THE BODY INJURIES OF FEMALE AND MALE SENIORS PARTICIPATING IN XXXIX POLISH KARATE KYOKUSHIN CHAMPIONSHIPS

Laura **PIEJKO**[A,B,C,D,E,F,G], Dagmara **GLOC**[A,C,D,E,F], Paweł **RYNGIER**[A,F]

Faculty of Physiotherapy, Academy of Physical Education, Katowice, Poland

Key words:
- athlete,
- combat sport,
- martial arts,
- protector,
- injuries,
- trauma

Abstract:
Introduction. Karate kyokushin training may take a form of occasional or regularly scheduled exercise or be the form of a competitive sport. Taking that form of physical activity, despite of the many positive aspects, it also carries the risk of accidents and injuries.
The aim of the work. The goal of the study was to evaluate the traumatic injuries of female and male athletes participating in XXXIX Polish Karate Kyokushin Championships.
The material and the methodology. The questionnaire survey was conducted among 41 karate kyokushin athletes divided into two groups. The first group consisted of 14 males and the second group consisted of 27 female individuals – participants XXXIX Polish Kyokushin Karate Championships. Respondents completing the survey were asked to answer questions about the: training experience, stage, severity of the trainee, frequency of other exercises, using protectors to avoid the injury, subjective most common causes of injuries, frequently recurring injuries, how many times during training or competition a particular part of the body was injured and about serious or permanent damage.
Results. Karate kyokushin athletes suffered a total of 472 different types of injuries. In the first group most common injuries were: contusions (93%) and joint injuries (43%) related to the left foot (13%), right hand (12%). Among women karate athletes mostly predominated –contusions (96%) and joint injuries (25%). Most of all, injuries in that group were related to the right foot (15%), right hand (14%).
Conclusions. Striking surfaces of hand and feet joints are the most vulnerable parts to the trauma. Injuries in karate kyokushin are frequent and minor, they do not tend to be life-threatening.

INTRODUCTION

According to the theory of martial arts and combat sports, a combat sports are group of activities which essence of competition consists in direct combat of two opposing athletes, while a martial arts are historical, based on tradition of warrior cultures category of systems hand-to-hand fight and handling weapon associated with elements of metaphysics. The humanistic theory of a martial arts provides theoretical perspective for this issue [5,6,7,12,14].

Karate kyokushin is a fully contact style, founded by Masutatsu Oyama in 1964 [16,20]. Over the past several years a martial arts became an increasingly popular activity and benefited people of all ages. Practicing martial arts can lower level of aggression, improve self-reliance, self-discipline, improve general fitness and physical body [7,11,19], for example: cardio-respiratory, musculoskeletal systems as well as body composition [1,10]. Instead of positive profits, each of martial art style has many risks such as accidents and injuries. The risk of experience variable injuries is dependent on a style (technical aspects of each particu-

lar style), hours of training and a degree of competitiveness [17,21]. In the kyokushin style of karate injuries are mostly associated with the karate striking surfaces – hands and feet and therefore they can be often damaged.

THE AIM OF THE STUDY

The main goal of this study was to analyze the injuries occurring in participants of XXXIX Karate Kyokushin Championships which practicing karate professionally.

MATERIAL AND METHODS

Questionnaire survey was conducted amongst the group of 41 people selected randomly. The inclusion criteria for the study were: regular participation in karate training for at least 5 years and consent to participate in the study. Exclusion criteria were: lack of consent to participate in the study, irregular participation in karate trainings and too short training experience (less than 5 years). Then the 41 athletes were divided into 2 groups. The first group consisted of 14 males and the second consisted of 27 females – participants XXXIX Polish Kyokushin Karate Senior Championships.

Among males, the mean age of was 22±5 years (18-33), mean weight of – 76±1 kg (57-100), mean body height of – 181±6 cm (172-195). 13 individuals showed right laterality of the upper limbs, ambidexterity was declared by 1 person. Prevailing right laterality of the lower limbs (11 athletes), right and left (both) laterality of the lower limbs indicated 3 athletes. Among the male group the mean of training experience was 10 years. These athletes practiced karate kyokushin approximately for 3-4 days per week, additionally they practiced another kind of physical activity for more than 3 days per week. The largest group were athletes with: 3 kyu[2] (37%), subsequently 4 kyu (14%), 2 kyu (14%), 1 kyu (14%), 1 dan (14%), 2 dan (7%).

Among females in turn, the mean age of was 23±4 years (18-31), mean weight of was 63±7 kg (51-80), mean body height of was 168±5 cm (157-176). 24 females showed right laterality of the upper limbs, left one – remaining 3 females. Prevailing right laterality of the lower limbs (18 females), while left and right laterality of the lower limbs declared 9 of them. The mean of training experience was 10 years. These athletes practiced karate kyokushin approximately for 3-4 days per week. Also they practiced other physical activities for 2 days a week. The largest group were females with: 2 kyu (38%), then 1 dan (25%), 1 kyu (21%), 4 kyu (8%), 3 kyu (4%), 2 dan (4%). Characteristics of the study groups are presented in Table I.

Table I. Characteristics of the study groups: number (N), age, body weight, body height (mean, standard deviation, minimum-maximum range)

Groups	N	Age (years)	Body height (cm)	Body weight (kg)
Polish Male Championship Seniors	14	22±5 (18-33)	181±6 (172- 195)	76±1 (57-100)
Polish Female Championship Seniors	27	23±4 (18-31)	168±5 (157-176)	63±7 (51-80)

The method of diagnostic survey questionnaire technique was used. Karate athletes anonymously filled out the individual author's questionnaire, consisting of ten questions. Survey included questions about: gender, age, height, weight, laterality of the limbs, length of

[2] In the kyokushin style of karate, the following degrees (for persons over 14 years of age): a athletes with no degree kyu – white belt, 10 kyu – orange belt, 9 kyu – orange belt with blue stripe, 8 kyu – blue belt, 7 kyu – blue belt with yellow stripe, 6 kyu – yellow belt, 5 kyu – yellow belt with a green stripe, 4 kyu – green belt, 3 kyu – green belt with brown stripe, 2 kyu – brown belt, first kyu – brown belt with a black stripe. Dan master's degrees: a black belt with a gold stripe – 1 dan black belt with two gold epaulettes – 2 dan and up to the 10 dan.

training experience, stage of karate training (kyu/dan), severity of the trainee, frequency of other exercises, using protectors to avoid the injury, subjective most common causes of injuries, frequently recurring injuries, how many times during training or competition a particular part of the body was injured and about serious or permanent damage to the respondent's health. Survey results were collected and subjected to statistical analysis using Microsoft Excel. The mean, standard deviation, minimum and maximum values and severity rates specific indications were calculated.

RESULTS

Karate kyokushin athletes in both groups were asked about their opinion on the most common causes of injuries. The answers from males were as follows: inadequate warm-up (79%), overstrain (57%) and dissociation (50%), followed by excessive partner aggression (21%) and overestimating self-current skills (21%). Women in turn, as main causes of injuries pointed: improper warm-up (75%), dissociation (50%), excessive aggression of partner (42%), overestimating current self-skills (25%) and fatigue (21%). Responses are shown in Table II.

Table II. The most frequently indicated causes of injuries by males, females of Polish Championships: number (N), the percentage of athletes who indicated specific cause of injury

Indicated cause of injury - Polish Seniors Championships males	**N**	**The percentage of males who indicated specific cause of injury**
improper warm-up	11	79%
overstrain	8	57%
dissociation	7	50%
partner excessive aggression	3	21%
training errors (overestimate self-skills)	3	21%
Indicated cause of injury - Polish Seniors Championships females		**The percentage of females who indicated specific cause of injury**
improper warm-up	18	75%
dissociation	12	50%
partner excessive aggression	10	42%
training errors (overestimate self-skills)	6	25%
overstrain	5	21%

Karate athletes were also asked to indicate what type of protectors they use to prevent or minimize the risk of injury. In the first group, the most common protector was suspensor (protector of the genitals), used by 93% of the karate practitioners. Other often used protectors were: leg – the tibia and feet (64%), upper extremities and hands (43%). Several athletes have also used a teeth guard (21%) and knees protector (14%). All questioned female athletes taking part in the Polish Championships, to minimize the risk of injury applied at most tibia and foot protectors (100%). Then – breasts protector (96%), arms and hands (50%), knee (21%) and teeth (13%). One of the women used additionally head protector. There was not person who did not use any protection during exercises (Table III.).

Table III. The most commonly used protectors by males, females of Polish Championships: number (N), the percentage of athletes who indicated the type of protection

Used protectors - Polish Seniors Championships males	**N**	**The percentage of males who use a particular type of protectors**
suspensor	13	93%
tibia and foot	9	64%
arms and hands	6	43%
teeth	3	21%
knee joint	2	14%

Used protectors - Polish Seniors Championships females		**The percentage of females who use a particular type of protectors**
tibia and foot	24	100%
breasts	23	96%
arms and hands	12	50%
knee joint	5	21%
teeth	3	13%
head	1	4%

In the next question, karate kyokushin athletes were asked to indicate the most common injuries. In the group of male karate athletes prevailed: contusions (93%), joint injuries (43%) and myofascial damages (29%). Reported selected cases of torsion (7%) and fracture (7%). Among women in turn, predominantly dominated: contusions (96%), joint injuries (25%), torsions (21%). Less than in the group of men were damaged muscle and fascia (13%). The results are shown in Table IV.

Table IV. The most common injuries in males, females of Polish Championships: number (N), the percentage of athletes who indicated the type of injury

The type of injury - Polish Seniors Championships males	**N**	**The percentage of males who indicated the type of injury**
contusions	13	93%
joint injuries	6	43%
muscle and fascia damages	4	29%
torsion	1	7%
fracture	1	7%
The type of injury - Polish Seniors Championships females		**The percentage of females who indicated the type of injury**
contusions	23	96%
joint injuries	6	25%
torsions	5	21%
muscle and fascia damages	3	13%

Subsequently, contestants were asked to indicate how many times during karate training particular part of the body was damaged and were asked about injuries that occurred in the body during the last year. The results are presented in Tables V-VII.

In the first group most injuries were related to the left foot (13%), right hand (12%) and right foot (10%). Reported cases of the right lower extremity injuries (hip injury, 9%), chest, left hand, back (all at 8%), right upper extremity (hip injury), face, right leg (muscle-ligamentous injury), left leg lower (joint sprain) (all at 5%), left lower limb (ligamentous injury-muscular, 4%), left upper limb (joint injury 3%) and abdominal (3%). Joint injuries were more frequent than muscle damages. There was no report of pelvis injury. There was no person who does not suffer any injury of the mentioned. The total number of injuries was 186 (Table V.).

Table V. The most damaged part of the body in males of Polish Championships: number of males who suffered trauma (N), the mean incidence of injury to one karate athlete, the percentage of males who identified the part of the body

Indicated part of the body - Polish Seniors Championships males	**N**	**The mean incidence of injury on 1 person**	**The percentage of indicated part of the body in the total number of reported injuries**
back	14	1.00	8%
right upper limb - joint trauma	9	0.64	5%
right upper limb - ligamentous-muscular trauma	2	0.14	1%

left upper limb - joint trauma	5	0.36	3%
left upper limb - ligamentous-muscular trauma	2	0.14	1%
right hand - joint trauma	23	1.64	12%
left hand - joint trauma	14	1.00	8%
right lower limb - joint trauma	17	1.21	9%
right lower limb - ligamentous-muscular trauma	9	0.64	5%
left lower limb - joint trauma	10	0.71	5%
left lower limb - ligamentous-muscular trauma	8	0.57	4%
right foot - joint trauma	19	1.36	10%
left foot - joint trauma	25	1.79	13%
pelvis - joint trauma	0	0.00	0%
face	9	0.64	5%
thorax	15	1.07	8%
abdomen	5	0.35	3%
TOTAL NUMBER OF INJURES	**186**		

In the second group, among women while practicing karate kyokushin the most commonly reported injuries were related to the: right foot (15%), right hand (14%) and left foot (12%). Reported cases of right upper extremity injury (injury to the joint 8%), left hand (7%), chest, face (7% each), right arm (joint sprain, 6%), left upper extremity (hip injury 5%), left lower limb (hip trauma – 4%), abdominal (4%), back (3%), right left leg (ligamentous-muscular injury 2%), and left and right upper limb (ligamentous-muscular injury 1%). Joint injuries were more frequent than muscle ones. The total number of injuries was 286. Responses are shown in Table VI.

Table VI. The most damaged part of the body in females of Polish Championships: number of females who suffered trauma (N), the mean incidence of injury to one karate athlete, the percentage of females who identified the part of the body

Indicated part of the body - Polish Seniors Championships females	**N**	**The mean incidence of injury on 1 person**	**The percentage of indicated part of the body in the total number of reported injuries**
back	10	0.37	3%
right upper limb - joint trauma	24	0.89	8%
right upper limb - ligamentous-muscular trauma	2	0.07	1%
left upper limb - joint trauma	14	0.52	5%
left upper limb - ligamentous-muscular trauma	2	0.07	1%
right hand - joint trauma	41	1.52	14%
left hand - joint trauma	20	0.74	7%
right lower limb - joint trauma	18	0.67	6%
right lower limb - ligamentous-muscular trauma	6	0.22	2%
left lower limb - joint trauma	11	0.41	4%
left lower limb - ligamentous-muscular trauma	5	0.19	2%
right foot - joint trauma	43	1.59	15%
left foot - joint trauma	34	1.25	12%
pelvis - joint trauma	5	0.19	2%
face	20	0.74	7%
thorax	19	07	7%
abdomen	12	0.44	4%
TOTAL NUMBER OF INJURIES	**286**		

Respondents suffered a total of 472 different types of injuries – 186 injuries among men and 286 injuries in women. Mean rate of injury for one person among men, participants of the Polish Championships were: 0.78, in which the right hand was: 1.64, left hand was: 1.0, right foot was: 1.36, left foot was: 1.79; head was: 0.64. For women, the mean rate of injury for one person was: 0.62, including the right hand: 1.52, left hand: 0.74, right foot: 1.59, left foot: 1.25, head 0,74.

In the past year in the group of males, 43% of them did not suffer injury. Most injuries underwent were right hand (21%), left lower limb (21%) and chest (14%). Reported isolate cases of injury to face, left hand, right leg, foot and back (all at 7%) (Table VII).

Table VII. The most damaged part of the body in the last year among males of Polish Championships: number (N), the percentage of males who identified the part of the body

Indicated part of the body - Polish Seniors Championships males	N	The percentage of males in the group who indicated particular part of the body
face	1	7%
right hand	3	21%
left hand	1	7%
left lower limb	3	21%
right lower limb	1	7%
left foot	1	7%
right foot	1	7%
left upper limb	0	0%
right upper limb	0	0%
abdomen	0	0%
pelvis	0	0%
lack of the injury in the past year	6	43%
thorax	2	14%
back	1	7%

In the second group, in the last year 8% of karate kyokushin female athletes did not suffer any injury. Similarly as in male group, the most occurring was the right hand injury (42%). Subsequently – right foot (29%), right lower limb (21%), face (17%), left lower limb (17%), left foot (17%). There were several cases of abdominal trauma (13%), left hand (13%), right arm (4%), chest (4%) and back injury (8%). Responses are shown in Table VIII.

Table VIII. The most damaged part of the body in the last year among females of Polish Championships: number (N), the percentage of females who identified the part of the body

Indicated part of the body - Polish Seniors Championships females	N	The percentage of females in the group who indicated particular part of the body
face	4	17%
right hand	10	42%
left hand	3	13%
left lower limb	4	17%
right lower limb	5	21%
left foot	4	17%
right foot	7	29%
left upper limb	1	4%
right upper limb	2	8%
abdomen	3	13%
pelvis	0	0%
lack of the injury in the past year	2	8%
thorax	1	4%
back	2	8%

Lastly, athletes were questioned whether during training they encountered with serious or permanent damage to the health. Serious and permanent injury occurred rarely. In the first group experienced them 35% of males and in the second group it was 12% of females. In the first group 65% of men during long-term training were not encounter with a severe or permanent damage to the health. The other karate athletes from that group mentioned: bone fractures – tibia and nose, a concussion, damage to the ligaments of the knee joint and incompetent use of cooling spray resulting in necrosis of the skin. 88% of females in turn, have no experienced serious or permanent injury. Other women from the second group mentioned: fractures – of the forearm, metacarpal bones and knee ligament damage. The results are shown in Table IX.

Table IX. The most indicated severe or permanent damage to the health experienced during exercises, of the males, females of Polish Championships: number (N), the percentage of athletes who indicated an injury

Indicated severe or permanent damage to health - Polish Seniors Championships males	**N**	**The percent of males who indicated the type of injury**
concussion (5 years ago)	1	7%
nasal fracture	1	7%
necrosis of the skin after application of cooling spray	1	7%
open fracture of the tibia	1	7%
rapture of the ligaments in the knee joint	1	7%
lack	9	65%
Indicated severe or permanent damage to health - Polish Seniors Championships females		**The percent of females who indicated the type of injury**
forearm fracture	1	4%
fracture metacarpal joint	1	4%
rapture of the ligaments in the knee	1	4%
lack	21	88%

DISCUSSION

Arriaza and Leyes [1] analyzed the injuries sustained by athletes training karate: shotokan, shito-ryu, goju-ryu and wado-ryu – taking part in three consecutive World Championships. The mean value of the injuries was at level 157.03/1000 competitors. Authors reported 891 injuries. The most common injuries were contusions of the large muscle groups (50.3%), facial traumas resulting in bleeding from nose (16.2%), cuts and abrasions (13.7%) and twisting (3.5%). There were 796 (89.3%) minor injuries, 70 (7.9%) moderate and 25 (2.8%) severe injuries. Severe cases of injuries resulted in concussion, internal organs damages, third-degree sprains, eye injuries and various types of fractures. Most injuries were related to the face (72.5%), head (11.6%) and lower limb (6.4%). In our study in groups of karate kyokushin athletes strongly dominated minor injuries as contusions and joint injuries within hands and feet. The overall proportion of severe injuries was lower than in Arriaza and Leyers study. These differences may be due to the fact that athletes analyzed by the Arriaza and Leyers took part in the World Karate Championships (high level of competitors), while our competitors were taking part in the Polish Championships. Differences may be also related to the dissimilarities occurring between each style of karate. The authors emphasize that competitive karate is associated with a relatively high injury rate and note that cases of severe injuries were rare what is compatible with our study.

Boostani M.H., Boostani M.A, Rezaei et al. [2] evaluated the incidence, type and mechanism of sport injuries in male national karate athletes in the World Championship held in Turkey (2010). In research most occurred injuries were muscular injuries (65.4%). The most common organic injuries occurred in head and face (32.4%). Analysis of the authors indicated that injuries most involved trauma (38.4%), contusion (15.1%), tension (7.5%) and strain. The most common reasons of injury were high pressure (26.9%), improper warning up (22.4%),

injuries inflicted by a partner (14.9%). Mechanism of injury incidence was also related to the opponent's kick and punch blows (56.9%), kicks and punches (33.3%) and falling down to the ground (9.8%). Authors reported heavier cases of injuries in comparison to the Polish karate athletes, where dominated minor contusions within right hand and left lower limb. Differences may be cause by the rules – level of judging and penalties for uncontrolled blows between athletes from Iran and Poland. Boostani M.H., Boostani M.A, Rezaei et al. emphasized that improving coaches and athletes' awareness of the prevailing injuries in karate by using protectors is (inter alia) the way for decreasing injuries in this martial art what is consistent with our observations.

Cynarski and Kudłacz [6] conducted analysis on 282 (257 males, 25 women) practitioners of various martial arts and combat sports. Among all combat sports and martial arts the most frequent injuries were broken bones (21%) and damages of knee ligaments (16%) whereas the least frequent – 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 2%). Specific types of damages were typical for particular forms of competition. In karate the most frequent injuries were broken bones (22%), knee injuries (17%), spine injuries and cuts – 10%. Only one contestant displayed lack of injury. 69% of injuries happened during sport fight, majority of those happened during competitions – 56%. Only 13% injuries happened during training. Injuries persistent quite often through training (25%). It is worth noting that some practitioners did more than one martial art or combat sport. Also, respondents did not mention an information about minor injuries like bruises and abrasions, which dominated in our analysis.

Destombe, Lejeune, Guillodo et al. [8] analyzed the injuries sustained by the 186 French karate athletes for a period of 1 year. Total number of injuries was 83 (63 during trainings, 20 during competitions), average injuries stood at 44.6/100 players. The most common injuries were: hematomas (53%), twisting (19%), muscle injuries (7%), fractures (7%), cuts and abrasions (7%). Predominated limb injuries were: the upper (28.9%) and lower (35%), followed by head (26.5%) and trunk (9.6%) injuries. Authors stressed that injury rate increased with time spent on trainings, rank of each competitor and years of practice what is similar to our study. Destombe, Lejeune, Guillodo et al. also emphasized that serious injuries in karate were rare. Minor injuries of the upper and lower limbs were dominating, what is compatible with our findings.

Gartland, Malik and Lovell [9] studied the incidence of injuries in muay thai kickboxing athletes. The survey was conducted among 152 people. Mean value of injuries stood at 13.5/1000 recreational competitors athletes (amateurs) and 2.79/1000 professional athletes. The most suffered injuries were: bruises, lacerations and abrasions. Among the amateurs dominated injuries to the lower limbs (75%), trunk (15.9%) and upper extremities (6.8%). Head injuries accounted for 2.3% of all injuries. Among professional athletes lower limb injuries (53%) also predominated. More often they experienced trauma to the head and trunk. The most frequently occurring injuries were: bruises, sprains, cuts and abrasions. Authors highlighted that different martial arts are associated with particular injury pattern which may explain the differences in percentage distribution of injuries between muay thai kickboxers and karate kyokushin practitioners. However, worth noting is fact that, according to the authors, karate is linked to the traumas within the lower extremities, as it can be seen in our study.

Kazemi, Chudolinski, Turgeon et al. [13] analyzed the injuries suffered by athletes training taekwondo for a period of 9 years. Average injuries stood at 16.18/100 athletes. Predominated head injuries (19%), foot injuries (16%) and thigh (9%). Minor traumas as: contusions (36%), sprains (19%) and muscle strains (15%) were the most common. Differences between Kazemi, Chudolinki, Turgeon et al. and our study occurred in the distribution of rates and the leading locations of injuries. Nevertheless, according to the authors, the most com-

monly reported injuries were bruises, injuries of joints and muscles, which is similar to our results.

Kujala, Taimela, Antti-Poika et al. [15] analyzed 54186 sports injuries sustained by judo, karate, football, ice hockey, basketball and volleyball players in the years 1987-1991. Average injuries stood at 142/1000 of karate athletes, 117/1000 of judo competitors, 94/1000 of hockey players, 89/1000 among football players, 88/1000 among basketball players and 60/1000 of the volleyball players. In team games 46-59% of injuries happen during competitions and tournaments, while in martial arts the figure was 70%. Injuries typical for each discipline predominated. Fractures and teeth injuries were the most common among players of hockey and karate, lower extremity injuries among football and volleyball players and upper extremity injuries in judo. Sprains, muscle injuries and contusions were the most common types of injuries. The most predominant areas of the injury among karate athletes, according to the authors' injury were: lower limbs (37.3%) – especially: knee (11%) and foot (10.7%), and upper limbs (26.3%) – fingers (9.3%). Other traumatic sites (36.3%) were head and neck (10.9%). Mostly injuries (sprains, strains, bruises, fractures) were related to the striking surfaces in karate – hand and feet joints, what is compatible with our study findings.

Pieter [18] assessed the injury profile in young – 7-15 years, 218 boys and 84 girls, karate athletes. Studied groups were competing at an Open Dutch Karate Championship. Author assessed a nature, site, circumstances and severity of the injury – calculated athletes-exposures (AE) per 1000 and relative risk (RR) as the 95%CI around the injury rates. Analysis indicated that there was no significant difference in injury rate between boys and girls: 99.74 per 1000 AE (95%CI: 77.32-122.16) vs 115.11 per 1000 AE (95%CI: 75.23-154.99). Girls were also not at a higher risk of incurring an injury (RR = 1.093, 95%CI: 0.788-1.516. The head and neck were more likely to get injured compared to the upper extremities in boys: RR = 2.65 (95%CI: 1.39-5.03). There was no significant difference between the injury rates of the head and neck and the upper extremities in girls but the head and neck were at a higher risk to sustain an injury: RR = 3.50 (95%CI: 1.29-9.49). The main mechanism of injury in boys tended to involve a punch compared to a kick: RR = 1.41 (95%CI: 1.00-2.00). The head and neck were at higher risk to sustain an injury, while punches were the main causes of injury. In our study we also noticed higher number of injuries in female athletes than in male (286 versus 186) but mainly dominated the hands and foot injuries. Noteworthy is the fact, that Pieter suggested prevention include using protective equipment and enforcement of the rules during competition what is consistent with our conclusions.

Zazryn, Finch and McCrory [21] in turn, studied the incidence of injuries among professional athletes training kickboxing for a period of 16 years. Total number of injuries was 382, mean value of injuries stood at 109.7/1000 competitors. The most common injuries were superficial ones like: bruises, lacerations and abrasions (over 64%). Predominated head, neck, face (51.6%) and lower limbs (39.8%) injuries, in particular the lower leg (23.3%), face (19.4%) and intracranial injuries (17.2%). The nature of kickboxing where kicking the opponent is the major movement and head is a prime object was associated with the distributions of body regions mostly injured by participants. Therefore, the results obtained by authors differed from results received in karate kyokushin athletes (differences between karate kyokushin and kickboxing style).

Zetaruk, Violán, Zurakowski et al. [22] investigated the incidence of injuries among the 263 athletes trained martial arts. The survey was conducted among athletes training: karate shotokan (114 individuals), aikido (47 people), taekwon-do (49 athletes), kung fu (39 athletes) and tai chi (14 individuals). Most injuries were related to the athletes practicing taekwon-do (59%), aikido (51%) and kung fu (38%). The least frequent injuries applied to karate shotokan athletes (30%) and tai chi (14%). According to the authors karate shotokan athletes suffered 114 injuries, among which the lower extremity (22.8%), upper extremity

(16.7%), trunk (14.9%) and head, neck injuries (9.6%) were dominating. The areas of suffered injuries in karate shotokan athletes are consistent with parts of the body that have been injured in karate kyokushin individuals.

Over the years a reduction in average number of injuries in martial arts [3,4], including a number of acute injuries as concussions to muscle and tendon ones, has been observed. Perhaps, it is due to the widespread use of protectors, greater awareness in the treatment area, prevention of damage and stricter enforcement of the competitions.

CONCLUSIONS

1. The hands and foot which are striking surfaces in karate kyokushin are reflected in commonly the most vulnerable parts to an injury.
2. Injuries in karate kyokushin are frequent, minor and they do not tend to be life-threatening.
3. Athletes and coaches should increase in awareness of injury prevention through the use of protectors and proper warm-up as well as execution of rules during the competition.

REFERENCES

1. Arriaza R., Leyes M. *Injury profile in competitive karate: prospective analysis of three consecutive World Karate Championships*. Knee Surgery Sports Traumatology Arthroscopy 2005; 13: 603-607.
2. Boostani M.H., Boostani M.A., Rezaei A.M., Khatamsaz S. *The study of sport injuries in the national team karate of Iran (kumite field)*. Ido Movement for Culture. Journal of Martial Arts Anthropology 2011; 11(4): 27-34.
3. Burke D.T., Barfoot K., Bryant S., Schneider J.C., Kim H.J., Levin G. *Effect of implementation of safety measures in tae kwon do competition*. British Journal of Sports Medicine 2003; 37: 401-404.
4. Critchley G.R., Mannion S., Meredith C. *Injury rates in Shotokan karate*. British Journal of Sports Medicine 1999; 33: 174-177.
5. Cynarski W.J. *Teoria i praktyka dalekowschodnich sztuk walki w perspektywie europejskiej*. Rzeszów University Press, Rzeszów 2004 [in Polish].
6. Cynarski W.J., Kudłacz M. *Injuries in martial arts and combat sports – a comparative study*. Archives of Budo 2008; 4: 91-97.
7. Cynarski W.J., Sieber L., Obodyński K., Ďuriček M., Król P., Rzepko M. *Factors of development of Far Eastern martial arts in Central Europe*. Journal of Human Kinetics 2009; 22: 69-75.
8. Destombe C., Lejeune L., Guillodo Y., Roudaut A., Jousse S., Devauchelle V., Saraux A. *Incidence and nature of karate injuries*. Joint Bone Spine 2006; 73: 182-188.
9. Gartland S., Malik M.H.A., Lovell M.E. *Injury and injury rates in Muay Thai kick boxing*. British Journal of Sports Medicine 2001; 35: 308-313.
10. Gloc D., Plewa M., Nowak Z. *The effects of kyokushin karate training on the anthropometry and body composition of advanced female and male practitioners*. Journal of Combat Sports and Martial Arts 2012; 1(2): 63-71.
11. Jakhel R., Pieter W. *Changes in participation motives in karate between 1970-1999.* Ido Movement for Culture. Journal of Martial Arts Anthropology 2013; 13(1): 48-57.
12. Kalina R.M. *Teoria sportów walki*. Centralny Ośrodek Sportu, Warszawa 2000 [in Polish].
13. Kazemi M., Chudolinski A., Turgeon M., Simon A., Ho E., Coombe L. *Nine year longitudinal retrospective study of Taekwondo injuries*. Journal of the Canadian Chiropractic Association 2009; 53(4): 272-281.

14. Kudłacz M., Cynarski W.J. *Injuries in martial arts and combat sports – preliminary results of research.* Archives of Budo 2007; 3: 62-67.
15. Kujala U.M., Taimela S., Antti-Poika I., Orava S., Tuominen R., Myllynen P. *Acute injuries in soccer, ice hockey, volleyball, basketball, judo, and karate: analysis of national registry data*. British Journal of the Sports Medicine 1995; 2, 311(7018): 1465-1468.
16. Lorden M.J. *Oyama Legenda i Dziedzictwo*. Budo-Sport, Warszawa 2003 [in Polish].
17. Nishime R.S. *Martial Arts Sports Medicine: Current issues and competition event coverage*. Current Sports Medicine Reports 2007; 6: 162-169.
18. Pieter W. *Competition injury rates in young karate athletes*. Science & Sports 2010; 25: 32-38.
19. Terry Ch.M. *The martial arts*. Physical Medicine and Rehabilitation Clinics of North America 2006; 17: 645-676.
20. Witkowski K. *Z historii systemów walk dalekiego wschodu. Aikido. Judo. Ju-Jutsu, Karate. Kendo. Sumo*. Akademia Wychowania Fizycznego, Wrocław 1993; 55-75 [in Polish].
21. Zazryn T.R., Finch C.F., McCrory P. *A 16 year study of injuries to professional kickboxers in the state of Victoria, Australia*. British Journal of Sports Medicine 2003; 37: 448-451.
22. Zetaruk M.N., Violán M.A., Zurakowski D., Micheli L.J. *Injuries in martial arts: a comparison of five styles*. British Journal of Sports Medicine 2005; 39: 29-33.