Spor Hekimliği Dergisi, 56(1):44-47; 2021
Turkish Journal of Sports Medicine
Turk J Sports Med. DOI: 10.47447/tjsm.0473

Research Article / Araştırma Makalesi

Correlation of epicardial adipose tissue and skinfold thickness in professional male soccer players

Profesyonel erkek futbolcuların epikardiyal yağ dokusu ile vücut yağ yüzdesi korelasyonlarının incelenmesi

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ABSTRACT

Objective: Epicardial adipose tissue (EAT) represents a proportion of visceral fat distributed around the heart. Measurement of EAT thickness is important for the diagnosis of visceral obesity. Skinfold thickness has been used in both clinical and research settings for visceral obesity diagnosis. The aim of this study is to evaluate the correlation between skinfold and EAT thickness in healthy professional male soccer players.

Material and Methods: A prospective, cross-sectional study was conducted with twenty professional male soccer players (mean age, 22.50+2.80 years). Anthropometric data was collected for all patients and skinfold measurements were obtained with a caliper. EAT thickness was assessed in parasternal long axis view by transthoracic echocardiography.

Results: Mean body mass index and waist circumference were 22.81±2.1 kg/m² and 78.80±6.59 cm, mean EAT thickness and body fat ratio were 3.45±0.94 mm and 10.89±4.04%, respectively. EAT thickness was significantly correlated with body fat percentage (r=0.518, p=0.019). EAT thickness was also significantly correlated with age, body mass index, body surface area and waist circumference. EAT thickness did not showed any correlation with systolic and diastolic blood pressure.

Conclusion: This study has shown that there was a relationship between body fat ratio and EAT thickness in male soccer players who are considered to be healthy and physically fit.

Keywords: *Epicardial adipose tissue, skinfold thickness, male soccer players*

ÖZ

Amaç: Epikardiyal yağ dokusu (EYD), kalbin etrafındaki viseral yağ oranı olarak tanımlanır. Deri kıvrım kalınlığı ve EYD klinikte viseral obezite tanısı için, araştırmalarda fiziksel performans belirlemede klinikte ve kullanılmaktadır. Bu çalışmanın amacı sağlıklı profesyonel erkek futbolcularda deri altı yağ kıvrım kalınlığı ölçümüyle elde edilen vücut yağ yüzdesi (VYY) ile EYD kalınlığı arasındaki ilişkiyi değerlendirmektir.

Gereç ve Yöntem: Bu çalışma 20 profesyonel erkek futbolcu ile (ortalama yaş; 22.50±2.80 yıl) prospektif, kesitsel bir çalışma olarak yapılmıştır. Tüm hastaların antropometrik verileri elde edildikten sonra, deri altı yağ kıvrım kalınlığı deri kıvrımı ölçüm cihazı ile ölçülmüştür, EYD kalınlığı ise parasternal uzun eksen görünümü ile transtorasik ekokardiyografi aracılığıyla değerlendirilmiştir.

Bulgular: Ortalama beden kütle indeksi (BKİ) ile bel çevresi sırasıyla 22.81±2.1 kg/m² ve 78.80±6.59 cm, EYD kalınlığı ile VYY ise 3.45±0.94 mm ve %10.89±4.04 olarak saptanmıştır. EYD kalınlığı, VYY ile istatistiksel olarak anlamlı pozitif korelasyon (r=0.518, p=0.019) göstermiştir. Ayrıca EYD kalınlığı ile bel çevresi, yaş, beden kütle indeksi (BKİ), vücut yüzey alanı da (VYA) istatistiksel olarak anlamlı pozitif korelasyon göstermiştir. EYD kalınlığı ile sistolik ve diyastolik kan basınçları arasında korelasyon saptanmamıştır.

Sonuç: Yapılan bu çalışma ile sağlıklı ve fiziksel uygunluğu olduğu düşünülen erkek futbolcularda da vücut yağ oranları ile EYD kalınlığı arasında ilişki olduğu gösterilmiştir.

Anahtar Sözcükler: *Epikardiyal yağ dokusu, deri kıvrım kalınlığı, erkek futbolcular*

INTRODUCTION

Although considered mostly as a storage organ, adipose tissue is now recognized for it's endocrine and metabolic functions (1). It is divided into two groups according to morphology, physiology and embryological development: White adipose tissue (WAT) and Brown adipose tissue (BAT) (2). WAT is subclassified according to its location as subcutaneous and visceral tissue, whereas subcutaneous fat tissue is located mainly in hypodermis (3).

Received / Geliş: 29.06.2020 · **Accepted / Kabul:** 17.09.2020 · **Published / Yayın Tarihi:** 30.11.2020

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Cite this article as: Kartal A, Ergin E, Çayırlı S, Güngör H, Babu AS. Correlation of epicardial adipose tissue and skinfold thickness in professional male soccer players. *Turk J Sports Med.* 2021;56(1).44-7.; http://dx.doi.org/10.47447/tjsm.0473

Epicardial adipose tissue (EAT) is part of visceral adipose tissue and it has endocrine, inflammatory, paracrine and vasocrine activity. Therefore, measurement of EAT thickness is important for the diagnosis of visceral obesity (4). EAT thickness measurement by transthoracic echocardiogrphy was firstly described by Iacobellis et al. (5). Echocardiographic measurement of EAT thickness is easily accessible with no radiation exposure and is repeatable. However, this modality is time consuming, expensive and operator depended (6).

Anthropometric measurements have been extensively evaluated as surrogate markers for WAT (7,8). Waist circumference is widely accepted as a predictor of visceral fat (9). Skinfold thickness, measured by calipers at standardized skin pinch points, has been used in both clinical and research settings for visceral obesity diagnosis as well (10,11).

To our knowledge, there is no study which examined the relation between skinfold thickness and EAT thickness measured by transthoracic echocardiography. The aim of this study is to evaluate any potential correlation between these two measurements in professional male soccer players.

METHODS

Study population

The present research was approved by local research ethics committee. Twenty male soccer players (mean age, 22.50±2.80 years) participated in this study. Participants were enrolled after their informed consents were obtained.

Skinfold thickness measurement

Standard Harpenden skinfold caliper (British Indicators Ltd, UK) was used in this study. The tester grasped a fold of skin firmly between the thumb and index finger of his left hand and lifted it away from the body. The fold was rolled to ensure that subcutaneous tissue was being measured, then jaws of the caliper positioned over the skinfold just 1 cm under his fingers.

The readings were obtained 1-2 seconds after releasing the grips. The fourth measurements were recorded as final. All measurements were taken from the right side of the body, while the subjects were standing upright in a relaxed posture. The skinfold thicknesses of following sites were measured; abdomen, biceps, triceps, suprailiac and subscapular sites. Sum of these five measurements were used in statistical analysis of the data.

Waist cirfumference measurement

Waist circumference was measured in the horizontal plane midway between lowest rib and the iliac crest.

Body fat ratio calculation

The Durnin-Womersley formula for soccer players was applied to calculate total body fat in all subjects.

Echocardiographic examination

Each subject underwent transthoracic echocardiography. Echocardiographic examinations were performed using the iE33 cardiac ultrasound system (Phillips, Best, The Netherlands) with 2.5-5 MHz probes. Evaluation was performed using the criteria of the American Society of Echocardiography and left ventricular ejection fraction (LVEF) was calculated by modified Simpson method. Simultaneous electrocardiographies (ECG) were recorded for all patients during the examinations. Doppler and tissue doppler measurements were performed to calculate various parameters of LV systolic and diastolic functions. The echocardiographic study required recording 10 cycles of two-dimensional parasternal long axis views. Epicardial fat thickness was measured on the free wall of the right ventricle from long axis view. In these views EAT was visualized as an echo-free space.

Statistical Analysis

All results were analyzed by using Statistical Package for Social Sciences (SPSS) for Windows (version 18.0; SPSS Inc., Chicago, IL, USA). Continuous data was reported as mean and standard deviation. Categorical variables were summarized as percentages and compared with the Chi-square test. Spearman's correlation analysis was performed on echocardiographic, anthropometric and clinical variables to identify correlates of EAT. A two tailed p value <0.05 was considered significant.

RESULTS

Baseline characteristics of subjects participated in this study is summarized in Table 1. Descriptive analyses regarding muscle and skin fold thickness of all subjects have been shown in Table 2 and 3. Mean body mass index and waist circumference (WC) were 22.81±2.10 kg/m2 and 78.80±6.59 cm, respectively. Mean EAT thickness and body fat ratio 3.45±0.94 mm and 10.89±4.04 % respectively. EAT thickness correlated well with body fat percentage (r = 0.518, p=0.019). EAT thickness was also significantly correlated with age, body mass index, body surface area and waist circumference. EAT thickness did not showed any correlation with systolic and diastolic blood pressure.

Table 1. Baseline characteristics and demographics

Age (years)	22.50±2.80
Height (m)	1.70±10.3
Weight (kg)	70.95±8.59
Body mass index (kg/m²)	22.81±2.10
Body Fat Ratio (%)	10.89±4.04
Waist circumference (cm)	78.80±6.59

Table 2. Two dimensional tissue Doppler echocardiographic parameters

Epicardial adipose tissue (mm)	3.45±0.94
Left atrium diameter (mm)	30.80±4.48
LVSED (mm)	32.60±7.74
LVEDD (mm)	42.65±9.13
Septum thickness (mm)	7.95±1.67
Posterior wall thickness (mm)	8.20±1.93
Right ventricle (mm)	27.95±2.43
LVEF	65.00±2.38
RVEF	62.25±3.34
E (m/sn)	0.84±0.18
A (m/sn)	0.67±0.14

LVESD: left ventricular end-systolic diameter; LVEDD: left ventricular end-diastolic diameter; LVEF: left ventricular ejection fraction; RVEF: right ventricular ejection fraction; E: Early diastolic transmitral ; A: Late diastolic transmitral

Table 3. Correlation analysis

Parameters	r	p-value
Body fat ratio	0.758	<0.001
Age	0.522	0.018
Body mass index	0.662	0.001
Body surface area	0.469	0.037
Waist circumference	0.458	0.042

DISCUSSION

The present study demonstrated a significant correlation between skinfold thickness and EAT thickness in healthy professional soccer players. There is limited data available on the correlation of anthropometric parameters with EAT thickness in the literature. To the best of our knowledge, this study is the first to investigate the correlation between skinfold thickness and EAT thickness in healthy people.

EAT is a metabolically active tissue that is used as a marker of visceral obesity. Also EAT thickness has been associated with obesity and cardiovascular risk parameters in adults and adolescents. Kim et al. demonstrated that EAT thickness was significantly increased in the obese group. In obese subjects, univariate analysis revealed that EAT thickness was significantly correlated with BMI, WC, fat mass, body fat ratio, visceral fat tissue, subcutaneous fat tissue, preperitoneal fat tissue. With multivariate linear regression analysis, EAT thickness was found to positively correlate with body fat ratio (12). Two Italian studies by Iacobellis and Vicennati showed strong correlation between epicardial fat and WC and BMI similar to the study by Kim et al. (5,13).

In our study, we aimed to check the validity of these results in healthy soccer players, hypothesizing an association between skinfold thickness and EAT thickness. Similar to the findings by Kim et al., our study demonstrated a positive correlation between EAT thickness and body fat ratio (12).

A recent study by Shetty et al. analyzed 350 healthy individuals and found a strong correlation between EAT measured by echocardiography and anthropometric parameters (7). However, they only analyzed waist circumference, weight and BMI.

Soccer performance is complex, multi-factorial, and depends on a number of different variables, such as anthropometric profile, physical fitness, psychological factors, player technique, and team tactics, among others (14). Within time, soccer has become a more dynamic game, which could be attributed to improvements in the speed, strength and agility of players (15). For soccer players, anthropometric and physiological factors must be highly developed to reach a professional performance level. Therefore, in order to be successful, soccer players need the best combination of body composition (16). However, body composition, especially body fat or visceral obesity, are shown as important elements which affect health and performance for soccer players. Body composition is an important fitness parameter for soccer as excess adipose tissue acts as dead weight in activities where the body mass must be lifted repeatedly against gravity (17).

The major limitations of our study are its cross-sectional and descriptive design, lack of follow-up of the players and lack of control group. Other limitations of this study are of not including female athletes and athletes from other sports. The sample size is relatively small, as well.

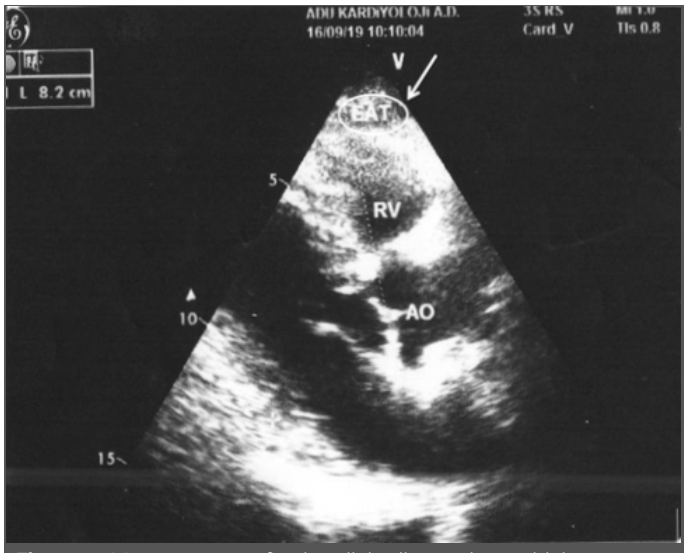

Figure 1. Measurement of epicardial adipose tissue thickness

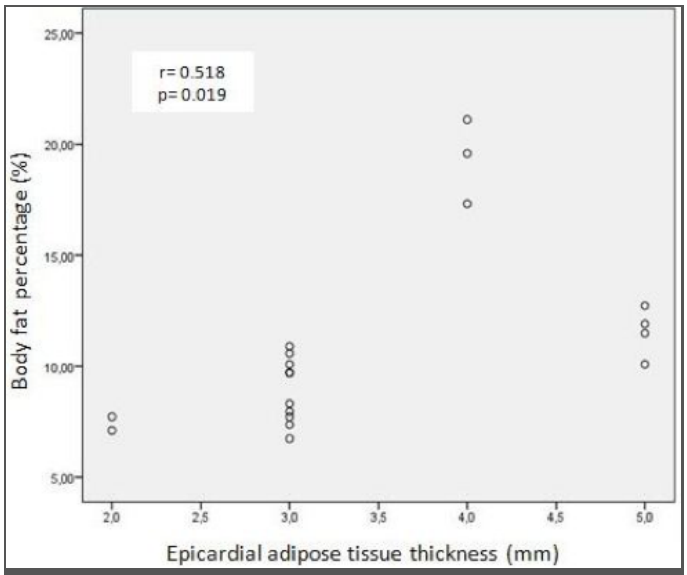

Figure 2. Correlation between epicardial adipose tissue thickness and body fat ratio

CONCLUSION

There is a strong correlation between skinfold thickness and EAT thickness in healthy professional male soccer players. EAT thickness can be measured easily by transthoracic echocardiography. Methods for measuring EAT thickness and skinfold thickness are

non-invasive and reliable. Furthermore, skinfold thickness can be periodically measured to predict the changes in EAT thickness.

Conflict of Interest / Çıkar Çatışması

The authors declared no conflicts of interest with respect to authorship and/or publication of the article.

Financial Disclosure / Finansal Destek

The authors received no financial support for the research and/or publication of this article.

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