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ASSESSMENT BODY COMPOSITION AND LEG REACTION TIME OF ELITE TAEKWONDO ATHLETES

ABSTRACT

The main aim of present study is to determine body composition and leg reaction times of elite male taekwondo athletes. Seventeen taekwondo athletes (Mean ± SD; age 21.2±4.7 year, height 173.6±6.5 cm, weight 63.1±10.9 kg, BMI 20.9±2.4 kg/m^2) who are doing taekwondo approximately ten years volunteer in present study. Left and right leg reaction time of subjects were measured. Body composition is analyzed with TANITA BC-418MA Segmental Body Analyze Monitor. The mean ± SD BMR, TBF%, TBFM, FFM and TBW of subjects were determined 7260.7±998.8 kj, 7.1±4.1%, 4.8±3.6 kg, 58.4±8.3 kg, and 42.7±6.1 kg, respectively. There was no significant difference between right leg reaction time (291±37 msec) and left leg reaction time (305±38 msec)of subjects (t=0.873, p>0.05). There was negative significant correlation (p<0.05) between a)leg reaction time and leg fat percentage and b)leg reaction time and leg fat mass. In conclusion, lower leg fat percentages and fat mass of taekwondo athletes affect reaction times in a positive way. Additionally, lower total body fat %, left and right leg fat %, left and right arm fat % and trunk fat % can affect the performances positively.

Keywords: Taekwondo, Martial Arts, Reaction Time, Physical Fitness, Body Composition

ELİT TAEKWONDOCULARININ VÜCUT KOMPOZİSİYONUNU VE BACAK REAKSİYON ZAMANLARININ DEĞERLENDİRİLMESİ

ÖZET

Bu araştırmanın temel amacı elit erkek Taekwondocuların vücut kompozisyonlarını ve alt ekstremite reaksiyon zamanlarını belirlemektir. Ortalama on yıl Taekwon-do ile ilgilenen toplam 17 erkek sporcu (ortalama±SD; yaş 21.2±4.7 yıl, boy 173.6±6.5 cm, ağırlık 63.1±10.9 kg, BMI 20.9±2.4 kg/m^2) çalışmaya gönüllü olarak katılmıştır. Deneklerin sağ ve sol bacak reaksiyon zamanları ölçüldü. Vücut kompozisyonu TANITA BC-418MA Segmental Body Analyze Monitor ile belirlendi. Deneklerin, ortalama±SD BMR, TBF%, TBFM, FFM ve TBW sırasıyla 7260.7±998.8 kj, 7.1±4.1%, 4.8±3.6 kg, 58.4±8.3 kg ve 42.7±6.1 kg olarak belirlendi. Deneklerin sağ bacak (291±37 msec) ve sol bacak (305±38 msec)reaksiyon zamanları arasında anlamlı fark olmadığı belirlendi (t=0.873, p>0.05). Deneklerin, a)bacak reaksiyon zamanı ile bacak yağ% arasında ve b) bacak reaksiyon zamanı ile bacak yağ miktarı arasında negatif anlamlı ilişki bulunmaktadır (p<0.05). Sonuç olarak, taekwandocularının bacak yağ yüzdeleri ve yağ miktarlarının az olması reaksiyon zamanlarını olumlu yönde etkilemektedir. Ayrıca total vücut yağ %, sağ ve sol bacak yağ %, sağ ve sol kol yağ % ile gövde yağ % düşük olduğunu bunun da performanslarını olumlu yönde etkileyebileceğini söyleyebiliriz.

Anahtar Kelimeler: Taekwondo, Dövüş Sanatı, Reaksiyon Zamanı, Fiziksel Uygunluk, Vücut Kompozisyonu

1. INTRODUCTION (GİRİŞ)

Taekwondo is a contact sport that comes from different Korean martial arts. Taekwondo which is created from old combat methods is becoming popular in worldwide since 1950s. While Taekwondo took place as a show in 1988 and 1992 Olympic Games, it was an official sport in 2000 Sydney Olympic Games. There were very few scientific researches about Taekwondo until 2000 Olympic Games. But in the last 10 years, researches about this field increased [1,2,3,4,5]. It is seen that most of these researches are about wounding or injury and there are very few researches about physical, physiological and anthropometric features [6,7,8,9]. Since physical, physiological and anthropometric features are very important for the performance of athletes, these features are needed to be searched and analyzed very carefully in every branch of sports. It is stated by many researchers that determining weaknesses of athlete and obstacles before successful performance in Olympic level, comparing them with other athletes, following their improvement and testing their conditional features while trainers are preparing their training schedule are very important [2]. Body composition and reaction time are important for taekwondo. Kules (1996) states that in combat sports, anthropometric features like weight, length, upper and lower extremities, body fat mass and fat free weight are determinant in sportive performance [10]. In many researches, it is found that elite athletes of all sport branches have very good physical and anthropometric profiles [11-14] Anthropometric components like body fat have positive effects on other conditional features, for example Max VO_2. Gao et al. (1998) discovered that decreasing the percentage of body fat content and increasing the weight of fat free body cause higher level of Max VO_2 [15]. Another factor that increases the success of taekwondo athletes is reaction time. According to Bompa (1999), starting some moves very fast and keep these moves on same speed, make them impossible to respond [16].

Besides determining body composition, physiological and physical features, planning accurate training, talent selection, finding the weak and strong features of athlete are obligatory factors in preventing the waste of human resources. Today, in order to get optimum performance from taekwondo techniques, it is needed to make use of improvements in science [2]. The main aim of present study is to determine body composition and leg reaction times of elite male taekwondo athletes. Secondary aim is to compare left and right leg reaction times. Third aim is to analyze the relation between leg reaction times and body composition. The effect of these features on taekwondo performance and lack of comprehensive studies in this field show the importance of our research.

2. RESEARCH SIGNIFICANCE (ÇALIŞMANIN ÖNEMİ)

Even though Taekwondo is far eastern sport which is composed of very old combat techniques, it took place as a sport branch in Olympic Games in 2000. Also, the popularity of Taekwondo is increasing in last 40 years. However, there are very few scientific studies about taekwondo. Especially studies about physical, physiological and anthropometric features of elite taekwondo athletes are very rare. It is known that being successful in any sport branch depends on athlete's being on sufficient level of physical, physiological, psychological, motor skill and body composition features. For this reason, these features like in any other sport branches should be analyzed very carefully in Taekwondo. It is believed that the data that is gained after this research will be useful in identification of

elite Turkish Taekwondo athletes and being a basis for future studies on this field.

3. METHODS (YÖNTEM)

3.1. Subject (Denekler)

17 male taekwondo athletes (Mean±SD; age 21.2±4.7 year, height 173.6±6.5 cm, weight 63.1±10.9 kg, BMI 20.9±2.4 kg/m^2) who are doing taekwondo approximately 10 years and join in national team volunteer in present study. All measurements were performed in May, 2010. All subjects are informed about test procedures before the application of test. All subjects gave their informed consent. Before carrying out reaction tests, subjects performed warm-up. Warm-up session lasted 10 min (running and stretching). Body composition analysis was performed before warm-up. Subjects were instructed that least 4 hours before measurements not eat, not intake caffein and drug.

3.2. Analyze of Body Composition (Vücut Kompozisyonu Analizi)

Body composition is analyzed with TANITA BC-418MA Segmental Body Analyze Monitor. This device analyzes total body weight, BMI, basal metabolic rate (BMR, kj), body fat (%), fat mass (kg), free fat mass (kg) ve total body water (kg). Also, this device analyzes the body both as different regions like left-right legs, left- right arms, trunk (5 different regions) and as total.

3.3. Reaction Time (Reaksiyon Zamanı): One of the impotant tests that determines the performance of athlete is reaction test [17 and 18]. Right- left leg reaction to souı nd tests of all subjects are made. As seen in Figure 1, subject is ready and waiting. When the sound comes from reaction device, subject lifts up his leg as fast as possible (kick move in taekwondo) Later it continues with a change of the leg. This test is repeated twice for each leg. By this way, better conclusion can be acquired. In reaction measurement devices, contacts are used as sensors. This makes difficult to use the system. In Figure 2, you can see the boundary diagram of optoelectronic reaction test device designed by the writer. Reaction test device consists of one U shaped sensor and two main devices. Main device consists of 4 digid numerator. Fast switching principle is used in device. U shaped sensor system simplifies the use of device. Device doesn’t need any adjustment (19). Important technical features of device can be stated as: Supply voltage is 220V, 50Hz. The power comes from network is 3W. Counting range is 9 seconds 999 milliseconds. There are two modes as sound and light alarmed. Modes are chosen by switch. There is a 4 digids 50X20mm size display on device. The connection of sensor is with connector.

Figure 1. Leg reaction test
(Şekil 1. Bacak reksiyon testi)

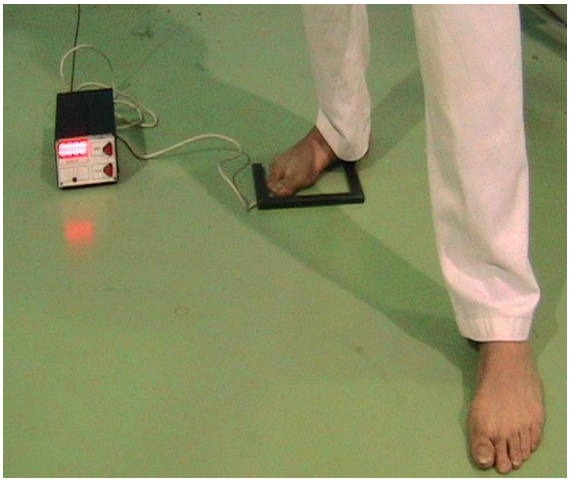

Figure 2. Reaction test equipment
(Şekil 2. Reaksiyon test cihazı)

3.4. Statistical Analysis (İstatistiksel Analiz)

All statistical analyses were performed using SPSS version 17.0 (SPSS, SPSS Inc, Chicago, IL, USA) software. The mean (±SD), minimum and maximum values of tests were determined. The relationships between leg reaction time (left and right leg seperately)and body composition variables were determined by Pearson correlations test. Left and right reaction times of subjects were comparised by Paired-Samples T test. The level of significance was set at 0.05.

4. FINDINGS (BULGULAR)

Body composition parameters of subjects are shown in Table 1-4. Comparison of left leg and right leg reaction time and the relation between reaction time and body composition parameters of subjects are shown in Table 5 and 6.

Table 1. Some body composition parameters of subjects
(Tablo 1. Deneklerin bazı vücut kompozisyonu parametreleri)

Variable	Mean	SD	Min	Max
BMR (kj)	7260,7	998.8	6259	10272
TBF (%)	7,1	4.1	1.9	16.5
TBFM (kg)	4.8	3.6	1.1	6.1
FFM (kg)	58.4	8.3	47	81.3
TBW (kg)	42.7	6.1	34.4	59.5

TBF%: Total Body Fat % FFM: Free Fat Mass
TBFM: Total Body Fat Mass TBW: Total body water
BMR: Basal metabolism rate

As shown in table 1, the mean±SD BMR, TBF%, TBFM, FFM and TBW of subjects were determined 7260.7±998.8 kj, 7.1±4.1%, 4.8±3.6 kg, 58.4±8.3 kg, and 42.7±6.1 kg, respectively.

Table 2. Right and left leg fat percentage, fat mass, fat free mass and predicted muscle mass of subjects
(Tablo 2. Deneklerin sağ ve sol bacak yağ yüzdesi, yağ ağırlığı, yağsız ağırlık ve tahmini kas ağırlığı)

Variable	Mean	SD	Min	Max
RLF(%)	8.4	3.4	2.9	16.4
RLFM(kg)	0.9	0.5	0.3	2.7
RLFFM(kg)	10.1	1.3	8.6	13.6
RLPMM(kg)	9.6	1.3	8.2	12.9
LLF(%)	8.5	3.8	2.4	16.1
LLFM(kg)	0.9	0.5	0.3	2.6
LLFFM(kg)	9.9	1.4	8.4	13.8
LLPMM(kg)	9.4	1.3	8	13

RLF%: Right Leg Fat %
LLF%: Left Leg Fat %
RLFM: Right Leg Fat Mass
LLFM: Left Leg Fat Mass
RLFFM: Right Leg Fat Free Mass
LLFFM: Left Leg Fat Free Mass
RLPMM: Right Leg Predicted Muscle Mass
LLPMM: Left Leg Predicted Muscle Mass

As shown in table 2, subjects' right leg fat % 8.4±3.4 %, right leg fat mass 0.9±0.5 kg, right leg fat free mass 10.1±1.3 kg, right leg predicted muscle mass 9.6±1.3 kg, left leg fat % 8.5±3.8 %, left leg fat mass 0.9±0.5 kg, left leg fat free mass 9.9±1.4 kg, left leg predicted muscle mass 9.4±1.3 kg were determined.

Table 3. Right and left arm fat percentage, fat mass, fat free mass and predicted muscle mass of subjects.
(Tablo 3. Deneklerin sağ ve sol kol yağ yüzdesi, yağ ağırlığı, yağsız ağırlık ve tahmini kas ağırlığı)

Variable	Mean	SD	Min	Max
RAF(%)	7.7	4	2.1	14.2
RAFM(kg)	0.3	0.2	0.1	0.7
RAFFM(kg)	3.5	0.7	2.5	5.5
RAPMM(kg)	3.3	0.6	2.3	5.2
LAF(%)	7.7	4.6	1.3	14.6
LAFM(kg)	0.3	0.2	0.1	0.8
LAFFM(kg)	3.5	0.7	2.5	5.5
LAPMM(kg)	3.3	0.7	2.4	5.2

RAF%: Right Arm Fat %
LAF%: Left Arm Fat %
RAFM: Right Arm Fat Mass
LAFM: Left Arm Fat Mass
RAFFM: Right Arm Fat Free Mass
LAFFM: Left Arm Fat Free Mass
RAPMM: Right Arm Predicted Muscle Mass
LAPMM: Left Arm Predicted Muscle Mass

As shown in table 3, subjects' right arm fat % 7.7±4 %, right arm fat mass 0.3±0.2 kg, right arm fat free mass 3.5±0.7 kg, right arm predicted muscle mass 3.3±0.6 kg, left arm fat % 7.7±4.6 %, left arm fat mass 0.3±0.2 kg, left arm fat free mass 3.5±0.7 kg, left arm predicted muscle mass 3.3±0.7 kg were determined.

Table 4. Trunk fat percentage, fat mass, free fat mass and predicted muscle mass of subjects
(Tablo 4. Deneklerin gövde yağ yüzdesi, yağ ağırlığı, yağsız ağırlık ve tahmini kas ağırlığı)

Variable	Mean	SD	Min	Max
TF(%)	6.8	4.6	3	17.8
TFM(kg)	2.5	2.2	0.9	9.3
TFFM(kg)	31.2	4.3	24.7	42.9
TPMM(kg)	29.9	4.1	23.8	41.2

TF%: Trunk Fat %
TFFM: Trunk Fat Free Mass
TFM: Trunk Fat Mass
TPMM: Trunk Predicted Muscle Mass

As shown in table 4, subjects' trunk fat % 6.8±4.6 %, trunk fat mass 2.5.±2.2 kg, trunk fat free mass 31.2±4.3 kg, trunk predicted muscle mass 29.9±4.1 kg, were determined.

Table 5. Comparison of subjects left and leg reaction time
(Tablo 5. Deneklerin sağ ve sol bacak reaksiyon zamanlarının karşılaştırılması)

Variable	Mean	SD	Min	Max	T
RLRT (msec)	291	37	182	356	-0.873
LLRT (msec)	305	38	187	365	

LLRT: Left Leg Reaction Time
RLRT: Right Leg Reaction Time

As shown in table 5, there was no significant difference between right leg reaction time (291±37 msec) and left leg reaction time (305±38)of subjects ($t=0.873$, $p>0.05$).

Table 6. Relationship between reaction time and some body composition parameters of subjects
(Tablo 6. Deneklerin reaction zamanı ile bazı vücut kompozisyonu parametreler arasındaki ilişki)

Reaction Time	BMI	TF %	LF%	LFM
Left Leg	0.195	0.131	-0.396*	-0.358*
Right Leg	0.302	0.144	-0.308*	-0.327*

TF%: Total Fat Percentage
LF%: Leg Fat Percentage
LFM: Leg Fat Mass
*: There was significant correlation

As shown in table 6, there was negative significant correlation ($p<0.05$) between Leg reaction time and leg fat percentage (for both left and right leg) and between leg reaction time and Leg Fat Mass (for both left and right leg). There was not significant correlation ($p>0.05$) between Leg reaction time and BMI, total fat %.

5. CONCLUSSION AND RECOMENDATIONS (SONUÇ VE ÖNERİLER)

The main aim of present study is to determine the anthropometric features and leg reaction times of elite male Taekwondo athletes. The second aim is to compare the left and right leg reaction times. Third aim is to analyze the relation between leg reaction times and some anthropometric features.

It is determined in present study average age 21.2±4.7 years, height 173.6±6.5 cm, weight 63.1±10.9 kg, BMI 20.9±2.4 kg/m^2 and fat % 7.1±4.1% of taekwondo athletes. This results are similar with the reults that is determined in Czech Taekwondo national team athletes by Heller et al. [1] (average age 20.9±2.2 years, height 179±6 cm, weight 69.9±8.7 kg, BMI 21.9±2 kg/m^2 ve fat % 8.2±3.1%). It is determined that right leg reaction time (291±37 msec) is better than left leg reaction time (305±38 msec) but there is no statistical difference between them ($p>0.05$). The reason of no statistical difference between right and left leg reaction time is that Taekwondo athletes make moves with both legs during exercises and competitions. There are similarities between reaction times in our research and reaction times (224±25 msec) in Heller et al. research ([1].

There was negative significant correlation ($p<0.05$) between Leg reaction time and leg fat percentage (for both left and right leg) and between leg reaction time and Leg Fat Mass (for both left and right leg). There was not significant correlation ($p>0.05$) between Leg reaction time and BMI, Total Fat %. BMR, TBF%, TBFM, FFM and TBW of Taekwondo athletes in this research, respectively 7260.7±998.8 kj, 7.1±4.1%, 4.8±3.6 kg, 58.4±8.3 kg, and 42.7±6.1. Arabacı and his friends found that the values of elite handball players are BMR 9422.53±800 kj ve TBF %12.2±3.8, TBFM 10.7±4.69 kg, FFM 75.2±6.4 kg ve TBW 55.1±4.7 kg in their study [20]. When we compare the results of these two studies, we can say that BMR, TBF%, TBFM, FFM and TBW of elite taekwondo players are lower than elite handball players.

In order to make better evaluation about anthropometric features of elite taekwondo athletes, measurements should be made before, during and after the season and also, these measurements should be compared. Because taekwondo is a weight sport, athletes should be evaluated according to their weights.

In conclusion, lower leg fat percentages and fat mass of taekwondo athletes affect reaction times in a positive way. There is no specific difference between left and right leg reaction times of taekwondo athletes. Additionally, lower total body fat %, left and

right leg fat %, left and right arm fat % and trunk fat % can affect the performances positively.

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