Relationship of Anthropometric Measurements with Cortisol, Dehydroepiandrosterone-Sulfate and Atherogenic Risk Factors in Obese Patients

OBEZ HASTALARDA ANTROPOMETRİK ÖLÇÜMLERLE KORTİZOL, DEHİDROEPİANDROSTERON-SÜLFAT VE ATEROJENİK RİSK FAKTÖRLERİ ARASINDAKİ İLİŞKİ

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Abstract

Objective: Central obesity is a risk factor for development of cardiovascular disease. Adrenal hormones, especially dehydroepiandrosterone sulfate (DHEAS), might be a cardiovascular risk factor and obesity itself can affect the levels of adrenal hormones. Body mass index (BMI) measurement is the most preferred method for predicting obesity in clinical practice but is insufficient for detecting central obesity. We studied the relation between anthropometric measurements [Waist circumference and BMI] with serum cortisol and DHEAS, serum lipid profile and fibrinogen levels in obese patients.

Material and Methods: Patients with BMI of 30-39.9 kg/m^2 were compared with patients with BMI of ≥ 40 kg/m^2. Also, obese patients with high waist circumference (>102 cm in men and > 88 cm in women) were compared with obese patients with normal waist circumference.

Results: No significant difference was obtained between the two BMI groups in the levels of lipid parameters, fibrinogen, cortisol and DHEAS. Serum cortisol levels were significantly higher in the high waist circumference group comparing to normal waist circumference group (16.40±3.18 ug/dl, 14.45±7.14 ug/dl respectively; p=0.013). A positive but modest correlation was obtained between fibrinogen and waist circumference (p=0.02, r=0.401). DHEAS levels within high waist circumference group in men were significantly lower than normal waist circumference group (108.8±3.00 µg/dl, 195.7±70.8 µg/dl; p=0.007).

Conclusion: Although our male patient group is small, low DHEAS levels may be taken into consideration when cardiovascular disease is evaluated in obese male patients with high waist circumference.

Key Words: Obesity, anthropometric measurements, adrenal hormones, coronary risk factors

Özet

Amaç: Santral obezite kardiyovasküler hastalık için bir risk faktörüdür. Surrenal hormonlar (özellikle DHEAS) kardiyovasküler risk faktörü olabilir; obezite de surrenal hormonları etkileyebilir. Vücut kitle indeksi (VKİ) klinikte obezite ölçümü için en çok tercih edilen yöntemdir, ancak santral obeziteyi saptamak için yeterli değildir. Çalışmamızda antropometrik ölçümlerin (bel çevresi ve VKİ), serum kortizol ve DHEAS, serum lipid profili ve fibrinojen düzeyleri ile olan ilişkisini araştırdık.

Gereç ve Yöntemler: VKİ 30-39.9 kg/m^2 olan hastalar ile VKİ ≥ 40 kg/m^2 olanlar ve bel çevresi erkeklerde ≥102 cm ve kadınlarda ≥ 88 cm olan hastalar kardiyovasküler risk faktörleri surrenal hormonlar açısından değerlendirildi.

Bulgular: VKİ'ne göre gruplandığında iki grup arasında serum lipid parametreleri, fibrinojen, kortizol ve DHEAS düzeyleri arasında fark saptanmadı. Serum kortizol düzeyleri bel çevresi fazla olan grupta normal olan gruba göre anlamlı olarak yüksek saptandı (16.40±3.18 ug/dl, 14.45±7.14 ug/dl; p=0.013). DHEA düzeyleri bel çevresi fazla olan erkeklerde normal olanlara göre belirgin olarak düşük bulundu (108.8±3.00 µg/dl, 195.7±70.8 µg/dl; p=0.007).

Sonuç: Bel çevresi fazla olan erkeklerde serum DHEAS düzeylerinin düşük bulunması DHEAS'ın kardiyovasküler bir risk faktörü olabileceğini düşündürmektedir.

Anahtar Kelimeler: Obezite, antropometrik ölçümler, surrenal hormonlar, koroner risk faktörleri

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It is known that obesity itself and related disorders like hyperlipidemia, hypertension and diabetes mellitus, which commonly accompany obesity, are cardiovascular risk factors.

As Framingham heart study indicated, obesity is an independent risk factor for cardiovascular diseases.[1] Lipid disorders accompanying obesity enhance atherogenesis and abdominal obesity is closely related with atherosclerotic complications.

In recent years, the data suggested that serum concentrations of dehydroepiandrosterone (DHEA) unconjugated or its sulfate form (DHEAS), the major secretory steroid product of adrenal gland, might be correlated with cardiovascular diseases.[2] An inverse relation between serum concentrations of DHEAS and cardiovascular disease was ascertained in men.[3] In contrast to this situation in men, no relationship between cardiovascular risk factors and DHEAS was observed in women. Relation between body mass index (BMI) and DHEAS concentrations are obtained as inverse, positive or unrelated in women in several studies.[4,5] However, no relation was found between DHEAS and waist circumference.

Hypercortisolemia causes an increase in adipose tissue mass, changes its distribution and this results in increase in abdominal adipose tissue deposition.

The aim of our study is to search the relation between anthropometric measurements with adrenal hormones (serum cortisol and DHEAS), lipid profile and fibrinogen levels in obese patients.

Material and Methods

Forty-one (33 female and 8 male) patients, with BMI ≥ 30 kg/m^2, administered to our department of Endocrinology and Metabolism were included in the study. Subjects with diabetes mellitus and any other endocrinological disorder and having history of atherosclerotic heart disease and abnormal electrocardiogram were excluded.

Height and weight was measured in all subjects and BMI was calculated as the weight in kilograms divided by the square of the height in meters. Circumference of waist was measured at the level midway between lower rib margin and the iliac crest.[6] Waist circumference > 102 cm in men and waist circumference > 88 cm in women was considered as high.[7]

Subjects were grouped according to BMI 30-39.9 kg/m^2 first group (20 female patients, 5 male patients) and ≥ 40 kg/m^2 second group (13 female patients, 3 male patients). Also, the patients were separated according to the waist circumference as waist circumference > 102 cm in men (n= 4) and > 88 cm in women (n=11) as the high waist circumference group; waist circumference < 102 cm in men (n= 4) and < 88 cm in women (n=22) as the normal waist circumference group.

Fasting blood glucose (by glucose oxidase method), total cholesterol, LDL-cholesterol, HDL-cholesterol, triglyceride (by enzymatic spectrophotometric method; Trinder reaction), fibrinogen (by coagulometric method), cortisol (by chemiluminesence method), DHEAS (by radioimmunoassay method) were measured in all patients after 10-12 hours of fasting in the morning.

For statistical analysis SPSS program for Windows 9.0 was used. Data were expressed as mean ± SD. The significance of difference between two unrelated variability were tested by Mann-Whitney U test. Correlation analyses between the parameters were appraised by bivariate correlation analyses. P values less than 0.05 were accepted as significant.

Results

The mean age of subjects were 37.7±10 years and mean BMI were 36.99±6.31 kg/m^2. BMI of 25 patients (61%) were between 30-39.9 kg/m^2 while BMI of 16 patients (39%) were ≥ 40 kg/m^2. Waist circumference of 15 patients (37%) were high and 26 (63%) were normal.

No significant difference was obtained between the two BMI groups in the levels of total cholesterol, LDL-cholesterol, HDL-cholesterol, triglyceride, fibrinogen, cortisol and DHEAS levels regardless of the sex of the patients (Table 1). Also no statistically significant difference was found between high and normal waist circumference groups in total cholesterol, LDL-cholesterol, HDL-cholesterol, triglyceride, fibrinogen, and DHEAS levels regardless of the sex of the patients (Table 2). Serum cortisol levels were significantly higher in the high waist circumference group comparing to normal waist circumference group (16.40±3.18 ug/dl, 14.45±7.14 ug/dl respectively; p=0.013).

Table 1. Laboratory measurements according to BMI values

	BMI=30-39.9 kg/m^2	BMI≥ 40 kg/m^2	P
Total cholesterol (mg/dl)	209.29±41.56	206.13±43.32	> 0.05
LDL-cholesterol (mg/dl)	127.95±37.19	128.00±28.60	> 0.05
HDL-cholesterol (mg/dl)	45.25±13.42	42.30±8.99	> 0.05
Triglyceride (mg/dl)	176.20±94.76	201.86±130.52	> 0.05
Fibrinogen (mg/dl)	358.95±88.70	403.46±72.45	> 0.05
Cortisol (μg/dl)	15.62±5.95	14.37±6.49	> 0.05
DHEAS (μg/dl)	193.50±112.45	155.68±15.39	> 0.05

Table 2. Laboratory measurements according to the waist circumference

	Normal WHR	High WHR	p
Total cholesterol (mg/dl)	210.04±44.72	213.35±39.92	> 0.05
LDL-cholesterol (mg/dl)	127.90±35.08	128.30±35.01	> 0.05
HDL-cholesterol (mg/dl)	45.09±13.41	43.92±10.20	> 0.05
Triglyceride (mg/dl)	182.98±13.53	192.14±11.50	> 0.05
Fibrinogen (mg/dl)	376.66±93.02	388.91±79.37	> 0.05
Cortisol (μg/dl)	14.45±7.14	16.40±3.18	0.013
DHEAS (μg/dl)	184.65±94.80	159.52±88.29	> 0.05

When correlation analysis was performed, a positive but modest correlation was ascertained between fibrinogen level and waist circumference (p=0.02, r=0.401).

Triglyceride levels in women were significantly higher within the BMI ≥ 40 kg/m^2 group than BMI< 40 kg/m^2 group (209.15±37.47 mg/dl, 165.10±18.54 mg/dl; p<0.05). The serum cortisol levels in women within high waist circumference group were significantly higher than normal waist circumference group (17.03±0.88 μg/dl, 14.22± 1.73 μg/dl; p=0.007).

DHEAS levels within high waist circumference group in men were significantly lower than normal waist circumference group (108.8± 3.00 μg/dl, 195.7±70.8 μg/dl; p=0.007). The limited number of men subjects should be considered with caution.

Discussion

It is known that obesity is an independent risk factor for development of cardiovascular disease. It is suggested that distribution of adipose tissue especially central obesity is a better predictor of cardiovascular disease more than the amount and degree of adiposity.[8] It is reported that BMI is effective in determining the degree of obesity. However, it is insufficient for detecting the distribution of adipose tissue and predicting the association between the degree of obesity and the cardiovascular risk factors. Different measurement methods have been used such as WHR, waist circumference, waist-to-height ratio for detecting central adiposity but the most suitable anthropometric index to be included in the routine clinical examination has not been suggested yet.[6,9,10] In our study, when patients were divided into two groups according to BMI cardiovascular risk factors like hyperlipidemia, fibrinogen, DHEAS did not show any difference in the two groups; so it may be suggested that BMI was not adequate for determining the cardiovascular risk factors.

In our study fibrinogen levels showed a positive correlation with waist circumference and that may be an important cardiovascular risk factor especially in patients with central obesity. As in the study of Megnien et al.[11] a positive correlation between waist circumference and fibrinogen levels were obtained. These results show that, fibrinogen levels should be considered while determining the

cardiovascular risk factors especially in obese patients.

Association of hypertriglyceridemia with WHR and waist circumference was confirmed in previous studies.[6,12] In our study although such a relation was not determined between hypertriglyceridemia and waist circumference, high levels of hypertriglyceridemia in women in high BMI group were obtained. This may reveal that hypertriglyceridemia is an important component of dyslipidemia in obesity but is not always associated with abdominal fat tissue deposition.

DHEAS is the most abundant steroid hormone produced by adrenal gland. Although all the functions of this hormone are not yet exactly known, it has either estrogen-like or androgen-like effects depending on hormonal milieu. Glucocorticoids increase lipoprotein lipase activity in visceral fat tissue more than subcutaneous fat tissue. This causes abdominal fat deposition like in Cushing's Syndrome. Besides, the androgenic effect of DHEAS may affect the fat tissue distribution. This may be especially important in women in whom adrenal gland is the major source of androgens. However, the relation between the levels of DHEAS and BMI is not clear in women; also any relation could not be found between DHEAS and waist circumference.[4,5] In our study, serum concentrations of DHEAS were found unrelated with BMI and waist circumference in women. However in men, it is suggested that low levels of DHEAS increase cardiovascular morbidity and mortality.[3] These different effects of DHEAS can be explained by its either estrogen-like or androgen-like effects. In men the effects of DHEAS are estrogenic and beneficial while in women they are androgenic in respect of cardiovascular disease. If increase in waist circumference is accepted as a cardiovascular risk concerning morbidity and mortality, low levels of DHEAS with high waist circumference might be accepted a cardiovascular risk factor in men as found in our study.

The levels of serum cortisol, all in normal range, were found higher in the group of high waist circumference comparing with normals. This can be explained as functional hypercortisolism seen in obesity. In obesity, cortisol production increases due to increased clearance of this hormone and this affects especially visceral fat tissue that is more sensible to cortisol. As a result of this, fat deposition in the abdomen become more apparent.

In conclusion, cortisol levels were elevated in high waist circumference group in our study. Also serum concentrations of cortisol in women within this group were high and levels of DHEAS in men in this group were low. Low DHEAS levels may be taken into consideration when cardiovascular disease is evaluated in obese male patients with high waist circumference.

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