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The physical fitness and the safety falling skills of karatekas

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Summary

Introduction. The aim of the work was answering the question whether there exists any dependence between the special fitness of karate competitors and the skills of falling and the susceptibility to bodily injuries.

Material and methods. In the research partook 42 persons (19 women and 23 men) training Shotokan Karate, diversed in respect of the technical level (3 DAN – 9 KYU). The examined performed a special efficiency test in the karate from the range of the speed (3 attempts) and the endurance (1 attempt). We used Kalina's the susceptibility test of the body injuries during the fall (STBIDF).

Results. Within the range of all agility attempts competitors technically more advanced obtained results saliently better ($p<0.000$), both with relation to the intermediate and the beginners. Together with the level of the initiation also the number of committed errors in TPUCPU grew smaller. One showed the existence of the strong relationship ($p<0.05$) between the level of the special fitness and the susceptibility to bodily injuries during falls.

Conclusions. Together with the increase of the special fitness the number of committed errors during the fall grows smaller. Consequently the ability of self-assurance of those exercising increases too. Elements of Shotokan karate training can be introduced to activities of other sports, as well as exercises of the physical education in schools. This would be able to increase the improvement of the safety during such frequent events as the loss of the equilibrium or the fall.

Introduction

The physical fitness in karate, similarly to all martial arts and combat sports is extremely important, because the high level of such motor features as power, speed or endurance can improve the effectiveness of performed techniques and lead to enlargement of chances of the high result in sport [1]. Equally important as power, endurance or speed, is the skill of the maintenance of the equilibrium. Therefore a lot of time on trainings is spent on the improvement of throws and take-downs. During the fight the single action lasts approx. 3-5 seconds because all happens very quickly. In case of the take-down by the opponent there is no time then for thinking how to arrange the body not to get the contusion. Such reaction should be performed automatically [2].

The learning of throws in the karate one starts already in the beginning of the training. Starting with rollings backward and forward, one learns back throw or side throw. The knowledge of those throws is very important, because in most cases during kumite fights in just such manner the competitor falls after the take-dawn by the opponent. Doing throw on the right side of the body the person exercising should perform the leftward strike with the right hand and leg. Then maximally lower the centre of gravity of the body on the left leg so that the body collides with the basis after the fall from the least height possible. The right buttock should touch the floor by the nearest heel of the left foot. In the moment of rolling on the right side, the right hand should energetically hit the floor for the purpose of the assurance. The arrangement of the hand should be analogous to the case of backward throw [3]. Perfecting above-techniques of throws and take-downs one can protect himself from traumata both during karate fights as well as in everyday life in great extent.

Karate can be classified as the art of the self-defence. This is not the art of aggression and only the answer to the aggression of the opponent. The foundation of Father of karate – Gichin Funakoshi – was the defence against the aggressor by means of definite blocks and attacks both manual and of foot. Simultaneously one ought to ascertain that the self-defence needs not mean the fight with the opponent, but also the skill of managing threatening situations eg. the fall [4].

Going out from these premises for the aim of the work one put the answer whether there exists the dependence between the special fitness of karate competitors, and skills of falling and the susceptibility to bodily injuries.

Material and methods

The examined group was determined by competitors training Shotokan karate in 3 clubs. The group consisted of 42 persons in which there were 19 women and 23 men diverse in respect of the technical level (3 DAN – 9 KYU). Different was also the advancement of the training of the examined persons and it ranged from 2 weeks to 20 years (Tab. 1).

Among the tests checking the physical fitness there were also special karate fighters fitness tests [5]:

1. A test of speed:
   a) A test of the speed of vertical punch – person exercising performed 30 repetitions of the combination consisting of two manual techniques (the knock with the right and left hand on the chest level). The exercise one ought to perform as quickly as possible. Techniques are performed on the disk held by the partner. Attacks should be performed exactly, in the moment of one hand streightening, the second should be on the hip.
   b) A test of the speed of kicks – the test consists of the realization of 30 kicks in as little time as possible. Kicks are performed on the punch bag, slightly on the height of the abdomen. The full repetition is counted from bringing the foot into contact with the floor, the kick to putting of the foot back on the floor.
   c) A test of the speed of hip twists – the examined accepted the left position of the fight then was tied-on with the string over the right hip. By twisting hips the string was tightened. The goal was to do 30 of such jerks of string in as short time as possible.
2. An endurance test – the test consisted of the realization of as great quantity of kicks during 90 seconds as possible. Kicks were performed on the punch bag on the height of the chest.

The susceptibility to traumata and the contusion was examined by the means of the test of the body vulnerability during the fall. This tool permits to evaluate the general vulnerability of the body during falls ((STBIDF), as well as the connected risk with the exposure of each body parts (a head, hands, hips, legs) traumata connected with falls. The test consisted of three attempts [6, 7, 8]:

- The first exercise was to quickly lay back on the mattress. One ought to keep all rules of safety such as: drawing of the beard to the chest, the descent on foot as lowest the mattress to gently sit on it, then to perform the backward cradle and to pass to resting position. The exercise was performed on the signal from the standing position. The test was considered finished when the head, back, buttocks and heels of the one exercising rested on the mattress. For any errors during the exercise there were added penalty marks. One evaluated three elements: the head (the backward bending of the head, the hit on the mattress – 1 penalty mark), hands (the support with one hand – 1 point, with two – 2 points), hips (the hit with buttocks on the mattress, the right angle or gaping of legs – 1 point).
- The second exercise looked identically as the first one with one additional difficulty in the form of the sponge which one should have to hold back with the beard. This caused the extortion of the habit of drawing of the beard to the chest while passing to resting position. In this exercise the penalty mark one could obtain for holding back of the sponge with the hand or when the sponge fell out from under the beard during the exercise. The rest of penalty points was granted similarly as in the first exercise.
- The third exercise was made difficult with the upward jump before the beginning of passing to the lying back position. Penalty marks were granted in the same way as in the second exercise. Additionally in the evaluation of legs one placed 1 penalty point for the landing on one leg after the jump and 2 points for the landing on straight legs.

Penalty points were noted on the special sheet (Tab. 2), qualifying the vulnerability of settled body parts during falls as well as the general indicator of the vulnerability of the body. Depending on the number of obtained penalty points, the examined obtained one from among four degrees of the traumaticness:

– 0 points – low level
– 1-3 points– average level
– 4-8 points – high level
– 9-14 points – very high level

To the statistical analysis of the results one used the Statistica 10 program. The normalcy of the range one qualified with the Kołmogorow-Smirnow test. The differentiation of the level of the special fitness of karate fighters on various levels and depending on the sex one qualified by means of the t-Student test. The dependence between the level of the fitness and the results of the Vulnerability of the Body During Falls Test one qualified by the means of the Pearson's correlation indicator. Values on level $p \leq 0.05$ were accepted as essential.

Tab. 1. Biometrical characterization of the examined group

Age (years)	Body height (cm)	Body mass (kg)	Years of training
ADVANCED GROUP 3 KYU – DAN (n=10)			
29,4 ±9,5	171,3 ±7,6	70,0 ±17,6	11,0 ±5,1
INTERMEDIATE GROUP 4 KYU - 7 KYU (n=16)			
14,1 ±6,6	154,2 ±14,9	47,8 ±18,5	3,1 ±1,6
BEGINNERS GROUP9KYU-8KYU (n=16)			
12,9 ±6,7	150,1 ±15,5	45,6 ±17,4	0,8 ±0,7

Results

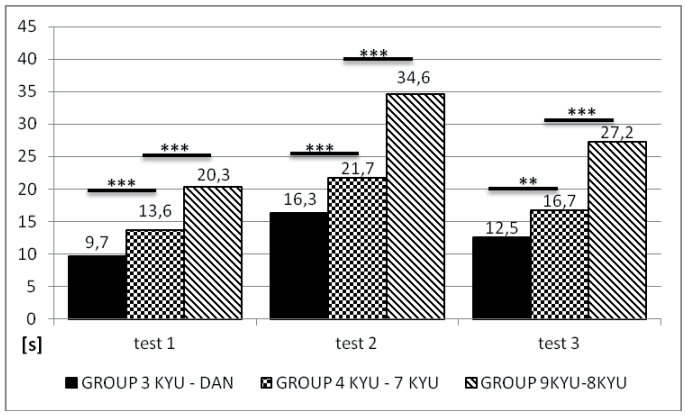
In run tests of the speed best results were obtained by competitors from the advanced group (Fig. 1). One showed the essential differentiation among each group of advancement and intermediate in all three tests: vertical punch, lower limb kick and hip twist.

In the test of the speed the intermediate group (7-4 KYU) obtained better results in all tests from competitors with the least training. The group of bronze and black belts (advanced) performed all tests in the shortest time. In the exercise checking the speed of vertical punches (1) the advanced group obtained the average result 9,7 s what determined the better result of about 3,94 s from the intermediate group and of 10,65 s from the beginners group. The average time of 2 tests in this group amounted 16,33 s, and the average time of the test of speed of hip twists (3) amounted 12,54 s (better of about 4,12 s from the intermediate group and of 14,68 s from the beginners group).

In the level of endurance, accepting as the criterion the level of advancement (fig. 2), one can notice, that the average number of repetitions increases together with the height of the level of Shotokan karate competitors. The lowest average result was obtained by beginner competitors who had student degrees 9 and 8 KYU (50 repetitions). Intermediate competitors (degrees of the initiation 7-4 KYU) within 90 s performed averagely 77 kicks on the bag. In compliance with expectations the best result was obtained by most experienced competitors (degrees of the initiation from 3 KYU to DAN degrees). The average of kicks in their realization amounted of 118 repetitions what determined a better result of about 41 kicks from the intermediate group and of about 68 kicks from the beginner group.

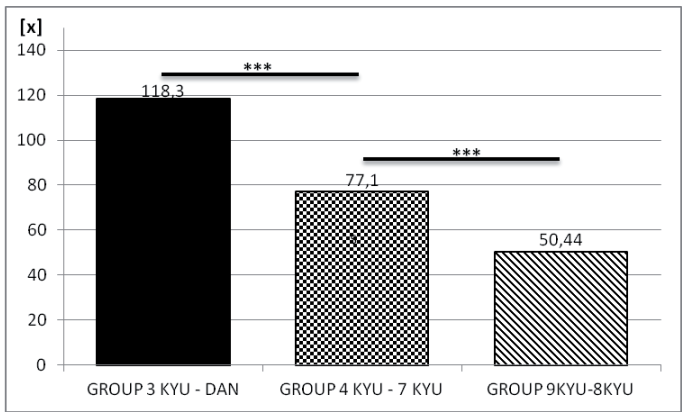
One showed statistically essential differences among each groups of advancement in the endurance test.

Assembling competitors according to a possessed degree of the initiation, within the range of skills of safe falling one observed the similar dependence as in the case of tests of speed and endurance. In all three exercises the least number of penalty points was obtained by competitors from the advanced group (Fig. 3). The average of points in first two exercises was in this group 0,1 and in the third exercise 0 points. The average result of the intermediate group (5 KYU – 7 KYU) in the first and second test did not exceed the barrier of 1 penalty point (respectively 0,5 and 0,75) instead in the third exercise it amounted 1,13 point. Beginner competi-



** significance at 0.01 level *** significance at 0.001 level

Fig. 1. Average test data of the speed on each level of advancement



*** significance at 0.001 level

Fig. 2. Average test results of the endurance on each level of advancement

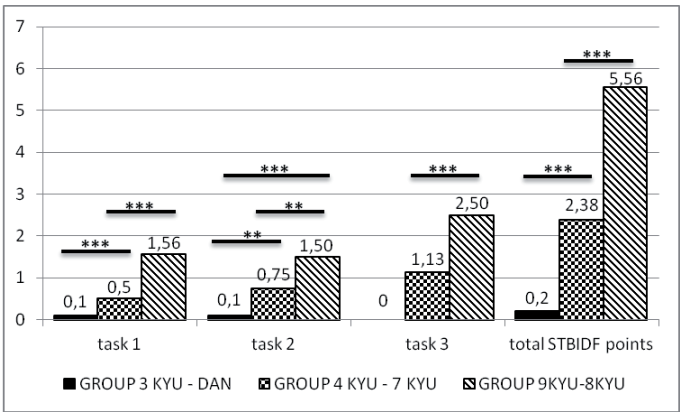


Fig. 3. Average test results of the vulnerability of the body during the fall on each level of advancement

tors in the first exercise obtained the average result of 1,56 point, instead in the second – 1,5 point. The third exercise caused most of problems to this group. The average of committed errors was here 2,5 points.

On level of all exercises one noted statistically essential differences among each level of advancement.

Seeking the relation among the special fitness and the skill of safe falling, we observed that in all tests of speed the correlation had a positive character ($p<0.05$). This means that the faster and more efficiently competitors performed each test, the less errors they committed during the test of the vulnerability of the body during the fall. Results of the correlation presented themselves as follows:

– the test of speed of vertical punches and the STBIDF test – $r=0.72$;
– the test of speed of kicks and the STBIDF test – $r=0.74$;
– the test of speed of hip twists and the STBIDF test – $r=0.74$.

The correlation of endurance test and the STBIDF test showed the negative character ($r=-0,7455$) what means that the more kicks the examined performed during 90 seconds the less errors they made in three following tries of the test of vulnerability of the body during the fall. Thus also in this case a higher level of the fitness translated into the skill of the self-assurance. All mentioned correlations were statistically essential ($p<0.05$).

Discussion

Lately the subject of epidemiology study became extended with following branch. One of them became just the traumaticness. The occurrence of traumata became so massive that it had become classified as one of non-infectious illnesses. It is doubtless one of most sizable problems of present sport – both in the professional version as well as unprofessional [9,10,11,12].

This problem is connected not only with the medical treatment, but also with the preventive activity which is dependent on the level of the preparation of the whole instructing personnel [13]. The other factor determining the susceptibility to traumata seems to be the degree of the agility preparation of competitors. This subject was undertook among others by Taniewski and the co-authors analysing the frequency of the occurrence of traumata in judo, wrestling and karate. They proved, that the place as well as the kind of occurring injuries is dependent on the level of advancement of those exercising [14].

Also wrestling can be added to disciplines in which various body injuries occur often. Higher indicator of the traumatisms than the one in wrestling is characterized only in football [15]. The most frequent trauma in these sports are bruises (41%). This type of contusions are typical in sports, where the competitor is a subject of falls [16].

To check whether a degree of the susceptibility on traumata is related to fitness of karate competitors, there were run some practical tests evaluating the level of two basic motor features: endurance and speed.

Speed tests applied in the present work have already been done more than once in earlier years. In 2009 identical high-speed tests were run on the group of 16 competitors of the Polish representation in Fudokan karate: 4 juniors, 7 youth and 5 seniors [5]. The similar set of tests was applied in 1992 by Sterkowicz who besides mentioned earlier three high-speed tests applied also the test of agility, a test of retreating ability, a test of flexibility, a test of power of punches (the maximum percussive force with the fist and the cut with the edge of the palm) and a test of bounces with the clap (an endurance test) [1]. For the purpose of the comparison of all three groups – competitors of Kyokushin, the group of Fudokan and the group of karate NSKF Shotokan fighters one took average results into such manner so that in every group competitors possessed the same degrees of the initiation. Confronting competitors more technically experienced one noticed that in the first and second test the best time had been obtained by Shotokan karate fighters, yet in last of the tests (a speed test) they had the worst time. Various results of groups of the same degree of the technical initiation can testify about the diverse manner of the instruction of each styles of the fight, the age of the examined and – what is most important – the different modality of techniques characterizing each of above-men-

tioned styles of karate. On the other hand the differentiation of results can surprise because all styles descend from the same branch. Apart from slightly different manner of the respiration during the exercise of techniques and rules connected with the fight during contests all punches and kicks used in the test look similarly. Besides in Kyokushin karate one puts less stress on the work of hips than in Shotokan and Fudokan and nonetheless competitors of this style had in this test a higher result than Shotokan. It may seem that differences in performance could be connected with the manner of training and with possibly current fitness level of the examined undertaking the test.

The endurance is also a very important feature in karate. Competitors preparing themselves for starts in the kumite competition must be prepared for the intense 90 second- lasting effort of the effective fight time and in the case of the draw for additional 60 seconds. Adamczyk and Antoniak ascertained, that the level of the endurance grows proportionally to the level of technical advancement of competitors [5].

One ought to remember that for its own specificity in combat sports force preparation of the competitor has a large meaning. This produces following challenges concerning the rational training, because as elaborations from the range of the sports-traumatology prove, the occurrence of strains, partly tearing and breaks of tendons and ligaments are typical for force disciplines [11,17].

Although test data of high-speed and endurance tests at each examined group differed, one can univocally ascertain, that changes in attained performance in very large extent were dictated by a degree of technical advancement of competitors. We univocally showed that the higher level of the physical fitness contributed to the greater safety in situations of the loss of the equilibrium of the body. Together with the increasing training (and with the level of training) competitors possessed much better skill of safe falling. Therefore one can conclude that karate as well as eg. judo is a perfect sport pertaining to general development with which one can shape all motor skills, and also evenly develop left and right side of the body. The possibility of the utilization of karate training for development acceleration of the level of the physical fitness already from the youngest years was showed among others by Boguszewski and Socha [18].

The great stress in the training of combat sports, among them also in karate, is put on the motorial co-ordination and the equilibrium what contributes to greater safety and self-assurance. Learning take-downs and throws plays the essential part in the training, during which every student learns the safe behaviour during the fall [19]. The learning and the improvement of these elements on gym lessons would be able to improve the safety at school and in the everyday life of persons which had never had contacts with martial arts [20]. All the more that an essential element of eastern martial arts is the formation of character, of regularity and the creation of habit of self-improvement [21]. In this context in using of elements of combat sports (in this karate too) lays large potential of making possible the activity both therapeutic as well as preventive [22,23,24,25].

Conclusions

1. There is dependence between the special fitness of Shotokan karate competitors and their susceptibility to traumata. One noticed that together with the height of the special efficiency decreases the quantity of committed errors during the fall. Consequently increases the ability of self-assurance of those exercising.
2. Both the level of the speed as well as endurance of Shotokan karate fighters rose proportionally with their level of the technical initiation.
3. The Shotokan karate training with its ability to pertain to general development, shapes and improves the level of all motor features. Thanks to exercises of throws and take-downs performed on karate classes, those exercising learn self-assurance and safety in an excellent manner.
4. Some exercises performed during karate trainings could be introduced to classes of other sports, as well as to the physical education lessons in schools. This would lead to improvement of safety during such frequent events as the loss of the equilibrium or the fall.

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