

The Relationship Between Body Compositions of Taekwondo Practitioners Aged 14-16 and Their Aerobic Endurance

DUYGU SEVİNÇ YILMAZ¹ BURAKHAN AYDEMİR²¹ *Erzincan Binali Yıldırım University, Sports Science Faculty, Department of Physical Education and Sports Teaching, Erzincan/ Turkey, 24duygusevinc24@gmail.com, Gsm: 0546 446 87 69, ORCID: 0000-0002-7737-564X*² *Karadeniz Teknik Üniversitesi, Rectorate Physical Education Department, Trabzon/Turkey, burakhanaydemir61@gmail.com, ORCID: 0000-0003-3922-3693*
Correspondence to: Burakhan Aydemir, Email: burakhanaydemir61@gmail.com

ABSTRACT

Background: Taekwondo (TKD) is a combat sport practiced by millions of children, young people and adults around the world.¹ It is an Olympic sports branch with many complex features and constant interaction between two opponents in the competitions, where attack-contact techniques are applied quickly, attacking techniques are strong^{2,3} but also have good flexibility.

Aim: This study has been carried out to identify the relationship between body composition of taekwondo practitioners aged 14-16 who regularly practice taekwondo, and their aerobic endurance.

Methods: A total of 33 registered taekwondo practitioners (17 male, 16 female) participated to this study on a voluntary basis. The age, height, weight, and body mass index of all the athletes who took part in the study are 14.96±0.80 years, 162.59±11.59 cm, 50.97±7.51 kg and 19.14±2.39 kg/m² respectively. The group who participated to the study practice taekwondo two days a week, for 2 hours each, for a period of 1.5 years. The aerobic endurance of taekwondo athletes was measured by 20-meter-long Shuttle Run Test. In order to measure the body composition values of the athletes, measurements of skinfold thickness (biceps, triceps, subscapula, subrailiac) were carried out. In calculating the body density, the formula of Durnning-Womersley was used; and in calculating the body fat percentage, the formula of Siri was employed. Data was evaluated by SPSS 22.0. The normality distribution of the data obtained at the end of the study was evaluated by Kolmogorov-Smirnov test and it was observed that the data was in line with normal distribution. Following the normalcy assessment, the relationship between body compositions and aerobic endurance was determined by Pearson Correlation analysis.

Results: It is possible to say that the body composition values of taekwondo practitioners aged 14-16 have positive and negative impact on their aerobic endurance. It is observed that as the values 20-meter Shuttle Run test increases, fat percentage of athletes decreases.

Conclusion: It is concluded that the findings obtained from the research results support the literature, and that body composition and aerobic capacity are important as performance criteria in many studies. It is thought that it may be beneficial for the athletes to perform aerobic endurance exercises during the annual training periods to perform the necessary practices to optimize their body composition and improve their aerobic capacity.

Keywords: Taekwondo, Body Composition, Aerobic Endurance

INTRODUCTION

Sport is really important not only sedentary person but also athletes performance. It is especially concern about many sciences such as psychology, sociology, physiology, anatomy, biomechanics.¹ Taekwondo (TKD) is a combat sport practiced by millions of children, young people and adults around the world.² It is an Olympic sports branch with many complex features and constant interaction between two opponents in the competitions, where attack-contact techniques are applied quickly, attacking techniques are strong^{3,4} but also have good flexibility.

TKD competitions are held in 1.5 minutes long 3 rounds and a 1-minute rest break between rounds. In a weight class, competitions continue until the athlete is renewed. This means that the athlete will play 7-8 matches for the final competition in a normal competition day. Although the competition time seems short in TKD competitions, overall total of other competitions to be performed by the athlete during the day determines the energy metabolisms that the athlete will use.

TKD competitions include short-term high-intensity technique practice with rest intervals.⁵ This indicates that anaerobic capacity must be strong for a good performance.^{3,6,7} According to another explanation, TKD requires physiological demands such as low-fat percentage, high anaerobic power, rapid movement ability and explosive power.^{3,8,9} However, good anaerobic capacity alone is not enough. Because aerobic capacity is also needed for good anaerobic energy production synthesis.¹⁰ In addition, high aerobic capacity is very important to meet the metabolic needs needed in TKD competitions and facilitate recovery.³

Aerobic fitness, neuromuscular function and anthropometric characteristics, which are regularly evaluated in athletes and are among the components of physical fitness, are important determinants of performance.^{9,11} Height, body mass index, body fat percentage and lean body mass play an important role in the TKD branch.^{12,13} In addition, since TKD is a weight sport, relative

strength is an important element.¹³ Therefore, athletes pay attention to their body composition in order to compete in the weight class they determine and become successful.

TKD, as an Olympic sport, is a branch where physical, physiological, and technical capacity is important. To achieve an effective performance in competitions, it is important to have information about the capacities of the athletes. Having sufficient information can provide convenience to develop the missing characteristics of the athletes. In parallel, this study aims to determine the relationship between body composition and aerobic endurance of athletes between the ages of 14 and 16 who regularly practice TKD.

MATERIAL AND METHODS

33 licensed athletes (17 male, 16 female) in the 14-16 age group who actively participate in taekwondo participated in the research voluntarily. Athletes participating in the study regularly practice taekwondo for 1.5 years, 2 days a week, for 2 hours.

The study was carried out in accordance with the Principles of the Declaration of Helsinki,¹⁴ and the parents of the participants were informed so that the study could be carried out, and a voluntary consent form was signed for the athletes to be included in the study.

Measurement Methods: To record the measurements and tests, measurement forms were prepared, and the measurement values were recorded on these forms.

Data Collection: While the ages of the individuals establishing the sample were determined in years, their height was measured with an accuracy of 0.01 cm using the height scale on the bare scale, and their body weight was measured with an accuracy of 0.01 kg with a dobo (taekwondo dress) scale. Body mass index (BMI) was determined by dividing the obtained weight by the square of the height.¹⁵

(BMI): body weight (kg) / height²(m)

To measure the aerobic endurance of the athletes, the 20-meter shuttle run test (Shuttle Run Test) was applied on them. For body composition measurements, skinfold thickness (biceps, triceps, suprailiac, sub scapula) measurements were taken with the Skinfold caliper and body density was calculated according to Durnin-Wormesley's formula¹⁶ and body fat percentage, lean body mass, and fat body mass were calculated according to the Siri equation. The body density calculation required for the application of the

Siri equation¹⁷ was made according to the Durnin-Wormesley equation.

Durnin-Wormesley body density equation:15:

BD= 1.1553 - 0.0643 x X (Boy)

BD= 1.1369 - 0.0598 x X (Girl)

BD=Body Density Log X = (bi+tr+ss+si)

Siri Equation:16 Fat% = (4.95/BD - 4.50) x 100

BD = biceps skinfold thickness, tr = triceps skinfold thickness, sc = subscapula skinfold thickness, si =suprailiac skinfold thickness.

Data Analysis: In the research, descriptive analyzes were included to determine the demographic characteristics of the athletes and examine their distribution to the groups. Afterwards, Kolmogorov-Smirnov normality analysis was performed to determine the suitability of the data for parametric analysis. As the data showed normal distribution as a result of the analysis, Pearson Correlation analysis was performed, and the level of significance was determined as $p < 0.05$.

RESULTS

Table 1 Shows the Demographic Characteristics of the Athletes

Demographic Information	Min.	Max.	Average±SS
Age (year)	14	16	14.96±0.80
Height (cm)	135	184	162.59±11.59
Body weight (kg)	40	67	50.97±7.51
Body Mass Index (BMI)	13.43	24.90	19.14±2.39

Table 1 shows the demographic characteristics of the athletes. According to the table, the average age of the athletes participating in the research is 14.96±0.80 years, the average height is 162.59±11.59 cm, the average body weight is 50.97±7.51 kg, and the average BMI is 19.14±2.39.

Table 2: Values of Male Athletes Regarding Aerobic Endurance and Body Composition Parameters

Parameters	n	Average	SS	Min.- Max
BMI	17	19.41	2.92	13.43-24.90
20Cm Shuttle Run	17	40.47	6.49	31.00-54.00
Fat Percentage	17	17.36	4.74	11.04-26.22
Body Fat Mass	17	9.46	3.70	4.42-17.22
Lean Body Mass	17	43.83	9.80	25.20-60.18

Considering the values of male athletes regarding aerobic endurance and body composition parameters are examined in Table 2, the mean value of BMI is 19.41±2.92, the average value of 20m shuttle run is 40.47±6.49, the mean fat percentage is 17.36±4.74, the mean body fat mass is 9.46±3.70 and the mean lean body mass is 43.83±9.80.

Table 3: Values of Female Athletes Regarding Aerobic Endurance and Body Composition Parameters

Parameters	n	Average	SS	Min.- Max
BMI	16	18.85	1.70	15.90-21.40
20Cm Shuttle Run	16	33.29	5.89	22.70-23.10
Fat Percentage	16	19.80	3.38	13.42-20.20
Body Fat Mass	16	12.20	2.79	6.98-18.68
Lean Body Mass	16	34.68	7.11	20.87-46.89

** $p < 0, 01$

Considering the values of female athletes regarding aerobic endurance and body composition parameters are examined in Table 3, the mean value of BMI is 18.85±1.70, the average value of 20m shuttle run is 33.29±5.89, the mean fat percentage is 19.80±3.38, the mean body fat mass is 12.20±2.79 and the mean

lean body mass is 34.68±7.11.

Table 4: The relationship between aerobic endurance and body composition of athletes

		BMI	Fat Percentage	Body Fat Mass	Lean Body Mass
20 m Shuttle Run Test (Male)	R	,318	-,192	,176	,658**
	P	,213	,461	,498	,004
20 m Shuttle Run Test (Female)	r	,165	322	-,573*	,034
	P	,541	,224	,020	,902

* $p < 0, 05$

As can be seen in Table 3, as a result of the analysis, it is seen that there is a positive medium level relationship between the 20m shuttle run and the lean body mass of male athletes. On the other hand, for the female athletes, it is seen that there is a moderately significant negative correlation between 20m shuttle run and body fat mass.

DISCUSSION

In this study, conducted to determine the relationship between the body compositions and aerobic endurance of the athletes between the ages of 14-16, it is seen that there is a positive and moderately significant relationship between the 20m shuttle run and the lean body mass of male athletes. On the other hand, for the female athletes, it is seen that there is a moderately significant negative correlation between 20m shuttle run and body fat mass. In other words, as the 20m shuttle run value increases in male athletes, the lean body mass also increases. On the other hand, for the female athletes, as the 20m shuttle run value increases, body fat mass decreases.

It is stated that there may be differences in body structures and sportive performances with the effect of growth and development in children and adolescents who do sports. Performance indicators can be directly related to parameters such as height, body weight, and body composition.¹⁸ Factors such as experience, endurance, body composition and anaerobic-aerobic power are also extremely important in evaluating the performance of athletes.^{19,20}

In 2011, Kim et al. applied TKD training to 31 sedentary women aged 15-16 for 12 weeks. They found that as a result of the applied TCD training, muscle fitness and flexibility improved, as well as a decrease in body fat percentage and body fat mass.²¹ In our study, they state that women who do routine TCD training have a decrease in body fat mass. This study in the literature supports our study.

According to Stanforth et al., body composition plays an important role in determining elite athletes.²² As one of the health-related elements of physical fitness, anaerobic-aerobic capacity and body fat percentages are closely related to endurance.^{23,24,25} These findings are parallel with our study.

In another study examining the relationship between skill, speed, reaction time and body mass index of taekwondo players, the mean BMI was reported as 20.9±1.4 kg/m² in female athletes with an average age of 13.7±1.5 years. In male athletes, the mean BMI was found to be 19.2±2.8 kg/m².²⁶ When these findings are compared with our study, it is determined that the average BMI of female athletes is higher than our results, while the findings of male athletes are the same.

In the study conducted by Badem et al. on taekwondo players, the mean age of women is 16.68±1.95 years, mean BMI is 21.3±2.62 kg/m², body fat percentage is 23.36±5.78, body fat mass is 14.22± 5.37 kg and lean body mass is 45.31±5.53 kg.²⁷ It is seen that all parameters are higher than the data of our study.

In the study examining the relationship between the somatotype structures and performance characteristics of 11-13 years old male taekwondo players, the average BMI of the athletes

is 19.98 ± 3.79 kg/m². In the study, it is seen that there is a significant relationship with strong negative aspect between 20m shuttle run value and endomorphic body type, and a moderately significant negative relationship between mesomorphy body type. In other words, as the shuttle run value increases, the fat rate decreases. It is indicated that there is a moderately significant positive correlation between the shuttle run value of 20m and the ectomorph body type. As the shuttle run value increases, so does the proportion of body muscularity.²⁸ The data obtained as a result of the literature review is parallel with our study.

According to Bridge et al., elite and sub-elite taekwondo players have low body fat level and a structure representing moderate muscle ratio. Athletes perform in many competitions during the day. Athletes must have moderate to high aerobic capacity to meet recovery and metabolic needs.³

The high aerobic endurance of taekwondo players contributes to better performance and late fatigue of them. In competitions, the performance of the athlete, especially in the last seconds of the round, can determine whether the match can be won or not. Therefore, intense fatigue in the last seconds may cause the athlete to lose the competition. From this perspective, it is important for TKD athletes to develop their aerobic endurance at an optimal level.²⁹

CONCLUSION

It is concluded that the findings obtained from the research results support the literature, and that body

composition and aerobic capacity are important as performance criteria in many studies. It is thought that it may be beneficial for the athletes to perform aerobic endurance exercises during the annual training periods to perform the necessary practices to optimize their body composition and improve their aerobic capacity.

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