© Archives of Budo, 2008; 4: 91-97

Received: 2008.09.22
Accepted: 2008.10.12
Published: 2008.11.14

Injuries in martial arts and combat sports – a comparative study

Authors' Contribution:
A Study Design
B Data Collection
C Statistical Analysis
D Data Interpretation
E Manuscript Preparation
F Literature Search
G Funds Collection

Wojciech J. Cynarski[1ABDEFG], Marcin Kudłacz[2ACDEF]

[1] Faculty of Physical Education, University of Rzeszów, Rzeszów, Poland
[2] Committee of Scientific Research, Idokan Poland Ass. in Rzeszów, Rzeszów, Poland

This work has been done within Idokan Poland Ass. (Stowarzyszenie Idôkan Polska, SIP) Project 1. Interdisciplinary multiaspect studies on the phenomenon of martial arts. Topic 1.2.: Systematic studies of the multidimensional phenomenon of far eastern martial arts.

Summary

Background: Practising sport is bringing the risk of the age behind himself to injury. The most movement organs of the move are exposed. Competition is a being of martial arts and combat sports. The cause of damage is usually main mechanical energy. At present it is estimated that the number of sportsmen of high professionality with serious disfunctions falls within 30-70% and in the Olympic years it usually reaches higher limits.

Aim of Study: Determining of the study of frequency and causes of injuries in individual martial arts and combat sports (boxing and kick-boxing, judo, jujutsu, karate).

Material/Methods: The research has been conducted on a target group of 282 practitioners of various martial arts and combat sports. As it happens in the environment of people doing sports, the majority of respondents were males – 257 compared to 25 women. (However, in statements by only two women there is information about injuries.) Those are contestants being at the top in the world, very successful in their sports. Among them there are Olympic, world and European champions. Among the practitioners of far eastern martial arts there are many holders of high and the highest master's degrees of 'dan'. The survey has been conducted with contestants at various ages among whom some finished their professional careers. There are also data concerning deceased people which had been collected earlier. The tool used here has been the 'budo questionnaire' consisting of five open questions. It is very important to note that some practitioners have done more than one martial art or combat sport.

Results: Among all combat sports and martial arts the most frequent injuries have been broken bones (21%) and damages of knee ligaments (16%). On the other hand, the least frequent have been eyebrow ridge cuts, elbow injuries, knocked out teeth (all consist 1%) and tensioned muscles, strained muscles, fractured bones, strained Achilles' tendon, hand injuries, bruises, hurts and injuries of an eye (all consist 2%). Respondents skipped information about minor injuries like bruises and abrasions. Particular types of injuries were typical for particular forms of competition.

Key words: **martial arts • combat sports • risk factors • injuries • comparative study**

Full-text PDF: http://www.archbudo.com/fulltxt.php?ICID=872090

Word count: 2918
Tables: 2
Figures: 12
References: 35

Author's address: Dr hab., Prof. UR Wojciech J. Cynarski, Faculty of Physical Education, University of Rzeszów, Piłsudskiego 30, 35-959 Rzeszów, Poland, e-mail: sp_walki@univ.rzeszow.pl

Background

Most sporting exercises and disciplines is, unfortunately, closely connected with health risks (sports injuries risk factors). It is estimated that the number of sportsmen of high professionality with serious disfunctions falls within 30–70% and in the Olympic years it usually reaches higher limits [1–3].

At present sports which are carrying the top stair of the risk with themselves exist. It concerns above all combat sports. Probably the main argument supporting this approach to them was the essence of competition – direct combat of two competing sports persons [4]. Due to great popularity of martial arts and combat sports it becomes necessary to draw attention to prevention of damages with practitioners [6]. Injuries sustained outside the training room and events development of the influence of the careers but they don't have any meaning on account of the step of the event trauma in given combat sport or martial art.

Dobrzański states that "Impact of energy from outside causing damage of a living organism is called an injury" [6]. Two types of injuries exist, from them they are first with result of long-term gradual using material (e.g. knees, different joints), and the second ones caused by the accident. It is necessary here to add, around all grudges are produced by the mechanical energy.

How do we define combat sports and martial arts? "Combat sports are customarily called a group of those sports which essence of competition consists in direct combat of two competing sports persons" ([7], p.18). Exercises are showing that competition in martial arts is being carried on, however his object isn't a direct fight but sets of formal exercises or different expressing forms of the move in general. The origin of most combat sports reaches for the tradition of combat practices or in some cases it is more adequate to say defensive practices ([7], p.18).

Looking from the perspective of humanist theory of far eastern martial arts; "Martial arts are a historical category of perfect systems of hand-to-hand fight and wielding weapon connected with elements of metaphysics" ([8], p.20). On the other hand, "Ways of martial arts are certain forms of physical culture which on the basis of the tradition of warrior cultures lead, through training of fight techniques, to psychophysical perfection and self-realization. At the same time those are processes of education and positive ascetics" ([8], p.20).

In this point of view fight is not form of negative cooperation but, paradoxically, of positive cooperation. There is no opponent, a partner of using, observation and the contemplation of the nature.

Aim of Research. Research hypotheses and questions

The basic aim of research is multifactor analysis of accidents in combat sports and martial arts. The research was supposed to give answers to a range of particular questions and aimed at estimating:

- if there are any interdependencies of the degree of trauma occurrence to the degree of contactness of the combat sport or martial art,
- if specificity of a given sport influences the type of sustained injuries,
- what kinds of injuries are characteristic for different varieties of martial arts and combat sports,
- detailed evaluation of accident occurrence and characteristics of injuries.

The following hypotheses were accepted:

- the more contact sport we are dealing with, the more injuries occur,
- specificity of a given sport influences the type of injuries,
- injuries specific for boxing are broken noses.

Material and Methods

The research has been conducted on the target group of 282 representatives of various martial arts and combat sports. The absolute majority were men (only 25 women versus 257 men) which reflects the scale of participation of both sexes. These are the leading contestants from all over the world very successful in their sports. Among them there are Olympic champions, world and European champions – people of all weight categories taking part in senior competitions. Among the practitioners of far eastern martial arts there are many holders of high and the highest master's 'dan' degrees.

The survey has been conducted on contestants at different ages of which some had already finished their sporting careers. There is also data concerning deceased people, gathered beforehand.

The tool used has been 'budo questionnaire' consisting of five open questions. It is very important to note that several contestants have trained more than one martial art or combat sport.

Among the cause for injuries which have been mentioned in the questionnaire the following four groups of causes have been distinguished:
1. Injuries sustained during competition.
2. Injuries sustained as a result of a hobby – outside the training room and competition.
3. Injuries sustained during training fight.
4. Injuries sustained during training.

The analysis of the frequency of injuries in particular sports has also been done. These combat sports and martial arts from which the most data has been collected have been specified. Those have been: boxing, judo, jujutsu, karate, kickboxing. The remaining group of sports has been called 'others'. The number of questionnaires was not large enough to consider them separately. This group includes: aikido, aikijutsu, arnis, escrima, fencing, iaido, kendo, kenpo, kobudo, kung-fu, kuntaiko, ninjutsu, sumo, taekwondo, thaiboxing, wrestling, yung jung do.

Results

Research concerning trauma occurrence in martial arts and combat sports has indicated that majority of contestants have not avoided injuries during their sporting career. Only 11.1% have not sustained any injury. Respondents skipped information on minor injuries such as bruises, abrasions. One may think

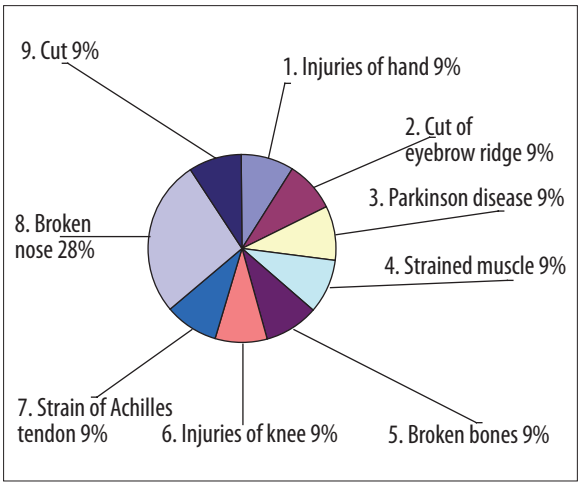

Figure 1. Injuries in boxing [Source: own research].

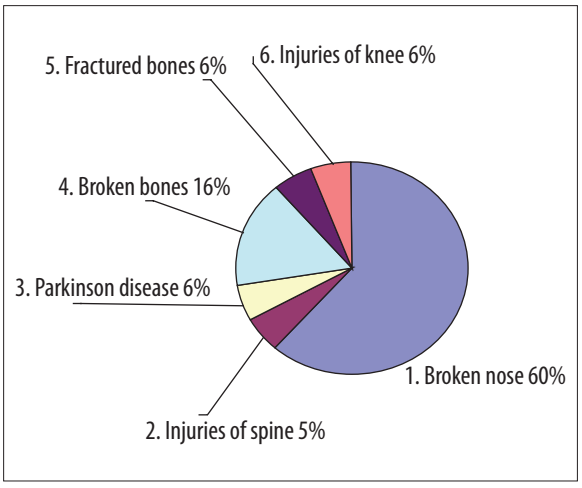

Figure 3. Injuries in kick-boxing [Source: own research].

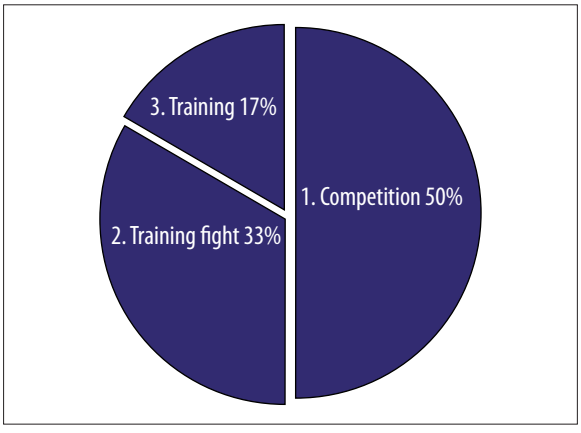

Figure 2. Percentage of injury sustainability in boxing [Source: own research].

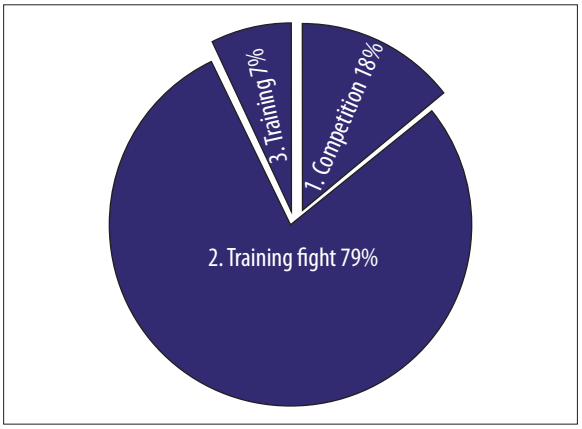

Figure 4. Percentage of injury sustainability in kick-boxing [Source: own research].

that in many cases this information has been omitted due to small degree of harmfulness of these injuries. This harmfulness may be questioned taking into consideration summing micro-injuries and their consequences but the contestants' awareness regarding this problem is often low, which negatively influences not only research results but also, what is even more important, their health. Among 88.9% of practitioners 114 injuries of different kind have been noted resulting from doing a combat sport or a martial art. It has not been unusual that an individual contestant sustained more than one injury.

Collective results

Among all combat sports and martial arts the most frequent injuries have been broken bones (21%) and damages of knee ligaments (16%). On the other hand, the least frequent have been eyebrow ridge cuts, elbow injuries, knocked out teeth (all consist 1%) and tensioned muscles, strained muscles, fractured bones, strained Achilles' tendon, hand injuries, bruises, hurts and injuries of an eye (all consist 2%) (Figures 1,2).

Kick-boxing

The next combat sport being the object of research has been kick-boxing. In kick-boxing the most frequent injury is broken nose (60%), the second frequent injury is broken other bones (16%). The remaining injuries are spine injuries, fractured ribs, Parkinson's disease and sprains of knees.

None of the contestants showed lack of injury during sporting career.

In kick-boxing only three groups of injury causes have been distinguished:
1. Injuries sustained during competition.
2. Injuries sustained during training fight.
3. Injuries sustained during training.

On the basis of the conducted research in kick-boxing one may state that injuries most often occur during training fights (79%), only 14% of injuries happen during competition fight and 7% during training (Figures 3,4).

Judo

Research concerning judo (Figure 5) has indicated the most frequent injuries are knee injuries (28%), broken bones (24%) and other injuries (18%) which occurred only in one case each. This group includes sprains of ankle joint, bruises and cuts of eyebrow ridge.

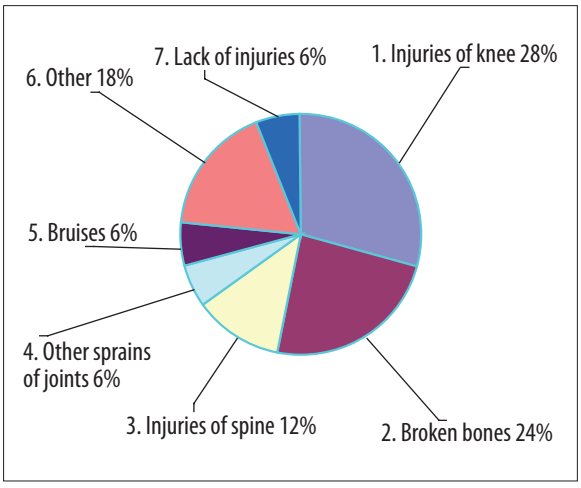

Figure 5. Injuries in judo [Source: own research].

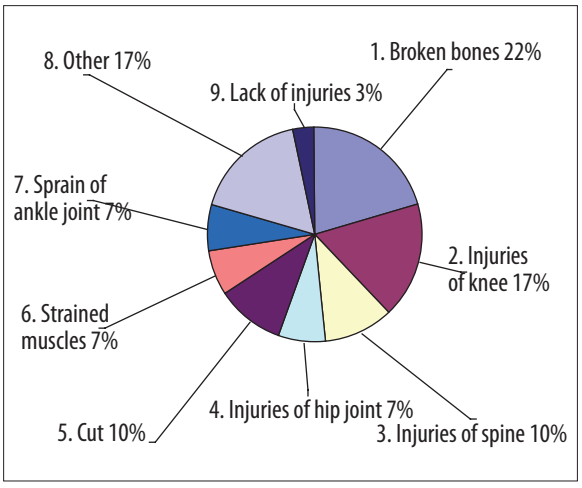

Figure 7. Injuries in karate [Source: own research].

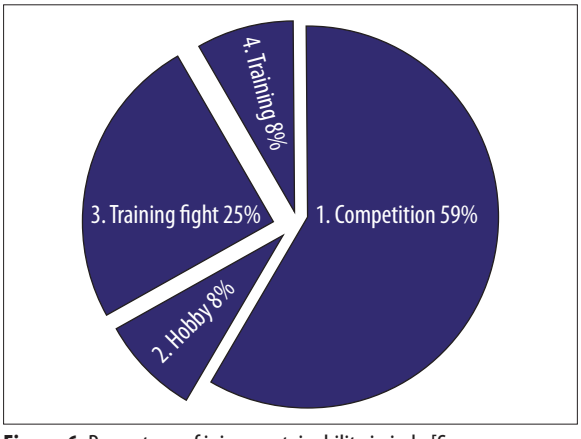

Figure 6. Percentage of injury sustainability in judo [Source: own research].

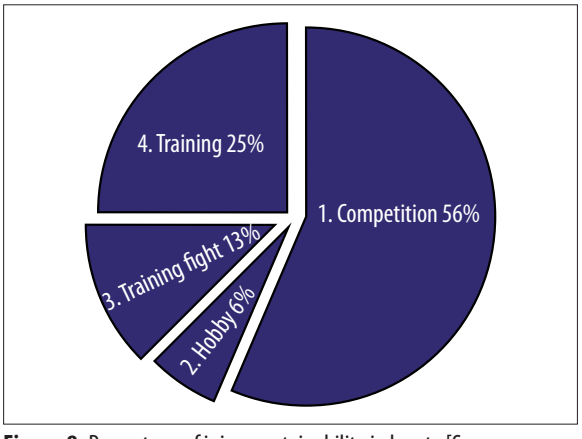

Figure 8. Percentage of injury sustainability in karate [Source: own research].

Only in one case the contestant has not sustained any injury during the career. In 59% of cases injuries happened during competition fight, 25% in training fight. Only 8% of injuries occurred during training (Figures 5,6).

Karate

It has been stated that The most frequent injuries are broken bones (22%). Quite frequent are knee injuries – 17% and spine injuries and cuts – 10%. Figure 7 illustrates the frequency of injuries in karate.

The group 'other injuries' includes injury of meniscus, knocked out tooth, bruises, eye injury, shoulder injury – this group makes up 17%. Only one contestant displayed lack of injury.

In karate 69% of injuries happened during sporting fight, however, majority of those happened during competitions – 56%. It was only 13% that happened during training fight. Injuries are sustained quite often during training (25%) (Figures 7,8).

Jujutsu (Jap. *jūjutsu*, written also "ju-jitsu")

The most frequent injuries in jujutsu (Figure 9) appeared broken bones (26%), a significant group of injuries is also a group of knee injuries (19%). 12% are other injuries which includes individual injuries such as tensioned muscle, eye injury, shoulder injury.

In jujutsu in as many as 12% of case lack of injuries has been noted. It is the best result among studies combat sports and martial arts. In 54% of cases injuries in jujutsu happen during fight but much more during competition (46%) than during training fight (only 8%). A large number of those occur during training (31%) (Figures 9,10).

Other combat sports and martial arts

This group of combat sports and martial arts includes these sports from which gathered data has been sparse (one questionnaire on injuries from each sport).

Data concerning the type of injury of practitioners of those martial arts and combat sports indicated that the most frequent injuries are damages of knee ligaments (18%), broken ear auricle (15%), broken bones (15%), spine injuries (10%), injuries of meniscus (10%, Figure 11). The rarest are strained muscles, broken noses and injuries of fingers (all 3% each).

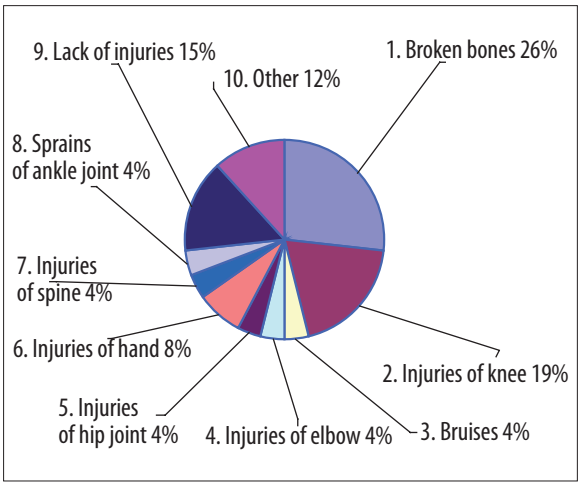

Figure 9. Injuries in jujutsu [Source: own research].

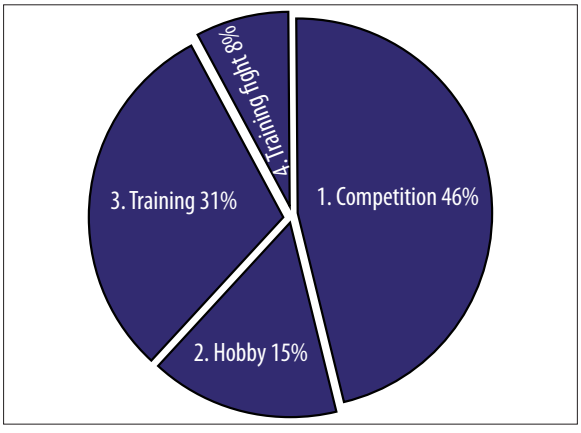

Figure 10. Percentage of injury sustainability in jujutsu [Source: own research].

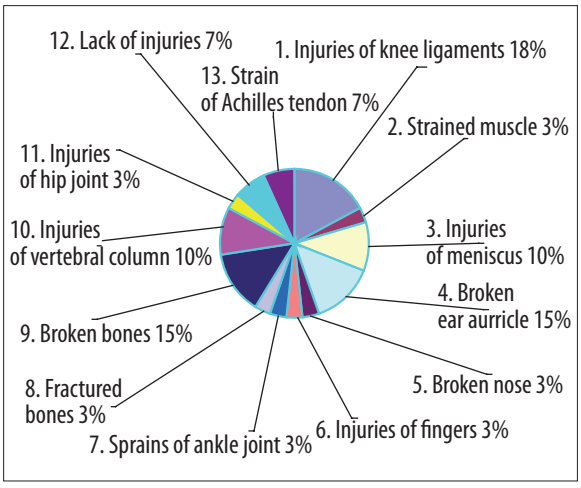

Figure 11. Other combat sports and martial arts (aikido, aikijutsu, fencing, iaido, kobudo, kung-fu, taekwondo, wrestling) [Source: own research].

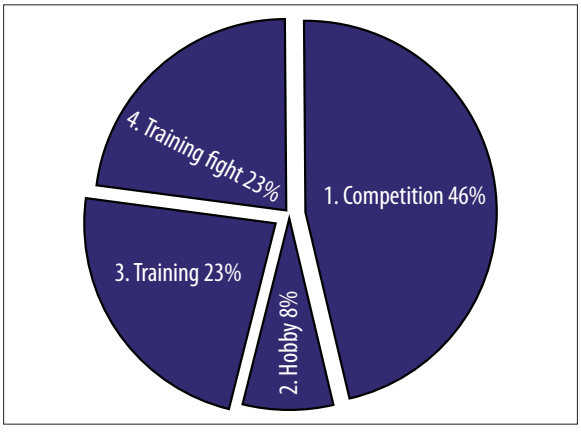

Figure 12. Percentage of injury sustainability in aikido, aikijutsu, fencing, iaido, kobudo, kung-fu, taekwondo, and wrestling [Source: own research].

In this group lack of injury is specified by the coefficient 7% (Figures 11,12).

Discussion

Injuries in particular parts of the body occurred with different frequency. There have been the most cases of head injuries (21), less frequent have been knee injuries (8) and hand injuries (7). Injuries of foot (4), shank, elbow and chest (3 in each category). There have been 2 injuries of the ankle joint and 1 injury of a thigh. In percentage terms injuries on the head are 35%. A little rarer injuries of a knee (14%) and of a hand (12%) were repeated. Injuries concerning a shoulder and a foot make up 7%. Those in the area of the chest, shank, elbow, back were 5% each. The smallest percentage is for the injuries of a thigh (2%) and of an ankle joint (3%).

In general most frequently the right side of the body was injured which was the most clearly visible in cases of damages of the right knee and right hand. In placement of head injuries the central line was dominant.

Many authors combine Asian traditions of martial arts with medicine in their works drawing main attention to their connections with acupuncture. Knowledge of these traditions allows to fight more effectively but also to treat [9–16]. However, literature on injuries in combat sports and martial arts has not exhausted the subject so far. Although much research has been already done in this respect, it has not answer all the questions. Surely there is still much to check in this area.

Macan, Bundalo and Romić conducted research among Croatian karatekas. They found out that in the male group the least number of injuries occurred in the young group (17.7%), and significantly more in the two older groups – juniors (27%) and seniors (26.7%). On the other hand in the female group injuries happened almost at the same level in all age groups: the young group – 21.1%; the junior group – 21.1% and the senior group – 20.7%. The authors stated that the reason for the injury was to receive a punch. In turn the most frequent place of an injury was the head [17].

James and Pieter researched on British judokas. Men indicated a higher degree of injuries (48.54/1000 people), in

Table 1. Injury sustainability in particular styles: kyokushinkai, shotokan, taekwondo.

	Bruises	Sprains	Dislocations	Breakings	Total
Kyokushinkai	136 (33w)	56 (3 w)	34 (1 w)	9	235 (37 w)
Shotokan	54 (24 w)	26 (3 w)	17	2	99 (27 w)
Taekwon-do	4 (2 w)	7	1	2	14
Total	194 (59 w)	89 (6 w)	52 (1 w)	13	348 (66 w)

Source [24, p.169].

case of women decidedly less injuries occurred (34.25/1000). The main type of an injury for men was congestion. For women the most frequent place of an injury was the elbow. The main mechanism for the injuries were the throws done during fight [18–20].

Similar research was conducted in Greece in Hellene Military Academy. 46% of cadets suffered form injuries [21]. In turn in research conducted in Belgium concerning injuries in judo it was proven that the risk of an injury for women was much higher than for men and the majority of damages was caused by the attack of an opponent. Violent movements during fight had greater influence on the occurrence of injuries than falls in these fights. The researchers stated that in 63.6% the reason for an injury was ignoring pain and too strenuous training contributed to it in 36.4% [21].

Sterkowicz in his research estimated the risk of accidents in judo stating that "general risk of an accident during judo practice is more than four times higher than average risk in sporting activity. Nonetheless relatively small number of people doing this sport in our country results in the fact that accidents in judo make up only 4% of all sporting accidents" ([22], p.201). The same author in another publication recognizes dependence between the placement of body injuries and the age of a contestant. "Injuries of the shoulders and upper limbs were the most frequent in the groups of children and youngsters and for juniors and seniors injuries of lower limb were characteristic ([23], p.39).

Hapek conducted survey in the group of 102 participants of a karate course representing the following styles, 59 – kyokushinkai, 36 – shotokan and 7 – taekwondo (Table 1). The questionnaires were completed during a recreational course with karate specialty. "Except three participants who stated no injuries 99 karatekas suffered from 348 injuries among which 66 were multiple" ([24], p.166). Hapek writes that the main reason for injuries is incorrect conduct of classes. "Long-lasting exercises of incorrect elements in the phase of exercise without the co-practitioner leads to microinjuries and injuries of an elbow, shoulder, knee, hip, spine etc. in particular" ([24], p.166). He noted the most sprains – 47% and bruises – 41%. Than there are dislocations – 5.9% and breakings – 5.9% [24].

Similar conclusions as those mentioned above were reached by American and English researchers [5,25–28]. On the other hand specialists indicate health or even therapeutic function of martial arts training [29–33].

Table 2. Intensive and extensive injuries' coefficients in chosen sports disciplines [3].

No.	Name of sports discipline	intensive coefficient	extensive coefficient
1.	Boxing	158.1	14.0
2.	Wrestling	103.0	6.1
3.	Fencing	64.2	2.7
4.	Ice hockey	25.7	1.1
5.	Skiing	22.4	2.6
6.	Basketball	8.1	17.0
7.	Football	5.0	4.4
8.	Volleyball	5.9	13.5

Source [3].

Conclusions

The fact that majority of martial arts and combat sports practitioners sustained at least one injury during their sporting career may suggest a high level of danger connected with practicing these sports. One of the few who did not suffer from any injury, Sato Shizuya (9th dan judo) said: "I had a lot of luck".

Combat sports and martial arts are classified in the first group of risk of an injury due to contactness. This group also includes football and skiing [34].

So far they were carrying out research in individual sports, however few researchers only conducted comparative examinations in different martial arts and combat sports. In Table 2 rates of the traumatism were compared in some sports disciplines [3].

On the other hand the range of sports being the most frequent causes of injuries includes many sports. Apart from recognized as the most "injuregenic" (with high level of sports injuries risk factors) contact sports such as hokey, basketball, football, handball or wrestling this list also includes horse riding, cycling, skiing, volleyball and tennis. Very interesting results were obtained from the analysis of frequency of injuries in particular sports. Football and basketball (19% of injuries each), skiing and cycling (14% each) are dominant. Commonly recognized as very "injuregenic" sports

such as ice hokey, boxing or wrestling make up altogether less than 4% of cases [35].

Majority of injuries happen during competition fights. It may result from the fact that it is then when contestants fighting with great dedication forget about the risk. Aiming at victory at any cost they put themselves in danger of an injury. The basis for many sports is punching which cause many injuries. Punches also contribute to falls during which damages happen. Apart from punches and kicks the throws used in judo, jujutsu and wrestling are also dangerous.

In researched sports the most frequent injuries have been broken bones and second frequent – injuries of knee ligaments. In particular in boxing and kick-boxing (related to boxing) broken noses occurred most often.

In the most contact combat sports, which are kick-boxing and boxing, broken bones have been definitely the most frequent (broken noses in particular). In sports in which contestants more often fight in distance breakings have also been the most frequent but they have outnumbered knee injuries only slightly. For boxing and kick-boxing broken noses appeared to be characteristic which results from hitting on the face. For far eastern martial arts practitioners injuries of knees have been specific.

The number of data from different varieties of martial arts and combat sports reflects popularity of a given sport. The best-known appeared karate, judo and jujutsu. Among the representatives of these disciplines the most data was collected.

Due to insufficient data it was impossible to analyze the influence of time (period of training a given sport) on frequency of injury occurrence.

On the basis of research results one may formulate the following conclusions:

a) injury sustainability in martial arts and combat sports at the stage of professional training is relatively high,
b) the most frequent injuries in martial arts and combat sports are broken bones (usually limbs),
c) broken bones occur in all studied sports,
d) the most frequent place of injuries is the head,
e) the most dangerous injuries were the injuries of knees which in a few cases resulted in finishing sporting career,
f) the most injuries happen during competition fights,
g) the more contact the sport is, the more broken bones occur,
h) specificity of a given sport influences the type of injuries, e.g. boxing punches in boxing and kick-boxing relatively often result in broken noses.

REFERENCES:

1. Hollman H: Risk factors in the development of performance. The World of Sport Medicine; 1988
2. Dziak A, Samer T: Urazy i uszkodzenia w sporcie. Kraków: Wydawnictwo Kasper; 2000
3. Kurzbauer R, Kalinowska-Waniek D: Wybrane zagadnienia z zakresu medycyny sportowej. Katowice, AWF, 1996
4. Bujak Z: Urazowość w Taekwon-do. In: Cynarski WJ, Obodyński K (eds.). Humanistyczna teoria dalekowschodnich sztuk walki – koncepcje i problemy. Rzeszów: Rzeszów University Press, 2003; 179–85
5. Bare Graunds T: Bare essentials guide for martial arts injury prevention and care. Hartford: Turtle Press, 2001
6. Dobrzański J: Medycyna wychowania fizycznego i sportu. Kraków, AWF, 1984
7. Kalina RM: Teoria sportów walki. Warszawa: Centralny Ośrodek Sportu, 2000
8. Cynarski WJ: Teoria i praktyka dalekowschodnich sztuk walki w perspektywie europejskiej. Rzeszów: Rzeszów University Press, 2004
9. Chang ST: The complete book of acupuncture. California, Celestial Arts, 1976
10. Garnuszewski Z: Renesans akupunktury. Warszawa, Sport i Turystyka, 1988
11. Kim MCh: Acupuncture for self-defense. USA: Traditional Taekwon-Do (n.d.)
12. Kogel H: Relationship between budo and medicine. Ido-Ruch dla Kultury/Movement for Culture, 2001; 2: 245–52
13. Kogel H: The sectret of kyusho jutsu – neuroanatomical basis. Ido-Ruch dla Kultury/Movement for Culture, 2006; 6: 283–98
14. Lawson-Wood D: Chinese systems of healing: an introduction to acupuncture. London: Health Science Press, 1951
15. Mann F: Acupuncture: the ancient Chinese art of healing and how it works scientifically. New York, Vintage Books, 1971
16. Serizawa K: Tsubo. Vital points for Oriental therapy. Tokyo, Japan Publications, 1976
17. Macan J, Bundalo D, Romić G: The prevalence and distribution of injuries in karate (kumite). Kinesiology, 2001; 33: 137–45
18. James G, Pieter W: Injury rates in adult elite judoka. Biology of Sport, 2003; 20(1): 25–32
19. Pieter W, Van Ryssegem G, Lufting R, Heijmans J: Injury situation and injury mechanism at the 1993 European Taekwondo Cup. Journal of Human Movement Studies, 1995; 28: 1–24
20. Sterkowicz S: Urazowość w sportach walki ze szczególnym uwzględnieniem karate i judo. In: Kalina RM (ed.), Sprawnościowe i moralne aspekty walki wręcz w wojsku. Wrocław: Wyższa Szkoła Oficerska Inżynierii Wojskowej, 1994; 147–63
21. Paxinos T, Kardaris D, Konstantinos H et al: Incidence and pattern of musculoskeletal injuries and physical fitness among Greek cadets during basic military training. Abstract Book, 10th Annual Congress, Belgrade, 2005; 411
22. Sterkowicz S: Wypadki w judo w świetle wieloczynnikowej analizy epidemiologicznej. Rocznik Naukowy AWF Kraków, 1987; 22: 199–243
23. Sterkowicz S: Analiza wypadków u kobiet i mężczyzn uprawiających judo w latach 1977–1980. Sport Wyczynowy, 1983; 4: 33–40
24. Hapek F: Urazowość i profilaktyka uszkodzeń w karate. Rocznik Naukowy AWF Kraków, 1981; 18: 165–86
25. Beis K, Tsaklis P, Pieter W, Abatzides G: Taekwondo competition injuries in Greek young and adult athletes. European Journal of Sports Traumatology and Related Research, 2001; 23: 130–36
26. Birrer RB, Birrer ChD: Medical injuries in the martial arts. Charles C. Thomas Pub. Ltd., 1981
27. Birrer RB: Trauma epidemiology in the Martial Arts, The result of an eighteen-year international survey. The American Journal of Sports Medicine, 1996; 24: 72–79
28. Canney JC: Martial arts injuries. London: A.&C. Black, 1991
29. Canney JC: Health and fitness in the martial arts. London, Bath Street Press, 1988
30. Cynarski WJ: Medycyna sztuk walki – wprowadzenie w problematykę. Nowiny Lekarskie [Medical News], 2001; 70(8): 948–52
31. Cynarski WJ, Litwiniuk A: Istotne zagadnienia medycyny sztuk walki. Ido-Ruch dla Kultury/Movement for Culture, 2001; 2: 253–63
32. Marx KW Sr: Martial arts therapy. Blamtsville (AL): Fifth Estate Publishers, 2005
33. Momola I, Cynarski WJ: Elementy jűjutsu i karate w usprawnieniu ruchowym i korygowaniu wad postawy ciaŭa. Nowiny Lekarskie, 2003; 2: 131–34
34. Tomaszewska M, Łukaszewicz J: *http://cygnus.et.put.poznan.pl/~psroka/zdjecia/* (2006)
35. *www.kulturystyka.pl/artykul74/* (2006).