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Comparison of Explosive Strength and Anaerobic Power Performance of Taekwondo and Karate Athletes

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Abstract

The aim of this study is to compare explosive strength and anaerobic power performance of taekwondo and karate athletes. 10 taekwondo and 10 karate athletes participated to the study voluntarily by taking "Informed Consent Form". The athletes' values were in taekwondo as mean of age 21±2.4 years, height 181.2±8.01 cm, weight 66.9±15.74 kg, sport age 7.5±5.52 years; in karate as mean of age 21.1±1.66 years, height 170.2±10.04 cm, weight 64.4±15.69 kg, sport age 10.5±3.83 years. Counter movement jump, standing long jump and Wingate Anaerobic Test were applied to the athletes. The data were analyzed by using statistical package program. Descriptive statistics were used for mean and standard deviation values, "Shapiro-Wilk" test was used to determine whether the data showed normal distribution or not and "Independent t Test" was used for comparisons. The results were evaluated according to "$p<0.05$" significance level. According to Independent t Test's results of vertical and standing long jump tests, there were statistically significant differences in both vertical jump and standing long jump test averages of athletes ($p<0.05$). In comparison Wingate anaerobic test, significant differences were found in "Watt" values of groups' Peak, Average and Minimum Power ($p<0.05$). In "kg/Watt" values of groups', differences were found statistically significant in Peak and Minimum Power ($p<0.05$), while differences were not found significant in Average Power ($p>0.05$). As a result, when explosive strength and anaerobic power characteristics of taekwondo and karate athletes were compared, a difference was found between the two branches. The reason for this can be said to be different competition times, training programs, training methods and physical requirements of the branches. In addition, taekwondo athletes foot techniques, karate athletes using hand techniques more than foot techniques can be listed as the reasons for this difference.

Keywords: Taekwondo, Karate, explosive strength, anaerobic power.

1. Introduction

Sports, according to pre-determined rules; In order to avoid stress and to stay healthy, it can be done as a leisure activity or as a performance/competition activity to win. It enables the individual to use his/her muscles during his/her performance, to use his/her mental abilities, to make instant decisions and to reveal his/her characteristics such as social and cultural qualities (Ozan, 2013).

These sport branches; such as judo, karate, jiu-jitsu and taekwondo and it includes a variety of flapping, kicking and punching techniques by using of hands and feet (Peacock et al., 2018). Far East sports also contains the spirit of struggle and defense. These sports aim to help the athlete's mind and body movements to reach maturity in balance and to perfect the athlete's character (Öktem et al., 2017). Basic technical training and tactical training in combat sports, renders the punches and kicks to a powerful and effective weapon with the repetition method. In addition, these high-intensity short-term sports; includes elements such as anaerobic character practices (Cingöz, 2016), aerobic-anaerobic power, skills, body fat ratio, agility and explosive force that affect performance (Savaş et al., 2014).

Taekwondo is a Far Eastern defense sport of Korean origin. Tae: is hitting and breaking with the foot; Kwon is hitting with hand and destroying; and Do: means the philosophy of fighting. These sports involve the use of unarmed combat techniques by the hands and feet to defend the athlete him/herself (Kan, 2009; Savaş et al.,

2014). Due to the taekwondo athletes have a strong instinct, they apply right-to-left dodging or bending movements in a variety of ways for self-protection and defending themselves against the attack from the rival. In order to apply these movements, to escape from the attack and to make defense, to kick by jumping, to apply counter-attack, the athlete needs anaerobic leg strength (explosive power) (Boyalı, 1997).

The word Karate-Do means the path of empty hands (Ramia et al., 2019).Karate is interpreted as self-defense with empty hands, in other words, without using weapons, tools or instruments (Savaş et al., 2014).Karate; It is a traditional martial art on the Okinawa island of Japan and was modernized by Funakoshi Gichin in the 1917s (Seong-Kon, 2018). In karate-do, techniques often require explosive strength and ability to use force. In karate-ka's technical attacks, block and genius applications (defense), to be able to move faster than the rival, it needs power. It is a branch that Aerobic energy system is used predominantly, but the anaerobic system is used in determining the result. This is a special sport related to the high anaerobic capacity values of the athletes and their resistance to fatigue (Turgut et al., 2016). In Karate competitions, it includes short and tiring repetitions. The first hit (kick-punch) is important to win. Athletes attack or defend. The attacker tries to surprise (give initiative) the rival to shorten the stroke distance and attack quickly. The defending athlete escapes from the rival's attack to the right or left and blocks the attacker's shot. Therefore, speed, displacement, power (Katić et al., 2005), such as sliding, are part of performance. Karate athletes are usually very quick and strong (Roschel et al., 2009).

Anaerobic power is defined as the ability of the individual to use the phosphogen system in short-term high-intensity muscle activities (Ozan et al., 2013). Some researchers have indicated that anaerobic power and capacity are the determinants of performance in sports branches that require speed, jump, sudden speed or direction change (Üstündağ et al., 2017). Anaerobic performance is a term that expresses great importance for sports branches requiring speed and explosive force (Ozan et al., 2013). Anaerobic performance comes to the forefront in many other sports such as taekwondo, karate, ski (alpine), gymnastics, as sudden and high intensity power is needed (Ozan et al., 2013; Özkan et al., 2002; Üstündağ et al., 2017). Karate consists of many explosion techniques. Technical strokes last for 1–3 seconds, while intensive strokes last for 18 seconds (Ravier et al., 2006). In taekwondo competitions; agility, anaerobic strength and endurance are very important. Taekwondo competitions consist of 3 rounds of two minutes each round and heart rate increase to an average of 85% in these competitions. So, it proves that this sport has high intensity. Therefore, athletes need to develop their anaerobic power to succeed in competitions. Because scoring is taken with very short attacks. Taekwondo athletes also need explosive strength to react (Seo et al., 2015; Taskın et al., 2016).

Taekwondo and Karate branches with similar characteristics, it is clear that their explosive strength and anaerobic power are so important. The aim of this study is to compare the explosive strength and anaerobic power performance of Taekwondo and Karate athletes.

2. Method

2.1 Participants

10 taekwondo and 10 karate athletes participated to the study voluntarily by taking "Informed Consent Form". The athletes' values were in taekwondo as mean of age 21±2.4 years, height 181.2±8.01 cm, weight 66.9±15.74 kg, sport age 7.5±5.52 years; in karate as mean of age 21.1±1.66 years, height 170.2±10.04 cm, weight 64.4±15.69 kg, sport age 10.5±3.83 years. We applied the principles outlined in the Declaration of Helsinki.

2.2 Measures

2.2.1 Measurement of Height

The height of the athletes was measured by using a SECA brand height scale having an accuracy of 0.01 mm sensitivity. The values were recorded as "cm".

2.2.2 Measurement of Weight

The body weight of the athletes was measured by using a SECA brand weight scale having an accuracy of 0.001 kg sensitivity. The values were recorded as "kg".

2.2.3 Measurement of Body Mass Index

Calculated by dividing the body weight (kg) by the square of the body height (m^2).

2.2.4 Vertical Jump Test

Counter movement jump (CMJ) test was applied to athletes by starts from an upright position with hands on hips, followed by a downward movement, immediately into a vertical jump. The best results were recorded as "cm"

from tool measuring digitally. "Takei jump-meter" was used with measurement capacity between 5 cm to 99 cm, showing the distance digitally by leaping with waist stuck.

2.2.5 Standing Long Jump Test (SLJ)

The distance between the line at the jumping point and the last trace of the athletes was measured after the athletes jumped without gaining speed at the standing point with both legs. The test was retreated twice, and the best score was recorded.

2.2.6 Wingate Anaerobic Test (WAnT)

Initially, the warm-up was performed (5 minutes) with 2- to 3-second duration flat-out sprints performed at the beginning of the fourth minute of warm-up. Tests were started 5 minutes after the end of the warm-up period. The WAnT consisted of exercise performed at maximal power for 30 seconds with an external resistance corresponding to 75 $g.kg^{-1}$ body mass. The cycle ergometer (Monark Ergomedic 894-E, Sweden) protocol began without external resistance, which was added immediately after the test was initiated. Pedal revolution rate was determined by Monark Anaerobic Test Software. Values were obtained at 5-second intervals and after calculated the peak power (PP) in the initial 5-second period, average power (AP) for 30 seconds, minimal power (MP) and drop power (DP); peak power per weight (PP/Wkg), mean power per weight (AP/Wkg), minimal power per weight (MP/Wkg) and drop power per weight (DP/Wkg) (Zagatto et al. 2009).

2.3 Statistical Analysis

The data were analyzed by using statistical package program. Descriptive statistics were used for mean and standard deviation values, "Shapiro-Wilk" test was used to determine whether the data showed normal distribution or not and "Independent t Test" was used for comparison between groups. The results were evaluated according to "$p<0.05$" significance level.

3. Results

Table 1. Independent t test's results of CMJ and SLJ

	Group	Mean	SD	t	p
CMJ (cm)	Karate	60.3	15.69	-2.53	**.021**
	Taekwondo	75.9	11.57		
SLJ (cm)	Karate	206.7	27.23	-1.29	.212
	Taekwondo	212.2	15.73		

Table 1 shows the Independent t Test's results of CMJ and SLJ. According to Table 1, there were statistically significant difference in CMJ ($p<0.05$), but there were not in SLJ test averages of Taekwondo and Karate athletes ($p>0.05$).

Table 2. Independent t test's results of WAnT

		Group	Mean	SD	t	p
PP	Watt	Karate	427.87	134.78	3.26	**.004**
		Taekwondo	644.84	161.11		
	kg/Watt	Karate	6.97	1.54	2.54	**.020**
		Taekwondo	9.26	2.4		
AP	Watt	Karate	318.36	102.48	2.92	**.009**
		Taekwondo	469.48	127.29		
	kg/Watt	Karate	5.12	.99	2.59	**.018**
		Taekwondo	6.48	1.33		
MP	Watt	Karate	125.92	27.83	2.19	**.041**
		Taekwondo	249.61	24.01		
	kg/Watt	Karate	1.89	1.62	2.27	**.036**
		Taekwondo	3.55	1.65		
DP	Watt	Karate	319.16	47.63	1.18	.253
		Taekwondo	394.14	36.15		
	kg/Watt	Karate	5.02	2.28	1.39	.181
		Taekwondo	6.26	1.66		

Table 2 shows Independent t Test's results of WAnT. According to Table 2, significant differences were found in

"Watt" and "kg/Watt" values of groups' Peak, Average and Minimum Power ($p<0.05$), but differences were not found significant in "Watt" and "kg/Watt" values of groups' Drop Power ($p>0.05$).

4. Discussion

Muscle power is directly measured as a output of anaerobic power using dynamometers, force platforms or jump meters; however, expensive and nonportable devices may not be feasible for population-based studies. As a result, muscle power is often predicted using equations that incorporate vertical jump height, which can be easily measured with these measurement equipments. So, the vertical and standing long jump demonstrate greater reliability and are commonly used to predict peak power of the lower limbs (Gomez-Bruton et al., 2019, Acero et al., 2011).

In our study, results of CMJ and SLJ tests show that there were statistically significant differences there were statistically significant difference in CMJ ($p<0.05$), but there were not in SLJ test averages of Taekwondo and Karate athletes ($p>0.05$).

Suna and Kumartaşlı (2017) investigated aerobic, anaerobic combine technical trainings' effects on performance. They found significant differences in vertical jump pre and post-test values. Faraji et al. (2016), selected 40 male kumite athletes at the World Karate Championship. Significant differences were found from these athletes vertical jump test, standing long jump and PP as 957.5±164.11 Watt. Boyalı (1997), applied a test for a comparison of vertical jump in 15 male taekwondo athletes, so he found a significant increase in vertical jump values ($p<0.05$). Özsoy et al. (2018), in a test made with 25 male taekwondo athletes and 20 poomse athletes found a significant difference between vertical jump test (taekwondo athlete X = 233±21.1 cm, poomse X = 216±16.6 cm) ($p>0.05$). Turna et al. (2019) investigate the effects of a six-week training program on several performance parameters. They found significant differences in CMJ test results and stated that the 6-week training process positively affected the increase in performance.

In many studies show the difference in vertical and standing long jump, but there are many of them show opposite. For example, Öktem and Şentürk (2017), as a result of an 8-week intensive training program, found a significant difference ($p<0.05$) between 15 male young national Karate athletes' standing long jump test with an average of 265±.10 cm, and 15 male young national wrestling athletes' standing long jump test average 192.6±0.21 cm. however, there was no significant difference between the vertical jump test means ($p>0.05$). Turna and Kılınç (2016) assessed the performance parameters according to combined performance analysis conducted routinely. They found the differences insignificant in vertical jump values. Aslan et al. (2011), in a test done with 80 male athletes stated the vertical jump test average as 61.77±7.3 cm and average of standing long jump test as 245.35±14.77 cm. Türkeri (2007) in a study done with 53 male, 22 female karate athletes, he stated the average vertical jump test as 36.9±7.91 cm.

Sport performance can be assessed with 5 main components. These include cardiorespiratory endurance, muscle strength/strength, muscle endurance, flexibility and body composition. Anaerobic activity is defined as energy expenditure using anaerobic metabolism (without oxygen) lasting less than 90 seconds using a strenuous effort. During the WAnT, two main energy sources are tested. The first is the adenosine triphosphate-phosphospreatine (ATP-PCr) system, which lasts 3 to 15 seconds during maximum effort. The second system is anaerobic glycolysis that can be sustained for the rest of the all-out effort (Wilmore & Costill, 2004). Therefore, WAnT measures the ability of muscles to work using both ATP-PCr and glycolytic systems. Taekwondo, Karate, Football, Gymnastics and many other sports during the competition intensely uses anaerobic metabolism (Zupan et al., 2009).

In our study, results of Want, significant differences were found in "Watt" and "kg/Watt" values of groups' PP, AP and MP ($p<0.05$), but differences were not found significant in "Watt" and "kg/Watt" values of groups' DP ($p>0.05$). When the studies in the literature similar to our study on the evaluation of anaerobic power and explosive strength parameters were examined; Ozan (2013); found the anaerobic power levels of wrestlers 11.22 W/kg, football players 9.90 W/kg, cyclists 10.64 W/kg, tennis players 9.81 W/kg, boxers 9.96 W/kg, and taekwondo 10.51 W/kg. In the study of Üstündağ et al. (2017), it has been determined significant differences in PP value of 10 boxing athletes as 11.55±1.34 W/kg, MP as 4.75±1.22 W/kg; 20 weightlifting athletes PP as 14.54±1.82 W/kg, and MP value 3.32±2.17 W/kg; 6 taekwondo athletes PP as 11.51 W/kg, and MP as 4.98±.95 W/kg. Baynaz et al. (2017), 20 sedentary women with a 6-week training program in the study, control group found the PP pre-test averages as 524.08±226,10 W, and post-test averages as 532.00±205.53 W; training group found the PP pre-test averages as 534.30±252.93 W, and post-test averages as 662.60±219.06 W. So, they defined the differences statistically significant. Suna et al. (2016) found the PP of basketball players as 998.59±73.66 W, and handball players as 830.47±128.54 W. So, the difference found significant between two

groups. Güvenç and Turgut (2004), in a test made with 50 trained athletes found a significant difference ($p<0.05$) between averages of anaerobic power values (PP 835.16±110.43 W; AP 625.68±93.56 W; MP 414.48±88.11 W) and mean values of anaerobic power values of evening measurements (peak power 863.78±113.04; AP 679.58±96.66 W; MP 477.77±94.26 W).

5. Conclusion

As a result, when explosive strength and anaerobic characteristics of taekwondo and karate athletes were compared, a difference was found between the two branches. The reason for this can be said to be different competition times, training programs, training methods and physical requirements of the branches. In addition, dissimilarity in foot techniques of taekwondo athletes, karate athletes also use hand techniques more than foot techniques can be listed as the reasons for this difference. It is also believed that our study will serve as a reference source for future studies and will shed light on sports scientists and coaches accordingly.

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