injuries was about 55% more than player-contact injuries.

Table 4. Mechanisms of injuries

Mechanism of injury	N	%
Contact	164	42.8
Non-contact	219	57.2
Total	383	100

N: number

3.5. Causes of injury

Based on the information provided in Table 5 which includes declarations made by athletes, fatigue (22.1%), falling (15.8%),

and overuse (15.1%) were the most significant causes of injury among elite Taekwondo athletes in Iran. The difference was statistically significant ($\chi^2= 117.03$, $P=0.00$). So, fatigue was the most important cause of injury.

Table 5. Causes of injuries

Causes of injury	N	%
Fatigue	73	22.1
Poor physical fitness	19	5.8
Overuse	50	15.1
Defense	34	10.3
Avoidance of exiting	3	0.9
Falling	52	15.8
Previous injury	24	7.3
Incorrect technique	14	4.2
Rival fault technique	36	4.2
Insufficient psychological preparation	25	7.6
Total	383	100

N: number

3.6. Injury severity

It was observed that the majority of injuries among Iranian elite Taekwondo athletes were severe (52.2%), they lost the opportunity to participate in training and competition for more than 28 days (Table 6). Also, this difference was statistically significant ($\chi^2= 289.54$, $P=0.00$).

Table 6. Severity of injuries

Severity of injury	N	%
0 day	30	7.8
1-3 days	14	3.7
4-7 days	50	13.1
8-28 days	89	23.2
More than 28 days	200	52.2
Total	383	100

N: number

4. Discussion

The aim of present study was to provide fundamental information on injuries in Iranian elite Taekwondo athletes. Various studies have been conducted concerning Taekwondo injuries in different countries.

Considering that the popularity of Taekwondo in Iran is increasing and Iran's national Taekwondo team is one of the world champions' teams, comprehensive information about the injuries of Iranian elite Taekwondo athletes was not available. As Iran's national Taekwondo team continues to achieve world champion status, it is increasingly important to understand the specific injuries that plague these elite athletes.

4.1. Injury in competition and training

This study revealed that among the reported injuries, the number of injuries that occurred during training was more than during competition. According to previous studies, some of the risks caused by training in martial arts can be prevented [15]. Also, injuries that occur in competitions can negatively impact Taekwondo athletes participating in training or competition [16]. The results were consistent with Lystad et al. (2015) according to which the number of injuries in training was higher than in competition [17]. Regarding the injury in the rounds of the competition, the same results were obtained in this study as in the previous study [18], and most of the injuries occurred in the second round of competition.

4.1.1. Injury location

In this study, the most common place injury location was the lower extremity. Investigating the location of injury in the anatomical sites of the body in Taekwondo is necessary to decide how to prevent unexpected injuries [16]. In previous studies including elite Taekwondo athletes, data on the distribution of injuries by anatomical site of injury exhibited a similar trend [9, 16]. Also, the anatomical sites with the most injury incidence were the knee, foot and ankle, and groin.

Jeong et al. (2021) reported that most injuries among athletes were in the lower limbs, the feet, and the toes [10]. The foot and ankle were the most prone to injury in Korean Taekwondo athletes [11], and also the knee, foot and ankle, and thigh were the main anatomical sites of injury in Spanish Taekwondo athletes [4]. In the past, most Taekwondo points were due to more powerful and efficient kicks. However, after changing in the rules in the Rio Olympics, the accuracy of the kick is more important than the force power of the kick for high scores because it is necessary to touch the electronic sensor accurately. Nevertheless, scoring points through foot kicks is still more than performing hand kicks (e.g., punch); it is also possible to perform foot kicks simultaneously by two players in the competition.

4.1.2. Injury type

In this study, regarding the types of injuries reported, like in the previous study [19], acute injuries were more than chronic injuries. Likewise, the most important type of injury in Iranian elite Taekwondo athletes was strain, followed by rupture and muscle spasm [8, 10-16]. Also, according to the Colorado Classification criteria [20], 1% of the athletes had a first-degree concussion. Only 0.5% of them had a second-degree concussion. In this case, Pate et al. (1995) documented that the most common type of injury was concussion [21]. The disparities observed between the present study and Pate et al.'s research could be attributed to changes in Taekwondo regulations, along with the adoption of alternative protective gear such as helmets and electronic shock absorbers to reduce injuries among Taekwondo players. The equipment that were not available during

the period of Pate et al.'s investigation.

4.1.3. Injury mechanism

Given that Taekwondo is a combative sport, it is reasonable to presume that the mechanism of injuries to Taekwondo athletes results from player contact. The present study showed that non-contact injuries were more than contact injuries in elite Taekwondo athletes. Still, in previous studies, injuries have been classified as contact ones [8, 11, 22]. The observed dissimilarity in the mechanism of injury may be attributed to a higher incidence of injuries during training as compared to competition. Additionally, certain aspects of Sparring training involve solo training. These factors collectively may suggest a plausible justification for the discrepancy identified in the study.

4.1.4. Injury causes

Acquiring an understanding of the factors that contribute to injury, encompassing both internal and external risk factors as well as driving factors, is imperative for devising efficacious preventative measures in the context of sports injuries [2]. In the present study, the most important cause of injury was fatigue. As a general definition, fatigue represents the inability of the muscle to produce force, which will happen and can lead to a decrease in strength and injury. Also, fatigue can affect the torque and reduce it, ultimately leading to a reduction in performance. Excessive fatigue affects decision-making and causes the player to make wrong decisions and mistakes [23]. Jeong and Chun (2022) also stated that the most important cause of injury is overuse and chronic fatigue [24].

4.1.5. Injury severity

According to the findings of the current research, the majority of injuries

experienced by elite Taekwondo athletes were categorized as severe, resulting in their inability to partake in training and competition for a period exceeding 28 days [22]. In elite Korean Taekwondo athletes, the injury severity in the adult age category was higher than in other categories [9].

5. Conclusions

It can be concluded that injuries during training were more than competition, acute injury was more than chronic, strain was the most common type of injury, and the most vulnerable joint was the knee. Fatigue was the leading cause of injuries in elite Taekwondo athletes. Therefore, it is that the aforementioned research results while designing injury prevention programs for this population, in order to mitigate the risk factors that lead to injuries and reduce their incidence. Additionally, future research should investigate the severity of injuries across various age groups and utilize these findings to prevent the occurrence of injuries.

Conflict of interest

The authors declared no conflicts of interest.

Authors' contributions

All authors contributed to the original idea, study design.

Ethical considerations

The authors have completely considered ethical issues, including informed consent, plagiarism, data fabrication, misconduct, and/or falsification, double publication and/or redundancy, submission, etc. The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Review Board (or Ethics Committee) of University of Isfahan (protocol code IR.UI.REC.1400.108 and

1400/11/10

Data availability

The dataset generated and analyzed during the current study is available from the corresponding author on reasonable request.

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