

Sport injuries of Karatekas at international competitions

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Abstract

Aims: Recognition of common sport related injuries and their causing factors is one of the ways of injury prevention. The goal of this study was to investigate the incidence, type and mechanism of injuries among the participants of International Unity & Friendship Karate Cup.

Methods: This descriptive survey was carried out in 2009. The statistical population was 165 male karatekas who participated in the 9th International Unity & Friendship Karate Cup and were selected by census method. Data were collected by injury report forms and weight of the athlete, the intensity of the injury, the injury site and the type, time and mechanism of injury were recorded. Descriptive statistical methods and SPSS 16 software were used for data analysis.

Results: 75 injuries were recorded, with the mean incidence of 0.32 injuries per match. 80% of injuries were minor, 17.3% moderate and 2.7% were severe. The injuries were most commonly located in the head and face (49.3%). The injuries consisted primarily of muscle contusion (60%) and hemorrhage (21.3%). 24% of injuries took place at the first minute of the competition, 37.3% of injuries in the second minute, 17.3% in third minute and 21.3% out of the competition time.

Conclusion: The majority of injuries are minor in Karate and severe injuries are uncommon. The injuries consisted primarily of muscle contusion. Most of injuries occur during the second minute of competition and injuries are most commonly located in head and face.

Keywords: Karate, Competition, Sport Injury

Introduction

In word, Karate means empty hand but in term, it's a fight without using martial art equipment against an opponent. This sport has different styles which are divided into controlling styles including shuto-kan, shito-rio, wada-rio, gojo-rio, and half controlling style kio-kushin. In controlling style, punches and kicks should be performed in suitable interval (without hurting the opponent) or stopped before hitting with opponent body. The techniques will have score which performed perfectly on head and body, but penalty is considered for uncontrolled hits [1]. This sport is very common in Iran, and Iran is one of the renowned countries in this field worldwide. Nevertheless, we had few studies related to spread, type, and mechanism of this sport in Iran. According to all of the advantages of harmonic physical activity, it's an undeniable fact to have damaging especially in the competitive or championship sports. Many things can increase the damaging rates and cause irreversible loss. Among the ways for prevention of damaging is recognition of the widespread damaging in sport and also risk factors which cause injuries. Therefore, researchers try to study the prevalence and severity of injuries in different sports, and finally could present the preventive reasons [2].

We have different reports about the prevalence of damaging in Karate. *Tuominen* reported the prevalence of damaging in Finn Karate to be 0.28%. *Critchlie* et al. studied damaging rate among the players of shuto-kan style in three periods of the English national challenges and reported that every athlete has encountered with 0.13% damaging (0.09 hurt per challenge or one injury in every 11 challenge). *Arriaza* and *Leyes* stated that in three periods of worlds Karate challenges; 0.31% damaging has occurred per challenge or 157.03 injuries per 1000 athletes [5]. *Macan* et al. reported the prevalence of the injuries of two courses of championship challenges in 1997 and 2002 at Croatia to be 10.28 and 9.82, respectively, per 100 minutes [6]. *Pieter* also reported the prevalence of the injuries to be 11.32 hurts per 1000 athletes in men and 2.44 hurts per 1000 in women [7]. *Daneshjoo* et al. also reported 57.5 hurts per 100 athletes in shuto-kan women professional players in Iran league [8]. Hereof, *Rahimi* et al. stated the prevalence of the injuries among the professional karate players in Isfahan to be 4.35 injuries per 1000 hours practices and challenges [9]. *Destombe* et al. in their study on the severity of the injuries among the French karate players stated that 68.7% of hurts had been mild, 20.5% severe, 8.4% moderate, and 2.4% too severe [10]. In their study, *Daneshjoo* et al.

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reported that the mild hurt was 23.7%, moderate hurt was 33.5%, severe hurt was 11.9%, and too severe was 30.9% [8]. *Rahimi* et al. also reported 43% of hurts to be mild, 27% to be moderate, and 30% to be severe, [9] and in the *Arriaza* and *Leyes* study, 89.3% of hurts were mild, 7.9% were moderate, and 2.8% were severe [5].

Critchley et al. reported head and neck with 57% were the most prevalent damaging sites, then, lower limb with 23%, upper limb with 14%, and body with 6% were the areas which were subjected to the injury [4]. *Destombe* et al.' in their study found that out of all of the injuries induced, 35% have occurred in lower limb, 28.9% in upper limb, 26.5% in head, and 9.6% in body [10]. *Daneshjoo* et al. showed that most of the injuries were in the lower parts of the body (42.8%) and other injuries were reported in head and neck with 23.3%, and in upper parts of the body reported to be 33.9% [8]. Likewise, in the study of *Halabchi* et al. the prevalence of the injuries in head and neck were found to be 55.4%, 21% in lower limb, 12.9% in upper limb, and 10.7% in body [1]. Furthermore, *Rahimi* et al. during their research found that the prevalence of the injuries in lower limb were 35%, 32% in head and neck, 23% in upper limb, and 10% in body and inner organs [9].

In the *Arriaza* and *Leyese's* study it was discovered that most common type of the injuries were contusion (50.3%) and nose hemorrhage (16.2%) [5]. The *Destombe* et al.' study showed that the most common injury was contusion (52%) for karate players [10]. *Halabchi* et al. reported that the occurrence rate of strain injury and contusion with 43.6% to be the most common injuries and the other main injury was nose hemorrhage with 26.3% [1]. In *Daneshjoo* et al. study, the most common type of injury was bruising (31.3%), then dislocation (11.9%) and strain (10.6%) [8]. *Rahimi* et al.'s study also showed that bruise (25%), then strain and dehiscence (13.5%) were the most common injuries [9].

In the *Arriaza* and *Leyese's* research on the injury causing mechanism, out of all injuries occurred, 82.7% of injuries had been caused by hand and 7.3% by feet, and other injuries had been occurred by other mechanisms. Moreover, in this study the most injuries had been occurred in the weight of -60Kg [6]. In the other study by *Arriaza* and *Leyes*, it was specified that 67% of injuries had been occurred by hand, 16% of injuries by feet, 10% of injuries by pulling feet and fall down, and other mechanisms had caused injuries [11].

With regard to the daily increasing of the sport participation especially in championship, athletes'

health is much more considered. Moreover, considering the high treatment costs for many of the athletic injuries and also irrecoverable injuries that may be caused by harm to the athletes, coaches, and even people, athletics' researchers and custodian have focused on recognizing type, intensity, mechanism, and common injuries in different athletic fields in order to offer some ways and guidance to decrease and prevention of injury outbreak [2].

So this research's aim is investigating the prevalence rate, intensity, type, and the mechanism of sport hurts in Karate players participating in the ninth international champion challenges of unity and friendship cup.

Methods

The present study is a descriptive-survey research which was done in 2009. Statistical population of the research included 165 professional men karate players who took part in the ninth international champion challenges of unity and friendship cup from 22 countries in 235 kata (exhibitory) and kumite (fighting) challenges (45 kata matches and 190 kumite matches) which is held in Tehran. These participants were included in the study using census method.

Data collection was done using injury recording form. Such information as athletes' weight, injuries' severity, injury location, injury type, injury time, during the competition and the injury mechanism were recorded. Competition medic completed all of the information and descriptive statistic was used for data analysis. Competition medic used physical examination of each part of the body for the injury specific diagnosis and considering the damaging type and previous damaging history, and if necessary through x-ray recognized the injury type and intensity of injury, and of course the improvement and treatment time of injured athletes became determined. According to the Worldwide Karate Federation (WKF) injury intensity classification, injuries are categorized into three groups namely, mild, moderate, and severe (Table 1) [5, 11].

Results

Totally, 75 injuries occurred in 235 competitions, which averagely equaled to 0.32 injuries per competition (45.4 injuries per 100 athletes). 80% of the injuries were mild and 17.3% were moderate. About three cases of athletes (2.7%) were suffering from severe injuries (a fracture case and two dislocation cases) in such a way that they couldn't

continue the competition that one of them was sent to the hospital.

Moreover, most of the injuries also occurred in head and face (49.3%). Injuries level were 25.3% in lower limb, 16% in upper limb, and 9.3% in body. Most of

injury type was contusion (60%), after that hemorrhage (21.3%), and muscular hematoma (8%), rupturing, straining, and dislocation injuries were each occurred at 2.7% rate. A lower arm fracture case and torsion (1.3%) were reported in these competitions.

Table 1- Classification of injuries intensity by Worldwide Karate Federation (WKF)

Injury Intensity	Injuries type
Severe	Third-degree traumatic brain injury (including losing of consciousness)
	Fractures which are including joint involvement or reduction of joint opening or inner spin
	Third-degree sprain or any other joint injury which need surgery or cause inability due to illness
	Joint dislocation which cause reduced joint movement
	Inner viscera injuries (injury to lung, heart, and severe abdominal pains)
	Face rupturing with its consequences on beauty and organs' function
	Eyes injury which probably lead in sight reduction
	Any injury which need surgery or hospitalization
	Second-degree traumatic brain injury (including reduced consciousness or gradual reduction of memory)
	Teeth harm without teeth reduction or their procedure renewal
Moderate	Cornea erosion
	Fracturing clavicle, nose, fingers, palm, sole
	The dehiscence which needs stitch
	Joint dislocation with lesser displacement
	Bruise, sprain, hemorrhage which prevents using that organ in the competition
Mild	First-degree traumatic brain injury (athlete becomes little confused, but recovers his/her consciousness within a few minute)
	Retina bruise
	Nose hemorrhage without fracture
	All other injuries which is not included in the list and don't necessitate leaving the competition or medical care

Each competition was divided into three categories: first minute, second minute, and third minute. 18 injuries (24%) were recorded in first minute, 28 injuries (37.3%) in second minute and 13 injuries (17.3%) in third minutes. In 16 cases (21.3%), athletes went to physician and tell him about their injuries. In addition, there was no report regarding injuries in the challenges which had extra time (forth minutes).

Table 2- the prevalence of injury rate in different weights in each challenge

Competitive weight (kg)	The occurrence rate of injury
-60	0.68
-65	0.71
-70	0.5
-75	0.47
-80	0.5
+80	0.2

In terms of the injuries mechanism, hand hits (58.7%) caused higher injuries compared to feet hits (24%). Other injuries (17.34%) were caused by other mechanism such as falling down or imbalance.

Most injuries occurred in -65Kg and then -60Kg (Table 2). Likewise, comparing the injury rate in team and individual challenges, injury rate in the team challenges (0.17 injury per challenge) were less than individual challenges (0.52 injuries per challenge).

Discussion

In this research, the prevalence of the injury was recorded as 0.32 in each competition equal to 45.4 injuries per 100 athletes. *Touminen* et al. and *Arriaza* et al. also reported the same prevalence rate [3, 5]. But *Halabchi* et al. and *Critchley* et al. reported the lower prevalence rate [1, 4]. Among the reasons for less prevalence rate of injury in Halabchi and *Critchley's* research the participants' differences (*Halabchi* et al. studied about women and *Critchley* et al. studied about children) and challenges' level can be mentioned. In the present research, it was shown that mild injuries with 80% damaging rates had been the most common injuries and the severe injury rate had been 2.7%. These results are consistent with other research results which have reported the mild injuries more prevalent than the other injuries [1, 5, 10]. The variation in the injuries severity report in above research can be attributed to the classification criteria and different definition of the injury severity in each research. In the present research, WKF classification criteria were employed for the injury classification, while privation period from exercises and challenges due to the injury had been the classification criteria in some researches. Moreover, in some studies, the severity of the injury has been divided into the three

categories (mild, moderate, severe) or four categories (mild, moderate, severe, and too severe). Thus the comparison of the studies is difficult [5, 10]. Anyway it doesn't seem that karate has less safety compared to other sports. *Tenvergert* et al. in their studies in 7 years investigated the prevalence rate of injury in four different sports and revealed that the annual damaging rate has been 59.2% (the maximum rate) in soccer, 16.7% in volleyball, 14.9% in gymnastic and 9.1% (the minimum rate) in martial arts.

In terms of injury site, head and face had the highest proportion of injury (49.3), yet the face and head injuries were less compared to other studies such as *Arriaza* and *Leyes* (84.1%), *Touminen* (97%), *Halabchi* (55.4%) and *Arriaza* (71%). The results of the present study in this field is consistent with *Arriaza* and *Leyes*, *Halabchi*, *Salesi*, and *Critchley* findings that have reported head and face as most vulnerable organs [1, 4, 5, 13]. But these results don't consistent with the *Karren*, *Komaestani* and *Destombe* findings [10, 14, 15]. One of the probable reasons for the reduced injury severity in face and head site can be justified in a way that in this area, the exertion of the techniques should be performed with more control and in the case of severe performance, there's a penalty for the trespasser player. So karate players hit this area more carefully. In this study, the injury of the lower limb (25.3%) is more than *Halabchi*, *Arriaza* and *Leyes*, *Johannsen* and *Norregaard* study which reported the injury rate of the lower limb to be 21%, 6.4%, and 4% respectively [1, 5, 16]. Changing in scoring law which leads in the increased feet hits' scores and as a result increased use of feet techniques compared with the past, could be considered as the reason for this issue. Feet injury mostly happens in the case of leg or feet accident clash with the opponent's elbow or forearm [1]. Of course using the protection for the leg and feet since 2005, has decreased the injury rate of the lower limbs [6]. But for the justification of the increased injury rates in face and head, one can say that while the scoring of the feet techniques is higher, yet their performance dangers is also more and thus the majority of karate players have practiced the hand techniques more (especially at head and face site) and used them in the challenges because they are more safety and maybe this is one reason of the increased damaging rate in the head and face in modern karate compared to other areas.

The results of the present research showed that most injury type is contusion, and then hemorrhage and muscular hematoma had the most prevalence. Rupturing and twisting were the least type of the injuries. These results is consistent with the *Zetaruk* et

al., *Daneshjoo* et al. and *Rahimi* et al. findings that mentioned the most common damaging type as bruise [8, 9, 17]. Likewise, in the *Destombe* et al.'s study, hemorrhage, and in *Critchley*, *Arriaza*, and *Leyes*'s studies, bruises were found to be the most common injury types. In *Halabchi* et al.'s research on the Iranian women's karate player, 44% of injuries had been related to bruise and strain and just 2% were related to the rupturing [1]. In *Salesi* et al.'s study, bruise and muscular hematoma with 72% have been reported to be the most common injuries [13]. In terms of damaged tissue type, *Rahimi* et al. stated that 33% of injuries had been dermal injuries, 26.5% had been muscular, 21.5% had been related to joints, and 20% had been pertinent to bones [9]. So most of the researches indicate that injury rate of the soft and muscular tissues in karate, is more than injuries of the hard and bony tissues. Different definition of the injuries in studies and the lack of the exact and same definition could be one of the reasons for these differences. Among other possible reasons for different report of the damaging rates, one can point to the different styles of karate. *Kujala*'s participants were just limited to the karate players [18], while *Karren* study addressed all martial arts [14]. In the present study and also *Destombe* and *Salesi*'s study, the participants were controlling style karate players. The other possible reason for the increased prevalence of bruise compared to the other injuries can be attributed to the fact that in karate sport, karate player obtains scores by hitting the opponent body and opponent loses score. So in competition, executing and defending of the technique plays an important role in the prevalence of the bruise.

In terms of injury time during the competition, despite the presumption that the injuries are occurring more in the last minutes of competition for such reasons such as maximum pressure, stress, and also exhausting, but most injuries have occurred in second minute and injuries in third minutes are also less than first minute. In the given course of competitions any injuries at fourth minute was not observed and about 21% of athletes went to medics after the end of the competition and told them about their injuries. It is worth mentioning that in the case where two karate players reach draw result in the standard time (3 minutes) in karate competition, they should fight for a minute and the one who achieve more scores in this time is the winner. *Halabchi* et al. in their study the whole competition time was divided into 3 categories: first 30 seconds, middle 60 seconds, and final 30 seconds. This research shows that the 51.6% of injuries have occurred in the middle 60 seconds [1].

In terms of injury mechanism, the results of this research is consistent with *Stricevic* et al. and *Arriaza* and *Leyes* which showed that hand hits cause more injuries compared to feet hits [5, 19]. *Pieter*'s research also showed that dominant injury mechanism in men is isochronal hand hits, while falling down is the main damaging reason in women. Yet this doesn't mean that the hand hits are more dangerous than the feet hits, because hand hits rates are more than feet hits (approximate ratio of 10 to 1) in a karate competition [1, 5].

In this study, the prevalence of injury rate is 0.17 injuries in every competition of team competition and we had 0.52 of injuries in each competition in individual kumite or fight. In *Arriaza* and *Leyes* research, damaging rate has stated in individual competition (0.319) more than team competition (0.304) [5]. In other *Arriaza* et al.' research, the prevalence of injury in individual competition of men was averagely 0.22 while it was 0.16 in team competition [11]. The higher prevalence of injury in individual competition can be justified in a way that if an athlete loses the individual competition, he/she will be excluded from the competition. So he/she do their best. But if a player loses in team competition, it's not resulted in team lose and the other players can compensate his/her defeat.

A standard approach in injury prevention strategies is to use up three factors such as: teaching, engineering, and execution [20]. Regarding teaching factor, behavioral intervention is used in order to prevent the behavior which causes injury. Usually more than half injuries are forced by other players. So the teaching approach should concentrate on the improvement and promotion of the safety exercises between participants in order to decrease the injuries. Hence, it is possible that active protection, which needed players' participation trying to prevent injuries themselves, may play an important role in reduction of injury related to martial arts [20]. Engineering factor also needs environmental changes in order to reduce the number and intensity of injuries through the inactive protection. Inactive protection approaches include some factors which do not necessitate the player active participation in order to prevent injury. For example, using suitable tatami and other protection tools are considered as the inactive protections [20]. Execution factor needs coaches and referees efforts in order to guarantee the safety's practices. Moreover, providing instructions for safety competition and practice can help the injury reduction [20]. Anyway, several factors play important role in injury prevention in karate. First factor is the medic presence beside the athletes who

can be effective in injuries and injuries treatment and they can also play an important role by recognizing the risk factors in the issue of prevention. Second factor is emphasizing on observing the competition's rules which should be considered by players who participate in danger sports. In this regard, stressing on rules by referee could be effective so that stopping the dangerous play and considering penalty for the trespasser player could be the important factor to prevent the injuries [1, 4, 5, 11]. Other factors like using standard tatami, using protection tools such as leg protection, feet protection, gum protection, and suitable globes can lead to reduce injury. Warming up activities at the beginning of each session and competition, play an important role in injury prevention. Other important factor is players' classification based on age, height, and weight which increase the proportion between them and may cause injury reduction. Mac latch claims that these changes are resulting in injury reduction from 0.25 per competition to 0.05 per competition. Despite this relative participation, each factor is not clear [21].

There were several limitations in this study. First of all, the basis of the occurrence of injury was referee's request for checking the injury from the team medic. So it's possible that some players have malingered injury and on the other hand, some individuals didn't express their injuries due to the competitions' sensitivity. One other limitation which can be pointed out is the lack of accurate time record of the competition. In this course of competitions, some of the competitions continued until the extra time but some of them ended soon. Hence, recording the exact time of the competitions was not possible. Anyway, it seems necessary to conduct more study regarding the effective strategies to reduce injury.

In addition, it is suggested that the standard classification and definition of the severity of the injury, prevalence rate (compared to time for each athlete and in each competition), and other factors be presented so that one may explain the studies' results better and achieve the aims (namely, minimizing the injuries). Based on the present research result, the rate of mild injuries enjoys the highest amount indicating the fact that karate is not a severe-harsh sport, although damaging rates is high, however, most of the injuries are mild and severe injuries are too low. So according to this study and other researches, one can conclude that most of the injuries are mild in karate and one can guarantee the athletes and their parents that unlike the public opinions based on severe-harshness of this sport, karate is the sport with suitable safety.

Conclusion

In karate, most of the injuries are mild and the prevalence of the severe injuries is low. Bruise is the most injury type. Moreover, appearance of injury in second minutes of competitions is more than other moments. Furthermore, most of the injuries are occurring in head and face compared to the other sites.

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