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Original article

THE COMPARISON OF REACTION TIMES OF KARATE ATHLETES ACCORDING TO AGE, GENDER AND STATUS

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Abstract

Aim. Reaction time is the elapsed time between a stimulus and the first corresponding response. The purpose of this study was to compare reaction times of karate athletes according to the age categories, gender and status (competing on national or international level).

Method. The groups of children (age: 10-12, n:73), cadets (age: 13-15, n: 77), juniors (age16-17, n: 34) and seniors (age 18 and over, n:43) were chosen from 3nd International Sakarya Karate Tournament. A total of 227 athletes were participated voluntarily. They were performed simple, choice and auditory reaction time tests. 1 trial and afterward 4 measurements were taken for each tests from all subjects. The best value of the 4 measurements was recorded as milliseconds. All measurements were taken from dominant hand.

Results. The auditory reaction time scores were found significantly higher in 10-12-year athletes ($p<0.001$).There was a significant difference between children and, juniors and seniors according to both simple ($p<0.001$) and choice reaction time ($p<0.01$)tests. Athletes competing on international level showed significantly shorter reaction time in auditory test ($p<0.05$), and choice reaction time scores were found significantly shorter in male athletes ($p<0.01$).

Conclusion. According to the results of reaction time in different age groups, the best reaction time scores were found in 16-17-year karate athletes. Therefore, it was thought that reaction time speed is well developed at the age of 16-17 years. Also, it was concluded that reaction time and rapid decision-making are better in male athletes, and can be improved by practice.

Key words: Karate athlete, auditory reaction time, visual reaction time.

Introduction

Karate is a kind of martial art developed in Japan. It involves kihon, kata and kumite training. Kihon consists of basic karate techniques and, kata and kumite are the two forms performed in competitions. Kata is composed of prespecified series of defensive and offensive techniques and, kumite is a real fighting between two athletes without contact in accord with rules (Doria et al., 2009, Chaabène, Hachana, Attia, Mkaouer, Chaabouni,& Chamari, 2012).

Reaction time is the elapsed time between a stimulus and the first corresponding response (Sevim, 2007). It involves firstly the perception and analysis of a stimulus, then the evaluation and implementation of a required movement. There are two types of reaction time mostly stated in the researches. Simple reaction time (SRT) requires just one response to a single stimulus. In the choice reaction time (CRT)**,** there is an alternative stimulus and the subject gives a particular response for the presented one (Simonek, 2011).

In general, fitness and skill characteristics are measured as physiological qualities of athletes. Endurance, cardiorespiratory function, muscular strength, flexibility, body composition are examined to determine the athletes' fitness characteristics. Agility, power balance, speed, coordination and reaction time are the skill-related characteristics' of athletes to be tested. However, though reaction time is a crucial component in martial arts especially karate by requiring high level performance of explosive techniques, researches related to reaction time in this field are rare. Furthermore, the existing literature related to simple and choice reaction time in martial arts is contradictory (Chaabène, Hachana, Franchini, Mkaouer, & Chamari, 2012). Therefore, testing the simple and choice reaction time is aimed in the present study to compare reaction times of karate athletes according to the age categories, gender and status (competing on national or international level).

Material and Methods

Subjects

Kata and kumite competitors in 3nd International Sakarya Karate Tournament participated in the study. All volunteer athletes were tested from children(age: 10-12, n: 73), cadet (age: 13-15, n: 77), junior (age16-17, n: 34), senior (age 18 and over, n: 43) categories of the tournament and a total of 227 athletes were participated voluntarily. Athletes were informed before testing. Informed consent was provided from the athletes above 18 years of age and from the parents for

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under 18-year old.

Experimental protocol

In this study, auditory and visual reaction time tests were performed in order to test the simple and choice reaction time.Newtest 1000 (Finland)was used to determine all reaction time measurements of the athletes. Two different test protocols of the device were used for SRT and CRT to determine them separately. Attention was shown the place where the measurements were taken to measure in euphotic and silent environment. 1 trial and afterward 4 measurements were taken to determine auditory and visual reaction time scores. All measurements were taken from dominant hand for both light and sound stimuli from each athlete. The best value of the 4 measurements was written as milliseconds as the score of the athletes (Orhan, 2013). Athletes were informed about the method of measurement, but for CRT measurement they were not informed about the order which they choose, the stimuli was given randomly and they chose by him/herself. Lastly, auditory reaction time score wasdetermined with the same device by taking the respond after hearing sound.All measurements were taken during the competition for 3 days.

Data Analysis

The data distribution was tested with the Kolmogorov-Smirnov test. The statistics of variables were briefly reported by using mean and standard deviation. The groups were compared with one-way analysis of variance (ANOVA) and to determine the source of the differences Tukey HSD test was conducted since the variances were homogeneous. An independent samples t-test was used for two-group comparisons. Significance level was taken as 0.05.

Results

Table 1. Comparison of Reaction Time Scores According to Age Categories.

Variable	*Category*	*n*	*X±SD*	*F*	*p*
Auditory Reaction Time(ms)	Children	73	0.152±0.034[a]	7.326	0.001***
	Cadet	77	0.134±0.031[b]		
	Junior	34	0.126±0.032[b]		
	Senior	43	0.132±0.029[b]		
Simple Reaction Time (ms)	Children	73	0.160±0.037[a]	7.111	0.001***
	Cadet	77	0.144±0.035[ab]		
	Junior	34	0.138±0.039[b]		
	Senior	43	0.130±0.032[b]		
Choice Reaction Time (ms)	Children	73	0.363±0.078[a]	4.045	0.008**
	Cadet	77	0.349±0.055[ab]		
	Junior	34	0.327±0.060[b]		
	Senior	43	0.328±0.050[b]		

Ab - No significant difference between the groups which have the same letter and in the same column. **p<0.01 ***p<0.001

There was a significant difference in auditory (p<0.001), simple (p<0.001) and choice (p<0.01) reaction time among the age groups. A significant difference was found in auditory reaction time between children and all other group. While there was a significant difference in both simple and choice reaction time between children and the groups of junior and senior, no significant difference was found between children and cadets (p>0.05).

Table 2. Comparison of Reaction Time Scores According to Status

Reaction Time	*Status*	*n*	*X±SD*	*t*	*p*
Simple Reaction Time (ms)	National	100	0.150±0.039	1.583	0.115
	International	127	0.142±0.035		
Choice Reaction Time (ms)	National	100	0.351±0.066	0.993	0.322
	International	127	0.343±0.064		
Auditory Reaction Time (ms)	National	100	0.144±0.033	2.342	0.020*
	International	127	0.134±0.033		

**p<0.05

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In the comparison of reaction time between the groups of national and international level athletes, the auditory reaction time of international level athletes were found shorter than national level athletes and the difference was statistically significant ($p<0.05$). No significant difference was detected in the simple and choice reaction time scores between the groups ($p>0.05$).

Table 3. Comparison of Reaction Time Scores According to Gender

Reaction Time	***Gender***	***n***	***X±SD***	***t***	***p***
Simple Reaction Time (ms)	Female	74	0.146±0.042	0.202	0.841
	Male	153	0.145±0.035		
Choice Reaction Time (ms)	Female	74	0.364±0.053	2.916	0.004**
	Male	153	0.338±0.068		
Auditory Reaction Time (ms)	Female	74	0.139±0.037	0.164	0.870
	Male	153	0.138±0.031		

**p<0.01

In the comparison of the reaction time between the groups of male and female, the choice reaction time of male athletes were found shorter than female athletes and the difference was statistically significant ($p<0.01$). There was no significant difference in the comparisons of simple and auditory reaction time ($p>0.05$).

Discussion

In this study, simple and choice reaction time were tested to compare reaction times of karate athletes according to the age categories, status (competing on national or international level) and gender. Reaction time is affected by some elements such as age, gender, number of stimuli and expertise.Age is one of these important factors influencing the reaction time and it is known that reaction time decreases with age and also it is minimum at 20 to 30 years of age. However, the amount of this decrease in time is not known, in other words, it is not clear whether the decrease in time occurs at an equal rate or not (Surnina & Lebedeva, 2001).On the other hand, the improvement of reaction time is slight between the ages of 7-12 compared to the other stages (Güzel, Gökmen, Sönmez, Yüktaşır, Konukman, & Demirel, 2005). In accordance with this knowledge, the present study found a significant difference in auditory reaction time between children and all other groups. As for the simple and choice reaction time, there was a significant difference between children and the groups of junior and senior, and the longest reaction time scores were measured in children group, between the ages of 10 and 12.In another study made on 8-year old children to find out the effects of arousal level on reaction time in karate, no significant difference was found in auditory reaction time, but low level of arousal made a positive effect on visual reaction time (Güzel et al., 2005).In the present study, junior group (age:16-17 years) is the fastest group for auditory and choice reaction time, and the senior group (age:18 and over years) is the fastest group for the simple reaction time. Like karate, in a study conducted on international level and recreational taekwondo players, for the hip reaction time the adult male national team members (age:18 and over) were found the fastest and the slowest reaction time was found in the male taekwondo players below 18 years (Vieten, Scholz, Kilani & Kohloeffel, 2007).In competitive high-level sports, the ability to perceive information quickly and properly simplifies decision making and provides more time for implementation of motor behaviour. Karate is a kind of competitive high-level sports requiring fast reactions (Mori, Ohtani & Imanaka, 2002). Also, high-level performance is based on especially explosive power of the karate techniques (Chaabène, Hachana, Franchini, Mkaouer, & Chamari, 2012). Therefore, reaction time is a crucial factor in karate, and there are so many studies in the literature about the level of expertise in karate. Some of them support great differences between experts and novices, some report little or no difference (Mori et al., 2002,Donovan, Cheung, Catley, McGregor & Strutton, 2006, Silverman, 2006). In the present study, the auditory reaction time of international level athletes were found significantly shorter than national level athletes. As for the simple and choice reaction time, no significant difference was detected between international and national level athletes. Likely, in a study made on high level martial artists andsedentary individuals, no significant difference was found in simple and choice reaction time between the martial artists and the sedanter individuals (Donovan et al., 2006). In another study comparing reaction times of karate athletes, it was found that regardless of the protocol, experts were quicker to react than novices and they showed significantly shorter reaction times with or without the information and consistently generated fast reaction times (Tanaka, Hasegawa, Kataoka & Katz, 2010). On the contrary, Fontani et al. (2006) found that high-experienced karate athletes, having 3rd and 4rd dan black belt, reacted significantly faster than low-experienced karate athletes, having 1st and 2nd dan black belt, on the simple reaction time test (Fontani, Lodi, Felici, Migliorini, & Corradeschi, 2006). Also, in a review reporting the important

physical and physiological characteristics of karate athletes, it was stated that a significant difference in the choice reaction time between high-level and novice karatekas occurred (Chaabène, Hachana, Franchini, Mkaouer, & Chamari, 2012). In another study measuring the reaction time and anticipatory skills of karate athletes, results indicated that there was a significant difference in the choice reaction time, while no significant difference was found in the simple reaction time between karate athletes and the novices (Mori et al., 2002). This discrepancy between the present study and previous ones may be due to differences of expertise level because there are two groups consisting of international level athletes, who can be named expert, and national level athletes, who are not completely novice or sedantary, in the study.According to the literature, there are so many studies supporting that men have faster reaction time than women (Silverman,2006, Dykiert, Der, Starr & Deary, 2012). As for the present study, the choice reaction time of male athletes were significantly found shorter than female athletes, but no significant difference was found in the comparisons of simple visual and auditory reaction time. Likely, in a study investigating the gender differences in choice reaction time, results showed a near-significant overall reaction time advantage for male participants and they tended to show faster reaction times than females (Adam, 1999). On the other hand, in a study conducted on taekwondo players to find reaction time differences depending on the skill level, age and gender, it was found that the adult male national team members are the fastest followed by the adult female national team members (Vieten et al., 2007). In a different study made on reaction time assessments of gender differences in visual-spatial performance, it was found that women were slower on the choice task, like the present study result, but more accurate (Blough & Slavin, 1987). In another study comparing values of force, precision, and reaction time of Kung Fu practitioners, women showed, on average, lower values of reaction time, but higher values of precision than men (Neto, Pacheco, Bolander & Bir, 2009). According to the results of reaction time in different age groups, the best reaction time scores were found in 16-17-year karate athletes.
Therefore, it was thought that reaction time speed is well developed at the age of 16-17 years for this research sample.

Conclusions. It was concluded that reaction time and rapid decision-making are better in male athletes because significant difference was found just in choice reaction time in the gender comparison, and choice reaction time is the shortest interval to respond to a stimulus that is given as an alternative to a number of other stimuli (Donovan et al., 2006) and requires also perceptual ability. Lastly, it can be said that reaction time can be improved by practice because two different groups (international and national level) in the study consist of trained athletes who have participated at least in one national competition, so the results of simple and choice reaction time of these two groups were found similar (not significantly different).

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