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MOST COMMON INJURIES TO PROFESSIONAL CONTESTANT KARATE

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ABSTRACT

Aim: The aim of the study is an attempt to answer the question whether a long-term karate practice exerts influence on the incidence of injuries and what its type and underlying cause.

Methods: The research was carried out in July 2013 in Cracow during a karate training camp. 125 people from Poland participated in the study. The participation in research

was voluntary and people were informed about its aim and application. The average age was $37,6 \pm 11,3$ years. The youngest participant was 15 and the oldest 57. Median age was 39 which means that half of participants was not older than 39 and the other half was at least 39. Questionnaire techniques were used in the study. The research tool used to implement the selected technique was survey questionnaire. The questionnaire consisted of 23 open- and close-ended questions.

Results: As results from own research, the greatest number of competitors (38) have suffered from contusion (47,1% of all injury types). This injury types constitutes almost half of all injuries. Among all injury types karate contestants suffered from last year, the most common were contusions (25,6% of all injuries).

Conclusions: Karate training is not related to any serious injuries apart from contusions which at the same time are most common injury in this type of training. Contestants' and training experience are not directly related to injury incidence. An appropriately organized, rational training and using prevention enables to avoid injuries. Circumstances of injury incidence change with contestants' age and training experience.

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INTRODUCTION

During the various stages of their existence people desire and strive to create the best possible living conditions for themselves. They aim to create favourable circumstances and to get to know more and more successful methods to obtain the aim of safe existence. Striving to satisfy their needs, people have always looked for effective methods for ensuring the best possible level of security (Piwowarski 2014a).

The results of research on security sciences, which belong to non-material resources of human's consolidated achievements, constitute a significant element of security culture (Piwowarski 2013).

Security culture is a set of material and non-material elements of human's consolidated achievements, which serve to cultivate, regain (if it has been lost) and raise security level of particular entities. It can be examined from an individual – mental-spiritual, social and physical (material) perspective.

This phenomenon constitutes a trichotomy, which is made up from three dimensions which permeate each other:

- the mental-spiritual (individual) dimension,
- the legal- organizational (social) dimension,
- the material dimension (Piwowarski 2014a).

Security culture serves humans to achieve and satisfy the following aims and needs:

1. Effective control of emerging risks, aiming to obtain a level of satisfactorily low level of risk.
2. Regaining safety in a situation in which it has been lost.
3. Optimization the level of multi-sector safety for a particular entity.
4. Raising awareness on a social and personal scale about the need to self-improvement and three dimensional development along with activating motivation and attitudes which result in individual and team actions, which, in turn, result in comprehensive development of individual and group sense of security (Piwowarski 2013, 2014a,b).

Human beings have always used their body as a work or security tool. Physical fitness obtained thanks to practicing combat sports (including karate) not only enables better effectiveness in professional area, but also minimizes external risks by reducing susceptibility to stress and giving self-confidence. That is why practice of combat sports becomes part of the issues of security culture. The sense of high physical and technical fitness, obtained thanks to karate practice is also a fulfillment of hedonistic values. The tendency to gain advantage over other people is a typical human characteristic (Grabowski 1997, Ambroży 2004) and that is why one of motives to practice karate is protection of one's body against risks coming from the outside, which is possible as a result of gaining advantage over one's opponent or occurrence. However, one should be careful so that an excess of ambition and the pursuit of records do not become a threat to health and functional harmony. Karate training should therefore be organized systematically, properly from the technical perspective and monitored in respect of gradual adaptation to increasing training load in order to avoid overburden and injuries.

Sports are characterized by high intensity, long duration and greater involvement of psyche in order to prepare oneself to a contest or competing for victory. The necessity of such actions and the course of competition (especially in case of sports involving direct contact) may be a cause

of injury. Injury is a laceration of tissue, organ or substantial area of human body as a result of impact of energy from the outside, which causes damage of a living system, e.g. mechanic, thermal, chemical or electrical factors which cause injury. Therefore, it can be assumed that sports injury is a damage of a living system, a result from the impact of external energy and disruption of a sportsperson's adaptation in conditions of increasing training load (Baszkirow 1990). From a legal point of view, each injury suffered in the course of sports practice should be treated as a sports accident, which is an unforeseen and unplanned disruption of movement of planned movement (Kurzbaauer, Kalinowska-Waniek 1996). Sports injuries can be divided into typical and accidental (Dziak, Tayara 1990) and acute and chronic ones (Kurzbaauer, Kalinowska-Waniek 1996). Whereas typical injuries are characteristic of one or a group of sports disciplines, accidental injuries occur in practicing sport in general. Reasons for the incidence of injuries may be technical in nature or may be caused by people (Bujak 2008). We can also distinguish between sports injuries which occur as a result of acute injury or repeated overloads (Zimmer 2004).

The most common injuries in sport include fractures, dislocations and the so-called soft components of human musculoskeletal system. In contact sports, such as karate, contusions also occur. The reasons for injury may be training mistakes, overtraining, wrong technical training, excessively one-sided specialization, unsuitable preparation of the location for training or equipment, wrong weather conditions, inappropriate warm up or lack of necessary protection measures (Zajączkowski 1984, Bujak 2008).

Attempt to classify sports disciplines has been made in which examples of sports of the so-called high risk sports are given. This group includes inter alia karate. It is difficult to say if such classifications are created on the basis of research or if the main argument for such an approach is the sense of competitiveness – a direct clash of two competing sportsmen (Kalina 2000, Bujak 2008).

THE AIM OF THE STUDY

The aim of the study is an attempt to answer the question whether a long-term karate practice exerts influence on the incidence of injuries and what its type and underlying cause.

The following research questions have been formulated:

1. What are the most common injuries to karate contestants?
2. Is sportsmen's age and training experience related to the number of injuries they suffered from last year?
3. Does the use of prevention of motor organ overload result in reducing the number of incidences of injuries?
4. Do the circumstances in which injuries occur change with age and training experience of contestants?

MATERIAL AND RESEARCH METHOD

The research was carried out in July 2013 in Cracow during a karate training camp. 125 people from Poland participated in the study. The participation in research was voluntary and participants were informed about its aim and application.

The average age was $37,6 \pm 11,3$ years. The youngest participant was 15 and the oldest 57. Median age was 39 which means that half of participants was not older than 39 and the other half was at least 39.

Questionnaire techniques were used in the study. The research tool used to implement the selected technique was survey questionnaire. The questionnaire consisted of 23 open- and close-ended questions.

Data obtained by means of the questionnaire were subjected to statistical analysis and then presented in the form of tables and figures. The analysis of data collected on the basis of research result was conducted based on percentage analysis as well as by means of statistical tools.

Statistical analysis of the collected material was conducted in Statistica 10.0. Tests belonging to the group of non-parametric tests were used for analysis. Their choice was conditioned by the failure to meet basic assumptions of parametric tests, namely homogeneity of the distribution of the examined variables with normal distributions or homogeneity of variance. Whereas the homogeneity of distributions with normal distribution was verified by Shapiro-Wilk test, the homogeneity of variance was examined by Levene test.

RESEARCH RESULTS

The research results have been presented in tables and on figures.

TABLE 1. KARATE TRAINING EXPERIENCE

Training experience (n people – 125)	[years]
Mean	16,7
Median	15,0
Minimum	0,5
Maximum	38,0
Standard deviation	9,9

As shown in Table 1, training experience in the examined group of sportsmen ranges from 0,5 – 38 years. On average it amounts to $16,7 \pm 9,9$ and the median is 15. The greatest number of participants has experience of approximately 10 years (10 people).

TABLE 2. THE NUMBER OF TRAINING DAYS PER WEEK

The number of training days per week (n people – 124)	[days]
Mean	3,5
Median	3,0
Minimum	2,0
Maximum	7,0
Standard deviation	1,2

The participants usually trained three times a week (on average it is 3,5 training day per week). The number of training practices ranges from the lowest value – 2 times per week to the greatest number – 7 days a week (Table 2).

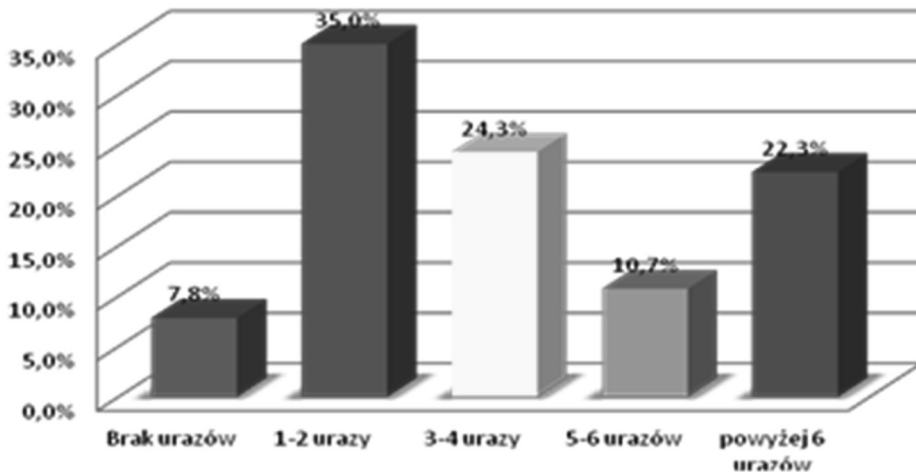
TABLE 3. THE NUMBER OF TRAINING HOURS PER WEEK IN THE COURSE OF RESEARCH

The number of training hours per week in the course of research (n people – 108)	[hours]
Mean	7,6
Median	6,0
Minimum	0,0
Maximum	30,0
Standard deviation	4,8

In the course of research contestant practiced $7,6 \pm 4,8$ hours per week. The maximum duration of practice per week was as high as 30 hours. Median for duration of practice per week was 6 hours (Table 3).

Presentation of the results of the questionnaire on injuries suffered in the course of karate practice:

FIG. 1. NUMBER OF INJURIES IN THE COURSE OF WHOLE SPORTS CAREER



brak urazów – no injuries

1-2 urazy – 1-2 injuries

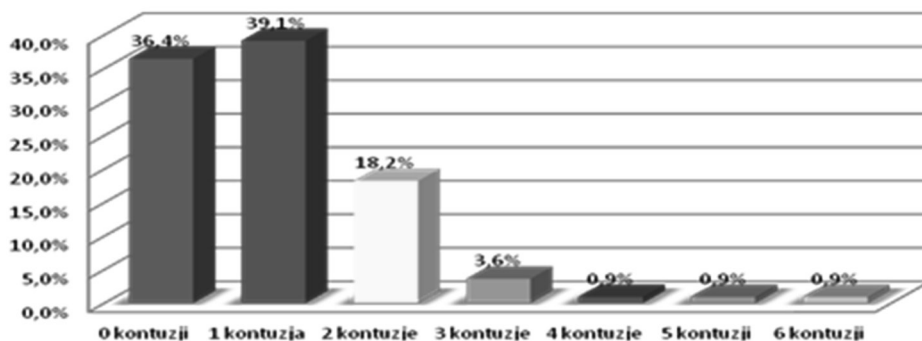
3-4 urazy – 3-4 injuries

5-6 urazy -5-6 injuries

powyżej 6 urazów – more than 6 injuries

In the course of their whole sports career 8 of 103 contestants (7,8%) has not suffered from any injury. Another 35,0% of sportsmen suffered from 1–2 injuries, 24,3% from 3–4 and 10,7% from 5–6 injuries respectively. The remaining 22,3% of subjects have suffered from at least 6 injuries (figure 1).

FIG. 2. THE NUMBER OF INJURIES SUFFERED LAST YEAR



0 kontuzji – 0 injuries

1 kontuzja – 1 injury

2 kontuzje – 2 injuries

3 kontuzje – 3 injuries

4 kontuzje – 4 injuries

5 kontuzji – 5 injuries

6 kontuzje – 6 injuries

As shown in fig. 2 last year as many as 43 of 110 participants of the study suffered from injury related to karate practice (39,1%). 40 subjects did not suffer from any injury (36,4%). Another 30 contestants (18,2%) have suffered from two injuries and the remaining 7 sportsmen suffered from them at least three times (6,3%). 70 participants suffered from at least one injury within the past year.

FIG. 3. TYPES OF INJURIES SUFFERED IN COMPETITIONS SO FAR



naciągnięcia mięśni – ścięgien muscle / tendon sprain

skręcenia, zwichnięcia stawów – sprain and dislocation of joints

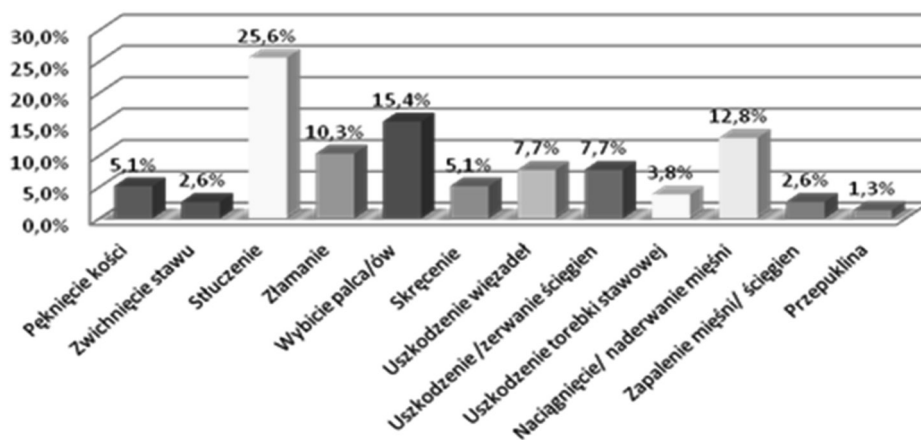
stłuczenia – contusions

złamania – fractures

urazy głowy – head injuries

So far (figure 3) the greatest number of sportspeople (38 subjects) have suffered from any bruises (47,1% of all types of injuries). This injury type constitutes almost half of all injuries. Muscle strain or dislocation of joints is also common (23 people – 27,9% of injury types). Sprains or dislocation of joints (16,9% of injuries), fractures (5,9% of injuries) and head injuries (2,2% of injuries) were less common.

RYC. 4. TYPE OF INJURY SUFFERED LAST YEAR



pęknięcie kości – bone fracture

zwichnięcie stawu – dislocation of joint

stłuczenie – contusion

wybicie palca(ów) – dislocation of finger(s)

Skręcenie – sprain

Uszkodzenie więzadeł – ligament damage

uszkodzenie torebki stawowej – synovial capsule damage

naciągnięcie/naderwanie mięśni – muscle strain/tearing

przepuklina – hernia

Figure 4 shows that of all types of injuries suffered from karate contestants last year the most common were contusions (25,6% of all injuries), finger dislocation (15,4% of all injuries) or muscle strain or tearing (12,8%). Participant also indicated the incidence of fractures (10,3%) and ligament and tendon damage (7,7% each).

TABLE 4. THE NUMBER OF INJURIES IN PARTICULAR PARTS OF THE BODY

The number of injuries in particular parts of the body		Number	%
Head / neck	1	7	6,7%
	2	3	2,9%
In total		10	9,5%
Chest	1	15	14,3%
	2	2	1,9%
	3	3	2,9%
	4	2	1,9%
In total		22	21,0%
Back	1	9	8,6%
	2	3	2,9%
	3	1	1,0%
	4	1	1,0%
In total		14	13,3%
Shoulder girdle and upper limbs	1	21	20,0%
	2	7	6,7%
	3	1	1,0%
	4	4	3,8%
	5	1	1,0%
	10	2	1,9%
	In total		36
Pelvic girdle and lower limbs	1	30	28,6%
	2	18	17,1%
	3	7	6,7%
	4	2	1,9%
	5	6	5,7%
	6	2	1,9%
	7	1	1,0%
	10	2	1,9%
	In total	15	1
		69	65,7%
In total		105	100,0%

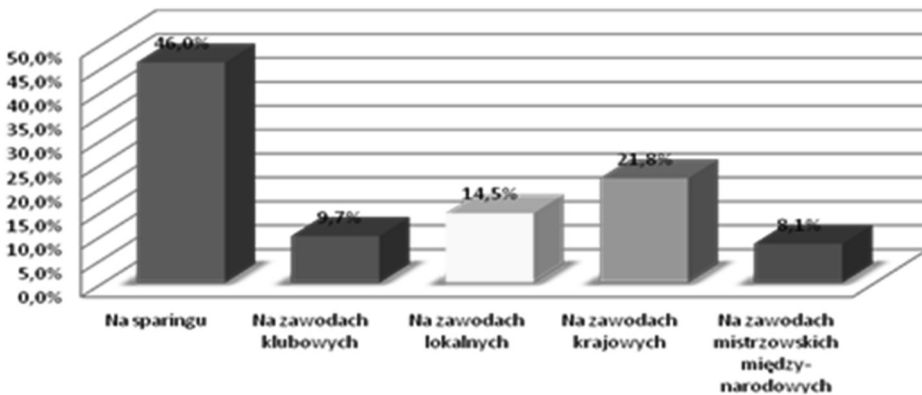
Table 4 presents the number of injuries in particular parts of the body suffered by the examined sportsmen. As results show, the greatest number of injuries occurred in pelvic girdle and lower limbs (69 sportsmen have suffered from at least one injury in this body part). Most often these injuries occurred only once (in case of 30 participants), but often occurred twice (in another 18 people). Injuries to shoulder, girdle and upper limbs occurred in 36 participants, chest injuries in 22 sportspeople, back injuries in 14 subjects and head / neck injuries were the least common and occurred in 10 participants.

TABLE 5. SITUATIONS IN WHICH INJURIES OCCURRED

Mechanism by which injury is caused	Number	%
Kumite (combat)	28	40%
Warm up	1	1,4%
Sparing	2	2,9%
Making mawashi geri gedan (low roundhouse kick)	1	1,4%
Movement during advance and retreat combat	1	1,4%
Excessive load in the course of strength training	4	5,7%
When kicking	9	12,9%
Stretching	5	7,1%
Jump	1	1,4%
Catching on a map / partner's kimono	2	2,9%
Tsuki	1	1,4%
Kata	1	1,4%
Long-term run	6	8,6%
Mawashi geri jodan (high roundhouse kick)	1	1,4%
Breaking areated concrete	1	1,4%
Badly performed technique	1	1,4%
Wrestling	1	1,4%
Tripping up	2	2,9%
Shin-shin contact	1	1,4%
Exercises on a pouncing bag	1	1,4%
In total	70	100,0%

The greatest number of injuries occurred during combat (40% of injury causes). Injuries also occur frequently when kicking (12,9%), but also during a warm up (7,1%), running training (8,6%) and as a result of muscle overload (5,7%).

FIG. 5. CIRCUMSTANCES OF INJURY INCIDENCE IN SPORTS CAREER SO FAR



na sparingu – during sparring

na zawodach klubowych – during club competitions

na zawodach lokalnych – during local competitions

na zawodach krajowych – during national competitions

na zawodach mistrzowskich międzynarodowych – during international championships

The greatest number of injuries occurred while sparring (fig. 5). This was the case for 57 contestants (46% of all injuries). 27 sportsmen suffered from injuries during national competitions (21,8% of all injuries). The incidence of injuries was least common during international championships (8,1%).

TABLE 6. INCIDENCE OF A SERIOUS INJURY DURING A COMPETITION

Incidence of a serious injury during a competition	Number	%
Yes	18	15,7%
No	97	84,3%
In total	115	100,0%

18 contestants suffered from a serious injury during competitions. They included: fractures of a lower limb, knee injuries, fractures of meta-

tarsal bones, slipped L disk, twisted knee, fractures of ribs, dislocation of shoulder, disorder of joint capsule, fracture of forearm bone, finger, nose and metacarpus.

TABLE 7. INCIDENCE OF A SERIOUS INJURY DURING A TRAINING SESSION

Incidence of a serious injury during a training session	Number	%
Yes	31	26,5%
No	86	73,5%
In total	117	100,0%

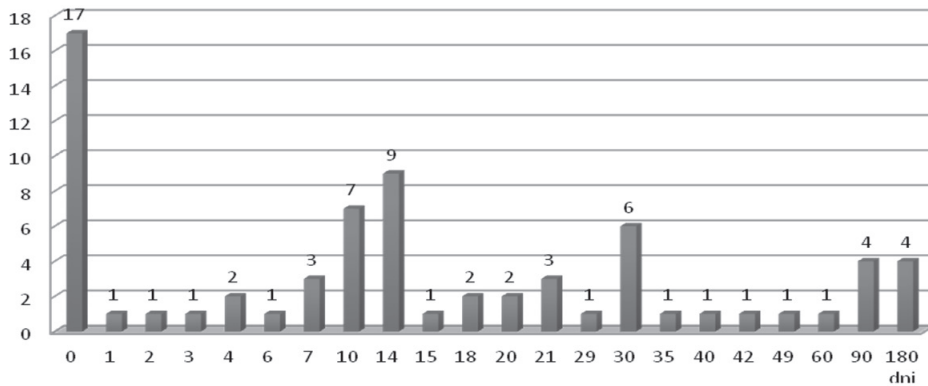
31 contestants suffered from a serious injury during a training session. These included inter alia: fracture of a toe, hip injury, fracture of zygomatic arch, tendon tearing, dislocation and sprain of ankle, knee sprain, rib contusion and fracture, synovial capsule tearing, quadriceps femoris muscle tearing etc.

TABLE 8. INJURIES SUFFERED DURING TRAININGS SESSIONS AND CONTESTS

Injuries suffered during a training session	59	84,3%
During a contest	11	15,7%
In total	70	100,0%

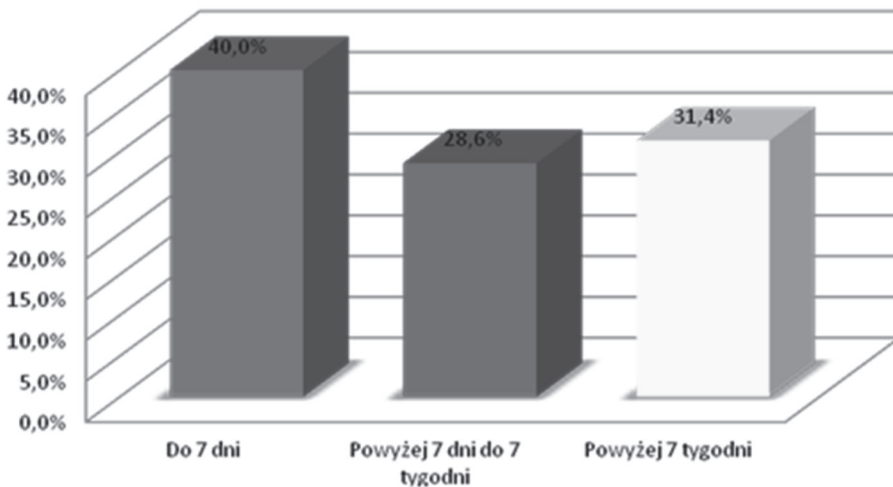
The majority of injuries occurred during training sessions (in case of 84,3% of contestants suffering from injuries). The remaining 15,7% of participants suffered from an injury during a karate contest.

FIG. 6. THE NUMBER OF DAYS OF BEING EXCLUDED FROM TRAINING



After incidence of injuries contestants were forced to stop training for $27,2 \pm 43,8$ days on average. The median for this variable is 14 days. The longest break in training was 180 days (in case of 4 contestants). 17 contestants, on the other hand, did not have to stop training at all (figure 6).

FIG. 7. THE DURATION OF INJURIES SUFFERED AT PRESENT



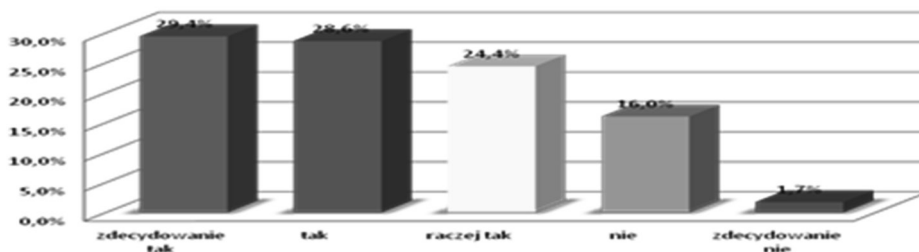
do 7 dni – up to 7 days

powyżej 7 dni do 7 tygodni – longer than 7 but less than 7 weeks

powyżej 7 tygodni – longer than 7 weeks

As shown in figure 7, nearly 40% of all injuries suffered at present does not last longer than 7 days. Injuries persisting from 7 days to 7 weeks were observed among another 28,6% of people, and the remaining 31,4% complained of pain lasting longer than 7 weeks.

FIG.8. USING PREVENTION OF MOTOR ORGAN OVERLOAD AS AN IMPORTANT ELEMENT OF A TRAINING SESSION



zdecydowanie tak – definitely yes

tak – yes

raczej tak – rather yes

nie – no

zdecydowanie nie – definitely no

The majority of contestants notice the role which prevention of motor organ overload plays in training (definitely yes – 29,4%, 35 respondents, yes 28,6% yes – 34 respondents and rather yes – 24,4% – 29 respondents). The remaining 1,7% (2 people) of all 119 respondents does not see and definitely does not see the need for using such measures during training (figure 8).

4 (5,7%) of 91 contestants who suffered from an injury last year underwent surgery. What is more 21,3% of all contestants were rehabilitated (18 people). Almost each of participants who suffered from injuries underestimated treatment and left their injury to self-treatment (98,6%).

TABLE 9. USED FORMS OF INJURY TREATMENT

Medical care – used forms of injury treatment	Number	%
Oral painkillers	11	20,0%
Ointments	12	21,8%
Physical therapy	6	10,9%
Kinesiotherapy	4	7,3%
Massage	4	7,3%
Dressings / compresses	8	14,5%
Plaster / orthosis	7	12,7%
Surgery	3	5,5%
In total	55	100,0%

The greatest number of subjects treated their injuries by means of oral painkillers or other medicines (20,0%) as well as ointments working locally (21,8%). Approximately 14,5% of all used forms of treatment included dressings or compresses (e.g. ice compresses) and the remaining 12,7% were plasters and orthosis (figure 9).

CONCLUSION AND DISCUSSION

Depending on the specificity of sports competition, the following types of combat are differentiated: single-, double- (combat sports) and multiple-level combats (Dziąsko *et al.* 1982). In a double-level combat, because of physical contact, various types of injury occur (Kalina 2000), which are conditional on the type in which one interacts with an opponent, ranging from mild (causing the opponent to lose balance, restricting movements, removing from a particular area) to extremely acute interactions (hits and kicks to the sensitive parts of the body). Superficial and light injuries (sprains and contusions) are most common injuries occurring in combat sports. Serious injuries are less common. Regardless of their type, injuries require proper treatment, which in case of light injuries is underestimated and their treatment (grading movement and effort) is neglected. Disregarding the rules of motor issues soft tissues healing and shortening the time needed for them to heal is a common practice in sport (Jegier *et al.* 2005). Traumatism in sport requires also knowledge on the causes of injuries in particular sports disciplines, which enables preventing or limiting their incidence (Bujak 2008).

As results from own research, the greatest number of competitors (38) have suffered from contusion (47,1% of all injury types). This injury types constitutes almost half of all injuries. Among all injury types karate contestants suffered from last year, the most common were contusions (25,6% of all injuries). Research by Destombe et al. (2006) also indicate that contusions are the most common injuries in this group of sportsmen. Muscle / tendon strain (27,9% of injury types) were also common among the participants. Sprains or dislocations of joints, fractures and head injuries were less common. Last year the most common injury was dislocation of fingers (15,4% of all injuries) and muscle strain or tearing (12,8% of all injuries). Bone fractures and ligament and tendons injuries were also observed. Similar results on the areas of injury incidence have been obtained by Destombe (2006).

As the results of own research show, the greater number of incidences were observed in the area of pelvic griddle and lower limbs (at least one injury in this area suffered by 69 sportsmen). Single incidence (30 people) were most common, but they often happened twice (in another 18 sportsmen). Shoulder griddle and upper limbs injuries were observed in 36 of participants, chest injuries in 22 sportsmen, back injuries in 14 of participants and head / neck injuries, which were least common – in 10 people.

Sterkowicz explains such topography of injuries in the following way: “typical body injuries in karate – apart from a particular frequency and seriousness – are characterized by peculiar pathomechanics, which is related to the technique of this sports discipline” and adds: “body injuries in combat are in principle caused by using the wrong technique or self-control loss” (Sterkowicz, 1992).

Contestants' age and training experience was not related to the number of injuries suffered by the participants last year. These relationship turned out to be statistically insignificant. Sterkowicz confirms such relationships as well (Sterowicz, 1992).

5,7% (4 people) of 91 who suffered from an injury last year underwent surgery. What is more, 21,3% of contestants were rehabilitated (18 people). Almost each of participants who suffered from an injury disregarded treatment and left injury to self-treatment. The majority of injuries occurred during training (84,3% of all injured contestants). The remaining 15,7% suffered from an injury during a karate contest.

18 of 115 contestants suffered from a serious injury during contests. These injuries included inter alia a fracture of a lower limb, knee injury, fractures of metatarsal bones, slipped L disk, twisted knee, fractures of ribs, dislocation of shoulder, disorder of joint capsule, fracture of forearm bone, finger, nose and metacarpus.

Numerous research studies present a low percentage of injuries during karate contest in comparison with other sports (Birrer and Halbrook 1988, Poirer 1990).

It can be concluded that younger sportsmen suffer from injuries during contests more often and older contestants during training sessions. This dependency was statistically significant at the level of $p < 0.05^*$. Destombe states that injured sportsmen were significantly older and that these injuries were more likely in contestants having brown or black belts (Destombe, 2006).

Looking ahead one may wonder if superficial injuries influence health of contestants and further research in this direction should be carried out. Friery indicates that a high level of training can result in a great number of injuries and that primary injuries may influence the development of motor organ disorders (Friery, 2008).

Balancing training sessions and prevention may in turn be a golden mean to tackle health problems, with attention being paid to high training experience. The statistical analysis has confirmed a dependency between frequency of injury incidence among the participants and prevention measures used by them. Frequency of injury incidence increased gradually with less and less frequent use of preventive measures. Whereas people applying principles of prevention have suffered from 0,6 of injury last year, the one who did not use them suffered from 1,5 of injury respectively.

Rationally organized training, with appropriately created training timetable with all elements kept is not harmful, it also has a positive influence on the development of skeletal system. It turned out that bone mineral density was higher in the group of karate contestants than in the control group with participants of almost the same age (Chaabene, 2012).

“Training” injuries in karate (unlike injuries occurring during sports competitions) occur most often during (Miłkowski 1983; Sterkowicz 1992):

- warm ups, shadow combat and formal exercises,
- intensive exercises developing flexibility, performed with a partner,
- kicking exercise equipment and braking objects (e.g. during technical exams),
- various types of combats (from arranged to free ones).

The most common negligence and mistakes in teaching methodology and training organization (Sterkowicz 1985) are:

- disregarding the rule of regularity and gradually increasing load by a trainer,
- using excessive loads, lack of appropriate post-training restitution,
- introducing too difficult exercises.

A review of literature and the analysis of own research indicate a great number of dependencies and a problem relate to the result of long-lasting training and injuries which can exert influence on the condition on contestants' health in the future. Monitoring body injuries in martial arts and combat sports should be carried out regularly and subjected to analysis.

Experiences of sports doctors all over the world (Kennedy, Fitzgerald 2001) indicate that at least 7 of 10 body injuries in children could have been avoided with knowledge of the areas of their most common occurrence. Benefits resulting from physical activity and sport are incomparable with possible risks related to them.

CONCLUSION

1. Karate training is not related with any serious injuries apart from contusions which at the same time are most common injury in this type of training.
2. Contestants' and training experience are not directly related to injury incidence.
3. An appropriately organized, rational training and using prevention enables to avoid injuries.
4. Circumstances of injury incidence change with contestants' age and training experience.

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