



## Types and frequency of the injuries and their preventive treatment in some combat sports

### Authors' Contribution:

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

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### Abstract

Combat sports and martial arts are in the first group of risk for sport injuries due to the direct contact of the opponents. The aim of this study was to estimate the specificity and the frequency of injuries in some combat sports: boxing, judo, jujitsu, and karate. The group of respondents was composed of 220 randomly selected sportsmen at the age of 11 to 49 ( $24,0 \pm 7,75$  years old on average), who have trained martial sports for at least 3 years. The cases of 202 respondents who admitted to be injured within last 3 years were further analysed. The study was based on the survey designed by the authors. The study shows that 92% of the participants were injured. The most frequent were foot injuries (18,8%), arm injuries (15,4 %); most of the injuries were bruises (50,6%). Injuries of the upper limbs were more frequent among boxers, whereas the lower limbs areas were more vulnerable to injuries among athletes training judo, jujitsu, and karate. Boxers reported to recover from injury faster (87,2%) than judokas (68,8%). Those practicing jujitsu were most likely to renew their injuries (43,5%), and judokas happened to renew their injuries less regularly (32,8%). Boxers tended to use preventive treatments most frequently, and jujitsu athletes admitted to do it the least often. We found that the groups prone to injuries the most were judokas and karate athletes; boxers were found to be the most resistant to injuries. There are specific injuries with the highest frequency in the area of the arm and foot experienced by boxing, judo, jujitsu and karate athletes. Respondents who did not use any medical treatment after the injury recovered fastest; injuries appeared to renew among sportsmen who underwent medical treatment earlier. Preventive treatment was reported by both athletes who experienced injuries and the respondents who were not injured at all.

**Keywords:** Combat sports and martial arts, Preventive treatment, Injury

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## INTRODUCTION

Sports such as boxing, judo, jujitsu, and karate are for everyone no matter sex, age, weight and body-build or the level of physical fitness [1]. Due to the direct contact of the opponents, martial sports are in the first group of risk for sport injuries [2]. As the duration of fights increases alongside an increase in the number of rounds, the fatigue of athletes increases and their movements become less dynamic and less precise [3]. The way of leading the fight, frequency of the attacks, and the way of performing certain technical elements change [4]. Specifying the rules of the fair play gave grounds for the safe competition. The risk of getting injured during a fight still exists, however. Injured athletes present lower level of physical fitness during trainings and competitions. Thus, analysis of the types and frequency of injuries in the combat sports gives basis to the development of strategies for preventing occurrence of an injury. Moreover, adopting a suitable preventive or a medical treatment after an injury occurs helps to return sooner to the normal level of physical activity and to practicing the sport.

Boxing, judo, jujitsu, and karate are very popular sports but by now only few authors focused on the topic of injuries and preventive treatment in those disciplines. The study on the type and frequency of the injuries in boxing was conducted, among others, by Junge et al. [6], Zazryn, Finich and McCorry [7], Kocharński et al. [8,9]. Preventive treatment in boxing was studied by Chojecki et al. [5], Gartland, Malik and Lovell [10], Inalsingh and Aberdeen [11]. As far as judo is concerned, similar studies were conducted by James and Pietera [12], Voinea [2], Witkowski et al. [13], Walentukiewicz [14], Souza et al. [15], Green et al. [16]. The types and frequency of the injuries in jujitsu were examined by Sterkowicz [17], Ratamess and Terry [18,19]. These topics were also studied in regard to karate by Arriaz and Leyes [20], Ziaee et al. [21], Boosanti et al. [22], and Wesółowski et al. [23]. Rather a scarce number of publications about the types and frequency of the injuries, as well as the preventive treatment in the area of the mentioned martial sports led the authors of this article to verify the current academic reports in that field.

The term injury - used in the article - denotes an injury that happens during a physical activity such as training and competitions, which has negative impact on the sportsman's health and therefore causes temporary or permanent exclusion from the participation in the sport activity [24].

Preventive treatment might be defined as the action and the means exploited in order to prevent the injuries. It also means using different preventive measures so that damage, accidents and disasters are avoided.

Next, rehabilitation is "a contemporary scheme of treatment which makes it possible to quickly bring back the ability of an active social life or, in case of a morphological damage, forming the replacement mechanisms and consolidating for the reconstruction of the ability of an active social life" [27].

## MATERIALS AND METHOD

### *Subject*

The group of respondents consisted of randomly chosen athletes who train boxing, judo, jujitsu or karate. There were 220 athletes in the group: 72 women and 148 men. Among all the respondents 202 people got injured and their cases became the basis for the analysis. Among the injured subjects 51 were boxers, 64 were judokas, 52 were jujitsu fighters, and 53 were karate practitioners. The respondents were professionals actively taking part in competitions. The vital criterion to become a part of the respondent's group was at least 3 years' training experience. The injuries from past 3 years of training were taken into consideration.

The respondents fall into  $24,0 \pm 7,75$  age range. Experience in training varied from 3 to 38 years ( $13,66 \pm 13,23$  years), the participants trained 3 times a week on average. Four sportsmen did not return to sport after injury. Analyses were based on the remaining group, whose respondents took up to 144 weeks break from training ( $7,57 \pm 15,59$  weeks) after injury.

### Protocol

The study was conducted on the basis of the survey, which consisted of 14 questions, and a table specifying the types of injuries and the areas of their occurrence. There were two types of questions - closed and open ones; the latter enabled the participant to add supplemental information. The questions asked about general information about the athlete, as well as about the circumstances of the experienced injury, also asked about the treatment and the length of a break from training, identified the current state of health as related to the injury and the basics of undertaking preventive treatment. The table on the last page of the survey was devoted to the question about the specificity of the injury. The survey designed by the authors was created on the basis of the other researchers' surveys taking into account their critical opinions.

### Statistic

Data comes from the anonymous surveys, which were conducted in sports clubs as well as via Internet. The respondents were aware of the academic purpose of the study. Collected data was analysed by means of the software called Statistica 12. The injury was a statistical feature, whereas the type of injury was the unit of measurement. In order to estimate the dependence between the variables, Spearman's rank correlation coefficient  $r$  was used. Increase of correlation was evaluated according to Guilford [28]. Significance of the differences was measured by Student's t-test for the independent samples.

## RESULTS

In total, 220 people were observed. Frequency of the injuries in the analysed combat sports is high. 202 respondents suffered from injury, which constitutes 91 % on average. Injuries were most frequent in judo and karate, whereas boxers suffered from the smallest number of physical damages (Fig. 1).

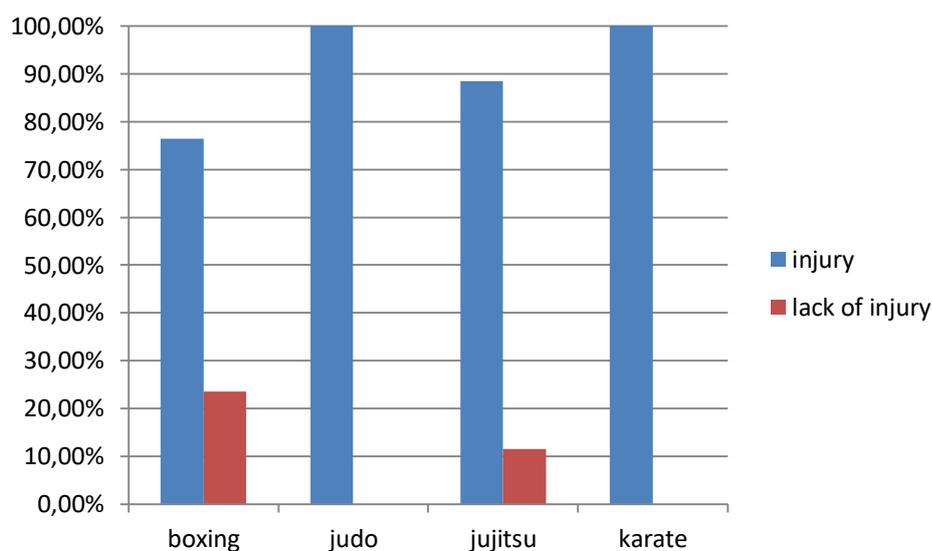


Figure 1. Injury frequency rate in particular combat sports.

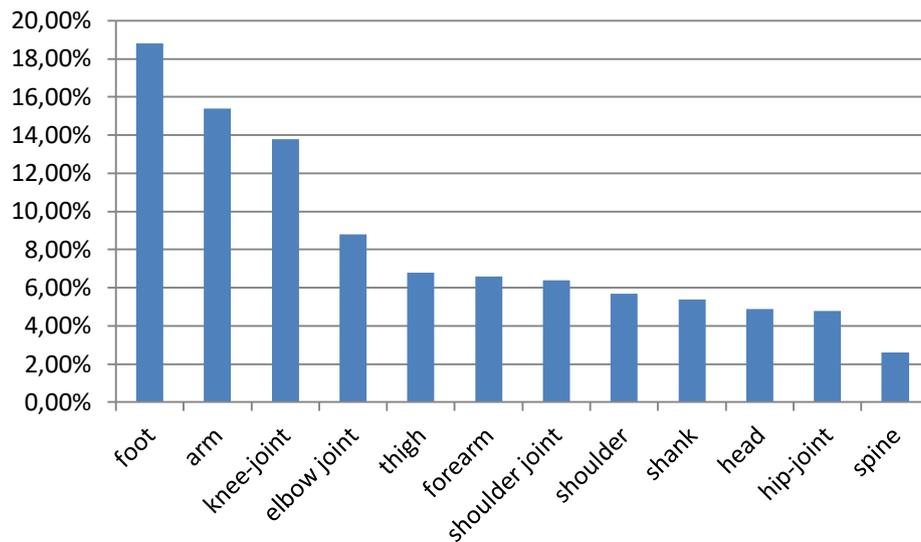


Figure 2. Comparison of the injured body part within the whole group of respondents.

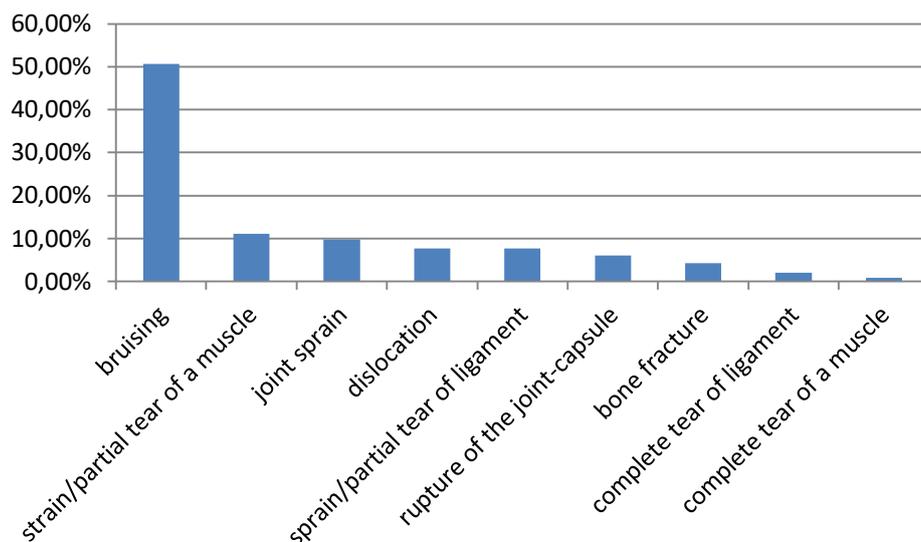


Figure 3. Comparison of the type of injury within the whole group of respondents.

The further analysis was based on the cases of those 202 sportsmen who suffered an injury. The respondents mentioned 1000 injuries altogether. The majority of injuries was related to the foot, the smallest number referred to the spine (Fig. 2) Bruising was the most frequently mentioned type of injury, whereas muscle rupture was the least popular one (Fig. 3)

Boxers were the most likely to become injured in the area of the upper limb, whereas judo, jujitsu and karate fighters reported the lower limbs to be the most prone to injury. The most frequently injured part of the body was the arm among boxers and the foot among judo, jujitsu and karate fighters (Table 1, Table 2).

Table 1. Comparison of the injured body part

Part of the body	Boxing	Judo	Jujitsu	Karate
Foot	13,68%	20,3%	19,55%	17,83%
Shank	3,16%	3,76%	5%	8,74%
Knee-joint	9,47%	17,8%	12,73%	10,49%
Thigh	0%	5,51%	7,27%	10,49%
Hip-joint	0%	6,02%	4,55%	4,9%
Arm	25,26%	13,03%	13,64%	16,78%
Forearm	10,53%	4,51%	5,91%	8,74%
Elbow joint	12,63%	10,03%	10%	4,9%
Shoulder	6,32%	5,26%	5,45%	6,3%
Shoulder joint	10,53%	6,52%	7,73%	3,85%
Spine	2,11%	2,76%	4,09%	1,4%

Table2. Comparison of the type of injury

Type of injury	Boxing	Judo	Jujitsu	Karate
Bruising	31,58%	44,86%	50,91%	64,69%
Joint sprain	10,53%	11,78%	9,55%	7%
Dislocation	12,63%	8,02%	8,18%	5,24%
Bone fracture	5,26%	4,01%	4,55%	4,2%
Sprain/ partial tear of ligament	11,58%	9,52%	5,91%	5,24%
Complete tear of ligament	3,16%	2,51%	1,36%	1,4%
Strain/ partial tear of a muscle	18,95%	12,03%	11,82%	6,64%
Complete tear of a muscle	4,21%	0,5%	0,45%	0,35%
Rupture of the joint-capsule	2,11%	6,77%	7,27%	5,24%

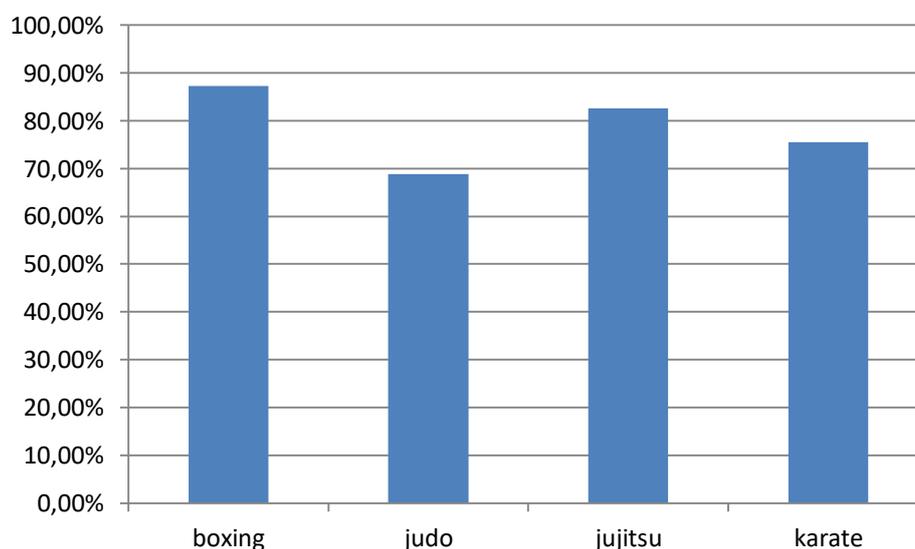


Figure 4. Percentage of the respondents who went back to the previous physical fitness within the analysed combat sports

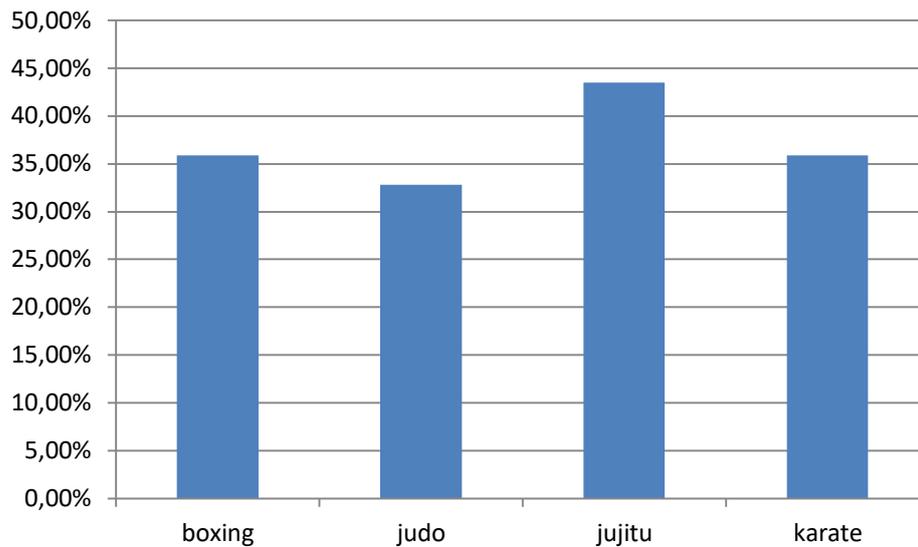


Figure 5. Percentage of the respondents who suffered from the reoccurrence of the injury within the analysed combat sports

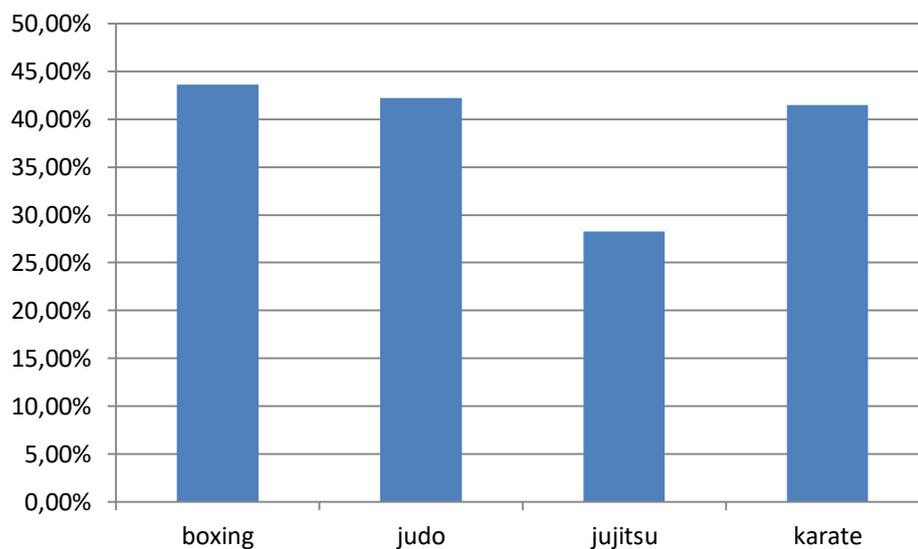


Figure 6. Percentage of the respondents who use preventive treatment within the analysed combat sports

Among the analysed combat sports, boxers were the most likely to return to physical activities (Fig. 4) Reoccurrence of the injury was the most popular among jujitsu competitors (Fig. 5). Preventive treatment was used in all four disciplines (Fig. 6). The difference between the respondents who used treatment and those who were not cured was proved (Table 3).

Table 3. Number and percentage of respondents who went back to the previous health condition and physical fitness.

Combat sports	Underwent treatment	Managed to go back to the previous health condition and physical fitness	Did not manage to go back to the previous health condition and physical fitness	Total
Boxing	Yes	18	4	22
		81,82%	18,18%	
	No	16	1	17
		94,12%	5,88%	
Total	34	5	39	
Judo	Yes	28	13	41
		68,29%	31,71%	
	No	16	7	23
		69,57%	30,43%	
Total	44	20	64	
Jujitsu	Yes	16	5	21
		76,19%	23,81%	
	No	22	3	25
		88%	12%	
Total	38	8	46	
Karate	Yes	7	23	30
		23,33%	76,67%	
	No	6	17	23
		26,09%	73,91%	
Total	13	40	53	

The difference in the frequency of the reoccurrence of the injury between the respondents who underwent treatment and those who were not cured was observed. (Table 4).

According to the survey there is no correlation between currently used preventive treatment and the reoccurrence of the same injury or of an injury in the same area of the body.

However, some weak correlations were observed between:

- Medical treatment and current preventive treatment
- The current preventive treatment and currently observed ailments
- The length of a break from training and current preventive treatment

Meaningful correlations were observed between:

- Medical treatment and immobilisation
- Medical treatment and the length of a break from training
- Going back to the previous health condition and physical fitness and currently observed ailments

On the basis of the survey, it can be assumed that those respondents who underwent medical treatment were cured by the immobilisation. It is related to a longer time of break from training. However, the athletes who managed to return to the previously observed physical fitness, rarely complained about ailments connected to the injury (Table 5).

Table 4. Number and percentage of respondents who suffered from the reoccurrence of the injury

Combat sports	Underwent treatment	Reoccurrence of the same injury or of an injury in the same area of the body	Lack of the reoccurrence of the same injury or of an injury in the same area of the body	Total
Boxing	Yes	8 36,36%	14 63,64%	22
	No	6 35,29%	11 64,71%	17
	Total	14	25	39
Judo	Yes	14 35,15%	27 65,85%	41
	No	7 30,43%	16 69,57%	23
	Total	21	43	64
Jujitsu	Yes	12 57,14%	9 42,86%	21
	No	8 32%	17 68%	25
	Total	20	26	46
Karate	Yes	20 66,67%	10 33,33%	30
	No	14 60,87%	9 39,13%	23
	Total	34	19	53

Table 5. Spearman's rank correlation coefficient

Variable	Spearman's rank correlation coefficient																					
	Sex	Age	Dis	Deg	Yrs	Nr	IWU	IT	IC	IOC	UMT	S	I	PT	R	P	K	B	A	RoI	CPF	PT
Sex	-	0,17	-0,03	0,01	0,09	0,02	0,00	-0,03	-0,05	0,10	-0,20	0,13	-0,10	-0,17	-0,19	-0,14	-0,13	0,02	-0,14	0,12	-0,11	0,04
Age	0,17	-	-0,17	-0,10	0,27	-0,10	0,06	-0,02	-0,14	0,04	0,06	0,07	-0,05	0,03	0,08	0,17	0,05	0,07	-0,09	0,19	-0,02	0,04
Dis	-0,03	-0,17	-	0,15	0,09	-0,10	0,07	-0,06	0,04	0,03	-0,05	-0,09	0,01	0,02	0,02	-0,08	0,02	-0,11	0,00	0,03	0,03	0,04
Deg	0,01	-0,10	0,15	-	-0,22	-0,18	0,09	-0,10	-0,10	0,03	0,08	0,01	0,05	0,01	0,10	0,06	0,06	-0,03	-0,01	-0,11	-0,02	-0,03
Yrs	0,09	0,27	0,09	-0,22	-	0,28	0,05	0,00	0,22	-0,04	0,20	0,33	0,13	0,02	0,19	0,22	0,25	0,17	0,04	0,21	0,16	-0,06
Nr	0,02	-0,10	-0,10	-0,18	0,28	-	0,02	0,05	0,39	-0,11	0,06	0,22	0,04	0,03	0,04	0,12	0,06	-0,01	0,04	-0,06	0,04	-0,07
IWU	0,00	0,06	0,07	0,09	0,05	0,02	-	-0,15	0,01	0,04	0,09	0,05	0,11	0,07	-0,10	-0,01	-0,03	0,02	0,07	0,05	-0,08	-0,10
IT	-0,03	-0,02	-0,06	-0,10	0,00	0,05	-0,15	-	-0,30	-0,31	-0,11	-0,01	-0,05	0,10	0,01	-0,04	0,08	-0,07	-0,04	0,17	-0,17	-0,01
IC	-0,05	-0,14	0,04	-0,10	0,22	0,39	0,01	-0,30	-	0,00	0,06	0,14	0,18	0,12	0,04	0,09	0,06	0,04	0,14	0,08	0,13	-0,11
IOC	0,10	0,04	0,03	0,03	-0,04	-0,11	0,04	-0,31	0,00	-	0,05	-0,10	0,15	0,04	-0,01	0,01	-0,03	0,03	-0,07	0,12	-0,04	-0,10
UMT	-0,20	0,06	-0,05	0,08	0,20	0,06	0,09	-0,11	0,06	0,05	-	0,31	0,59	0,32	0,46	0,38	0,33	0,47	0,12	0,05	0,07	-0,25
S	0,13	0,07	-0,09	0,01	0,33	0,22	0,05	-0,01	0,14	-0,10	0,31	-	0,00	0,00	0,25	0,31	0,30	0,37	0,20	0,05	0,21	-0,15
I	-0,10	-0,05	0,01	0,05	0,13	0,04	0,11	-0,05	0,18	0,15	<b>0,59</b>	0,00	-	0,09	0,28	0,22	0,14	0,30	0,10	0,10	0,00	-0,22
PT	-0,17	0,03	0,02	0,01	0,02	0,03	0,07	0,10	0,12	0,04	0,32	0,00	0,09	-	0,19	0,16	0,21	0,18	0,25	0,19	0,16	-0,13
R	-0,19	0,08	0,02	0,10	0,19	0,04	-0,10	0,01	0,04	-0,01	0,46	0,25	0,28	0,19	-	0,75	0,69	0,39	0,21	0,01	0,23	-0,15
P	-0,14	0,17	-0,08	0,06	0,22	0,12	-0,01	-0,04	0,09	0,01	0,38	0,31	0,22	0,16	0,75	-	0,35	0,41	0,23	0,06	0,26	-0,11
K	-0,13	0,05	0,02	0,06	0,25	0,06	-0,03	0,08	0,06	-0,03	0,33	0,30	0,14	0,21	0,69	0,35	-	0,21	0,14	0,09	0,14	-0,15
B	0,02	0,07	-0,11	-0,03	0,17	-0,01	0,02	-0,07	0,04	0,03	<b>0,47</b>	0,37	0,30	0,18	0,39	0,41	0,21	-	0,34	0,02	0,34	-0,25
A	-0,14	-0,09	0,00	-0,01	0,04	0,04	0,07	-0,04	0,14	-0,07	0,12	0,20	0,10	0,25	0,21	0,23	0,14	0,34	-	0,16	<b>0,48</b>	<b>-0,23</b>
RoI	0,12	0,19	0,03	-0,11	0,21	-0,06	0,05	0,17	0,08	0,12	0,05	0,05	0,10	0,19	0,01	0,06	0,09	0,02	0,16	-	0,05	<b>0,00</b>
CPF	-0,11	-0,02	0,03	-0,02	0,16	0,04	-0,08	-0,17	0,13	-0,04	0,07	0,21	0,00	0,16	0,23	0,26	0,14	0,34	0,48	0,05	-	-0,15
PT	0,04	0,04	0,04	-0,03	-0,06	-0,07	-0,10	-0,01	-0,11	-0,10	<b>-0,25</b>	-0,15	-0,22	-0,13	-0,15	-0,11	-0,15	<b>-0,25</b>	-0,23	0,00	-0,15	-

Where:

Dis - Discipline, Deg - Degree, Yrs - Years of training, Nr - Number of trainings in the week, IWU - Injury-warm-up, IT - Injury-training, IC - Injury-competition, IOC - Injury-other circumstance, UMT - Underwent medical treatment, S - Surgery, I - Immobilisation, PT - Pharmacological treatment, R - Rehabilitation, P - Physiotherapy, K - Kinesiotherapy, B - Break, A - Ailments, RoI - Reoccurrence of injury, CPF - Comeback to physical fitness, PT - Preventive treatment

## DISCUSSION

Participation in the martial sports activities brings many positive implications. It enables the athletes to shape and maintain the physical form, strengthens the will power, courage, and personality. However, it is also often connected with the occurrence of numerous injuries [8]. Major cause of most injuries in contact sports seems to be the direct confrontation with the opponent [6]. Physiotherapy plays an important role in curing and preventing injuries. It enables detection of motor skill disorders and leads to introduction of a suitable correction [9]. There is a need to identify injuries characteristic for particular martial sports.

This research has shown that more than a half of boxers suffered from an injury (76%). Upper limb injuries were dominant (65,3%), with the most frequent injuries of the arm (25,3%). Foot, elbow joint, forearm glenohumeral joint were also mentioned. The respondents most frequently pointed to bruises - mainly arm bruises - 12,6%, which is probably related to the fact that combat sports require the competitors to strike and resist blows as well as amortise the falls. Subsequently, the athletes mentioned strains or partial tears of a muscle as well as joint sprains

and dislocations. Bruised ribs and liver or injuries of the nose were the other characteristic contusions. The research led by other authors among a group of professional boxers prove that the athletes most frequently suffered from head, neck, face and arm injuries [7,29,10,30,31]. In the study undertaken by Zazryn, Finich and MaCorry apart from concussions, also grazes, lacerations, surface wounds and bruises [7]. Kočański et al. emphasise that the most frequent but also the most harmful injuries are linked to the head area [8].

Judokas are also exposed to injuries during the trainings and competitions. According to this research, all of the judo fighters underwent the injury and more than a half of them concerned the lower limbs (53,4%). Most judokas mentioned the foot as the injured part of the body (20,3%), subsequently some of them pointed to knee-joint and arm. In terms of the type of the injury, bruising (44,9%) were dominant, most of them remaining the bruising of the knee-joint (6,8%). Among other injuries strains and partial tears of a muscle and displacements were the most frequent. Other injuries which occurred in the course of the study were concussions and overextensions of spine, breakages of the nose, black eye injuries, split eyebrows. The athletes mentioned overextensions of chest muscles and ribs breakages as particular injuries. Other authors' research does not prove lower limbs to be more prone to injuries. According to James and Pieter's study, most injuries are connected with neck and head areas, subsequently upper and lower limbs. They mention mostly abrasions, bruising and overextensions [12]. Voinea's research proves that most common injuries in judo are wounds and hematomas. Often, judokas also suffer from knee injuries, while the sport itself is full of quick changes of pace, recurrent falls and injuries in the area of the shoulder, especially acromioclavicular joint, which are caused by the improper falls [2]. Witkowski et al. emphasise the frequency of upper limbs injuries - in order of occurrence - ligaments, muscles, bones, which is also proved by Walentukiewicz [13,14]. Souza et al. [15] as well as Green et al. [16] point to the common injuries of the upper limbs and the knees, occurring through dislocations, sprains and strains, lesions. Moreover, very characteristic injury among judokas is so called 'cauliflower ear' - deformation of the auricle caused by frequent falls [32].

In case of the jujitsu fighters, this research proved that 88,5% of respondents suffered from injury. Most of them were connected with the lower limb (49,1%), with the foot being the most frequently harmed (49,1%), followed by the arm, knee-joint and elbow joint. Bruising constituted half of the injuries (50,9%) - proving bruised arms to be the most frequent ones - followed by the strains or partial tears of the muscle and sprains. Sterkowicz in his research emphasises predominance of the upper limb injuries - mostly bruising, sprains (among others of the wrist). Bruising, apart from forearm and elbow, concerned also thigh and shank areas [17]. In Ratamess's study, though, respondents mentioned sprains, overextensions and bruising of the shoulder, knee or foot [18].

Karate fighters also suffer from many frequent injuries. In this study, it was proved that in the analysed group of respondents, in which everybody underwent some injury, lower limb contusions were dominant (52,5%), especially in the foot, knee-joint or thigh. In the case of the upper limb, arm (16,8%) was the most prone to become injured. More than a half of injuries were bruising (64,7%), subsequently sprains and muscle injuries such as strains. Additionally, the athletes mentioned also concussions, wounds in the area of face, knocked out teeth, breakages and bruising of the nose, as well as muscle contusions in the area of the stomach. Other authors prove that research. Wounds, bruising and sprains in the area of the head and limbs were dominant in the study of Arriaza and Leyes [20]. Ziaee et al. emphasise that the most frequently injured parts of the body were the head, cervical spine, torso, lower and upper limbs. Bruising and overextensions of muscle seemed to happen the most often [21].

Undertaking the suitable and effective treatment is dependent upon the type and seriousness of the injury. Contusions usually cause the reduction of training intensity, which sometimes contributes to the decline of physical form. It is crucial to mention that the time pressure accompanying sportsmen's lives, the demand to follow contracts and the popularity

make it necessary to come back to fighting quickly, sometimes not fully recovering from the injury [5].

Research proves that most boxers decide to undertake medical treatment [8]. In this study 56,4% of respondents training boxing declared that. According to Chojecki et al. 28,5% of boxers undertook some kind of rehabilitation, which was carried on in a health care institution or at home [5]. Similar data was obtained by our own study, which proved 30,8% percentage rate of undertaking rehabilitation. It is well known that suffering from injury during training or fight results in a temporary break from physical activity [29]. In our own research an average break lasted 11 weeks. 81,8% of the athletes who underwent treatment fully recovered from the injury, whereas 43,6% of respondents felt some ailment caused by the injury. According to Gartland, Malik and Lovell's research in only 7% of cases total break from training was employed [10]. Chojecki's and et al.'s study shows that 32,8% of the respondents suffered from the renewal of the previous injury [5].

In the group of judokas our own research shows that more than a half of the respondents (64,1%) underwent medical treatment, whereas 56,3% of them undertook rehabilitation. 68,8% of the competitors managed to fully recover from the injury. Among them, 68,3% underwent medical treatment, whereas 69,6% went back to physical activities despite lack of the medical treatment. Only one person did not come back to training after suffering the injury. Moreover, our study proved that due to the injury and the treatment, an average time of break from training was 8 weeks. According to Witkowski et al. the duration of the break depends on the part of the body that is injured. In addition, they emphasise that most judokas had the ensured conditions to come back to physical form [13]. However, due to the lack of full recovery and quick comeback to training, athletes often renewed previous injuries. According to our own research, 32,8% of the respondents suffered from the renewal of the previous injury or the other injury but in the same area of the body, whereas 51,6% of the judokas still suffer from ailments connected with the injury. Witkowski proves that soft tissue injuries reoccur among 50% of the competitors and most of the respondents return to training despite the pain in the area of the injury [13].

In the case of jujitsu fighters, much less respondents who underwent injury, declared undertaking medical treatment (45,7%) or rehabilitation (39,1%). 82,6% of the respondents managed to return to the physical form, whereas nearly half of the jujitsu fighters (45,6%) who suffered from an injury feel some ailments connected to that. 43,5% of the respondents declare the reoccurrence of the same injury or suffering from injury in the same area of the body.

Many of the karate fighters who suffered from injury, in our own research declared undertaking medical treatment (56,6%). Immobilisation was the most popular form of treatment, surgery was mentioned rarely. Rehabilitation was undertaken by less than a half of the respondents (43,4%). According to Boostani's research, cooling of the injured part was most popular, whereas only in three cases the athletes underwent hospitalisation [22]. In our own research, large percentage of the respondents returned to the physical form and the health condition from before the injury (75,5%), however nearly half of them feel some ailments connected to the injury (47,2%). 35,9 % of the sportsmen declared the renewal of the injury or the reoccurrence of an injury in the same area of the body. The study proved that more than a half of the respondents (75,5%) managed to return to the same level of health condition and physical form as before the injury. Among them, 23,3% of the competitors underwent medical treatment, whereas 26,1% recovered despite the lack of medical intervention. More than a half of those respondents who suffered from the reoccurrence of the previous injury or injury in the same area of the body (57,9%), as well as those who did not manage to fully recover (58,8%) both use the preventive treatment.

According to Spearman's rank correlation coefficient (Table 5.), immobilisation was the most popular method of medical treatment among boxers, judo, jujitsu and karate fighters. It was connected with the longer break from training. It seems important to mention that

competitors who declared full recovery, rarely complained about ailments connected with the injury.

Damage of the body - more or less severe - causes a temporary decline of physical strength during training and competitions. That is why not only immediate and proper medical intervention but also the right preventive treatment guarantee a quick return to the physical activities [5]. According to our own research, 43,6% of the analysed boxers declared using preventive treatment such as boxing tapes, stabilizers, teeth protectors, elastic bands and different forms of heat therapy. Much more boxers (61,4%) use various types of prevention in the study of Chojecki et al. [5] Inalsingh and Aberdeen emphasise that in the case of preventive treatment of the arm, it is crucial to use boxing gloves and tapes [11].

In our own research, similar percentage of the respondents training judo (42,2%) and karate (41,5%) declared using preventive treatment. Prevention is reasonably less popular among jujitsu fighters (28,3%). On one hand, as preventive measures, judo, jujitsu and karate athletes mention teeth and joint protectors, stabilizers, elastic bands, finger tapes and taping. On the other hand, Souza et al. emphasise that most efficient form of prevention seems to be the proper technic of throws and falling on the mat [15]. Similarly, Terry repeats the same thesis in the study concerning jujitsu and Cynarski in the case of karate [19,33]. Poecocco et al. as well as Witkowski et al. mention the importance of the thorough physical preparation [32,13]. According to Wesołowski et al., Boostanii et al., and Arriaza and Leyes, the least effective method which prevents the athlete from the risk of injury of the facial skeleton, is using the proper protectors [23,22,20].

According to our study, it was shown that among all the athletes, who comprised boxers, judokas, judo and jujitsu competitors, the most frequent injuries were bruises of the arm and foot. Half of the injuries (50,6%) comprised bruising, strains and partial tears of the muscle, sprains, sprains and partial tears of ligaments, dislocations of joint. The most frequently injured parts were foot (18,8%), arm (15,4%) and knee-joint (13,8%). This research proved that the largest number of the same injuries in one area of the body, occurred among jujitsu competitors (43,5%) and the smallest among judokas (32,8%). Moreover, it was shown that boxers were most likely to return to physical form (87,2%), whereas judokas - the least likely (68,8%). Preventive treatment was the most popular among boxers (43,6%), and the least popular among jujitsu fighters (28,3%). The respondents mentioned teeth protectors and different forms of joint protection such as stabilizers or protectors as preventive measures. Despite the risk of injury, combat sports are highly popular because systematic training is a great way to maintain psychophysical fitness for years [33].

## CONCLUSION

The research proved that judo and karate athletes are the most prone to injuries, whereas boxers seem to be the least likely to suffer from them. The study distinguished the most characteristic injuries in the world of boxing, judo, jujitsu and karate, which focused in the area of the foot and arm. Those respondents who did not undertake medical treatment returned to the physical form faster, whereas reoccurrence of the injury happened more frequently among the competitors who were cured. Preventive treatment is used both by the respondents who suffered from injury and those who did not.

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