



The relationship between some physical fitness characteristics and body composition of elite wrestlers

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Abstract: The aim of present study was to investigate the relationship between elite wrestlers' body composition and static strength, anaerobic power and static balance characteristics. Eleven elite male freestyle wrestlers (age = 18.8 ± 1.1 years, height = 170.9 ± 5.3 cm, weight = 75.2 ± 9.6 kg, BMI = 25.7 ± 2.4 kg/m²) who struggle in Turkish Wrestling Super League from Bursa Metropolitan Municipality Sports Club, voluntary participated. Subjects' height, weight, body composition, balance (Peri Length 443.1 ± 140.6 cm, Aria Gap P 20.6 ± 12.9 cm), anaerobic power (106.3 ± 16.8 kg/m/sec), back strength (140.2 ± 30.7 kg) and grip strength (47.6 ± 6.4 kg) test were measured. Pearson correlation coefficient were performed to determine the relationship between variables. In conclusion, anaerobic power, strength and balance are related to body composition components such as height, body weight, BMI, arm and leg fat %, muscle mass and body weight.

Key Words: Wrestling, Strength, Balance, Body composition.



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1. Introduction

Wrestling is defined as the struggle of two wrestlers or people on the cushion of certain dimensions by using their technical, skill, strength and intelligence in accordance with the rules of United World Wrestling (UWW) without using a vehicle [1].

Wrestling was an important part of the ancient Olympics and is still one of the most important games of modern Olympics. Studies have shown that the general physiological profiles of successful wrestlers; high anaerobic power and capacity, muscular strength, above average aerobic power, lean muscle mass, outstanding flexibility and balance characteristics [2].

Wrestling is a sport that requires sporty performance and control such as high aerobics and anaerobic endurance, strength, flexibility, speed, quickness, balance, reaction and strategy [3]. Wrestlers should be able to control their balances effectively, because the techniques applied in wrestling are mostly based on push, pull and displacement, this sport is intended to disrupt the balance of the opponent [4].

In the wrestling sport, the anaerobic power is crucial for sudden attacks, able to lift the opponent from the ground and succeed against the opponent's attacks [5].

Wrestlers are shown among the strongest athletes in sports performed according to body weight. As a biomotor characteristic, strength is very important in both defense and offense or counteract the technique and counterattack [6].

It is very important for wrestlers to have an optimal body composition, because competitions are based on body weight, and athletes have to adjust their weight for each competition. Most of the wrestlers try to reduce the body fat and total body weight while trying to increase the lean mass ratio [7]. According to the studies, high body fat ratio is negatively related to movement and technical performance [6-8].

The aim of present study was to investigate the relationship between elite wrestlers' body composition and static strength, anaerobic power and static balance characteristics.

2. Methods

2.1 Subjects

Eleven elite male freestyle wrestlers (age = 18.8 ± 1.1 years, height = 170.9 ± 5.3 cm, body weight = 75.2 ± 9.6 kg, BMI = 25.7 ± 2.4 kg/m²) who struggle in Turkish Wrestling Super League from Bursa Metropolitan Municipality Sports Club, participated to research as voluntarily. All athletes stay in the same place and the same diet is applied to the athletes. In the last 6 months, the athletes who were taken into the study were cared for due to disability or any other reason. The necessary permits were obtained from the Bursa Metropolitan Municipality Sports Club before study. The athletes were informed about the tests and study protocols and the volunteer consent form prepared in accordance with the Declaration of Helsinki was filled out.

Experimental Procedure

Our study was performed before the competition period when the performance of the athletes was at the highest level. The tests were performed on the parquet floor in the gym before the evening practice (at 4 pm). In the last 24 hours prior to the tests, the athletes have not made any other compelling physical activity and have not consumed any food or drink other than water within the last 3 hours. All tests and measurements were performed on the same day and 15 minutes warming and stretching applications were performed before the tests.

Height and Body Weight Measurements

The height of the athletes was determined on the chart written in cm above the gym wall. The athletes' shoes were removed and their height was measured in an upright position based on the table wall. The body weight was recorded in kg with the body composition measuring device indicated below. Weight measurement of the athletes was made only wrestling jersey.

Body Composition Measurement

Bioimpedance method was used to determine body composition. (Tanita BC-418MA, Tanita Europe B.V. Hoogoorddreef 56E1101 BE in Amsterdam, Holland). Determining the total body weight, fat content, lean weight and total body fluid, this device determines the weight of the right - left arm, right - left leg and trunk fat and calculates the Body Mass Index (BMI).

Balance Test

Prokin Tecnobody PK 200 (Italy) balance meter was used for static balance measurements. The test was carried out on the non-fixed platform, with the hands on the feet, fixed at the waist and standing in the standing position. The optimum position in the double leg test is determined so that the feet are open at the shoulder width and the feet stand at the same distance as the origin point with reference to

the lines on the x and y axis. During the test which lasted for 30 seconds, the position was requested to be maintained and the position of the subject was monitored on the screen. In the static equilibrium test, the perimeter was used as data in millimeters. As the balance score increases, the balance of the individual is poor and the balance is assumed to be good as the score decreases.

Anaerobic Power Test

The vertical jump performance of the participants was measured using the Sport Expert TM, MPS-501 (Tümer Elektronik LTD.) Power platform with a sensitivity of 0.1 cm. Squat jump test protocol was used to evaluate splash performance. The participants had a knee with a twist of about 90 degrees, while their hands were fixed on the hip and did a maximal jump at the beginning without spring movement. After 3 minutes of rest, they performed the 2nd experiment and the best grades were recorded as data. The anaerobic power calculation was calculated using the Lewis Formula.

Anaerobic Power = $\sqrt{4.9 \times \text{body weight (kg)} \times \sqrt{\text{high jump distance (m)}}$

Back Strength Test

Measurements were made using Takkei Back and Leg Dynamometer. After five minutes of warm-up, the subjects placed their feet on the dynamometer stand with their knees stretched, and the arms were stretched, the back was straight and the body was slightly tilted forward, and the dynamometer bar, which he grasped with his hands, vertically upwards. This traction was repeated 3 times and the best value was recorded for each volunteer.

Grip Strength Test

The strength of the grip was made with the grip hand dynamometer of the right or left hand (Takei Brand Hand Dynamometer). Volunteer's dominant hand grasped the instrument with all the power of the determined value is recorded in kg.

During the measurement, the subject was standing in the upright position without bending the arm, without touching the body and away from the body.

Correlation analysis showing the relationship between the body composition and the anaerobic power, strength and balance of the subjects.

Statistical Analysis

SPSS 24 package program was used to analyze the data (SPSS Inc., Chicago, IL, USA). Pearson correlation coefficients were performed to determine the relationship between body composition and strength and balance. $P < 0.05$ was accepted for the level of significance in the interpretation of statistical operations.

In table 1, the wrestlers participating in the study, Fat (body fat ratio) averages $8.5 \pm 3.6\%$, RL Fat (right leg fat ratio) averages of $11.8 \pm 2.8\%$, RL Muscle (right leg 10.9 ± 1.0 kg mean weight, LL Fat (left leg fat ratio) averages $11.9 \pm 2.9\%$, LL Muscle averages 10.8 ± 1.0 kg RA Fat (right arm fat ratio) averages $8.0 \pm 3.4\%$, RA Muscle (right arm muscle weight) averages 4.3 ± 0.5 kg, LA Fat (left arm fat percentage) averages the mean of LA Muscle (left arm muscle weight) was 7.4 ± 3.3 and the mean of Trunk Fat was 7.0 ± 3.9 and the mean of Trunk Muscle was 34.7 ± 3.7 kg, the mean of anaerobic power is 106.3 ± 16.8 kg / m / s, the grip strength averages are 47.6 ± 6.4 kg, the back strength averages 140.2 ± 30.7 kg, Peri Length the mean values were 443.1 ± 140.6 cm and the Aria Gap P averages were 20.6 ± 12.9 cm.

3 Results

Table 1 shows the mean, standard deviation, minimum and maximum values of all test results (body composition, strength and balance).

Table 2 shows the results of the Pearson

Table 1. Arithmetic Mean, Standard Deviation, Minimum and Maximum Values of Test Results

	Mean	Std. Deviation	Min.	Max.
Fat %	8.5	3.6	3.4	14.6
RL Fat %	11.8	2.8	7.5	15.7
RL Muscle (kg)	10.9	1.0	8.7	12.2
LL Fat %	11.9	2.9	8.1	16.3
LL Muscle (kg)	10.8	1.0	8.8	12.1
RA Fat %	8.0	3.4	4.7	15.7
RA Muscle (kg)	4.3	.5	3.3	5.1
LA Fat %	7.4	3.3	3.8	14.7
LA Muscle (kg)	4.3	.58	3.3	5.2
Trunk Fat %	7.0	3.9	3.0	14.0
Trunk Muscle (kg)	34.7	3.7	27.8	39.2
Anaerobic Power (kg/m/sec)	106.3	16.8	82.8	130.5
Grip Strength (kg)	47.6	6.4	39.9	59.3
Back Strength (kg)	140.2	30.7	95.5	199.0

Peri Length (cm)	443.1	140.6	278.7	765.1
Aria Gap P (cm)	20.6	12.9	2.01	45.0

RL = Right Leg, LL = Left Leg, RA = Right Arm, LA = Left Arm.

Table 2. Relationship between Body Composition and Anaerobic Power, Force and Balance Characteristics (Pearson Correlation Test)

	Anaerobic Power	Grip Strength	Back Strength	Peri Length	Aria Gap P
	Pearson Correlation				
Height (cm)	.656*	.568	.109	.787*	.243
Body Weight	.957*	.543	.611*	.387	-.017
BMI	.861*	.338	.781*	-.020	-.177
Fat %	.559	.360	.168	.189	-.160
RL Fat %	.664*	.552	.300	.145	-.004
RL Muscle	.905*	.427	.673*	.386	.006
LL Fat %	.722*	.516	.357	.160	-.078
LL Muscle	.891*	.513	.627*	.448	.091
RA Fat %	.738*	.152	.657*	-.053	-.338
RA Muscle	.793*	.645*	.390	.548	.323
LA Fat %	.774*	.149	.642*	-.033	-.318
LA Muscle	.851*	.656*	.506	.511	.232
Trunk Fat %	.456	.241	-.019	.278	-.246
Trunk Muscle	.954*	.531	.725*	.305	.003

BMI = Body Mass Index, RL = Right Leg, LL = Left Leg, RA = Right Arm, LA = Left Arm. $p < 0.05$ was accepted for the level of significance.

Table 2 presents the relationship between the body composition and the anaerobic power, strength and balance characteristics of the wrestlers participating in the study. There were statistically significant relationships in positive direction between the mean height of the subjects and the anaerobic power and peri length, between the body weight and the back strength and the anaerobic power value, between the body mass index and the anaerobic power value and the back strength, between the right and left foot fat ratio and the anaerobic power value, between right and left leg muscle weight and back strength and anaerobic power value, between the right and left arm fat ratios and back strength and anaerobic power value, between the right and left arm muscle weight and the grip strength and anaerobic power value, between trunk muscle weight and the anaerobic power and back strength ($p < 0.05$).

4 Discussions and Conclusion

In present study, which was conducted to

examine the relationship between body composition and static strength, anaerobic power and static balance characteristics of elite level wrestlers, it was seen that there are statistically significant relationships between the grip strength, back strength and balance properties, especially the anaerobic power with many components of body composition.

According to the results of the study, it was found that the athletes who participated in the study were 18.8 ± 1.1 years old, 75.2 ± 9.6 kg body weight, 170.9 ± 5.3 cm tall and their BMI averages were 25.7 ± 2.4 kg/m². When these results are compared with the studies in the literature, it is seen that elite wrestlers have similar characteristics [2, 4, 15].

In present study, as the height of the subjects increased, anaerobic power and peri length values increased significantly. In our study, as the body weight of the subjects increased, back strength and anaerobic power values increased significantly. In a study conducted by Agaoglu et al [1] in the elite judoists, they found a positive relationship between anaerobic power and height and body weight. Our study showed similar results with the study of Agaoglu et al [1]. It is thought that the fact that anaerobic power is obtained by vertical jump test result increases the relationship with height. In later studies, it is recommended to measure anaerobic power by other methods.

As the BMI of the subjects increased, back strength and anaerobic power values increased significantly. Gursoy et al [9] found a significant positive relationship between the body mass index and the back force in their study on wrestlers [9]. According to our study, no significant relationship was found between the body weight and balance characteristics of the subjects. Goulding and his friends work on sedentary men have a negative relationship between weights and balance [8]. Our study contradicts the study of Goulding and his colleagues. This situation; our subjects are thought to be elite level wrestlers, and even those who are overweight are due to their low fat percentage. In present study, as the right and left foot fat ratio of the subjects increased, the anaerobic power values increased statistically significantly. In our study, as

the right and left feet muscle weight of the subjects increased, back strength and anaerobic power values increased significantly. In our study, as the right and left arm fat ratios of the subjects increased, back strength and anaerobic power values increased significantly. In our study, as the right and left arm muscle weight of the subjects increased, grip strength and anaerobic power values increased significantly. According to our study, there was no significant relationship between the balance characteristics of the subjects and the leg fat ratio and muscle weight, but according to the study by Sapina and her friends [13]. Present study contradicts the study of Sapina et al [13]. It is believed that the fact that Sapina et al [13] did their work on the children and that we did it with elite wrestlers caused this contradiction because it is known that the strength is much more important in exhibiting many motoric features in children. The muscle strength of the subjects increased and back strength and anaerobic power values increased significantly. On the other hand, there was no significant relationship between lean muscle weight and balance. According to study of Goulding and his friends there was no significant relationship between lean muscle weight and balance [8]. Our study supports the work of Goulding and his friends.

In conclusion, it is seen that anaerobic power, strength and balance properties are related to body composition components such as height, body weight, BMI, arm-leg fat ratio, arm-leg muscle weight and body muscle weight. In order to develop anaerobic power, strength and balance properties, it is necessary to work on the physical, physiological and anthropometric properties of the athlete. In addition to this, considering the vertical jump and relationship of anaerobic power, it is important to evaluate the vertical leap ability of children in directing to wrestling sport.

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