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TECHNICAL & TACTICAL ISSUES

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Diagnostics of selected motor skills of Oyama Karate competitors preparing for the championships

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Abstract

Aim. The aim of the study was to evaluate the changes in selected parameters of motor preparation of Oyama Karate athletes in training before championship competitions. The research involved ten male athletes at the Oyama Rzeszow Sports Club (aged 22.9 ± 12.3, training period 17.6 ± 8.5 years).

Method. The anaerobic endurance (90-second test with a punching bag) and aerobic endurance (20 MSRT) and speed (circular kick, hip twist, two straight strikes) and jumping ability (squat jump-SJ and countermovement jump-CMJ) were tested.

Results. The tests were carried out during the preparatory period and during the pre-competition period.

Conclusion. The analysis shows that in all subsequent experimental studies an improvement or stabilisation of most of the analysed motor preparation parameters has been noted.

Introduction

Martial arts belong to the sports disciplines which are gaining in popularity both among the youngest and participants of advanced age [Chaabane *et al.* 2015; Szot *et al.* 2017]. Karate is one of the most popular martial arts and its cradle is Okinawa in Japan. In this sport, various defensive movements of the upper and lower body are used. Oyama Karate style is developed in terms of a martial art and self-defence as well as in the contact sports formula [Oyama 1979; www.oyama.rzeszow.pl]. Karate competitions are divided into *kata* (forms) and *kumite* (match) [Roschel *et al.* 2009].

The evaluation of the current sporting level of players is carried out at different points in the training process. It plays an important role in the selection of the training load. The training process depends on the current state of the player. Trainers make every effort to improve this process and prepare the competitor for the starts as well as possible. In order to improve the effectiveness of sport struggle, scientists often in their research dealt with the assessment of motor skills and their impact on work efficiency [Mori *et al.* 2002; Hoff *et al.* 2002; Kotzamanidis *et al.* 2005; Donovan *et. al.* 2006; Roschel *et. al.* 2009; Neto *et. al.* 2009; Adamczyk *et al.* 2010; Fong *et al.* 2012; Szot *et al.* 2017]. Noteworthy is the research conducted by Chatzopoulus *et al.* [2014], who observed that the improvement of agility and speed of upper limb movements in team sports games improves the effectiveness of the sports fight. Similar issues were dealt with by Ambrozy *et al.* [2014], Kisiel *et al.* [2014], Roschel *et al.* [2009] and Droscak [2017]. They evaluated the dynamics of arms and legs and the work of the whole body during the implementation of various techniques occurring in martial arts. Interesting conclusions were reached by Hrysomallis [2011], who conducted research on the ability to maintain balance. He noted that there is a correlation between work efficiency and the ability to maintain balance [Hrysomallis 2011]. It was also noted that, in order to improve performance, the improvement of the ability to maintain balance should be a fundamental aspect of training. This is confirmed by research carried out by Sterkowicz *et al.* 2012; Pion *et*

al. 2014; Truszczynska *et al.* 2015; Mala *et al.* 2016; Skorupinska 2017. The research conducted by Helgerud *et al.* [2001] and Roschel *et al.* [2009] is also worth mentioning. They noticed that improving aerobic endurance has an impact on athletes' performance [Helgerud *et al.* 2001; Roschel *et al.* 2009].

The effort in contact karate fight is not homogeneous. The fight may vary in course, rhythm and pace, depending on whether it is interrupted by a referee due to an incorrect attack or other irregularity. It may also be continuous and undisturbed [Szeligowski 2010]. Due to the specific nature of work in contact karate, the improvement of the sports level is based on the improvement of fitness. It also includes specific hybrid features such as power, agility and jumping ability, which seem necessary for effective performance of sports fighting techniques [Ambrozy *et al.* 2014]. It is also very important to move the body or individual parts of the body in space. An athlete should also have a reliable technique [Kasa *et al.* 2012; Ambrozy *et al.* 2014] which results from an optimal combination of strength, speed, endurance, flexibility, jumping ability and coordination [Piepiora *et al.* 2017].

Due to the high requirements of the sports discipline, the winner of the competition (especially in the group of competitors fighting at a high level) will certainly be a karateka, who will show versatility and diversity. In order to adjust the training load to the competitor's capabilities, it is important to assess the current level of training. Diagnostics makes it possible to optimise this process, therefore it seems reasonable to take up the subject related to the diagnostics of selected motor skills of competitors. The study focuses on training preparations for competitors participating in the full-contact formula of karate.

The aim of the study was to evaluate the changes in selected parameters of motor preparation of Oyama Karate athletes in training before championship competitions (the most important event in the season).

Material and Methods

The research involved ten male athletes at the Oyama Rzeszow Sports Club (aged 22.9 ± 12.3, training period 17.6 ±, 8.5 years). The participants of the study had 2 kyu and 1 kyu ranks (6 competitors) and master ranks from 1 to 2 dan (4 competitors). The athletes underwent basic anthropometric measurements and body composition analysis using the electrical bioimpedance method (BIA), followed by tests to diagnose endurance, speed and jumping ability [Adamczyk, Antoniak 2010; Leger *et al.* 1988; Markovic *et al.* 2004]. The following tests were used in this work:

— jumping ability (squat jump – SJ and countermovement jump – CMJ) – Each competitor had the opportunity to give two series of jumps from which a better attempt was selected. The jump test was performed during all three tests. The competitors gave successively the following jumps measured in centimetres:
  - SQUAT JUMP – a jump with upper limbs on the hips with 3 seconds of squat position (angle of bending of knee joints is 90 degrees).
  - CMJ without arm swing – a jump with upper limbs on the hips from a standing position after making any leg deflection (ensuring maximum high jump).
  - CMJ with arm swing – a jump with upper limbs supporting with a swing the work of lower limbs from a standing position after making any leg deflection.
— anaerobic endurance (90-second test with a punching bag) – The test consists in the execution the biggest number of kick during 90 seconds. The competitor kicks a punching bag at chest height level. Competitors wear sports testers that record their heart rate during the test.
— speed (circular kick, hip twist, two straight strikes) – During the test the competitors had to perform a sequence of repetitions in the shortest possible time. These included 2 straight punches to the shields – 30 combinations; 1 punch to the height of the head, the second to the height of the torso, twist of the hip – 30 quick twists of the hip, the competitor was held with a belt over the right hip, then took the fighting position with the twist of the left hip, tightening the belt. Belt tension and *mawashi – gheri-jodan* kicks were counted – the competitor performed 30 rounds of kicks in the fighting position with a lead leg to the chest height. Kicks were counted from the moment the foot touched the ground.
— aerobic endurance (20 MSRT) – is a 20-metre shuttle run test, which assesses the level of human motoric endurance abilities (individual ability to withstand fatigue and ability to perform a specific job for a long time) on the basis of the distance run. The competitors do a shuttle run over a distance of 20m [Leger 1988]. Their task is to place a foot on a defined end line at a specific signal. Every 1 minute the pace of the run is increased. The distance run and maximal heart rate are measured.

The tests were carried out during the preparatory period and during the pre-competition period. During the preparatory period, two measurements were made at an interval of 6 weeks, while during the pre-competition period the measurements were carried out just before the master fight.

Statistical analysis was carried out using descriptive methods, statistical inference methods, and methods to detect the interdependence of features. Statistical analysis was performed using the STATISTICA program.

Results

The paper presents an analysis of the effects of training in the form of a comparison of the levels of individual fitness abilities in subsequent studies. The results were presented in the form of descriptive statistics, additionally assessing the significance of training effects using statistical tests. Table 1 shows the difference between the individual measurements for each analysed variable.

The squat jump test result (cm) improved statistically significantly in study no. 2 compared to study no. 1 (by 2.1 cm on average). Statistically significant was also the difference between study no. 1 and no. 3 – the average increase in the height of the jump by as much as 5.2 cm. As can be seen in Table 1, an improvement in the results was noted among all squat jump parameters. Similar training effects were observed on the basis of jump power (squat jump in W). There was a statistically significant increase in power in study 2. There were no significant changes between study 2 and study 3. The jump power converted into kilograms of body weight is also a measure of fitness, which behaves like the two previous ones. We note a statistically significant increase in study 2, compared to the initial value and no changes in the next period. As a consequence, of course, there is a statistically significant difference between the initial and final study (1 vs. 3). Subsequent measurement (CMJ without arm swing in cm) does not show significant increases or decreases as a result of training. There are no statistically significant differences between tests (the value of test probability *p* significantly exceeds 0.05) – Table 1.

The CMJ result without an arm swing expressed in watts does not show statistically significant differences, although the value of the test probability *p* for the comparison of tests 2 and 3 is quite low (slightly above 0.10). Nevertheless, we should stop at the conclusion that the considered value does not change during trainings. CMJ (result expressed in centimetres) shows a statistically significant increase between study no. 2 and 3 – on average by 6.4 cm. The result of the CMJ trial expressed in power units does not show statistically significant differences between the studies – the result of the closest statistical significance is recorded for comparison of study no. 1 and 3. Conclusions for power converted into kilograms of body weight are similar to the result of CMJ expressed in centimetres. A statistically significant improvement in the result was recorded between the initial and final study – on average by 5.4 W/kg.

The analysis shows that in all subsequent experimental studies an improvement or stabilisation of most of the analysed motor preparation parameters has been noted. The results have shown, for example an increase of special endurance. The number of kicks dropped statistically significantly between study 2 and study 3. On average, this drop was about 4 kicks within 30 seconds. A statistically similar decrease in the number of kicks between 30

Table 1. Statistics of changes between measurements

Tests	Changes between measurements		
	1--2	2--3	1—3
Jumping ability			
Squat jump (cm)	**2.1 (p = 0.0357*)**	1.5 (p = 0.2945)	**5.2 (p = 0.0431*)**
Squat jump – power (W)	**122 (p = 0.0500*)**	-21 (p = 0.9165)	**197 (p = 0.0431*)**
Squat jump – power (W/kg)	**1.6 (p = 0.0500*)**	1.5 (p = 0.3454)	**4.5 (p = 0.0431*)**
CMJ without arm swing (cm)	-0.6 (p = 0.8336)	-1.2 (p = 0.9165)	-0.8 (p = 0.6858)
CMJ without arm swing – power (W)	-41 (p = 0.7794)	-185 (p = 0.1159)	-168 (p = 0.3452)
CMJ without arm swing – power (W/kg)	-0.5 (p = 0.6744)	-0.8 (p = 0.9165)	-0.5 (p = 0.6858)
CMJ (cm)	2.3 (p = 0.2626)	0.5 (p = 0.9165)	**6.4 (p = 0.0431*)**
CMJ – power (W)	135 (p = 0.2626)	-80 (p = 0.6002)	267 (p = 0.1380)
CMJ – power (W/kg)	1.7 (p = 0.2626)	1.0 (p = 0.4631)	**5.4 (p = 0.0431*)**
Endurance test			
amount of kicks 0-30 s	2.1 (p = 0.3270)	**-4.2 (p = 0.0277*)**	1.8 (p = 0.5839)
amount of kicks 30-60 s	-1.8 (p = 1.0000)	-4.3 (p = 0.0796)	-0.8 (p = 0.7874)
amount of kicks 60-90 s	-1.1 (p = 0.3980)	-1.5 (p = 0.4185)	-2.2 (p = 0.4185)
total amount of kicks	-0.8 (p = 0.3980)	**-10.0 (p = 0.0431*)**	-1.2 (p = 0.6858)
HR max	1.0 (p = 0.6750)	3.0 (p = 0.3454)	5.8 (p = 0.0796)
Speed test			
circular kick 30 repetitions (s)	-	-	-0.3 (*p* = 0,1159)
hip turn 30 repetitions (s)	-	-	**-1.1 (*p* = 0,0464*)**
Two straight punch 30 repetitions (s)	-	-	-0.1 (*p* = 0,7532)
20 MSRT			
distance (m)	-	-	303 (p = 0,0277*)
Maximal HR	-	-	3.8 (p = 0,0431*)

Source: Own research.

and 60 seconds can be observed when comparing study no. 2 and 3. There are no statistically significant differences in the number of kicks in the final 30 seconds of the test in individual studies (the test probability value *p* significantly exceeds 0.05). The sum of kicks decreases between study no. 2 and 3. This is a statistically significant effect, the average decrease is about 10 kicks. The maximum heart rate increased between the initial and final studies, on average by 5.8, as shown in Table 33 and Figures 20 and 21. This effect is similar to the level of statistical significance (test probability value p=0.0796).

In the case of speed tests, only the results of the studies 1 and 3 were available. There was a statistically significant decrease in the time of hip turn during 30 repetitions. The improvement here was, on average, about 1 second. The remaining results also improved, however, they did not show any significant statistical changes.

The study also analysed the process of restitution after endurance tests. For the aerobic endurance test, again only results from tests 1 and 3 were available. A statistically significant improvement relates to distance covered during the trial (303 m) and maximum heart rate (3.8 bpm).

Conclusions

In the semi-annual training cycle, in which ten male competitors participated, an improvement of some motor parameters can be noted. The improvement of the special endurance, speed of the lower limbs and technique had a positive effect on the sports results. Knowledge acquired in this area should be the basis for people training and preparing for master-rank championships, and the diagnosis of motor skills of competitors is one of the elements of preparation.

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