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Differences in Anthropometric Parameters Between Male Athletes and Sedentaries

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Abstract

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Aim: This study was conducted to demonstrate the anthropometric differences between athletes who have been training at least three times per week for a minimum of two years and healthy individuals (sedentary) who do not exercise.
Method: Thirty males aged between 18-31 years (athlete group N=15; sedentary group N=15) participated in the study. Body mass index, weight, muscle percentage, fat percentage, water percentage data were obtained with the Tanita body composition analyzer. Circumference and length were measured with a tape measure and subcutaneous fat thickness was measured with a caliper (Holtain). Mann-Whitney U test and Spearman correlation analysis were performed to compare the two groups.
Results: Body mass index, fat/muscle/water percentages, hand length, waist and abdominal circumference, waist-hip ratio, posterior upper arm and abdominal subcutaneous fat thickness demonstrated statistically significant differences between the groups (p<0.05). While a positive and moderate correlation was found between back subcutaneous fat thickness and chest subcutaneous fat thickness in athletes (r=,538; p<0,05), a positive and high correlation was found between back subcutaneous fat thickness and chest subcutaneous fat thickness in sedentary people (r=,748; p<0,01).
Conclusion: This study clearly demonstrates that regular exercise for two years or more leads to significant differences in body composition compared to sedentary individuals, specifically decreasing body fat, increasing muscle mass and reducing central adiposity.

Keywords:
Anthropometric Parameters, Body Composition, Fat Percentage, Subcutaneous Fat Thickness.

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Erkek Sporcular ve Sedanterler Arasındaki Antropometrik Parametrelerin Farklılıkları

Özet

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Amaç: Bu çalışma, en az iki yıl boyunca haftada üç gün egzersiz yapan sporcular ile egzersiz yapmayan sağlıklı bireylerin (sedanter) antropometrik özellikleri arasında farklılıkları göstermek amacıyla yapılmıştır.
Yöntem: Çalışmaya yaşları 18-31 arasında değişen 30 erkek katılmıştır (sporcu grup N=15; sedanter grup N=15). Katılımcıların boy, kilo vb. tanımlayıcı ölçüleri metre ve vücut analizörü (tanita) ile yapılmıştır. Tanita cihazı ile vücut kütle indeksi, kilo ile kas, yağ, su yüzde verileri elde edilmiştir. Çevre ve uzunluk ölçüleri mezura ile, deri altı yağ kalınlığı ise kaliper (Holtain) kullanılarak ölçülmüştür. İki grup karşılaştırılmasında Mann-Whitney U testi ve Spearman korelasyon analizi uygulanmıştır.
Bulgular: Vücut kütle indeksi, yağ, kas, su yüzde değerleri, el uzunluğu değerleri, bel ve karın çevresi, bel- kalça oranı değerleri, arka üst kol ve karın deri altı yağ kalınlığı değerleri gruplar arasında istatistiksel olarak anlamlı bir fark göstermektedir (p<0,05). Sporcularda sırt deri altı yağ kalınlığı ile göğüs deri altı yağ kalınlığı arasında pozitif ve orta düzeyde bir ilişki tespit edilirken (r=,538; p<0,05), sedanterlerde ise sırt deri altı yağ kalınlığı ile göğüs deri altı yağ kalınlığı arasında pozitif ve yüksek düzeyde bir ilişki tespit edilmiştir (r=,748; p<0,01).
Sonuç: Bu çalışma, iki yıl veya daha uzun süre düzenli egzersiz yapmanın sedanter bireylere kıyasla vücut kompozisyonunda önemli farklılıklara yol açtığını, özellikle vücut yağını azalttığını, kas kütlesini artırdığını ve merkezi yağlanmayı azalttığını açıkça göstermektedir.

Anahtar Kelimeler:
Antropometrik Parametreler, Deri Altı Yağ Kalınlığı, Yağ Yüzdesi, Vücut Kompozisyonu

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Introduction

Body composition, which is an important determinant of general physical health (Çiçek, 2010), is a structure that examines body components (fat, bone, muscle tissue and extracellular fluids) and the relationship between these components. It is affected by various factors such as age, gender, physical activity and nutrition (Yavuz & Başyiğit, 2023).

Anthropometry is a method that refers to the systematic measurement of physical characteristics of the human body, such as body weight, body size and shape (Padilla et al., 2021). It enables comparison of people with data such as body weight, measurements, strength and movement limits. Anthropometric measurements are important for monitoring the performance levels of athletes and evaluating the effects of training (Duyul, 2005). Anthropometry is used to determine body structure, composition and proportions. It is one of the basic methods of physical anthropology and is applied in many fields such as sports sciences, pediatrics, plastic surgery and nutrition. It provides information about the physical fitness of individuals by evaluating the proportions of body parts, ideal measurements and functional structure (Özer, 2009).

Subcutaneous fat analysis is based on the basic assumption that most of the total fat in the body is found in subcutaneous stores and that these stores are related to the general fat ratio (Zorba, 2006). More subcutaneous fat thickness has been observed in individuals exhibiting sedentary lifestyles compared to those engaging in regular exercise regimens. A strong correlation exists between body circumference measurements and body fat mass and overall weight, indicating that a decline in body fat directly contributes to a decrease in circumference measurements (Kadi, 2021). High body fat decreases the physical capacity of the person and being overweight can cause loss of strength, agility and flexibility by creating additional load during movement (Cicek, 2010). Correct and regular exercise increases skeletal muscle mass and reduces body fat (Kadi, 2021).

Body proportions in athletes show in which sports branch they are more advantageous (Cakiroglu et al., 2002). Circumference measurements and subcutaneous fat thickness give information about nutritional status and body fat distribution. Therefore, anthropometric measurements are critical for athlete selection and training programmes (Yolcu, 2012).

Anthropometric indices such as body mass index (BMI) or waist-hip ratio enable the identification of individuals at risk of disease (Zorba, 2006). Regular exercise has been demonstrated to exert beneficial effects on various physiological parameters, including blood pressure regulation, balance maintenance, enhanced lung capacity, increased bone mineral density, improved postural control, reduced cholesterol levels, and weight management (Kadi, 2021)

Circumference measurements constitute a prevalent methodology for assessing body composition within fitness assessments. Moreover, these measurements function as a crucial indicator in both predicting health risks, such as the association between waist circumference and cardiovascular disease and evaluating desired alterations in body dimensions. (ACE, 2010).

In conclusion, sports anthropometry plays an important role in sports sciences and performance analyses. Knowing the physical characteristics of successful athletes helps to determine training and selection criteria (Kılınç, 2008).

This study makes a unique contribution to the literature by examining in detail the effects of long-term (at least two years) regular exercise on body composition in comparison with sedentary men. Unlike general athlete studies, the focus on a specific exercise period reveals the long-term effects of exercise more clearly. The data obtained with detailed anthropometric measurements provide valuable information for athlete selection, training programs and health applications, enabling practical applications in the field of sports sciences. The aim of this study was to investigate the differences in anthropometric characteristics between sedentary healthy men and athletes who exercise three days a week for at least two years.

Methods

Research Group

The population of this study consisted of 30 male participants between the ages of 18-31 (age: 20.8±3.12 years) residing in Istanbul. Power analysis was conducted using the G*Power (v3.1.9.7) program to determine the sample size. The Type 1 error rate was set at $\alpha=0.05$, and the power of the test was set at $1-\beta=0.80$. Based on this, it was determined that at least 28 individuals could be included in the research group. The distribution of the groups in this study was organized based on the responses individuals provided to the questions in the Participant Evaluation Form. Participants were selected from healthy individuals without any known chronic diseases or musculoskeletal disorders. Two groups were formed as individuals who have been exercising three days a week for at least two years (athletes) and individuals who do not exercise regularly (sedentary). The majority of the athlete group is engaged in combat sports (taekwondo, muay thai, kickboxing, wrestling) and other disciplines (rowing, basketball, volleyball, football, athletics, cycling, archery). Due to the low number of athletes in each discipline, no comparison was made between branches. The athlete group has been exercising regularly for an average of 8.13±3.38 years and training an average of 4.67±1.99 days per week.

Data Collection

Before the study, the participants were informed about the purpose of the study, and a written informed consent was obtained from all participants. The participants participated in accordance with the measurement criteria and in appropriate clothing. The measurements were carried out in Marmara University Sports Sciences Laboratory. The study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki and was approved by the Ethics Committee of Marmara University (Approval Number: 09.2024.124, Date: 02/02/2024)

Data Collection Tools

The measurements were conducted in accordance with the International Standards for Anthropometric Assessment (ISAK, 2001). Height was assessed using a stadiometer; body weight, fat, muscle and water percentages were measured with an electronic body composition analyzer (Tanita MC 780). Length and circumference were measured with a tape measure (KDS F10-02 DM). Subcutaneous fat thickness measurements were made using a Holtain caliper with a sensitivity level of 0.2 mm and a standard pressure of 10 g/mm² at each opening between the ends. Zorba formula (% Fat= 0.990+ 0.0047 weight+ 0.132 (biceps+ triceps+ subscapula+ chest+ abdominal+ suprailiac+ thigh)) was used for calculation.

The body weight (in kilograms) was measured without shoes on the Tanita MC 780 device and in light clothing. Participants were instructed to fast for at least 4 hours prior to the measurement, refrain from consuming water 1 hour before, avoid exercise for 12-24 hours prior, urinate 30 minutes before, abstain from alcohol consumption for at least 48 hours, and discontinue diuretics for 7 days before the assessment. Additionally, they were advised to remove any metal accessories and wear light clothing during the measurement.

Anthropometric Assessments

Upper arm length, the distance between the acromiale and radiale; forearm length, from the distance between the radial and stylion; hand length, from the distance from the midstylion line to the dactylion (most distal point of the third digit); thigh length, the distance between the trochanterion and tibiale laterale; leg length, from the distance between tibiale mediale and sphyrion tibiale; foot length was measured from the acropodion (the tip of the longest toe- which may be the first or second phalanx) to the pternion (most posterior point on the calcaneus of the foot) (ISAK, 2001).

Arm circumference, from the midpoint of the acromiale and radiale; forearm, from the highest point distal to the epicondyles of the humerus; chest circumference, from the mesosternale level; waist circumference, from the narrowest point between the lower costal (10th rib) border and the iliac crest; hip circumference, from the level of the largest posterior prominence of the hip, usually anterior to the level of the symphysis pubis; thigh circumference, from the midpoint of the trochanterion and tibiale laterale; calf circumference was measured at the widest point of the calf (ISAK, 2001). Shoulder circumference was measured from the maximal protrusion of the deltoid muscles and the junction of the sternum and the 2nd rib (Zorba, 2006).

Waist and hip circumference were measured with the subject in an upright position. Waist circumference was measured at the midpoint between the iliac crest and the lowest rib as the thinnest part of the waist. Hip circumference was measured at the widest part of the hip. Waist and hip measurements were read to the nearest 5 mm. Waist to hip ratio (WHR) was calculated as waist divided by hip circumference.

Triceps skinfold, from the most posterior part of the triceps when viewed from the side at the mid-acromial-radial level; biceps skinfold, from the anterior most part of the biceps when viewed from the side at the mid-acromiale-radiale level; subscapular skinfold, from a point 2 cm from the subscapular (the undermost tip of the inferior angle of the scapula); supraspinale skinfold, from the intersection of the line extending from the iliospinale to the anterior axillary border and the horizontal line at the level of the iliocristale; abdominal skinfold, from a point 5 cm to the right of the omphalion (midpoint of the navel); upper leg skinfold, from the midpoint of the distance between the inguinal fold (the fold at the angle of the trunk and thigh) and the upper edge of the anterior surface of the patella; calf skinfold was measured medial to the widest part of the calf (ISAK, 2001). Chest skinfold was measured from the midpoint between the axillary starting point and the breast nipple, which is close to 1/3 of the anterior axillary line (Zorba, 2006).

All measurements were performed by the same researcher to prevent any researcher bias. All measurements except subcutaneous fat thickness in the thigh region were taken from the right side in the standing position. To avoid inaccurate measurement, only skin and subcutaneous fat (excluding muscle tissue) were grasped 1 cm behind the measurement point with the thumb and index fingers. The data were recorded in millimetres (mm) 2-3 seconds (sec) after the caliper tips were applied to the measured point.

Analysing Data

The research was conducted with comparative cross-sectional study design. The data obtained on the participant follow-up form and the measurements were recorded in an Excel file. All data were analysed using SPSS for Windows 22 software. Descriptive statistics for all variables were subsequently calculated for the groups with arithmetic mean and standard deviation values. The normality of the data was evaluated using the Shapiro-Wilk test. The Mann-Whitney U test and Spearman correlation analysis (p<0,01, p<0,05), were used to compare two groups due to the small sample size in the groups. A significant level of p<0.05 was considered statistically significant.

Results

Table 1. Comparison of descriptive measurements between the two groups

Variable	Athlete (n=15)		Sedentary (n=15)		Z; p
	X̄±Std	Med (Min/Max)	X̄±Std	Med (Min/Max)	
Age	20,80±3,12	19,0 (18,0/28,0)	21,73±4,08	21,0 (18,0/31,0)	z:-0,48; p:0,63
Height (cm)	1,82±0,09	1,8 (1,6/1,9)	1,79±0,08	1,8 (1,7/2,0)	z:-1,16; p:0,24
Weight (kg)	75,53±11,77	76,0 (56,0/95,4)	80,47±15,36	73,8 (61,7/114,8)	z:-0,68; p:0,49
BMI	22,75±1,87	22,3 (19,9/26,1)	25,10±3,62	24,1 (20,6/33,5)	z:-1,99; p:0,05*
WHR	0,81±0,04	0,8 (0,7/0,9)	0,88±0,06	0,9 (0,8/1,0)	z:-3,43; p:0,00**
Muscle Mass (%)	82,81±3,75	81,6 (77,2/91,8)	75,34±4,82	74,1 (68,3/83,8)	z:-3,63; p:0,00**
Oil Percentage (%)	12,87±3,96	14,2 (3,4/18,9)	20,60±5,05	21,1 (11,8/28,2)	z:-3,63; p:0,00**
Water Percentage (%)	63,53±3,61	62,0 (57,7/69,4)	57,54±4,33	57,2 (51,7/66,3)	z:-3,59; p:0,00**

**p<0,01, *p<0,05; z: Man Whitney-U test, n: Number of people, X: Mean, Std: Standard deviation, Med: Median, Min: Minimum, Max: Maximum, cm: Centimeter, kg: kilogram, %: Yüzde, BMI: Body Mass Index, WHR: Waist to Hip Ratio

A significant borderline difference was found between the athlete and sedentary groups in terms of BMI (z:-1,99; p=0,05). A significant difference was found between the athlete and sedentary groups in terms of WHR (z:-3,43; p<0,01). A statistically significant difference was found between the athlete and sedentary groups in terms of muscle mass percentage (z:-3,63; p<0,01); fat percentage (z:-3,63; p<0,01) and water percentage (z:-3,59; p<0,01).

Table 2. Comparison of length measurements between the two groups

Variable	Athlete (n=15)		Sedentary (n=15)		Z; p
	X̄±Std	Med (Min/Max)	X̄±Std	Med (Min/Max)	
Upper Arm Length (cm)	30,77±2,19	31,0 (28,0/34,0)	30,40±2,05	30,0 (26,5/34,0)	z:-0,48; p:0,63
Front Arm Length (cm)	29,70±2,46	29,0 (27,0/34,0)	28,85±2,73	29,0 (25,5/34,0)	z:-0,98; p:0,33
Hand Length (cm)	20,09±5,04	18,0 (15,2/29,2)	16,68±1,33	16,5 (15,5/21,0)	z:-2,11; p:0,04*
Thigh Length (cm)	41,90±8,15	44,5 (25,5/53,0)	41,47±4,76	40,5 (36,0/52,0)	z:-0,67; p:0,51
Leg Length (cm)	53,43±4,29	54,0 (45,0/60,0)	51,52±2,96	53,0 (46,0/55,5)	z:-1,50; p:0,13
Foot Length (cm)	30,17±5,17	29,0 (26,0/45,0)	28,07±3,93	27,5 (25,0/41,0)	z:-1,77; p:0,08

*p<0,05; z: Man Whitney-U test, n: Number of people, X: Mean, Std: Standard deviation, Med: Median, Min: Minimum, Max: Maximum, cm: Centimeter

A statistically significant difference was found between the athlete and sedentary groups in terms of hand length (z:-2,11; p<0,05).

Table 3. Comparison of circumference between the two groups

Variable	Athlete (n=15)		Sedentary (n=15)		Z; p
	X̄±Std	Med (Min/Max)	X̄±Std	Med (Min/Max)	
Shoulder Circumference (cm)	110,32±7,81	113,0 (97,0/124,0)	109,37±9,01	109,0 (97,0/128,5)	z:-0,58; p:0,56
Chest Circumference (cm)	92,11±6,04	92,5 (83,0/104,5)	96,75±5,67	95,0 (87,2/108,0)	z:-1,72; p:0,08
Waist Circumference (cm)	77,93±5,36	79,0 (71,0/88,5)	87,10±8,34	84,5 (75,5/105,5)	z:-3,22; p:0,00**
Abdominal Circumference (cm)	82,17±5,05	81,5 (73,0/88,5)	90,80±8,37	91,0 (77,0/105,0)	z:-2,76; p:0,01**
Hip Circumference (cm)	96,65±5,93	95,0 (87,5/107,0)	99,06±8,51	95,5 (88,0/117,0)	z:-0,66; p:0,51
Thigh Circumference (cm)	51,32±4,60	53,5 (43,5/58,5)	52,43±4,31	51,0 (47,5/60,5)	z:-0,08; p:0,93
Calf Circumference (cm)	36,24±2,63	36,0 (30,7/41,0)	37,09±3,26	37,5 (32,5/45,3)	z:-0,42; p:0,68
Arm Circumference (cm)	29,50±3,60	28,5 (24,2/37,0)	29,54±3,24	29,0 (24,0/36,5)	z:-0,02; p:0,98
Forearm Circumference (cm)	26,34±3,17	26,8 (17,0/30,2)	26,69±1,93	26,0 (23,5/30,5)	z:-0,04; p:0,97

**p<0,01, *p<0,05; z: Man Whitney-U test, n: Number of people, X: Mean, Std: Standard deviation, Med: Median, Min: Minimum, Max: Maximum, cm: Centimeter

A statistically significant difference was found between the athlete and sedentary groups in terms of waist circumference (z:-3,22; p<0,01). A statistically significant difference was found between the athlete and sedentary groups in terms of abdominal circumference (z:-2,76; p<0,01).

Table 4. Comparison of subcutaneous fat thickness measurements between the two groups

Variable	Athlete (N=15)		Sedentary (N=15)		Z; p
	X̄±Std	Med (Min/Max)	X̄±Std	Med (Min/Max)	
FUAS Fat Thickness (mm)	4,83±1,51	4,6 (2,8/8,0)	6,09±2,36	5,6 (3,8/13,0)	z:-1,79; p:0,07
RUAS Fat Thickness (mm)	8,87±2,56	8,6 (4,2/13,2)	13,52±4,29	13,4 (8,2/24,6)	z:-3,26; p:0,00**
BS Fat Thickness (mm)	10,99±1,64	11,2 (7,8/13,2)	17,85±6,70	17,6 (8,2/28,6)	z:-2,99; p:0,00**
CS Fat Thickness (mm)	7,03±2,24	6,8 (3,2/12,0)	13,03±5,23	14,0 (5,2/22,0)	z:-3,40; p:0,00**
LS Fat Thickness (mm)	11,23±3,11	11,2 (5,2/15,8)	17,88±6,12	17,4 (5,4/33,0)	z:-3,55; p:0,00**
AS Fat Thickness (mm)	14,04±3,96	15,0 (7,6/22,8)	20,93±6,59	22,2 (7,0/33,6)	z:-2,93; p:0,00**
ULS Fat Thickness (mm)	13,76±4,27	13,8 (9,0/24,6)	16,83±6,96	17,6 (8,4/30,2)	z:-1,14; p:0,25
CAS Fat Thickness (mm)	8,87±3,15	8,4 (5,0/15,2)	11,33±3,77	10,4 (6,6/20,8)	z:-2,16; p:0,03*
Body fat percentage (%)	10,68±1,80	10,2 (8,0/14,1)	15,38±4,28	15,2 (7,4/25,7)	z:-3,34; p:0,00**

**p<0,01, *p<0,05; z :Man Whitney-U test, FUAS: Forearm Upper Arm Subcutaneous, RUAS: Rear Upper Arm Subcutaneous, BS: Back Subcutaneous, CS: Chest Subcutaneous, LS: Lateral Subcutaneous, AS: Abdominal Subcutaneous, ULS: Upper Leg Subcutaneous, CAS: Calf Subcutaneous, n: Number of people, X: Mean, Std: Standard deviation, Med: Median, Min: Minimum, Max: Maximum, mm: Millimeter, %: Percentage

Specifically in Table 4, right upper arm, back, chest, lateral, abdominal, and calf subcutaneous fat thickness values were significantly lower in athletes compared to sedentary individuals (p<0.05 or p<0.01). However, no significant difference was observed in upper lateral subcutaneous fat thickness (p=0.25). Additionally, the body fat percentage was significantly lower in the athlete group than in the sedentary group (p<0.01). These findings suggest that regular athletic training is associated with reduced subcutaneous fat accumulation and lower overall body fat percentage.

Table 5. Findings related to the relationship between variables in athletes

		Waist Circumference (cm)	Abdominal Circumference (cm)	AS Fat Thickness (mm)	BUAS Fat Thickness (mm)	BS Fat Thickness (mm)
Abdominal Circumference (cm)	r	**,856****				
	p	0,00				
AS Fat Thickness (mm)	r	0,37	**,546***			
	p	0,18	0,04			
RUAS Fat Thickness (mm)	r	-0,16	0,06	0,29		
	p	0,57	0,83	0,30		
BS Fat Thickness (mm)	r	**,582***	**,697****	**,697****	0,21	
	p	0,02	0,00	0,00	0,45	
CS Fat Thickness (mm)	r	0,08	0,32	**,686****	0,30	**,538***
	p	0,79	0,24	0,00	0,27	0,04

**p<0,01, *p<0,05; r: Spearman's rho, RUAS: Rear Upper Arm Subcutaneous, BS: Back Subcutaneous, CS: Chest Subcutaneous, LS: Lateral Subcutaneous, AS: Abdominal Subcutaneous, BUAS: Back Upper Arm Subcutaneous, cm: Centimeter, mm: Millimeter

Table 5 presents the correlation coefficients between waist circumference, abdominal circumference, and various subcutaneous fat thickness measurements. A strong positive correlation was found between waist circumference and abdominal circumference (r=0.856, p<0.01), indicating that an increase in waist circumference is associated with an increase in abdominal circumference. Additionally, abdominal circumference showed a moderate positive correlation with AS fat thickness (r=0.546, p<0.05), suggesting that greater abdominal fat thickness corresponds to larger abdominal circumference. A significant moderate correlation was observed between BS fat thickness and waist circumference (r=0.582, p<0.05), as well as between BS fat thickness and abdominal circumference (r=0.697, p<0.01), implying that fat accumulation in the back region is related to central adiposity. Furthermore, a strong positive correlation was detected between BS fat thickness and AS fat thickness (r=0.697, p<0.01), as well as between CS fat thickness and AS fat thickness (r=0.686, p<0.01), indicating that fat deposition in these regions tends to occur together. Moreover, a moderate correlation was identified between CS fat thickness and BS fat thickness (r=0.538, p<0.05), suggesting a tendency for fat accumulation in both areas simultaneously.

Table 6. Findings related to the relationship between variables in sedentary group

		Waist Circumference (cm)	Abdominal Circumference (cm)	AS Fat Thickness (mm)	RUAS Fat Thickness (mm)	BS Fat Thickness (mm)
Abdominal Circumference (cm)	r	**,913****				
	p	0,00				
AS Fat Thickness (mm)	r	**,567***	,541*			
	p	0,03	0,04			
RUAS Fat Thickness (mm)	r	**,919****	**,873****	**,539***		
	p	0,00	0,00	0,04		
BS Fat Thickness (mm)	r	0,49	0,37	**,659****	0,46	
	p	0,06	0,18	0,01	0,09	
CS Fat Thickness (mm)	r	**,822****	**,759****	**,694****	**,812****	**,748****
	p	0,00	0,00	0,00	0,00	0,00

**p<0,01, *p<0,05; r: Spearman's rho, RUAS: Rear Upper Arm Subcutaneous, BS: Back Subcutaneous, CS: Chest Subcutaneous, LS: Lateral Subcutaneous, AS: Abdominal Subcutaneous, BUAS: Back Upper Arm Subcutaneous, cm: Centimeter, mm: Millimeter

Table 6 illustrates the correlation coefficients between waist circumference, abdominal circumference, and various subcutaneous fat thickness measurements. A strong positive correlation was found between waist circumference and abdominal circumference (r=0.913, p<0.01), suggesting that an increase in waist circumference is closely associated with an increase in abdominal circumference. Additionally, a moderate positive correlation was observed between waist circumference and AS fat thickness (r=0.567, p<0.05), indicating that individuals with larger waist circumference tend to have greater abdominal fat accumulation. A very strong correlation was detected between waist circumference and RUAS fat thickness (r=0.919, p<0.01), as well as between abdominal circumference and RUAS fat thickness (r=0.873, p<0.01), implying that fat deposition in the upper arm is strongly related to central adiposity. Moreover, a significant moderate correlation was found between AS fat thickness and RUAS fat thickness (r=0.539, p<0.05), suggesting a tendency for simultaneous fat accumulation in these areas. BS fat thickness exhibited a significant correlation with AS fat thickness (r=0.659, p<0.01), implying that fat accumulation in the back is associated with abdominal fat. Additionally, CS fat thickness was highly correlated with both AS fat thickness (r=0.694, p<0.01) and RUAS fat thickness (r=0.812, p<0.01), reinforcing the idea that fat accumulation tends to occur concurrently across multiple upper body regions. Furthermore, a strong positive correlation was observed between BS fat thickness and CS fat thickness (r=0.748, p<0.01), supporting the relationship between back and chest fat accumulation.

Discussion and Conclusion

The aim of this study was to investigate the differences in anthropometric characteristics between healthy sedentary men and athletes. Results of the study show that skinfold thickness is higher in sedentary men and the waist-to-hip ratio of athletes is significantly lower. These findings are consistent with previous studies (Şavkın, 2014; Öztürk 2008), supporting the idea that regular exercise contributes to a lower waist-to-hip ratio and reduced skinfold thickness.

In terms of age distribution, it was observed that athletes and sedentary individuals had a homogeneous distribution and there was no statistical difference in the values. As a rule, athletes have a lower percentage of body fat than non-athletes of the same chronological age. Excess body fat can have a negative impact on sports performance and is often seen as a major limiting factor in athletic achievements (Kızılörs et al., 2023; Arı et al., 2024). Alternatively, a lower body fat percentage among athletes may be associated with various health complications which may be relevant to sports professionals (Nordhamn et al., 2000). The results revealed that the body fat percentage averages of athletes were lower than those of sedentary individuals both in literature and in our study. Active individuals have a lower body fat percentage than sedentary individuals (Pazarözyurt & İnce, 2009). Studies on individuals in developed countries have proved that weight increases with age (Albay et al., 2008). This is due to the slowing down of metabolism and decrease in physical activity with aging (Arı et al., 2024).

Aladro-Gonzalvo et al. (2012) concluded that regular participation in a physical exercise program caused positive changes in body composition such as decreased body fat percentage and increased lean body mass, and these changes varied depending on variables such as frequency, intensity and duration. Studies have revealed that there is a significant difference in values such as body weight, body mass index and body fat percentage in individuals who exercise regularly compared to sedentary individuals (Ünver, 2021; Baştuğ, 2014; Vergili, 2012; Zorba et al., 2004; Sevimli, 2008). The reason for this may be that exercise increases metabolic rate, supports fat burning and improves body composition by increasing muscle mass. Sedentary life increases the fat percentage and decreases the lean body weight (Akkoc & Yucesir, 2016).

In the study, it was observed that sedentary people reflected higher values in variables related to fat mass and skinfolds. Karakaş et al. performed bioimpedance measurements on sedentary and physically active university students and found significant differences in body fat percentage, lean body weight and total body water content between sedentary and regular athletes (Karakaş et al., 2005). In our study, the results obtained by bioimpedance method were in parallel with these findings and significant differences were found in body fat percentage and total body water values between athlete and sedentary groups. Studies have found that the subcutaneous fat thickness of athlete groups is lower than sedentary groups (Çetinkaya, 2009; Türkan, 2020; Güler, 2024). Baylan (2008) examined the subcutaneous fat measurements of the exercising group. He found a significant decrease in suprailiac, abdomen, triceps and subscapular regions. In our study, a statistically significant difference was found in the triceps, supscapula, chest, suprailiac, abdomen and calf regions. Exercise increases fat burning in the body, resulting in significant reductions in areas where fat accumulation is intense, such as the abdomen (Paoli et al., 2021). These findings suggest that both studies show that regular exercise is an effective method of reducing body fat.

In our study, a positive and high correlation was found between posterior upper arm subcutaneous fat thickness and abdominal circumference and between chest subcutaneous fat thickness and abdominal circumference. Yosmaoglu et al. (2010) predicted that a significant decrease in regional subcutaneous fat values would lead to a decrease in regional circumference measurements. Katayıfçı et al. (2014) investigated the effect of exercises on physical fitness in healthy individuals. As a result of the data obtained from the measurements, the changes in waist-hip ratio, waist and hip circumference were found to be statistically significant because regular exercise has positive effects on body composition. Cakmakci (2012) found significant decreases in body weight, body mass index, waist circumference, waist-hip ratio, fat percentage, body mass, biceps, triceps, subscapular and suprailiac measurements in the exercising group. Sönmez (2006) demonstrated that body fat percentage and body fat weights of athletic men were lower than sedentary men. In addition, differences were found in suprailiac, abdominal, triceps, biceps, subscapula and calf skinfold measurements of athlete and sedentary men. In terms of circumference measurements, chest, hip and abdominal circumference of male athletes were found to be higher than sedentary men. Cavdar (2006) examined the subcutaneous fat ratio measurements of the study and control groups before and after the study and found that there was a significant decrease in most of the subcutaneous fat ratios of the study group (chest, subscapula, calf, biceps, triceps, abdominal and upper leg), whereas there was an increase in most of the subcutaneous fat ratios of the control group (chest, suprailiac, calf, abdominal and midaxilla).

In the study of Şavkın (2014), a significant decrease was found in weight, body mass index, fat percentage, lean body mass, waist circumference, waist-to-hip ratio, biceps, triceps, subscapular and suprailiac skinfold thickness measurements in individuals who exercised. In this study, no statistically significant difference was found between the athlete and sedentary groups in terms of height. In sedentary individuals, an increase was observed in body mass index value, abdominal and hip circumference measurements, thigh and abdominal skinfold thickness measurements and fat percentage. The findings of this study suggest that exercise has favourable effects on body composition and that a sedentary lifestyle increases body fat and magnifies circumferential measures. Öztürk (2008) concluded that there was a significant decrease in triceps skinfold thickness, body mass index, body fat percentage, waist and hip circumference, waist-to-hip ratio in the exercising group, while there was no change in suprailiac, skinfold thickness and body weight. Kutlay et al. (2012) found a high correlation between circumference measurements and skinfold thickness in their study. In our study, abdominal circumference and back subcutaneous fat thickness were positive and highly correlated. Both studies support that body circumference increases in parallel with subcutaneous fat thickness. Ashtary- Larky et al. (2018) found a strong relationship between waist-to-hip ratio and body fat percentage in men.

Athletes generally have lower body fat, higher muscle mass and higher total body water content. This result reinforces the beneficial impact of regular exercise on body composition. Athletes were observed to have longer upper arm, forearm, hand, thigh, and leg lengths compared to sedentary individuals. This suggests that regular exercise may contribute to the development of long bones. Athletes exhibited lower subcutaneous fat thickness in all body regions compared to sedentary individuals. There is a highly significant positive correlation between waist circumference and abdominal circumference. Indicating that an increased waist circumference indicates an increased accumulation of fat in the abdominal area. Abdominal circumference is positively correlated with all subcutaneous fat thicknesses. This indicates that abdominal fat is distributed in conjunction with fat in other parts of the body. Positive correlations are also commonly reported between subcutaneous fat thicknesses in different areas. This result suggests that body fat distribution tends to be homogeneous, implying that increased fat accumulation in one region is likely to be accompanied by fat deposition in other regions.

This study showed that athletes who exercise regularly have lower body fat, higher percentages of muscle and water, thinner waist and abdominal circumferences, and less subcutaneous fat thickness compared to sedentary individuals. Furthermore, strong positive correlations were found between waist and abdominal circumference and subcutaneous fat thickness, suggesting that central adiposity (abdominal fat accumulation) is closely associated with overall body adiposity. These findings emphasize that regular physical activity contributes to improved health and performance by exerting positive effects on body composition.

Suggestions

- The findings of this study highlight the positive effects of regular physical activity on body composition. Therefore, encouraging exercise participation from an early age, especially in structured athletic programs, could help mitigate negative body composition trends associated with sedentary behavior.
- Future research should include a larger and more diverse sample, incorporating athletes from different sports disciplines and sedentary individuals with varying activity levels to enhance the generalizability of the findings.
- Considering potential gender-based differences in body composition, future studies should examine similar anthropometric parameters among female athletes and sedentary female students within the same age group.
- A longitudinal study tracking the physical development of athletes and sedentary individuals over time could provide deeper insights into how training duration and age influence body composition.

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