ORİJİNAL ARAŞTIRMA ORIGINAL RESEARCH

The Efficiency of Anthropometric Indices and Body Fat on Estimating Impaired Serum Lipids in Turkish Adults

Erişkin Türk Toplumunda Kan Yağlarındaki Bozulmayı Öngörmede Beden Yağı ve Antropometrik Ölçütlerin Etkinliği

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ABSTRACT Objective: Anthropometric measurements are frequently used to determine the body composition. Bioelectrical impedance analysis is a fairly a new technique that is used to assess the percentage body fat (PBF). The objectives of this study were to examine the association between PBF, anthropometric measurements and serum lipids in men and women and to compare the ability of anthropometric measurements and PBF for estimating impaired serum lipids. **Material and Methods:** This cross sectional study included 974 participants (age ≥30) of the Heart of Balçova (BAK) Project. Serum lipids [total cholesterol, low-density lipoprotein-cholesterol (LDL-C), high-density lipoprotein-cholesterol (HDL-C), triglyceride], PBF and anthropometric measurements (body mass index-BMI, waist circumference-WC, waist hip ratio-WHpR, waist height ratio-WHtR) were examined. **Results:** Obesity was common among participants. Mean total cholesterol (TC) and LDL-C values were above the recommended levels. PBF and anthropometric measurements were associated with HDL-C in men. The association between PBF and anthropometric measurements with HDL-C and triglyceride was stronger for women than it was for men. BMI was the best indicator for HDL-C in men. For women, all indices and PBF were successful in estimating serum lipids; WHpR was the best indicator for TC and LDL-C, WHtR for triglyceride and WC for HDL-C. **Conclusion:** PBF and anthropometric measurements had weak but significant correlations with serum lipids and PBF was not superior to anthropometric indices. Waist-height ratio is an easy, non-invasive anthropometric measurement that can be used in defining obesity.

Key Words: Body fat distribution; anthropometry; lipids

ÖZET Amaç: Beden bileşiminin saptanmasında antropometrik ölçümler sıklıkla kullanılmaktadır. Biyoelektriksel Empedans Analizi, beden yağ yüzdesi (BYY) değerini belirlemede kullanılan görece yeni bir tekniktir. Erkek ve kadınlarda BYY, antropometrik ölçümler ve kan yağları arasındaki ilişkiyi incelemek ve kan yağlarındaki bozulmayı öngörmede antropometrik ölçümlerin ve BYY'nin başarısını değerlendirmek bu çalışmanın amaçlarıdır. **Gereç ve Yöntemler:** Bu kesitsel çalışmaya Balçova'nın Kalbi (BAK) projesine katılan 974 birey dâhil edilmiştir. Kan yağları [total kolesterol, düşük dansiteli lipoprotein- kolesterol (LDL-C), yüksek dansiteli lipoprotein-kolesterol (HDL-C), trigliserit], beden yağ yüzdesi ve antropometrik ölçümler [beden kitle indeksi (BKİ), bel çevresi (BÇ), bel kalça oranı (BKO) ve bel boy oranı (BBO)] değerlendirilmiştir. **Bulgular:** Katılımcılar arasında şişmanlığın sık olduğu belirlenmiştir. Ortalama total kolesterol (TK) ve LDL-C değerleri istenilenin üzerindedir. Erkeklerde beden yağ yüzdesi ve antropometrik ölçümler HDL-C ile ilişkili bulunmuştur. Kadınlarda beden yağ yüzdesi ve antropometrik ölçümlerin HDL-C ve trigliserit ile ilişkisi erkeklerdekine göre daha güçlüdür. Erkeklerde HDL-C'yi belirlemede en başarılı ölçüt BKİ'dir. Kadınlarda ise tüm antropometrik ölçütler ve BBY, kan yağlarındaki bozulmayı öngörmede başarılı olmuştur; TK ve LDL-C için BKO, trigliserit için BBO ve HDL-C için BÇ en başarılı ölçütler olarak saptanmıştır. **Sonuç:** Beden yağ yüzdesi ve antropometrik ölçümler ile kan yağları arasındaki korelasyon anlamlı, ancak zayıftır. Diğer antropometrik ölçümlere kıyasla BYY, kan yağlarındaki bozulmayı öngörmede daha başarılı bulunmamıştır. Şişmanlığın tanımlanmasında bel-boy oranı girişimsel olmayan, kolay bir yöntem olarak önerilebilir.

Anahtar Kelimeler: Vücut yağ dağılımı; antropometri; lipidler

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Serum lipids have associations with age, sex, menopause, obesity and lifestyle.[1-5.] Obesity is defined as excessive fat accumulation in the body that leads to high serum lipids and eventually may cause cardiovascular diseases (CVD).[4,6] The body composition can be determined by high technology devices such as Hydrodensitometry, and DEXA as well as the anthropometric measurements.[7-9] Antropometric measurements are done to determine the body composition by measuring some parts of the body.[9] Body Mass Index (BMI), Waist Circumference (WC), Waist Hip Ratio (WHpR) are the most commonly used measurements to define obesity.[9] In addition, recently Waist Height Ratio (WHtR) has also emerged as an anthropometric index. Bioelectrical impedance analysis (BIA) is a relatively novel technique that is used to assess the percentage body fat (PBF). In BIA, insensible electrical current passes through the body and according to the resistance that the tissues give the body fat percentage is calculated. Even though BIA is not considered the gold standard such as DEXA, it is non-invasive, cheap and easy to use compared to DEXA.[7,10] Although most studies show that obesity is associated with CVD, the relationship between percentage body fat and serum lipids is controversial. Relevant studies suggest that there is a weak but significant correlation between percentage body fat, anthropometric measurements and serum lipids.[11-15] The objectives of this study were to examine the association between PBF, anthropometric measurements and serum lipids in men and women and to compare the ability of anthropometric measurements and PBF for estimating impaired serum lipids.

MATERIAL AND METHODS

This cross-sectional study was conducted in the Teleferik District of Balçova, İzmir and included male and female participants aged older than 30 years (n=5233). The authors estimated that at least 854 participants should be included in order to determine the weak association (r=0.10) between PBF and serum lipids, within 5% precision and 95% confidence level. Therefore, sample selection was not done and all participants of the Heart of Balçova (BAK) Project in the Teleferik District were included in the study (n=974).

BAK project was started in 2007 in Balçova, an urban settlement of İzmir, with the collaboration of Balçova Municipality and Dokuz Eylül University, Faculty of Medicine. The objective of the BAK project was to improve cardiovascular health of the population through population and individual level primary prevention initiatives including reducing smoking and promotion of healthy diet and physical activity. A baseline population survey was conducted to determine the cardiovascular risk status of the residents from 2007 to 2009. Participants were visited at home by trained pollsters, completed a questionnaire and were invited to the local municipality unit. In this unit, trained nurses took fasting venous blood sample and researchers recorded health history and conducted the anthropometric measurements. Ethical approval was given by the Ethics Committee of the University and each participant gave written informed consent. The BAK project was detailed elsewhere.[16,17]

VARIABLES

Variables included were serum lipids [total cholesterol, low-density lipoprotein-cholesterol (LDL-C), high-density lipoprotien-cholesterol (HDL-C) and triglyceride], PBF and anthropometric measurements (AMI, WC, WHpR, WHtR). Serum lipids were tested according to National Cholesterol Education Program (NCEP)-Adult Treatment Panel III and for statistical analysis they were dichotomized, such as total cholesterol ≥200 mg/dl, LDL-C ≥130 mg/dl, HDL-C ≥40 mg/dl for men and ≥50 mg/dl for women, and triglyceride ≥150 mg/dl were considered elevated serum lipids.[5.] Serum lipid values were always presented as mg/dl. All blood samples were collected after one night of fasting with vacutainer by a trained nurse. All blood samples were analyzed at the Dokuz Eylül University Central Laboratory by Abbott Architecht c16000 auto-analyzer with original kits. PBF was determined by a Jawon-Gaia 359 Plus, tetra-polar, multi-frequency (5-50-250 kHz) BIA with a special apparatus that measures from the ankle, after a night of fasting. Pregnant women and individuals with pacemaker or metal implants were excluded from the study because BIA measurement was contraindicated. In men PBF ≥25% was considered excessive PBF, where in women the cut-off value was 35%.[18,19] Body mass index, waist circumference, waist hip ratio and waist height ratio were evaluated for anthropometric measurements. Weight was measured with BIA, with light clothes and without shoes; height was measured without shoes standing still in an upright position with a standard type height scale hanging on the wall. BMI was calculated as the square of weight divided by height and it was grouped according to the World Health Organization (WHO) recommendations and BMI ≥30.0 kg/m^2 was considered obese.[19-21] Waist and hip circumference were measured with a non-elastic standard measuring type, with light clothes, standing still in an upright position and arms open to the sides. Waist circumference was measured from the midpoint between the distal border of the lowest rib and the superior border of the iliac crest. Hip circumference was measured from the widest point of the hip. For waist circumference, the cut off value for men and women were 102 cm and 88 cm,respectively and for waist hip ratio, the cut off points were 0.90 and 0.85, respectively.[22-25] In the recent studies, 0.5 was recommended as the cut-off point for WHtR for both men and women.[26,27]

STATISTICAL ANALYSIS

Continuous variables were presented as mean ± standard deviation. Men and women were compared for anthropometric measurements, PBF and serum lipids using the Student's t test. Chi-square test was used to compare men and women for categorized anthropometric measurements and lipids. Pearson correlations coefficients were calculated for PBF, anthropometric measurements and serum lipids in men and women. Receiver Opeating Characteristic (ROC) curves for anthropometric measurements were drawn for impaired serum lipids, where the measurement with the largest area under the curve (AUC) was considered the best indicator. Data were analyzed using SPSS version 15.0 software. Significance was defined as $p<0.05$.

RESULTS

Overall (n=974), 267 (27.41%) men and 707 (72.59%) women were examined. The mean age of men and women was 54.68±12.11 and 51.51±12.36 years, respectively. Of the female participants, 55.0% were in menopause.

The mean PBF in men was 25.89±5.89 and women had significantly higher mean PBF (35.13±6.16, $p<0.001$) compared to men. In men, the mean BMI was 27.44±4.06 kg/m^2, WC 95.68±10.00 cm, WHpR 0.96±0.8 and WHtR 0.57±0.06, whereas in women the corresponding values were 29.24±5.56 kg/m^2, 88.42±12.59 cm, and 0.87±0.08, 0.57±0.09 respectively. Women had a significantly higher BMI ($p<0.001$), while men had a significantly higher mean WC and WHpR ($p<0.001$ for both). There was no significant difference between men and women in waist height ratio. Table 1 includes PBF and anthropometric measurements grouped according to their cut off values and elevated serum lipids in men and women (Table 1).

According to Table 1, elevated WC and BMI were significantly more common among women whereas elevated PBF, WHpR and WHtR were significantly more common among men.

High total cholesterol ($p=0.003$), LDL-C ($p=0.001$), and low HDL-C ($p=0.002$) levels were more common in women compared to men, while the percentage of men with elevated triglyceride levels was significantly higher compared to women ($p=0.007$) (Table 1).

In men, the mean total cholesterol level was 203.63±42.59, LDL-C 123.79±33.99, HDL-C 47.28±11.58 and triglyceride 166.31±105.25; in women, the corresponding values were 214.12±42.88, 131.23±36.15, 55.34±12.54, and 140.78±88.36, respectively. In women the mean total cholesterol ($p=0.001$), LDL-C ($p=0.003$) and HDL-C ($p<0.001$) levels were significantly higher than in men, whereas in men the mean triglyceride ($p<0.001$) level was significantly higher than in women.

The correlation between PBF, the anthropometric measurements and serum lipids in men and women were presented in Table 2 (Table 2).

TABLE 1: Elevated PBF and anthropometric measurements and serum lipids in men and women.

	Men (n=267)		Women (n=707)		
	n	%	n	%	p
Elevated anthropometric measurements					
PBF (≥%25.0;%35.0)	164	61.4	381	53.9	0.035
WC (≥102 cm;88 cm)	78	29.21	360	50.92	<0.001
BMI (≥30.00kg/m2)	73	27.34	289	40.88	<0.001
WHpR (≥0.90;0.85)	221	82.77	428	60.54	<0.001
WHtR (≥0.50)	227	88.0	539	78.8	0.001
Elevated serum lipids (mg/dl)					
Total cholesterol (≥200)	133	49.82	427	60.40	0.003
LDL-C (≥130)	101	37.83	351	49.65	0.001
HDL-C (<40;50)	70	26.22	261	36.97	0.002
Triglyceride (≥150)	119	44.60	249	35.22	0.007

BMI: Body mass index; HDL-C: High-density lipoprotein cholesterol; LDL-C: Low-density lipoprotein cholesterol; PBF: Percentage body fat; WC: Waist circumference; WHpR: Waist hip ratio; WHtR: Waist height ratio.

TABLE 2: The correlation between PBF, anthropometric measurements and serum lipids in men and women.

	Men (n=267)				Women (n=707)			
	T. Cholesterol	LDL-C	HDL-C	Triglyceride	T. Cholesterol	LDL-C	HDL-C	Triglyceride
PBF r	---	---	-0.211	0.124	0.138	0.101	-0.183	0.261
p	0.579	0.408	0.001	0.044	<0.001	0.007	<0.001	<0.001
WC r	---	---	-0.261	0.133	0.120	0.084	-0.245	0.304
p	0.974	0.695	<0.001	0.030	0.001	0.026	<0.001	<0.001
BMI r	---	---	-0.266	---	---	---	-0.201	0.244
p	0.587	0.939	<0.001	0.071	0.052	0.321	<0.001	<0.001
WHpR r	---	---	-0.139	---	0.163	0.121	-0.140	0.250
p	0.981	0.740	0.023	0.242	<0.001	0.001	<0.001	<0.001
WHtR r	---	---	-0.250	0.143	0.137	0.093	-0.214	0.306
p	0.735	0.736	<0.001	0.019	<0.001	0.013	<0.001	<0.001

BMI: Body mass index; HDL-C: High-density lipoprotein cholesterol; LDL-C: Low-density lipoprotein cholesterol; PBF: Percentage body fat; T. Cholesterol: Total cholesterol; WC: Waist circumference; WHpR: Waist hip ratio; WHtR: Waist height ratio.

According to Table 2, in men, the correlation coefficients between PBF, anthropometric measurements and total cholesterol and LDL-C were very small and not significant. With HDL-C, PBF and anthropometric measurements had significant but weak correlations, in which BMI (r=-0.266) and WC (r=-0.261) had the most powerful correlation. As PBF and anthropometric measurements increased, HDL-C decreased. With triglyceride, the correlation of PBF and the anthropometric measurements were significant except for BMI and WHpR. In women, correlation coefficients were higher, compared to men. Except for non-significant correlations between BMI and total cholesterol and BMI and LDL-C, all correlations were significant. The most significant correlation of PBF and anthropometric measurements were with triglyceride followed by HDL-C. WC had the most significant correlation with HDL-C (r=-0.245) and WHtR with triglyceride (r=0.306). As PBF and anthropometric indices increased, HDL decreased and triglyceride increased (Table 2).

According to the ROC curves, none of the anthropometric indices was successful enough to estimate impaired serum lipids, except for HDL-C in men. For HDL-C, BMI (AUC 61.0%) was found to

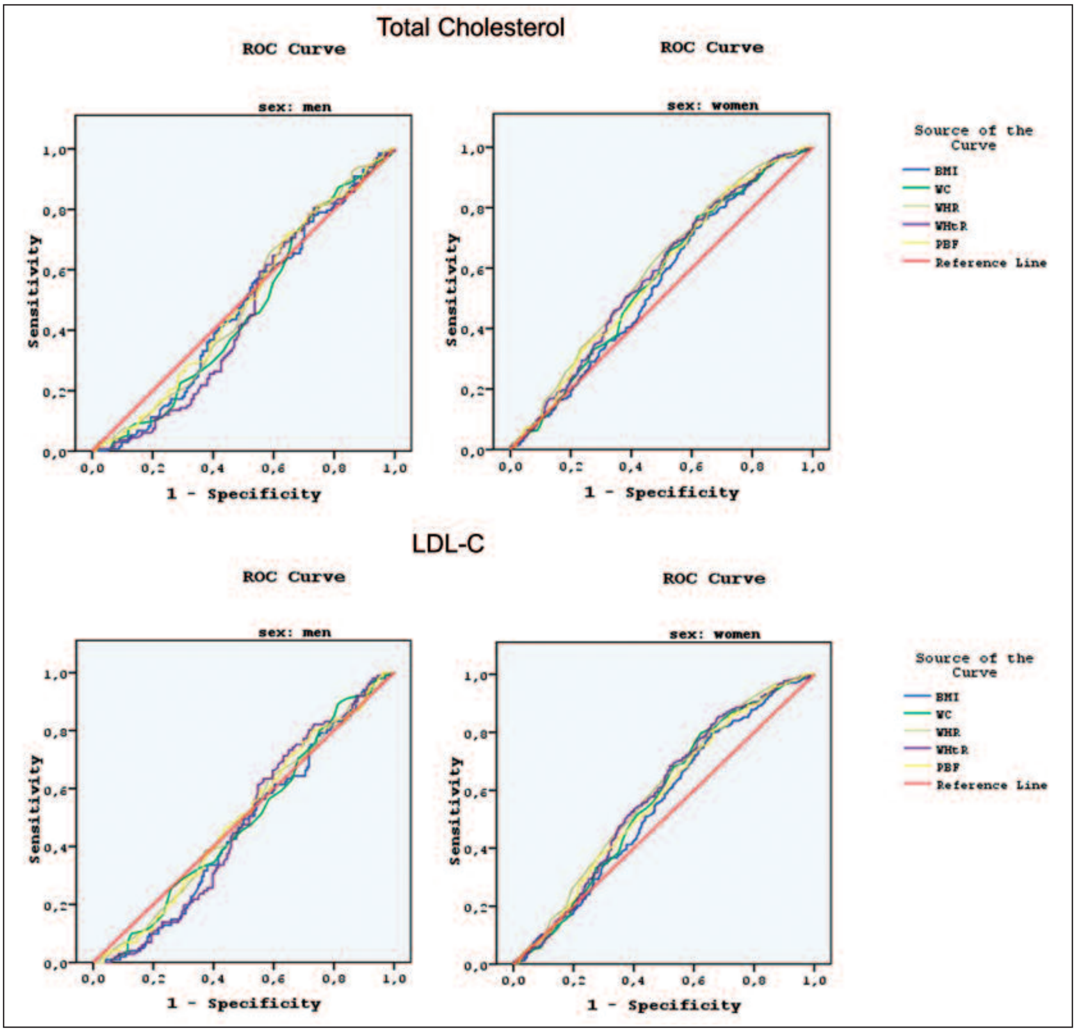

FIGURE 1: ROC curves for total cholesterol and low-density lipoprotein-cholesterol (LDL-C) for men and women.
(See color figure at http://tipbilimleri.turkiyeklinikleri.com/)

be the best indicator for estimating low HDL-C. In women, all anthropometric indices were successful in estimating impaired serum lipids ($p<0.05$). For total cholesterol and LDL-C, WHpR (AUC 59.6%, 59.0% respectively) and WHtR (AUC 57.8%, 58.1% respectively) were the best indicators, for triglyceride, it was WHtR (AUC 68.4%) and WC (AUC 68.2%) and for HDL-C it was WC (AUC 60.6%) followed by WHtR (AUC 59.3%). PBF was not found to be superior compared to anthropometric indices (Figure1, 2) (Table 3).

DISCUSSION

OBESITY

Among participants of this study, obesity was quite frequent in both men and women. Women had significantly higher anthropometric indices compared to men. The mean WC and WHpR levels were significantly higher in men, whereas in women the mean PBF and BMI were significantly higher than in men. According to BMI, the prevalence of obesity among men and women was 27.3% and 40.9%, respectively. In a study from Turkey including 15468 adults similar results were reported where the prevalence of obesity was 21.6% for men and significantly higher for women (41.3%).[19] In another study including women who presented to 69 Cancer Screening and Early Diagnosis (KETEM) centers, the obesity prevalence was slightly lower with 35%.[28] This may be due to the cancer specialty of the center. In the Turkish Heart Study, which is a cross sectional study that included participants

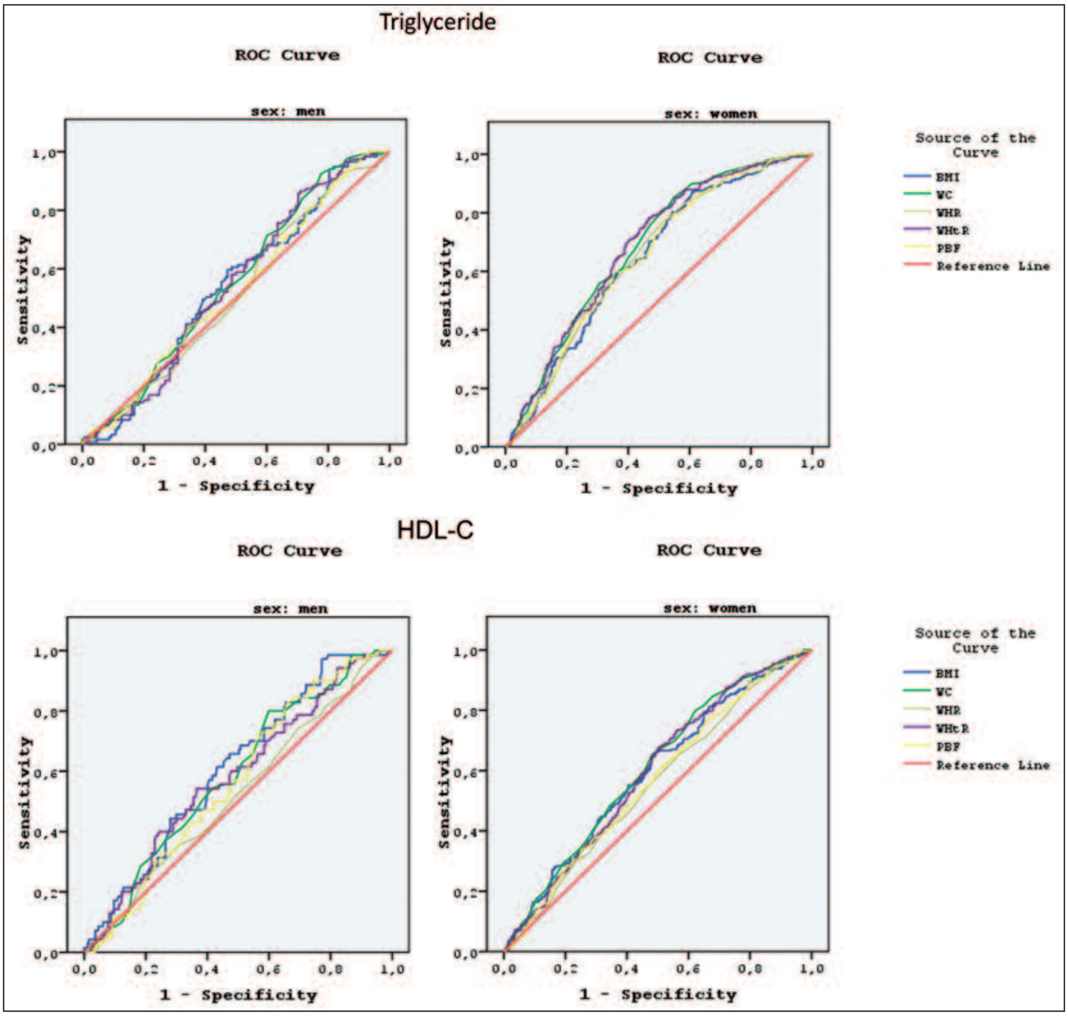

FIGURE 2: ROC curves for triglycerides and high-density lipoprotein-cholesterol (HDL-C) for men and women.
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aged 18 year and above, the mean WC and WHpR were found to be significantly higher in men and BMI and WHtR were higher in women.[29] However, the study group was not based on a nationally representative sample and the age group was younger compared to the current study. Older age distribution of our sample might be the reason for not having a significant difference in WHtR.

Our findings were parallel to the results of studies form Japan where women had higher mean PBF then men.[11,13] In our study, there was no significant difference in the mean WHtR according to sex. Studies from China, Japan and Hong Kong-China reported significantly higher mean BMI levels for men than for women.[11,13,30] On the other hand, a large cross sectional study from China (InterASIA), showed that the mean BMI was significantly higher in women.[31] These controversial results may be due to the different age distribution of the participants. The participants of the InterASIA study were aged between 35 and 74 years, similar to the age group in the present study. In our study, the mean BMI was higher for both sexes than those in the Japanese, Chinese and Hong-Kong Chinese studies.[11-13,30]

Although there are some studies examining body composition in young athletes and adolescents in Turkey, population based reports measuring PBF with BIA are few. The number of studies reporting on PBF is higher in the Far-East and China, which may be due to the localization of the two main BIA companies in that area. The people

TABLE 3: Area under the curve (ROC curves) for total Cholesterol, LDL-C, triglycerides and HDL-C for men and women.

	T. Cholesterol (≥200 mg/dL)				LDL-C (≥130 mg/dL)				Triglyceride (≥150 mg/dL)				HDL-C (<40 mg/dL, <50 mg/dL)			
	Men		Women		Men		Women		Men		Women		Men		Women	
AUC	AUC	p	AUC	p	AUC	p	AUC	p	AUC	p	AUC	p	AUC	p	AUC	p
PBF	---	0.824	0.574	0.001	---	0.962	0.570	0.001	---	0.489	0.650	<0.001	---	0.098	0.564	0.004
BMI	---	0.459	0.546	0.039	---	0.318	0.549	0.024	---	0.281	0.647	<0.001	0.610	0.006	0.591	<0.001
WC	---	0.310	0.564	0.004	---	0.687	0.570	0.001	---	0.138	0.682	<0.001	0.586	0.033	0.606	<0.001
WHpR	---	0.755	0.596	<0.001	---	0.851	0.590	<0.001	---	0.693	0.657	<0.001	---	0.583	0.553	0.019
WHtR	---	0.215	0.578	<0.001	---	0.533	0.581	<0.001	---	0.226	0.684	<0.001	0.582	0.042	0.593	<0.001

BMI: Body mass index; HDL-C: High-density lipoprotein cholesterol; LDL-C: Low-density lipoprotein cholesterol; PBF: Percentage body fat; T. Cholesterol: Total cholesterol; WC: Waist circumference; WHpR: Waist hip ratio; WHtR: Waist height ratio.

in the Far East have a different body type, which may affect their anthropometric measurements. Studies from the Far-East report that different cut off values should be used for those people.[3,23,30] This difference makes it difficult to compare the results between the populations.

ELEVATED SERUM LIPIDS IN MEN AND WOMEN

In this study, generally women had worse lipid profiles than men. Except for the mean triglyceride level, women had significantly higher mean serum lipid levels than men. Parallel to this, when grouped women had significantly more hypercholesterolemia and increased LDL-C compared to men, and hypertriglyceridemia was more frequent among men. Similarly, in a study from Tokat[(32)] (northeastern part of Turkey) women had more frequent hypercholesterolemia and increased LDL-C compared to men and hypertriglyceridemia was more common among men. Even though the gender difference is similar, the prevalence of impaired serum lipids seems to be lower than in our study. The study from Tokat had a younger age group (18 years and above) compared to our study group and it also included rural areas where physical activity might be higher. Although the mean HDL-C value was higher in women, when categorized, the frequency of low HDL-C levels was more common among women (37.0%) compared to men (26.2%). A study from the Mediterranean region of Turkey reported similar results with HDL-C prevalence 29.5% in men abd 38.5% in women.[33]

Sedentary life and obesity might be the main raisons of impaired serum lipids in women of this study. Women participants of the study were mainly (nearly 90%) not working or retired at the time of data collection. This may be among factors that reduce physical activity.

THE ASSOCIATION BETWEEN PBF, ANTHROPOMETRIC MEASUREMENTS AND SERUM LIPIDS

Some studies suggested that there was a positive association between total cholesterol, LDL-C and obesity but this is controversial.[2,13,34,35] In most studies, PBF and anthropometric measurements had the highest correlation with triglycerides followed by HDL-C. As obesity increased, HDL-C decreased and triglyceride increased, as in this study.[2,11,13,14,34-36]

PREDICTABILITY OF UNFAVORABLE SERUM LIPIDS USING ANTHROPOMETRIC INDICES VIA ROC CURVES

According to ROC curves, in men anthropometric measurements and PBF failed to predict elevated TC and LDL-C (all values of AUC were less than 50.0% and insignificant) levels. In women, AUC's were slightly larger; whereas WHpR and WHtR were found to be the best indicator for both parameters significantly. In women, all the indices found to be significant for predicting decreased HDL-C, WC (60.6%) and WHtR (59.3%) had the highest AUC where in men, BMI, WC and WHtR were found to be significant with BMI (61.0%) having the highest AUC. There was a strong distinction between men and women in predicting elevated triglyceride levels. In men, none of the measurements was found to be significant, while in women all measurements were significant in predicting elevated triglycerides with AUC higher than 60.0%. WHtR (54.3%, 68.4%) and WC (55.3%, 68.2%) were the best indicators in men and women respectively for elevated triglycerides.

Although the number of studies that examine the predictability of unfavorable serum lipids using ROC curves is few in Turkey, a study that described having one lipid abnormality as dyslipidemia, found that waist height ratio was the best indicator similar to the findings of our study.[34] In a study from Singapore on women from different ethnic backgrounds, WHtR was found to be the best indicator to determine dyslipidemia Another cross sectional study representative of China including similar age groups showed that WC gave the largest AUC for decreased HDL-C and elevated triglycerides in men similarly.[37] In women, WHtR was the best indicator for elevated TC; in contrast, for elevated LDL-C and triglycerides and decreased HDL-C, WHpR was the best indicator. This can be due to different body shapes of the race.[38]

STRENGTHS AND LIMITATIONS OF THE STUDY

This was the first community-based study where approximately 1000 individuals were examined with BIA and the associations between PBF and serum lipids were analyzed. All data were collected within a month so that the factors that can affect BIA measurement such as nutritional differences, differences in water loss due to sweating were kept at minimum. Blood sample collection, anthropometric measurements and BIA measurements were done after one night of fasting, which increased standardization. All serum lipids were analyzed in the Dokuz Eylül University Laboratory. The number of studies that examine waist height ratio in Turkey is few. In our study waist height ratio was shown to be an easy and important anthropometric measurement which indicated the cardiovascular risk.

Although the number of participants was adequate to show the weak association between PBF and serum lipids, the participants of this study do not represent the Teleferik District. In general, women, unemployed individuals, and those who are relatively old and have concerns about their health are more likely to take part in population studies.[39,40] In our study, the number of women were two-fold higher than the number of men, the mean age of men was higher than women, and only one third of men were employed. This suggests that young-working-men population was not represented well in this study. Even though the sample size was sufficient to show the significant associations, due to incisive differences between men and women, they were analyzed separately. Insignificant results found in men could be due to low participation rates in men, which did not have enough power to detect the significant associations.

In conclusion, obesity is very common in this population. Half of men had high total cholesterol and high triglyceride, half of women had high LDL-C, more than half had high total cholesterol levels. Mean total cholesterol and LDL-C values were higher than the targeted levels in both sexes. PBF and anthropometric measurements were associated more with HDL-C and triglyceride compared to total cholesterol and LDL-C. Overall PBF and anthropometric measurements had weak but mainly significant correlations with serum lipids. PBF was not a better index in association with serum lipids compared to the anthropometric measurements. BIA is useful in monitoring patients but can be expensive and time-consuming in primary health care settings in developing countries compared to BMI, WC, WHpR and WHtR that only needs a scale or a non-elastic measuring tape. Waist height ratio is an easy, non-invasive anthropometric measurement that can be used for defining obesity.

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