

## SPORTS INJURIES IN KARATE

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### Abstract

The purpose of this paper is, through continuous monitoring of major sports competitions, to obtain a more detailed picture of the injuries in karate sports, their frequency, degree of severity, the reasons and conditions of their occurrence, as well as analysis of the possibilities for their reduction. The injuries that are the subjects of this paper are recorded from three European championships of WSKF (The World Shotokan Karate-Do Federation) held in Stralsund, Germany in 1998, in Istanbul, Turkey in 2004, and Bucharest, Romania, in 2008. Analyzing the aforementioned championships, we concluded that most of the offensive actions were aimed at the head and neck area. In the section of the officially diagnosed injuries, according to our research, the most common by weight was light injuries and by diagnosis were light contusions.

*Keywords:* karate, kumite, sports injuries, diagnosis, karate championships

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### Introduction

The sports fight in karate belongs to the family of acyclic situational polystructural movement activities. Therefore, both motorically and technically, it belongs to the sports activities with the highest degree of specialization. According to the rules, the match lasts for 3 minutes effectively. Depending on the number of participants, it can continue for up to six rounds. Competitors must fight within the designated area. Three points (WKF), and one point (in Shotokan) are awarded for landing head kicks or scoring techniques delivered on a thrown or fallen opponent. Two points (WKF), 0.5 points (in Shotokan) are awarded for landing body kicks, while one point (WKF), 0.5 points (in Shotokan) are awarded for punches to the body or head. Punches must be controlled without causing an injury. If the given punch is excessive, then appropriate penalties are received which can cumulatively cause disqualification. The fight ends early if there is a difference of 8 points (WKF), and 2 points (in Shotokan). If the fight ends in a tie, the advantage of the first point won decides who will win in WKF. In Shotokan, there are extra rounds and if there is no winner after the completion of those rounds, the judges have to decide who the winner will be. A competitor who is disqualified with the so-called "kiken" (cancellation) may not compete again in the same match. The valid weight categories in WKF are -50kg, -55kg, -61kg, -68kg, and +68kg for senior female athletes and -60kg, -67kg, -75kg, -84kg, and +84kg for senior male athletes. In Shotokan, there is an open category without a weight limit (absolute category).

There is a completely wrong opinion in the public that the greatest number of sports injuries are generated in martial arts, where in reality there is only a high risk. First, it should be distinguished that classifying all martial arts into the same group is wrong. For example, boxing, kickboxing, MMA, etc. as contact sports, and karate as a non-contact sport are very different, not only according to the applicable rules, technical performance, and specific movement structures but also according to the approach to the fight. In contact sports, although there is protective equipment, the idea is to disable the opponent to further fight (knockout). In karate, the idea is to use strong and fast but maximally controlled techniques to let the opponent know that he is partially or permanently disabled if the judges confirm the same. Therefore, karate as a non-contact

sport requires an extremely high level of concentration of attention related to the performance, but also the control of the kicks. Conducted research indicates that injuries in karate are rare and of a lighter nature. Most of the injuries according to the diagnosis are traumas, sprains, and mild local injuries. More serious injuries such as fractures, dislocations, and sprains are much more common in football, wrestling, skiing, and athletics, for example than in karate (ex. Nouzari 2010). In comparison with a relatively similar sport such as taekwondo, according to the research done by (ex. Zetaruk et al., 2005), the number of serious injuries in taekwondo is 3 times higher than in karate.

### **Sports Fight in Karate**

In a sports fight in karate, two opponents compete. The rules allow controlled techniques of hand and leg kicks aimed at the body and head area. In certain karate organizations according to the rules almost no protective equipment (Shotokan) is used, while in others (for example, WKF) the rules oblige wearing full protective equipment such as gloves, shin and foot guards, chest guards, and protective mouth guards, while groin protectors are recommended. We can underline that the rules established in this way related to the equipment and the sanctioning of the contacts play a very important role in the prevention of injuries during sports competitions.

### **Research methods and data processing**

For the purposes of this research, the methods of descriptive statistics were used.

### **Classification of Injuries**

Injuries are an integral part of sports competitions. They are inevitable in almost every sport, including karate. Injuries occur during sports activities and the reasons are mostly mechanical. Most often, the locomotor apparatus is at risk. The term sports injury, in the broadest sense, includes injuries that occur during a sports activity. A sports injury, in the narrower sense, means an injury that is typical for a certain sport, both in terms of the cause of its occurrence and in terms of its frequency. The most appropriate classification of sports injuries is according to the severity of the injury, according to the anatomical location of the injury, i.e. the region, and according to the diagnosis.

### **Classification by Weight**

(ex. Baker et al.,1974) created the Injury Severity Score. This medical score is based on the previously developed Abbreviated Injury Scale (AIS) and takes into account the three (out of six) most severe system injuries. According to (ex OB. Bolorunduro et al., 2010) the Injury Severity Score (ISS) is the most commonly used measure of injury severity. The score has been shown to have the excellent predictive capability for trauma mortality and has been validated in multiple data sets. For each part of the body, they proposed the following classification of the injuries: less than 9 points - minor, 9-15 points – moderate, 16-24 points - severe, 25 points and more - very severe/profound. According to those standards, for this research, we further modified the ISS platform. So, we classified light bodily injuries as situations when the competitor can continue with the current fight and the competition, and if the injury needs to be treated permanently, that would not cause an absence from training longer than a week; medium-severe bodily injuries were classified as situations when the competitor cannot continue with the current fight but can continue with the competition, and if the injury needs to be treated permanently, that would not cause an absence from training longer than a week or up to a month; severe bodily injuries when the competitor cannot continue with the respective competition, and if the injury needs to be treated permanently, that

would cause an absence from training for at least 3-6 months; and very severe bodily injuries when the competitor cannot continue with the relevant competition, and if the injury needs to be treated permanently, that would cause an absence from training longer than 6 months. Accordingly, all techniques that were performed with contact and caused shorter or longer interruptions of the fight, conditioned by the intervention of the medical team, were registered as injuries and were presented in the study.

### **Classification by Region**

According to the anatomical location, we classified the injuries as Head and neck injuries; Shoulder injuries; Injuries of upper extremities and palms; Injuries of the trunk and pelvis; Injuries of lower extremities and feet.

### **Classification by Diagnosis**

According to the established diagnosis, we classified the injuries as: Contusion; Laceration; Abrasion; Hematoma; Meniscus; Muscle tear; Torn ligament; Muscle tendon; Epistaxis; Muscle strain; Concussion; Luxation; Fracture, etc.

### **Medical logistics, equipment and procedures used**

The injuries that are the subject of this paper are recorded from the total number of fights 1306 (386/500/420) from 3 European championships of WSKF (The World Shotokan Karate Do Federation) held in Stralsund, Germany in 1998, in Istanbul, Turkey in 2004 and in Bucharest, Romania, in 2008. An average of 20 countries participated in the aforementioned championships (19-22-19) with an average number of 510 competitors per championship (470-550-510) in individual and team competitions. In this paper, the data from the elimination and final fights of the competitions for female/male senior athletes and veterans in the team and individual competitions are presented. The fights were held according to standard shotokan rules. In the absolute category, the fights lasted for three minutes and the scoring was up to one Ippon. The fights were conducted with 5 judges, one man in the arena, and four assistants, i.e. corner judges. The rules did not allow wearing hand, leg, and body protectors, and for the prevention of infectious diseases, it was allowed to wrap the palms in the area of the fist with self-adhesive tape.

The procedure for the implementation of this paper was agreed upon with the management of the WSKF and their medical committee, as well as with the technical organizers of the championships. In the implementation of this study, two of our professional volunteers were involved. Under the patronage of the medical team on duty at the arena, they recorded all the injuries diagnosed by the doctors on duty in special forms (made for this research). At the aforementioned championships, the professional medical team consisted of two doctors and 2 nurses, and one ambulance driver. The medical teams had at their disposal complete mobile equipment needed for emergency actions in the field. In case of more serious injuries, fully equipped ambulances were available in front of the arena during all championships for possible further clinical treatment of injured athletes.

## Results

After the collection and processing of data, the results showed that out of 1306 fights in the three championships there were 180-recorded injuries, which means that there were about 0.14 injuries in each fight. The largest number of recorded injuries belonged to athletes with one injury each (70%). A smaller number of athletes recorded two (18%) or three injuries (12%). During the elimination fights, there were 137 injuries (76%), while in the semi-final and final matches there were 43 injuries (24%). Table 1 shows that out of 180 recorded injuries, 111 (61.7%) were injuries in the region of the head, face, and neck, 27 injuries (15%) were in the region of the pelvis and lower extremities, 32 injuries (17.8%) were in the region of the shoulders and upper extremities and 10 injuries (5.5%) were in the body region. Tables 2 and 4 illustrate that light bodily injuries occurred most often i.e. 164 (91.1%) with diagnoses that were mostly light contusions, lacerations, hematomas or blood clots, etc. followed by moderate bodily injuries i.e. 14 (7.8%), out of which the most common were sprains of the joints and dislocations of the fingers. The number of severe bodily injuries was two (1.1%), and the most commonly diagnosed injuries were ligament, muscle, and joint dislocations, fractures, abrasions, and mild concussions. Very serious life-threatening injuries, such as meniscus tears, ligament, and muscle tears, were not observed.

**Table 1.** Number of Injuries by Region

<b>Location of the injury</b>	<b>Number of injuries</b>	<b>%</b>
<b>Head, face and neck</b>	111	61.7 %
<b>Shoulders, humerus, elbow</b>		
<b>Forearm, wrist, palm and fingers</b>	32	17.8 %
<b>Pelvis, femur, knee, shin</b>	27	15.0 %
<b>Ankle, foot, toes</b>		
<b>Back, stomach, ribs</b>	10	5.5 %
<b>Total</b>		100 %
<b>180</b>		

Table 2 also illustrates in detail the recorded injuries according to the diagnosis, where by far the most frequent diagnosis is light contusion at 60%, followed by abrasions at 12.7%, lacerations at 6%, etc. In Table 3, we have a presentation of to what extent and with which techniques the injuries were caused.

**Table 2.** Number of Injuries by Diagnosis

<b>Injuries by diagnosis</b>	<b>Number of injuries</b>	<b>%</b>
<b>Contusion</b>	131	72.77 %
<b>Laceration</b>	10	5.55 %
<b>Abrasion</b>	7	3.9 %
<b>Hematoma</b>	12	6.7 %
<b>Meniscus</b>	2	1.11%
<b>Muscle tear</b>	2	1.11%
<b>Ligament torn</b>	1	0.55 %
<b>Muscle tendon</b>	1	0.55 %
<b>Epistaxis</b>	10	5.55 %
<b>Muscle strain</b>	2	1.11 %
<b>Fracture</b>	1	0.55 %
<b>Concussion</b>	1	0.55 %
<b>Total</b>		100 %
<b>180</b>		

**Table 3.** Number of Injuries by the Performed Technique

<b>Causes of the injury</b>	<b>Number of injuries</b>	<b>%</b>
<b>Injuries caused by hand blows</b>	117	65%
<b>Injuries caused by kicks</b>	47	26.1 %
<b>Injuries caused by throws and sweeps</b>	16	8.9 %
<b>Total</b>		100 %
<b>180</b>		

**Table 4.** Number of Injuries by the Severity of the Injury

<b>Severity of the injury</b>	<b>Number of injuries</b>	<b>%</b>
<b>Minor bodily injuries</b>	164	91.1 %
<b>Medium-severe bodily injuries</b>	14	7.8%
<b>Severe bodily injuries</b>	2	1.1 %
<b>Very severe bodily injuries</b>	-	-
<b>Total</b>		100 %
<b>180</b>		

## Description of possible head, face and neck injuries

Head and neck (includes cervical spine); face facial skeleton, nose, mouth, eyes, and ears;

### Head Injuries

Considering that the head is one of the vital points for hitting, there are very common injuries to this part of the body. Brain injuries occur in the form of concussions. Loss of consciousness that lasts up to two minutes, headache, nausea, vomiting, breathing disorder, and amnesia also need to be monitored. Depending on the duration of the amnesia, there are four degrees: 1st degree - mild concussion (amnesia for up to 1 hour), 2nd degree - moderate concussion (amnesia from 1 to 24 hours), 3rd degree - severe concussion (amnesia from 1 to 7 days) and 4th degree - very strong concussion (amnesia for more than 7 days).

### Facial Injuries

Facial injuries can be classified as facial bone injuries and soft tissue injuries. The most common facial bone injuries are fractures of the nasal bone, which can be associated with injuries to the cartilage and mucous membrane of the nose. The nose becomes swollen, painful, and deformed and it bleeds. In addition to this type of fracture, tooth injury also occurs very often. They are manifested by loosening, cracking, and breaking of the teeth. To reduce the possibility of dental injuries, silicone mouthguards must be worn during competitions and training. An uncontrolled blow to the opponent can also lead to an injury to the jaw. Injury to the lower jaw is more common when the mouth is open or half-open. The most common injuries to the soft tissues of the face in karate are contusions, and lacerations of the lips, nose, arcades, and cheekbones. Ear injuries are less common.

### Neck Injuries

They are obtained from a direct blow and are accompanied by loss of consciousness. The observed injuries in this region are a result of insufficiently controlled kicks with the legs (Mawashi geri and Ushiro mawashi geri), while the injuries to the nose, zygomatic bone and teeth are the results of uncontrolled blows with the hands (kizami zuki and gyaku zuki).

**Table 5.** A detailed view of the injuries in the head, face and neck region, and the same in relation to the total number of injuries

Region	Number of injuries	% of Incapable of continuing the total number of injuries	% in relation to the fight
Nose	46	41.44 %	25.6 %
Lower jaw	7	-	
Arcade	5	6.31 %	3.9 %
Zygomatic bone	23	-	
Lips	20	4.5 %	2.8 %
Teeth	10	-	
		20.72 %	12.7 %
		-	
		18.02 %	11.1%
		-	
		9.01 %	5.6 %
		-	
<b>Total</b>	111	100 %	61.7 %
		-	

**Table 6.** A detailed view of the injuries in the head, face and neck region by diagnosis

<b>Diagnosis</b>	<b>Total number</b>	<b>Minor bodily injury</b>	<b>Medium-severe bodily injury</b>	<b>Severe bodily injury</b>	<b>Very severe bodily injury</b>
<b>L.Contusion</b>	67	67	-	-	-
<b>Hematoma</b>	12	12	-	-	-
<b>Epistaxis (nose bleeding)</b>	12	12	-	-	-
	4	-	4	-	-
<b>Laceration</b>	14	14	-	-	-
<b>Abrasion</b>	2	-	2	-	-
<b>Luxation</b>					
<b>Total</b>	111	105	6	-	-

### **Description of possible injuries to the shoulders and upper extremities**

Upper extremities or pelvic girdle: pelvic skeleton;

#### **Shoulder Joint Injuries**

Shoulder injuries in karate are not so common, but they can occur due to insufficient and improper warm-up. Injuries mainly occur in the form of stretching of the ligaments of the shoulder joint. In some cases, shoulder dislocations, or possibly muscle injuries, may occur.

#### **Elbow Joint Injuries**

Injuries to this part of the body manifest in different ways in karate. Most often, they appear in the form of contusion, and in some cases, there may be stretching of the ligaments.

#### **Forearm Injuries**

The most common injuries of the forearm are contusions of the soft tissues, which are characterized by the appearance of severe pain, hematoma, and weakening of muscle strength. Fractures of the bones of the forearm are rare, but if they occur, it is usually a fracture of the ulna.

#### **Hand Injuries**

Typical injuries in karate are hand injuries because this part of the body is the most manipulative and therefore very often prone to injuries. Injuries occur in the form of contusions, distortions, fractures, and dislocations of the metacarpal bones and fingers. As can be seen from table 8, injuries such as bleeding and light contusions predominate in this region, while the observed fracture is in the area of the outer part of the palm (a strong blow gyaku zuki to the elbow). The other injuries were caused by various improper blocking techniques.

**Table 7.** A detailed view of the shoulder and upper extremity injuries, and the same in relation to the total number of injuries

Region	Number of injuries	% relation to the total number of injuries	% in	Incapable of continuing the fight
Shoulder joint	1	3.12 %	0.6 %	-
Upper arm	4	12.5	%	-
Elbow joint	1	2.2 %		-
Forearm	9	3.13%	0.6 %	-
Wrist	5	28.13%		-
Top of palm	6	5 %		1
Fingers	4	15.63	%	-
Thumb	2	2.8 %		-
		18.75%	3.3 %	
		12.5 %	2.2	
		%		
		6.25 %	1.1 %	
<b>Total</b>	32	100	%	1
		17.8 %		

**Table 8.** A detailed view of the shoulder and upper extremity injuries by diagnosis

Diagnosis	Total number	Minor bodily injury	Medium-severe bodily injury	Severe bodily injury	Very severe bodily injury
Contusion	21	21	-	-	-
Hematoma	7	7	-	-	-
Fracture	1	-	-	-	1
Rotator cuff injury	1	-	1	-	-
L.Sprain	2	1	1	-	-
<b>Total</b>	32	29	2	-	1

### Possible body injuries

Chest: thoracic spine and diaphragm; Abdomen: abdominal organs and lumbar spine (includes pelvic contents);

### Chest Injury

When this part is injured in karate, usually a rib is broken, and in some cases several ribs. The injured person breathes hard and feels severe chest pain. A rib fracture is usually of a closed type. The competitor may be exposed to a diaphragm injury, which will result in loss of air and he may often be unable to continue the fight.



## Back Injuries

In karate, if competitors have not sufficiently warmed up, they can overstretch or partially tear certain muscles in the back while swinging with their hands and feet in full force or while throwing or falling, which causes immense pain and inability to continue the fight. Such injuries require serious treatment and rest. In this region only injuries done by stretching of the intercostal muscles have been observed, one grade 1 injury was done by light stretching (strain) of the back muscles in the lumbar area, as well as light contusions, exhalations, but all them of a lighter nature. The injuries observed have been caused by strikes such as gyaku zuki-chudan (hand strike) and mae geri-chudan (leg strike).

**Table 9.** A detailed view of the injuries in the trunk region, and the same in relation to the total number of injuries

Region	Number of injuries	% total of injuries	% in relation to the number	Incapable continuing fight	of the
Chest	3	30 %	1.7 %	-	
Ribs	4	40 %	2.2 %	-	
Collarbone	1	10 %	0.6 %	-	
Groin area	2	20 %	1.1 %	-	
<b>Total</b>	<b>10</b>	<b>100 %</b>	<b>5.5 %</b>	<b>-</b>	

**Table 10.** A detailed view of the trunk injuries by diagnosis

Diagnosis	Total number	Minor bodily injury	Medium-severe bodily injury	Severe bodily injury	Very severe bodily injury
Solar plexus knocked	5	4	1	-	-
Clavicular Contusion	1	-	1	-	-
L.Back muscle strain grade 1	2	-	2	-	-
Strain of the intercostal muscle	2	-	2	-	-
<b>Total</b>	<b>10</b>	<b>4</b>	<b>6</b>	<b>-</b>	<b>-</b>

Description of possible injuries to the pelvis and lower extremities: (femur, knee, shin, ankle and feet)

## Femur Injuries

Muscular injuries of this part of the body are characteristic of karate. These can be m.quadriceps femoris injuries, which are most acute and usually belong to contusions according to their type. This injury in karate usually occurs during direct collisions with the opponent or due to improper blocking. Apart from the m.quadriceps femoris injury, one of the most common injuries is an injury to the muscles of the back part of the femur, which usually occurs due to insufficient warming up of the body. Injuries to the inner thigh occur less often. In the femur region, not a single injury was observed that called for medical intervention.

## **Knee Joint Injuries**

The knee joint is susceptible to frequent injuries in karate. Usually, these are ligament injuries, very often-internal collateral ligament, and meniscus injuries. The meniscus is an extremely important part of the knee, which is quite sensitive, and, as such, it is easily susceptible to injuries. Injuries to the knee joint are characteristic during collisions with the opponent's knee and upon inappropriate sweeps by the opponent.

## **Shin Injuries**

The anterior of the shin is unprotected because there are no muscles in this part. Therefore, shin contusions are a very common and very painful injury. If it is more intense then there may also be an injury to the blood vessels of the bone, which causes bleeding between it and the bone. Apart from contusion, a fracture of the bones in the lower part of the leg is also possible. From table 12 attached below, it can be seen that in this region injuries such as light contusions and blood bruises prevail. By region (table 11) in the shin area, severe bodily injury is also observed i.e. grade 2 partial tear of the gastrocnemius muscle. The injuries from this region were the result of improperly performed sweeping techniques. The observed partial tearing of the muscle is a consequence of an uncontrolled and improperly performed sweep.

## **Ankle Injuries**

Ankle injuries are one of the most common injuries in karate. Usually, they occur in the form of distortion, where the external collateral ligament and internal collateral ligament are mainly injured.

There are three grades of this injury:

1. Grade I – no ligament tear – it is manifested as a sharp pain which is caused by over-twisting of the foot, without swelling
2. Grade II – partial ligament tear – manifested as pain, swelling, and hematoma on the outside of the foot
3. Grade III – complete ligament tears - it is manifested as a joint dysfunction, where support and movement are impossible.

## **Foot Injuries**

Since karateka fight barefoot, foot injuries are very common. Usually, fractures and dislocations of the fingers occur, most often the thumb toe. Apart from fractures and dislocations, contusion on the dorsal side of the foot is also frequent. Injuries in this region are the result of improperly performed sweeping techniques as well as poorly placed blows that end up in the elbow or knee area.

**Table 11.** A detailed view of the injuries by the pelvic and femoral region, and the same in relation to the total number of injuries

Region	Number injuries	% of Incapable of continuing the fight	% in relation to the total number of injuries
Knee	3	11.1%	1.6 %
Shin	9	-	
Foot	5	33.3 %	5 %
Ankle	5	1	
Fingers	5	18.5 %	2.8 %
		-	
		18.5 %	2.8 %
		-	
		18.5 %	2.8 %
		-	
<b>Total</b>	27	100 %	15 %
		1	

**Table 12.** A detailed view of the injuries in the pelvic and femoral region by diagnosis

Diagnosis	Total number	Minor bodily injury	Medium-severe bodily injury	Severe bodily injury	Very severe bodily injury
L.Contusion	15	15	-	-	-
Hematoma	8	8	-	-	-
Fracture	1	-	-	1	-
Sprain	3	1	1	1	-
<b>Total</b>	27	24	1	2	-

## Discussion

Analyzing the aforementioned championships, we concluded that most of the offensive actions were aimed at the head and neck area, which, of course, resulted in the highest number of injuries occurring in that region as measured in percent. The number of injuries in the other regions was significantly lower. It is a fact that this region is most sensitive to contact, whether it is of a lighter or heavier nature. This is illustrated in the previously attached table no. 5, where the number of 111 injuries in that region puts it at the head of the table in terms of risk of injury with (61.7%). Out of those, the highest percentage of injuries were observed on the nose at 25.6%, zygomatic bone at 12.7%, and the lips at 11.1% to the total number of injuries (180). The mechanism by which the injuries occurred was caused by hand strikes 65%, leg kicks, sweeps 26.1%, throws, and falls to the ground with 8.9%. Techniques, which were performed with the hands, were direct (kizami zuki, gyaku zuki) in moments of direct collisions during anticipation and less often during attack actions. Techniques, which were performed with the legs, were direct and circular strikes (mae geri, mawashi geri, ushiro geri, ushiro mawashi geri) and sweeps, while the falls were caused by nearby collisions with elements of drags and throws. Even though the number of 180 injuries is relatively large, the injuries did not leave any serious consequences to the competitors who were injured. It is also necessary to point out that the number of injuries is significantly higher in the forenoon and elimination fights, which in turn is correlated with the biorhythm of the athletes-competitors who usually perform the specific part of the training in the afternoon and evening. Out of a total of 180 injuries, 127 were done in the forenoon and 53 in the afternoon.

This difference is probably the result of the practice of organizing tournaments mainly in two parts, out of which the eliminations are usually in the forenoon, whereas the final fights are mainly organized in the afternoon or evening when motivation and tenacity are at much higher level.

Even though we are talking about an analysis of completely different competitions with different rules, the results obtained of the injuries by region are relatively similar to other researchers' results such as those obtained by (ex. Sterkowicz, 2013) where 50.0% of the injuries were in the head, face and neck area, 11.9% were in the trunk area, 9.5% in the upper extremity area and 28.6% were in the lower extremity area. Then, with the research of (ex. Peeri et al., 2011) the most common anatomical location of injuries was also the head (32.4%), followed by the legs (28.5%), the hands (26.5%) and the body and spine (12.6%). The results of the research done by (ex. Johannsen, Noerregaard, 1988) indicate that, out of 153 injuries, 78.0% were in the head, face, and neck area, 4.0% in the trunk area, and 18.0% in the upper and lower extremity area. Likewise, in the research done by (ex. Critchley et al., 1999), out of 160 injuries, 57.0% were in the head, face and neck area, 5.6% were in the trunk area, 14.3% in the upper extremity area and 23.1% were in the lower extremity area. Similar results were obtained by (ex. Halabachi et al., 2007) where, according to their research, out of 186 injuries, 55.4% were in the head, face and neck area, 10.8% in the trunk area and 33.9% in the upper and lower extremity area. The results obtained by (ex. Ariaza et al., 2009) are approximate to ours, where out of 64 injuries, 62.5% were in the head, face and neck area, 3.1% in the trunk area, 17.2% in the upper extremity area and 17.2% in the lower extremity area. Likewise, the studies done by (ex. Arriaza, Leyes, 2005), who monitored 3 world championships, discovered that most injuries were observed in the region of the head (84.1%) and the legs (6.4%).

The study done by (ex. Pieter, 2010) indicates that, out of 76 injuries (men), 52.6% were in the head, face and neck area, 22.4% in the trunk area, 10.5% in the upper extremity area and 7.9% in the lower extremity area. Whereas, in women, out of 32 injuries, 43.8% were in the head, face and neck area, 18.8% in the trunk area, 12.5% in the upper extremity area and 15.6% in the lower extremity area. The results obtained by (ex. Boostani et al., 2012) confirm the same that, out of 178 injuries, the most or 57.9% were in the head, face and neck area, 28.6% in the trunk area, 10.1% in the upper extremity area and 3.4% in the lower extremity area. In the section of the officially diagnosed injuries, according to our research, the most common diagnosis was contusion 131 (72.8%), followed by laceration 10 (5.7%), abrasion 7 (3.9%), hematoma 12 (6.4%), meniscus 2 (1.1%), muscle tear 2 (1.1%), ligament torn 1 (0.55%), muscle-tendon 1 (0.55%), epistaxis 10 (5.7%), muscle strain 2 (1.1%), fracture 1 (0.55%), concussion 1 (0.55%). As an illustration, we will list the diagnosed injuries by other authors where nearly the same injuries are present, but in different percentages, of course. For example, in (ex. Ariaza, Leyes, 2005) contusion injuries with (52.8%) are also in the first place, followed by concussion (3.8%), fracture (2.8%), luxation (- %), sprain (- %), strain (- %), other/unspecified (40.6%). In (ex. Halabchi et al., 2007) contusion injuries with (43.6%) are also in the first place, followed by concussion (7%), fracture (1.6%), luxation (1.6 %), sprain (- %), strain (- %), other/unspecified (46.2%). Likewise, in (ex. Pieter, 2010) contusion injuries accounted for (67.1%) of all injuries, followed by concussion (- %), fracture (2.6%), luxation (- %), sprain (- %), strain (1.3%), other/unspecified (29%). (ex. Sterkowicz, 2013) had similar results where contusion injuries (66.8%) were the most common injuries, followed by concussion (4.1%), fracture (-%), luxation (1%), sprain (8.3%), strain (-%), other/unspecified (19.8%), whereas in (ex. Critchley et al. , 1999) contusion injuries accounted for (85.6%) of the total injuries, followed by concussion (7.5%), fracture (6.3%), luxation (- %), sprain (- %), strain (- %), other/unspecified (0.6%).

## Conclusion and recommendations

Because of the increasingly stricter rules and the mandatory protective equipment, our latest research (in preparation) indicates that the injuries in karate (WKF) in the last few years tend to visibly decline. Nevertheless, they will remain inevitable in the karate sport and therefore the professional staff involved in the organization and the implementation of the training and competition process will have to seriously tackle this problem in the future to find ways to prevent their occurrence and to decrease their number and seriousness. A pretty big handicap is that in the competition system you can rarely find an organization that keeps an official record in which injuries are registered in detail, not only by diagnosis, region, and weight but with the records as well, for example, the reason for their occurrence, the techniques used to cause them, the time of their occurrence during the fight, etc. In that context, we recommend introducing a predefined template where, by keeping such mandatory records, we will provide better insight into this problem and its eventual marginalization. Such knowledge would help us in terms of raising the level of technical-tactical, socio-psychological, and theoretical methodical preparation and would lead to the reduction of injuries. Besides, we recommend taking care of the proper dosage of athletes' overload because injuries that have occurred during training are even more numerous than those that have occurred during the competitions. We must seriously consider the frequency of participation in different competitions to enable serious prevention of injuries in athletes. The introduction of special protectors for full protection of the face and head, which have been used in some countries and organizations for a while, would lead to a drastic reduction of injuries in the region of the head and the face. Another factor that can seriously affect the reduction of the percentage of injuries is multiple global debates with one studious and comprehensive approach to revise the existing judging rules and activate a much more serious quality control of judges and their judging criteria not only in the national federations but also in WKF.

These recommendations are because the crowded calendar of local and global competitions in the last decade requires athletes to constantly move their limits and deal with the overload to which they willingly expose themselves, jeopardizing their health along the way. At these competitions, we have witnessed that the daily activities start early in the morning and last until late in the evening, and this applies to all days while the championships last. This plays a major role in the quantity, as well as the seriousness of the injuries. Hence, the responsible staff in karate should think of the previously disclosed statements and create optimal conditions so that national, continental, and global championships would last much shorter. From our point of view, this could be achieved if the championships for katas and kumite were split on different dates and if they took place in several days. In addition, the competitions should be organized in a way that there would be fewer categories on the same day, which would further lead to a shorter duration of the tournaments. Hence, the concentration of attention among the competitors would be kept and the number of injuries reduced. Such an approach would result in the return of the audience (non-karate related) and the media in the venues, who would watch and broadcast the interesting fights in competitions, which would not last more than 3 hours a day. This would help karate to become much more understandable and attractive to the audience.

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