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Prevalence of sports injuries and chronic pain in athletes practising kickboxing and taekwondo

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Abstract

Background & Study Aim: Bodily injuries and pain conditions are the primary negative aspects related to practising combat sports. The study aimed to characterise the bodily injuries and chronic pain conditions experienced by men practising kickboxing and taekwondo.

Materials & Methods: The study involved 99 athletes practising kickboxing and ITF taekwondo; aged 16-35. The research tool was a custom-made questionnaire and the Laitinen Pain Scale. The Mann-Whitney U test was used to evaluate the differences between the groups, with minimal statistical significance set at $p \leq 0.05$.

Results: The examined sportsmen suffered 286 injuries (kickboxers 151 (53%), taekwondo athletes 135 (47%). The proportions of athletes with injuries were similar. The injuries most frequently occurred in the ankle joint, wrist, foot and knee. Significantly more head and spine injuries occurred in taekwondo athletes ($p = 0.027$). Forty-six (46.5%) out of 99 examined athletes reported chronic pain conditions of the musculoskeletal apparatus. The total average result was 3.89 (kickboxing 3.92, taekwondo 3.86).

Conclusions: The combat sports athletes suffered most frequently from contusions as well as from strains and ruptures of sinews and ligaments. The first kind of injuries was related mostly to the direct combat, whereas the second kind may have resulted from overexertion, an insufficient warm-up before the exercise or the accumulation of micro-damages. Pain conditions occurred mostly in the knees, feet and lower spine, which are the parts of the musculoskeletal system exerted most frequently during combat sports training.

Keywords: biological regeneration • combat sports • compensative exercise • martial arts • stretching

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INTRODUCTION

Sports practice implies exceeding one's limitations. Professional athletes fight against their competitors during championships. An amateur sportsman often competes against himself. Striving to achieve better results is related to reaching the limits of the human body, which may have negative results such as bodily injuries [1]. Performing dynamic physical exercises, especially in contact sports disciplines, may lead to falls and collisions resulting in contusions. They occur as a result of direct blows, collisions (e.g., with the competitor or the floor), or the excessive pressure exerted on a particular body part. It leads to the damage of blood vessels and blood extravasation. The accumulation of blood in the tissues leads to a haematoma. Swelling and pain also occur in the damaged area [2-4]. The athletes practising combat sports, such as kickboxing or taekwondo, are especially at risk of that kind of damages. Taking into consideration the aggressive nature of techniques used in these disciplines, they are recognised as aggressive close combat sports (based on R.M. Kalina's classification) [5]. The combat sports consists in inflicting blows (with hands and legs), which may additionally predispose to the incidence of bodily injuries [5-7].

The prevention of bodily injuries in sports consists in using various preventive measures. These measures include an appropriate preparation for the exercise (a warm-up), stretching and compensative exercise (usually performed at the end of a training), and a biological regeneration, in other words, an entire spectrum of physiotherapeutic treatments used for facilitating a post-exertional recovery, the improvement of the quality of movement, or the alleviation the existing pain conditions [8-12]. However, the use of appropriate preventive measures would not be possible without proper recognition of the condition. The functional diagnostics is, therefore, an indispensable element of the training process. Depending on the practiced sports discipline and individual characteristics of an athlete, it is possible to use globally-known functional tests, such as the Functional Movement Screen or Athletic 1080 test, and local tests, such as Rotational Test, Core Muscle Strength and Stability Test, Flamingo Test, Thomas Test, etc. [13-16]. It may also prove useful to use the most recent, advanced technologies helpful in defining the physical and psychological features of the human body, such as the thermographic imaging, the assessments of muscle strength moments in static and isokinetic conditions, or the Vienna Test System [17-23]. However, it is indispensable to evaluate the existing bodily injuries and their effects, such as discomfort and pain in a motor organ initially. Therefore, the present study aimed to characterise the bodily injuries and chronic pain conditions experienced by athletes practising kickboxing and taekwondo.

Damages of a motor system are changes in the tissues resulting from the force causing the trauma (mechanical, thermal energy, electrical energy, chemical factors), which leads to their impairment. Injuries in sports are most often caused by mechanical trauma. They may be an effect of a single traumatic event (macro-trauma) or may occur as a result of summing up of constant or repetitive traumatic factors of lower intensity (micro-trauma) [1].

Sports injury – *noun* any injury incurred as a result of taking part in sports, e.g. a sprain, shin splints or tendinitis [48].

The prevention of bodily injuries in sports involves activities that aim to lower the number of injuries and minimise their effects. The prevention of bodily injuries in sport consists in, among others, using various preventive measures, such as a preparation to exercise, i.e. a warm-up, optimal post-exertional recovery supported with various treatments (massage, sauna, cryotherapy, hydrotherapy), or the implementation of supplementary and compensative exercises as well as those improving the quality of movement.

A biological regeneration involves supporting the preparatory and recovery activities. It aims to optimise the physiological recovery processes, increase the athlete's psychophysical performance, and prevent injuries and minimise their effects.

MATERIAL AND METHODS

Participants

The study involved 99 sportsmen practicing kickboxing (n = 52) and ITF taekwondo (n = 47) aged 16-35. The criteria for being entered into the study group included: active participation in training and contests – i.e. having a valid competitor's licence of an appropriate sports association, at least two-year training practice (in combat sports), at least 4th kup in taekwondo. The groups did not differ significantly in terms of biometric features (Table 1).

Procedures

The research tool was a custom-made questionnaire. The questionnaire consisted of open and closed questions. The first part (general) concerned the basic information (biometric data, training practice, the characteristics of training). The second part contained questions related to bodily injuries (location, type), their causes and effects, as well as the types of commenced

Table 1. Characteristic of examined combat sports athletes.

Group	Number of people	Age [years]	Body mass [kg]	Body height [cm]	Training experience [years]	Number of session per week
Kickboxing	52	24.27 ±4.77	78.31 ±12.11	178.87 ±6.16	4.61 ±3.88	3.44 ±1.65
Taekwondo	47	23.09 ±4.96	75.20 ±8.71	178.17 ±6.77	6.22 ±3.39	4.06 ±1.49

treatment and the applied preventive measures. A bodily injury was defined as a factor excluding from active participation in a sports training for at least seven days.

Chronic pain conditions were characterised with the use of the Laitinen Pain Scale [24], which contains a set of four statements concerning the following: the intensity of pain and the frequency with which the pain occurs, the use of analgesics, and the degree to which physical activity was limited. The questions concerned the period of the previous seven days. Each answer was awarded from 0 to 4 points. Therefore, the studied person could obtain a maximum of 16 points [24].

Statistical analysis

The differences between the groups (particular disciplines) were established based on the Mann-Whitney U test. The relationships between particular variables (e.g., the number of injuries and age, training practice, or frequency of training) were established using the Spearman's rho correlation analysis. The minimal statistical significance was set at $p \leq 0.05$.

RESULTS

The examined sportsmen suffered 286 injuries (kickboxers 151 (53%), taekwondo athletes 135 (53%) that excluded them from training for at least seven days. The proportions of athletes with injuries were similar (87% kickboxing; 85% taekwondo). Taking into account the length of the training practice, kickboxers suffered from injuries most frequently – on average 0.82 per person per year. Most injuries were located in the lower limb (Table 2). The most frequently injured body parts were the ankle joint (51 cases), wrist (37), foot (36), knee (28) and lower leg (27). Significantly more head and spine injuries occurred in taekwondo athletes ($p = 0.027$).

The most frequent type of injuries were contusions (78 cases), and strains and ruptures of sinews and ligaments (67 cases). Kickboxers suffered from contusions with significantly higher frequency ($p = 0.009$), whereas the taekwondo athletes – from the bone fractures ($p = 0.039$). Significant differences were not observed in other categories (Table 3).

The factors most frequently identified by the athletes as the causes for injuries included overexertion and overtraining (30 cases), improperly (incorrectly) performed exercises (23), and an inappropriate warm-up or the lack thereof (19) (Table 4). About 5% of the studied athletes could not indicate the cause of the injuries they incurred. The injuries occurred most frequently during training in a sports club (44 cases), during competitions (25), and during preparatory events (23).

Forty-six (46.5%) out of 99 studied sportsmen (24 kickboxers and 22 taekwondo athletes) reported chronic pain conditions of the musculoskeletal system. The total average result, in the scale of 0-16, was 3.89 (kickboxing 3.92, taekwondo 3.86). The highest result (10 points) was obtained by a sportsman practising taekwondo. The average intensity of pain amounted to 1.37 (in a 4-point scale). One of the taekwondo athletes obtained the maximum result that signified "unbearable pain". Somewhat higher results

Taekwon-do ITF – an informed use of one's body in combat; a taekwon-do fighter's body has reached its peak capacity through consistent and intense physical and mental training. Taekwon-do is a martial art that mainly involves striking the opponent. To put it simply, it is an unarmed fighting style created to aid in self-defence. In addition, taekwon-do constitutes an original system of education that approaches human physical and mental development in a versatile manner. It combines Eastern traditions with Mediterranean culture and revolves around human instincts and natural needs. Translated literally, tae means jumping, flying, performing fighting techniques using one's legs; kwon means "fist" or to strike or destroy with one's hand; and do indicates an art or a path and the proper behavioural norms created and developed by ancient scholars [46, 47].

Kup – a term used to denote one's technical level in taekwondo (preceding dan level, i.e. black belt).

Table 2. Location of injuries in the body of combat sports athletes.

Group	Location in body			Sum
	head and spine	upper limb	lower limb	
	Indicator of injuries [n / person]			
Kickboxing (n = 52)	**0.25*** ±0.65	1.02 ±2.11	1.63 ±2.21	2.90 ±4.49
Taekwondo (n = 47)	**0.57*** ±0.77	0.55 ±0.82	1.77 ±1.98	2.89 ±2.58
	Indicator of injuries [n / person / training experience]			
Kickboxing (n = 52)	0.07 ±0.18	**0.27***±0.51	0.48 ±0.59	0.82 ±1.01
Taekwondo (n = 47)	0.15 ±0.31	**0.13*** ±0.23	0.40 ±0.49	0.67 ±0.70

*p<0.05 difference between groups

Table 3. Types of injuries in the body of combat sports athletes.

Groups	Bone fracture	Dislocation	Twist	Strain and rupture	Bruise	Others
Kickboxing (n = 52)	**0.27*** ±0.91	0.44 ±1.42	0.44 ±1.22	0.62 ±1.08	**1.08**** ±1.31	0.06 ±0.31
Taekwondo (n = 47)	**0.64*** ±0.84	0.53 ±0.88	0.43 ±0.82	0.74 ±0.92	**0.47**** ±0.96	0.06 ±0.24

*p<0.05; **p<0.01 difference between groups

Table 4. A number of causes of injuries in combat sports athletes.

Group	Overload	Unsuitable exercise	Incorrect warm-up	Lack of equipment	Not cure the last injury	Lack of assurance	Too difficult exercise
Kickboxing (n = 52)	18	10	11	5	6	3	2
Taekwondo (n = 47)	12	13	8	5	3	5	5
Sum	30	23	19	10	9	8	7

Table 5. Characteristic of pain (Laitinen Pain Scale [24]) in combat sports athletes.

Group	Frequency of pain	Intensity of pain	Reduction of physical activity	Use of analgesics	Sum
Kickboxing (n = 27)	1.38 ±0.49	1.46 ±0.65	0.38 ±0.49	**0.71*** ±0.69	3.92 ±1.69
Taekwondo (n = 22)	1.36 ±0.58	1.59 ±0.67	0.55 ±0.96	**0.36*** ±0.49	3.86 ±1.98

*p<0.05 difference between groups

Table 6. Location of pain in the body of combat sports athletes (number of cases).

Group	Knee	Foot	Lumbar spine	Hip	Shoulder	Wrist and hand	Cervical spine	Thoracic spine
Kickboxing (n = 27)	16	4	6	3	2	3	2	2
Taekwondo (n = 22)	9	9	5	2	2	1	1	1
Sum of cases	25	13	11	5	4	4	3	3

(1.52 on average) were obtained in the category referring to the frequency with which the pain occurred. Two representatives of both disciplines showed the maximum result that signified "constant pain". Two taekwondo athletes were not able to take part in training because of their condition. Twenty-two persons (48% of suffering from pain conditions) reported the use of analgesics. Kickboxers took medication with a significantly higher frequency (p = 0.046) (Table 5).

Chronic pain conditions occurred most frequently in the knee joint (25 cases), foot (13), and lumbar region of the spine (11) (Table 6).

DISCUSSION

Sports practice – both professional and recreational – is connected with a risk of injuries. According to various estimates, from several to less than twenty percent of athletes suffer from injuries [7, 25, 26]. The majority of them occur in combat sports. During large sporting events, injuries eliminate from participating in or prevent from completing a contest as many as every eighth contestant [27]. According to Engebretsen et al. [28], during the London Olympics, injuries were reported in the case of 12.9% of athletes, the majority of which (54.9%) occurred during tournaments. Among the combat sportsmen, only

in taekwondo, the percentage of the injured was higher than the average for all the other disciplines (39.1%).

The lower limb (knee and ankle joint) is the body part that is most frequently indicated as the location of injuries among persons practising sports and combat sports [7, 29-31]. That kind of injuries constituted 58% of all injuries among the athletes examined in this study. Ankle joint injuries were reported most frequently. The most frequently occurring kind of damage to the ankle joint is a sprain. It is usually caused by an inversion injury, i.e. damage to the side of the ankle. Primarily, the damage occurs to the anterior talofibular ligament. In the case of more serious sprains, a rupture of the calcaneofibular ligament may occur, whereas ruptures of the posterior talofibular ligament happen only in the case of very serious sprains [32]. A full rehabilitation is important in such cases (including the strengthening of muscles and proprioception exercises). Equally important is the prevention of future injuries through appropriate supplementary exercises and reinforcement of the outer side of the joint (taping) [33]. Ankle joint sprain tends to recur, and one of the causes of the injuries indicated by the athletes participating in this study was not recovering fully from the previous injury.

The incurred injuries may cause chronic pain conditions. Almost half of the studied sportsmen reported that they experienced chronic pain of a motor organ. It is consistent with the information concerning other social groups [34]. This issue concerns young people as well, both those conducting a sedentary lifestyle and those practising sports [35-38]. However, it may be assumed that the sources of their conditions are different.

Pain is a subjective and individual experience; it may have a different nature and intensity. The most frequent pain conditions are located in the lower region of the spine. Pain episodes are experienced by about 80% of society [34]. Most athletes covered by the survey conducted during own research indicated that the pain occurred with the highest frequency in the knee joint. One of the causes may be overexertion of the musculoskeletal system; incorrect movement patterns reproduced during training or body posture defects [30, 36].

Pain conditions and body injuries most often result from training errors or inappropriate health behaviours. Recurring body injuries and their consequences, such as chronic pain, may result from inadequate treatment or the lack of rehabilitation. Many injuries may be prevented by developing proper joint stability, learning muscle strength control and improving flexibility. Stretching exercises should be a standard element, especially of the strength training [39]. Apart from exercises, a biological regeneration should also be an important element of the prevention of injuries. The main elements of a biological regeneration, which enhance regeneration processes, strengthen the immune system, eliminate fatigue, regenerate the body energy reserves, increases the resistance to stress and the ability to work, including all kinds of hydrotherapy treatments, massages and sauna [40-42].

The occurrence of bodily injuries and pain conditions are, without doubts, the main negative aspects of practising combat sports. Although these ailments also occur among athletes practising other disciplines, and even among people who do not practice sports, the issue requires a more profound scientific research and searching for more practical solutions. The functional assessment of the musculoskeletal system and the introduction of the latest technologies to support the training process and a biological regeneration are a step towards the implementation of more effective preventive measures [16, 19, 43-45].

CONCLUSIONS

The combat sports athletes suffered most frequently from contusions as well as from strains and ruptures of sinews and ligaments. The first kind of injuries was related mostly to the direct combat, whereas the second kind may have resulted from overexertion, an insufficient warm-up before the exercise or the accumulation of micro-damages. Therefore, the risk they carry may be limited through the implementation of preventive measures.

The number of injuries corresponded to the training experience and the frequency of training. In designing the preventive actions, it is crucial to pay special attention to experienced athletes, to minimise the risk of recurring injuries.

The pain conditions occurred mostly in the knees, feet and lower spine, which are the parts of the musculoskeletal system exerted most frequently during combat sports training. This may indicate that there were errors committed during the training (workout not suited to the athlete's capabilities), an inappropriate warm-up or insufficient regeneration after training.

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