ANDROLOGY

Original Article

# Is there any difference in severe erectile dysfunction detection when different diagnostic metabolic syndrome criteria are used?

## *Farklı metabolik sendrom tanı kriterleri kullanıldığında şiddetli erektil disfonksiyon saptama oranları arasında fark var mıdır?*

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## ABSTRACT

**Objective:** To investigate the relationship between two different metabolic syndrome (MS) diagnostic criteria and the severity of erectile dysfunction (ED).

**Material and methods:** A total of 400 male patients over 50 years of age who suffered from ED were included in this study. The 2005 criteria of the International Diabetes Federation (IDF) and American Heart Association/The National Heart Lung and Blood Institute (AHA/NHLBI) were used for the diagnosis of MS. Subsequently, the patients were divided into two groups: those with MS and those without MS. The first-five version of the International Index of Erectile Function (IIEF-5) was applied to assess the severity of ED (IIEF-5 score 5-7, severe ED; IIEF-EF score 8-21, mild to moderate ED). The severity of ED was compared according to the two different MS diagnostic criteria.

**Results:** The mean age of the patients was 59.2 years. A total of 48.8% (n=195) and 50.5% (n=202) of patients had MS according to IDF and AHA/NHLBI criteria, respectively. Overall, 209 (52.3%) patients had mild to moderate and 191 (47.8%) patients had severe ED. The IIEF-5 score was lower in MS patients compared with patients without MS for both diagnostic criteria (8.9 vs 10.1 for IDF and 8.8 vs 10.3 for revised AHA/NHLBI). The severe ED ratio was 55.4% and 58.4% in MS patients according to IDF and AHA/NHLBI diagnostic criteria, respectively.

**Conclusion:** MS was observed in almost half of the patients with ED. Severe ED was more prevalent in MS patients. A similar severe ED ratio was observed for both MS definitions.


**Key words:** Diagnosis; erectile dysfunction, fasting blood glucose; metabolic syndrome; waist circumference.


## ÖZET

**Amaç:** Erektil disfonksiyon (ED) şiddeti ile iki farklı metabolik sendrom (MS) tanı kriteri arasındaki ilişkiyi incelemek.

**Gereç ve yöntemler:** Çalışmaya yaşları 50 yaşın üzerinde erektil disfonksiyon (ED) yakınması olan 400 erkek hasta dahil edildi. MS tanısı için 2005 yılı Uluslararası Diyabet Federasyonu (IDF) ve Amerikan Kalp Derneği/ Ulusal Kalp Akciğer ve Kan Enstitüsü (AHA/NHLBI) tanı kriterleri kullanıldı. Daha sonra hastalar MS olan ve olmayan hastalar olarak iki gruba ayrıldı. ED şiddeti, Uluslararası Erektil Fonksiyon Sorgulama formu'nun ilk 5 sorusu (IIEF-5) ile belirlendi. Hastaların ED şiddeti iki farklı MS tanı kriterine göre karşılaştırıldı.

**Bulgular:** Hastaların ortalama yaşı 59.2 yıl idi. IDF ve AHA/NHLBI kriterlerine göre sırası ile hastaların %48.8 (n=195) ve %50.5'inde (n=202) MS saptandı. Hastaların 209'unda (%52.3) hafif-orta, 191'inde (%47.8) şiddetli ED saptandı. Her iki tanı kriteri için MS olan hastalarda ortalama IIEF-5 skoru MS olmayan hastalardan daha düşük idi (IDF için 8.9 ve 10.1, revize-ATP III için 8.8 ve 10.3). IDF ve AHA/NHLBI kriterlerine göre MS olan hastalarda şiddetli ED oranı sırasıyla %55.4 ve %58.4 idi.

**Sonuç:** Erektil disfonksiyonu olan hastaların yaklaşık yarısında MS görüldü. MS hastalarında şiddetli ED daha fazla görülmekteydi. Her iki MS tanımı için şiddetli ED oranı benzer şekilde gözlendi.


**Anahtar sözcükler:** Açlık kan şekeri; bel çevresi; erektil disfonksiyon; metabolik sendrom; tanı.

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## Introduction

Erectile dysfunction (ED) is defined as the persistent inability to achieve and maintain a sufficient erection for a satisfactory sexual performance.[1] ED has a multifactorial pathogenesis, including hormonal, vascular, psychogenic and lifestyle factors.[2,3] Currently, the clinical entity of so-called metabolic syndrome (MS) is stated as a crucial risk factor for ED.[4-6] This clinical entity has been referred to by various names (Reaven syndrome, syndrome X, polymetabolic syndrome, and civilization syndrome) and includes a set of risk factors for cardiovascular disease: insulin resistance, abdominal obesity, hypertension (HT), impaired glucose tolerance and impaired lipid profile.[7,8]

In the Massachusetts Male Aging Study (MMAS), the prevalence of ED was reported as 52% in males between 40 to 70 years old.[9] In a study by Akkus et al. from our country, the prevalence of ED was reported as 69.2% for the same age group.[10] The prevalence of ED may differ according to the features of the population in which the study is conducted (ethnic differences and age), the persons responding to the questionnaire (patients, nurses, physicians, telephone) and the type of questionnaire used (SHIM or IIEF-EF). Similarly, the ED prevalence in MS patients may differ according to the MS diagnostic criteria.

The main difference between AHA/NHLBI (revised NCEP-ATP III) and IDF criteria is the fasting blood glucose, which was increased to 110 mg/dL from 100 mg/dL. The second difference is that waist circumference ≥94 cm is accepted as the main criterion for MS in the IDF, whereas waist circumference ≥102 cm is assessed as a risk factor in itself in the AHA/NHLBI. Additionally, the presence of MS has been considered as waist circumference ≥94 cm plus any two risk factors for IDF and any three risk factors for AHA/NHLBI.

In this study, we analyzed the prevalence of severe ED according to two different MS diagnostic criteria and the relationship between these criteria and severe ED.

## Material and methods

The files of 400 male patients who were over 50 years old and referred to our clinic with complaints of ED between September 2007 and September 2011 were retrospectively examined. Their detailed medical histories, including risk factors, such as trauma, previous surgery, diabetes mellitus, HT, dyslipidemia, atherosclerosis and coronary artery disease, were recorded. Patients who had used drugs that may cause ED (hormonal drugs, 5α reductase inhibitors, psychiatric medications, etc.) and those with urogenital system malignity, chronic liver or renal failure and a history of a previous pelvic surgery were excluded from the study.

The erectile function of the patients was evaluated according to the first-five version of the International Index of Erectile Function (IIEF-5). Accordingly, an IIEF-5 score ≤7 was considered as severe ED, and a score between 8 and 21 was considered as mild to moderate ED. Following a detailed physical examination, the height and weight of the patients were measured. The body mass index (BMI) was calculated by dividing the weight by the square of the height. The waist circumference (WC) was measured with an elastic meter from the level of the umbilicus over the iliac crest in the morning by the same doctor (MB) after fasting and after taking off the upper body clothing of the patients. High-density lipoprotein (HDL) levels, triglyceride (TG), total testosterone (TT), glycated hemoglobin (HbA1C) and fasting blood glucose (FBC) values were measured in all of the patients.

The 2005 criteria of the International Diabetes Federation (IDF) and American Heart Association/The National Heart Lung and Blood Institute (AHA/NHLBI) were used for the diagnosis of MS.[8,11]

**IDF Criteria:**
- Waist circumference ≥94 cm plus any two of the following factors:
- Triglyceride level ≥150 mg/dL or specific treatment for this
- HDL cholesterol <40 mg/dL or specific treatment for this
- Increased blood pressure (systolic BP ≥130 or diastolic BP ≥85 mmHg or treatment of previously diagnosed hypertension)
- Increased fasting plasma glucose (FPG) ≥100 mg/dL or previously diagnosed type 2 diabetes

**AHA/NHLBI:** Any three of the following factors;
- Waist circumference ≥102 cm
- Triglyceride level ≥150 mg/dL or specific treatment for this
- HDL cholesterol <40 mg/dL or specific treatment for this
- Increased blood pressure (systolic BP ≥130 or diastolic BP ≥85 mmHg or treatment of previously diagnosed hypertension)
- Increased fasting plasma glucose (FPG) ≥100 mg/dL or previously diagnosed type 2 diabetes

**Statistical analysis**

Statistical Packet for Social Science (SPSS) Version 13.0 software was used for the statistical analysis. Descriptive statistics of the groups were calculated. The outcomes were expressed as the mean±standard deviation. The numerical data with normal distribution were compared with Student's t-test, and the data without normal distribution were compared among groups with the Mann-Whitney U test. The relationship between MS criteria and severe ED was evaluated with logistic regression analysis. The significance level was accepted as $p<0.05$.

## Results

The mean age of the patients was 59.2±5.7 (50-77) years. There was a history of hypertension in 38.5%, diabetes mellitus in 30.7% and smoking in 37.3% of the patients. The mean waist circumference, serum HDL, TG, HbA1C values and IIEF scores were 99.1±11.2 cm, 38.3±9.6 mg/dL, 162.6±101.4 mg/dL, 7.8±2.3% and 9±6.4 respectively. The general features of the patients according to both criteria are provided in Table 1.

According to IDF and AHA/NHLBI criteria, MS was identified in 48.8% (n=195) and 50.5% (n=202) of the patients. The mean IIEF-5 score was lower in patients with MS than those without MS for both diagnostic criteria. The mean IIEF-5 score was 8.9±4.7 in patients with MS and 10.1±5.4 in those without MS according to the IDF criteria (p=0.015). According to the revised AHA/NHLBI criteria, the IIEF-5 score was 8.8±4.7 and 10.3±5.3 in patients with and without MS, respectively (p=0.003).

In the patients, mild to moderate ED was observed in 52.3% (n=209) and severe ED was observed in 47.8% (n=191). According to the IDF and revised AHA/NHLBI criteria, the rate of severe ED was 55.4% and 58.4%, respectively (p=0.132).

When the relationship between severe ED and MS risk factors was examined with logistic regression analysis, the criterion of increased fasting plasma glucose (FPG) ≥100 mg/dL or specific treatment for this was found to increase the risk for severe ED by 4.7 times (95% CI 3.7-10.1, p<0.001) (Table 2).

## Discussion

The criteria for MS were first described in 1998 by the World Health Organization (WHO) and subsequently described in 1999 by the European Group for the Study of Insulin Resistance (EGIR), in 2001 by the National Cholesterol Education Program Adult Treatment Panel (NCEP-ATP III), in 2003 by the American Association of Clinical Endocrinologists (AACE), in 2005 by the International Diabetes Federation (IDF) and again in 2005 by the American Heart Association and The National Heart, Lung, and Blood Institute (AHA/NHLBI), which described the revised NCEP-ATP III criteria. Insulin resistance, increased blood pressure, increased levels of TG, decreased levels of HDL and central obesity appear to be the common components of all of these definitions.[8]

The prevalence of MS is 20-30% in middle-aged men.[12] In a screening study of 2371 men by Heidler et al.,[5] IDF criteria were used, and the prevalence of MS was found to be 33.8% in the 30-69 age group. Yeh et al.[13] reported the prevalence of MS as 37% and 32% in 103 patients according to NCEP-ATP III and IDF criteria, respectively. Ford et al.[14] stated that the MS prevalence increases with age. In their study using NCEP-ATP III criteria, they reported the prevalence of MS as 6.7% in the 20-29 age group, 43.5% in the 60-69 age group and 42% in the over 70 age group. In a multicenter study conducted in our country with similar criteria, the prevalence of MS was reported as 39.9% in males in the 40-70 age group.[6] In our study, MS was identified in 48.8% and 50.5% of the patients according to IDF and AHA/NHLBI criteria, respectively. We believe that these different results came from the different study designs,

**Table 1. The principal characteristics of the study population are shown. Variables are given as the means±standard deviation**

| | IDF | | | AHA/NHLBI | | |
|---|---|---|---|---|---|---|
| | MS (+) | MS (-) | p value | MS (+) | MS (-) | p value |
| Age | 59.1±5.8 | 59.4±5.8 | 0.531 | 59.3±5.9 | 59.2±5.6 | 0.963 |
| WC (cm) | 105.8±8 | 92.7±10 | <0.001 | 103.6±10.6 | 94.5±9.9 | <0.001 |
| BMI (kg/m$^2$) | 29.5±3.8 | 26.4±3.3 | <0.001 | 29.3±3.9 | 26.5±3.3 | <0.001 |
| FBG (mg/dL) | 161.3±84.3 | 130.8±79 | <0.001 | 166.5±87.6 | 124.5±72.2 | <0.001 |
| HDL (mg/dL) | 36±8.7 | 40.5±9.8 | <0.001 | 34.7±7.9 | 42.1±9.8 | <0.001 |
| TG (mg/dL) | 189±112.7 | 136.1±80.5 | <0.001 | 198.2±111.2 | 124.1±72.2 | <0.001 |
| HbA1C (%) | 7.9±2.2 | 7.7±2.4 | 0.447 | 8.2±2.4 | 7.2±2.1 | 0.001 |
| IIEF-5 score | 8.9±4.7 | 10.1±5.4 | 0.015 | 8.8±4.7 | 10.3±5.3 | 0.003 |
| Percentage of severe ED (%) | 108 (55.4%) | 83 (40.5%) | 0.003 | 118 (58.4%) | 73 (36.9%) | <0.001 |

WC: waist circumference, FBG: fasting blood glucose, HDL: high-density lipoprotein, TG: triglyceride, BMI: body mass index, HbA1C: glycated hemoglobin, IIEF-5: the first-five version of the International Index of Erectile Function, MS: metabolic syndrome, IDF: International Diabetes Federation, AHA/NHLBI: The American Heart Association/The National Heart Lung and Blood Institute

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**Table 2. Logistic regression analysis of metabolic risk factors for erectile dysfunction. The variables are shown as categorical variables, except for age and WC**

| Risk factors | Beta coefficient | p value | OR | 95% CI (Min-Max) |
|---|---|---|---|---|
| Age | 0.038 | 0.066 | 1.0 | 1.0-1.1 |
| WC (cm) | -0.027 | 0.054 | 1.0 | 0.9-1.0 |
| Abnormal blood pressure | 0.167 | 0.537 | 1.2 | 0.7-2.0 |
| Abnormal HDL | 0.050 | 0.001 | 1.1 | 1.0-1.1 |
| Abnormal TG | 0.002 | 0.161 | 1.0 | 1.0-1.0 |
| Abnormal FBG | 1.538 | 0.000 | 4.7 | 2.7-8.2 |
| Presence of MS (IDF) | 0.006 | 0.988 | 1.0 | 0.5-2.1 |
| Presence of MS (AHA/NHLBI) | 0.743 | 0.050 | 2.1 | 1.0-4.4 |

OR: odds ratio, CI: confidence interval

different ED definitions and societal differences as well as different MS diagnostic criteria.

In addition to cardiovascular diseases, MS has been reported to be associated with many urological conditions, such as lower urinary tract symptoms, female urinary incontinence, urolithiasis, hypogonadism, prostate cancer and ED.[15] There are numerous studies analyzing the relationship between MS and ED in the literature.[5,6] However, studies examining the presence of MS in patients with ED are relatively fewer, and in these studies, the prevalence of ED is reported to be higher in patients with MS.[6,13,16]

In a study from our country by Bal et al.,[6] the rate of severe ED was reported as 24.8% in patients with MS and 19.1% in those without MS. Yeh et al.[13] reported the rates of severe ED as 41.4% and 31% in patients with MS according to NCEP-ATP III and IDF criteria, respectively. In a study by Heidler et al.,[5] the prevalence of ED at various degrees was reported as 68.4% for men under 50 years old and 74.8% for men over 50 years old.

Similar to the literature, in our study, MS was found in approximately half of the patients according to both MS diagnostic criteria. The mean IIEF-5 score was lower in patients with MS compared to those without MS (8.9 vs 10.1 according to IDF criteria and 8.8 vs 10.3 according to AHA/NHLBI criteria). In our series, severe ED was detected in 47.8% of the patients, and the rates of severe ED were similar in patients with MS according to both diagnostic criteria (55.4% and 58.4% according to IDF and AHA/NHLBI, respectively).

Endothelial dysfunction is thought to be a common pathophysiology in ED and MS. There are numerous studies demonstrating the relationship between MS and macrovascular and microvascular complications.[17,18] Cuspidi et al.[17] found that the prevalence of MS in patients with cardiac and renal organ damage was 2.3 times higher than those who had no damage. In another study by Abdul-Ghani et al.[19] of 415 diabetic patients, the risk of retinopathy was 3.42 times higher in patients with MS (9.6% vs 4.1%) compared to those without MS.

When the relationship between MS and ED is analyzed, the incidence of ED is reported to increase as the number of risk factors for MS increases, and some components of MS further increase the risk for ED.[4,20] In a study by Bal et al.,[6] increased blood glucose, increased blood pressure and waist circumference were found as the most important risk factors for ED. Heidler et al.[5] emphasized that the age limit of 50 years and the waist-to-hip ratio are more important components. In another study, poor glycemic control was stated as a more important risk factor for ED.[21] In a study conducted in our clinic on 93 ED patients, fasting blood glucose ≥100 mg/dL or the presence of type 2 diabetes was found to increase the risk for ED by 7.1 fold.[16] In the present study, we found the same MS criterion as the most important risk factor for ED, and it increased the risk for ED by 4.7 fold.

The MS diagnostic criteria have been changed several times. As the main difference between IDF and AHA/NHLBI (revised NCEP-ATP III) criteria, the fasting blood glucose was decreased to 100 mg/dL from 110 mg/dL, while the waist circumference remained unchanged. Again, in the revised form, lipid anomalies and specific treatment due to impaired glucose tolerance were added to the criteria for MS. While each criterion is assessed as a risk factor in itself in the AHA/NHLBI, waist circumference ≥94 cm is accepted as the main criterion for MS in the IDF. Furthermore, previous NCEP-ATP III criteria are easier to be used clinically, and they have been mainly used in the large series.[12,14,22]

The definition of MS according to the IDF criteria appears to be a better predictor of acute coronary syndrome than NCEP-ATP III and NHLBI/AHA. However, some researchers have an opposite opinion.[22,23]

In our study, MS was identified in approximately half of the patients with ED. The risk for ED was higher in patients with MS. The most important MS criterion was impaired fasting blood glucose for severe ED in patients with MS. Both IDF and AHA/NHLBI diagnostic criteria can be used in the evaluation of the erectile function of patients with MS.

**Conflict of interest**

No conflict of interest was declared by the authors.

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