

## Tests for the evaluation of the improvement of physical fitness and health at the secondary school

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### Abstract

**Background.** The karate is a sport with increasing popularity and many sports centers and schools promote it. Several studies have shown that the karate can have positive effects, both on improving motor skills and on improving physical fitness. **Objective.** The purpose of this study is to estimate the effects of four weeks of karate training among boys aged 14 to 16 years. **Methods.** The study method is experimental with the division of the boys in 2 groups of 12 each: experimental group (karate training) and control group. Data were collected during four weeks. All data detected were expressed as average  $\pm$  SD for experimental group and for the control group: height, weight, body mass index (BMI), shuttle run test, medicine ball throw and squat jump (SJ). The significant differences has been fixed in  $p < 0.05$ . **Results.** The results show that there was an effect of group ( $F=6.3$ ,  $p=0.01$ ) for the medicine ball throw; while for shuttle run test there was an effect of moment ( $F=16.8$ ,  $p=0.001$ ) and an effect was found for squat jump ( $F=4.7$ ,  $p=0.014$ ). **Conclusion.** The results suggest that the karate can be a physical activity that can provide health promotion and a significant exercise to improve fitness.

**Key words:** Combat sport, motor tests, training, performance and wellness.

### Introduction

The main purposes of sport-specific testing can comprise both talent identification and development of young athletes (Tabben et al., 2014; Chaabane & Negra, 2015) as well as the identification of strengths and weaknesses in young for to improve the training of the physical fitness and health. In addition, there is a consensus in the scientific literature on the importance of assessing physical and physiological qualities to optimize sport performance (Franchini et al., 2011; Bridge et al., 2014) especially for those characterized by complex technical/tactical and physical/physiological demands (e.g., karate; Chaabène et al, 2012). However, prior to the design of a test protocol for sport-specific performance assessment (Chaabene et al, 2018), it is recommended to conduct a systematic needs analysis to identify the above-mentioned demands of the specific sport (Gaetano, Rago, 2014, Gaetano, 2012ab, Kraemer et al., 2012). The karate is a sport with increasing popularity and many sports centers and schools promote it (Ziaee et al, 2015). Performance, in karate, depends on the physiological (Sertić et al, 2011), biomechanical and psychological characteristics of athletes (Bosco et al., 1983). This sport has a bioenergetic profile that depend from aerobic and anaerobic energy system. Several studies have shown that, in general, combat sports can have positive effects (Chamari et al., 1995; Guidetti et al, 2002) on motor skills, physical fitness and health (Hopkins, 2002; D'Isanto et al, 2017). Being the karate a combat sport, during the training various basic skills are practiced, different exercises of combination and motor coordination (Raiola, 2017, 2015, 2014, 2011ab,) are proposed. The purpose of this study is to estimate the effects of four weeks of karate training among boys aged 14 to 16 years.

### Methods

#### Participants

For this study, twenty-four subjects were trained for four weeks, were selected in random form. The boys were divided into two groups: experimental group ( $n=12$ ) and for the control group ( $n=12$ ). The characteristics of the experimental group (karate training) were: (aged  $15,34 \pm 0,75$ ; height  $1,70 \pm 4,16$  (m); weight  $65,75 \pm 3,77$  (Kg); BMI  $22,75 \pm 1,10$ ), for the control group were: (aged  $15,13 \pm 0,58$ ; height  $1,68 \pm 3,93$  (m); weight  $63,30 \pm 3,93$  (kg); BMI  $22,44 \pm 0,90$ ). All the subjects spontaneously in the study gave written consent and committed themselves not to carry out other activities during the experimentation period.

#### Experimental procedure

An evaluation of the anthropometric parameters has been measured the following variables: height(m) and weight (kg). As far as the assessment of the rapid strength concerns, the upper limbs were used for the throwing of a 1 kg medical ball; in addition to that, the evaluation of the speed and agility was used 10x5 shuttle run test; while for the assessment of lower limb strength was used the Bosco test. The standardized tests selected for the trials were: for the assessment of the upper limbs the medical ball was used. The participants were given a 1 kg ball and they sited on a chair with their shoulders in contact, throwing the medicine ball ahead (Stockbrugger et sl., 2001), using a passage two hands from the chest. The boys did the test three times. The distance between the shoulders of the participant up to the point of impact of the ball with the ground, it was considered the best the longest launch. It was used 10x5 shuttle run test for the evaluation of the speed and agility.

The 10 x 5m Shuttle Test is a measure of speed and agility and is part of the Eurofit Testing Battery. Participants run back and forth over 5 meters, for a total of 50m. They have been positioned marker cones and/or lines to five meters apart and the departure it has been established with a foot at one marker. At the start, the subject, runs to the opposite marker, turns and returns to the starting line, repeating it five times without stopping (covering 50 meters in total). At each marker both feet must fully to pass the line. The total time gets registered to complete the 50 m of course. For measures the explosive strength of the lower limbs (D'Isanto et al, 2019) has been used the Bosco test, considered a valid protocol(D'Elia et al, 2019). Each subject performed three jumps providing quantitative data. Has been calculates the contact and flight times in milliseconds, the heights in centimeters and the powers in Watts. In the Squat jump each subject performs a vertical jump starting from a position with the lower limbs bent 90° with the hands on the hips, without making any downward movement. All tests were executed before (Pre-test) and after four weeks of training (Post-test).

*Statistics analysis*

All data has been presented as mean and standard deviation (SD) and data anthropometric and results of the Bosco test. The normality of the distribution was verified with Shapiro-Wilk test. The analysis of the variance was performed for the comparison of the anthropometric data and of the motor skills, while the statistical analysis was performed using the software IBM SPSS Statistics 23. The significance level has been set at  $p < 0.05$ .

**Results**

**Table 1 - Average ± SD for experimental group and for the control group.**

	<b>Experimentalgroup</b>		<b>Control group</b>	
	(n=12)		(n=12)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
<b>Age (years)</b>	15,34	0,75	15,13	0,58
<b>Height (m)</b>	1,70	4,16	1,68	3,93
<b>Weight (kg)</b>	65,75	3,77	63,30	3,92
<b>BMI</b>	22,75	1,10	22,44	0,90

**Table 2 - Results pre and post training in experimental group and control group**

<b>Variables</b>	<b>Experimental group</b>		<b>Control group</b>	
	<b>Before</b>	<b>After</b>	<b>Before</b>	<b>After</b>
Medicine ball throw (m)	3.2 ± 0.3	3.7 ± 0.4	2.8 ± 0.3	2.9 ± 0.2
Shuttle run test (min)	16.2 ± 1.2	16.5 ± 1.0	16.5 ± 0.7	16.3 ± 0.6
SJ - Power (W·kg <sup>-1</sup> )	43.1 ± 3.4	45.2 ± 9.9	42.2 ± 2.9	42.3 ± 2.2

In the table 1, all data are presented as mean and standard deviation (SD) for both of the groups. In table 2, for the medicine ball throw, there was an effect of group ( $F=6.3$ ,  $p=0.01$ ), with higher values for the experimental group. For the 5x10-m shuttle run test, an effect of moment ( $F=16.8$ ,  $p=0.001$ ) was observed with higher values post compared to pre. An interaction effect was found ( $F=5.3$ ,  $p=0.18$ ) with the karate training group presenting higher values at the post compared to pre ( $p < 0.01$ ) and post ( $p=0.04$ ); while was found for squat jump an interaction effect ( $F=4.7$ ,  $p=0.014$ ). The present study shows that the training of karate for four weeks produced significant improvements both in muscle power and speed than at the control group that perform physical activity at free body.

## Discussion

Some studies (Kim et al., 2011; Sterkowicz et al., 2012), highlighted that combat sports training showed no aerobic improvement. For speed, the improvement obtained are due to specific karate movements as all those rapid movements characterized by agility and speed (e.g., to hit and to dodge). Finally, the training with the karate can provide a method to increase muscle flexibility, agility, muscle power and providing preventative health benefits.

## Conclusion

The present study showed that karate training has induced numerous benefits previously shown. The results suggest that the karate appears to be a physical activity that can provide health promotion and a significant exercise capable of to improve fitness and, then, it is not only a self-defense method. Therefore, the teachers of physical education, fitness instructors, the coaches may recommendation karate to their students, clients or players as a form of beneficial exercise to promote physical fitness and to prevent injuries by increasing muscle flexibility.

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