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Prevalence of the Metabolic Syndrome in a Rural Turkish Population: Comparison and Concordance of Two Diagnostic Criteria*

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Aim: This study was performed to compare the prevalence of the metabolic syndrome (MES) according to the International Diabetes Federation (IDF) and Adult Treatment Panel III (ATPIII) definitions in a population-based sample and to determine the concordance of the definitions.

Materials and Methods: A total of 244 adults aged ≥20 years (145 women and 99 men), selected systematically from household registration cards in a rural village in West Anatolia, were analyzed. Kappa test was done to examine the agreement between the definitions.

Results: The mean age of the group was 46.9 ± 14.9 years. The prevalence of MES using ATPIII and IDF definitions was 38.1% and 41.4%, respectively. MES prevalence increased with age 50 in both genders using both criteria ($P < 0.001$). Only 9.8% and 6.3% of the population had none of the components of MES according to ATPIII and IDF, respectively. The agreement rate between the IDF and ATPIII was 91.1% ± 0.04% (Kappa = 0.812). The subjects defined only with ATPIII and not IDF were all men and had lower body mass index and waist circumference than those defined by both ATPIII and IDF.

Conclusions: The MES was common among our population using either ATPIII or IDF definition. The agreement between the two definitions was good. The insufficiency of IDF definition for detecting leaner but metabolically abnormal men should be kept in mind. Screening, prevention and treatment interventions for this syndrome seem to be organized promptly.

Key Words: Metabolic syndrome, prevalence, definitions, Turkish

Türkiye'de Kırsal Bir Alanda Metabolik Sendrom Prevelansı: İki Tanı Kriterinin Karşılaştırılması ve Uyumu

Amaç: Bu çalışmanın amacı, topluma dayalı bir örneklemde metabolic sendrom (MES) prevelansını Uluslararası Diyabet Federasyonu (IDF) ve Erişkin Tedavi Paneli III (ATPIII) tanımları temelinde karşılaştırmak ve iki tanımın uyumunu araştırmaktır.

Yöntem ve Gereç: Çalışmaya Batı Anadolu'daki kırsal bir kasabada ev halkı tespit fişlerinden sistematik olarak seçilen 20 yaş ve üzerindeki 244 yetişkin alındı. Tanımlar arasındaki uyum Kappa test ile araştırıldı.

Bulgular: Grubun yaş ortalaması 46,9 ± 14,9 yıldı. MES prevalansı ATPIII ve IDF tanımlarına göre sırasıyla % 38,1 ve % 41,4 olarak saptandı ve hem erkek hem de bayanlarda 50 yaş üzerinde MES prevalansında artış gözlendi ($P < 0,001$). ATPIII ve IDF tanımlarına göre grubun sırasıyla sadece % 9,8'i ve % 6,3'ü hiçbir kriteri taşımıyordu. IDF ve ATPIII tanımları arasındaki uyum oranı % 91,1 ± % 0,04 (Kappa = 0,812) olarak bulundu. Sadece ATPIII ile MES tanısı alan ancak IDF tanımına göre MES olmayanların hepsi erkekti ve vücut kitle indeksleri ile bel çevreleri her iki tanım ile de MES saptananlardan daha düşüktü.

Sonuç: Metabolik sendrom prevalansı bölgemizde yüksektir ve iki tanım arasında iyi bir uyum bulunmaktadır. IDF tanımının zayıf ancak metabolik unsurları bozuk olan erkekleri saptamada yetersiz kalabileceği akılda tutulmalıdır. Bu sendroma yönelik olarak tarama, önleme ve tadavi girişimlerinin acilen organize edilmesi gerekli görünmektedir.

Anahtar Sözcükler: Metabolik sendrom, prevelans; tanımlar, Türkiye

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Introduction

The metabolic syndrome (MES), which is characterized by insulin resistance, consists of several cardiovascular risk factors such as glucose intolerance, central obesity, dyslipidemia and hypertension (1). It is associated with an increased risk for the development of type 2 diabetes (2,3), cardiovascular disease (CVD) (4) and mortality due to coronary heart disease (CHD) (5,6).

A recent study revealed that in two out of every three cases, CHD originates from MES among Turkish people (7). Therefore, it is important to identify subjects with MES earlier. Several definitions of the MES have been approved to date for research and/or clinical purposes. This study aimed to estimate and compare the prevalence of MES in a rural adult Turkish population using the definitions proposed by the International Diabetes Federation (IDF) (8) and the National Cholesterol Education Program Adult Treatment Panel III (ATPIII) (9) and to determine the concordance of the definitions.

Materials and Methods

Study Population

The study was conducted in Umurlu, a medically underserved town in West Anatolia. The study population included 244 subjects selected among 7276 adults aged 20-80 years from household registration cards by cluster sampling method from all four districts. The sample size was calculated on prevalence of 20%, d = 0.05 at a confidence level of 95% (10).

Measurements

The participants were invited to the primary care center of the Family Medicine Department after an overnight fast. Demographic and anthropometric data were obtained with face-to-face interview. Body weight, height and waist circumference (WC) were measured for each subject. Weight and height were measured while participants wore light clothes without shoes. WC was measured with a soft tape on standing subjects midway between the lowest rib and the iliac crest. Body mass index (BMI) was calculated as a ratio of weight (kg) to height squared (m). Overweight was defined as BMI ≥25 kg/m^2 and obesity as ≥30 kg/m^2 (11). Systolic blood pressure (SBP) and diastolic blood pressure (DBP) were measured twice at 5-min intervals in the sitting position after a 10-min rest, and the mean was taken in all subjects.

Blood samples were drawn after 8-12 h fasting for the measurement of triglycerides, high-density lipoprotein-cholesterol (HDL-C), and glucose levels, and Architect C800 autoanalyzer (Abbott, USA) was used for measurements. All subjects gave written informed consent, and the Ethics Committee of Adnan Menderes University Medical School approved the research protocol for this study.

Definitions of Metabolic Syndrome

The MES was defined according to the ATPIII and IDF definitions. Subjects having three or more of the diagnostic criteria were defined as having MES according to the ATPIII report (9). These criteria are: 1) Obesity: WC >102 cm in men or >88 cm in women, 2) Hypertriglyceridemia: triglyceride ≥150 mg/dl, 3) Low HDL-C, <40 mg/dl in men and <50 mg/dl in women, 4) Hypertension: known hypertensives or BP ≥130/85 mmHg, and 5) Dysglycemia: known diabetes mellitus (DM) or fasting plasma glucose ≥110 mg/dl.

According to the IDF definition (8), for a person to be defined as having MES, he/she must have a central obesity (defined as WC ≥94 cm for men and ≥80 cm for women), plus any two of the following four factors: 1) Raised triglyceride levels ≥150 mg/dl, or specific treatment for this lipid abnormality, 2) Reduced HDL-C, <40 mg/dl for men and <50 mg/dl for women, or specific treatment for these lipid abnormalities, 3) Raised SBP ≥130 or DBP ≥85 mmHg, or treatment of previously diagnosed hypertension, and 4) Raised fasting plasma glucose (FPG) ≥100 mg/dl, or previously diagnosed type 2 diabetes.

We divided the subjects with MES into three groups: subjects identified as MES by IDF but not ATPIII, by ATPIII but not IDF, and by both IDF and ATPIII as Group 1 (n = 15), Group 2 (n = 7) and Group 3 (n = 86), respectively.

Statistical Analysis

SPSS 13.0 was used for statistical analysis. Descriptive statistics are presented as means ± standard deviations (SD). The categorical variables are given as percentages. Relations among different groups were analyzed with the χ^2 test. Student's t-test and one-way ANOVA were used to compare means and test for significant differences in anthropometric and metabolic indices between the groups. Kappa statistics was used to test the degree of agreement between the two definitions. A p value <0.05 was considered statistically significant.

Results

The mean age of the 244 subjects in the study was 46.9 ± 14.9 years. Of those, 145 were women (59.4%) and 99 were men (40.6%). Of the total, 70.5% were overweight or obese. The characteristics of the subjects are summarized in Table 1. Women had higher BMI and HDL-C and lower triglyceride levels than men. Other characteristics were not significantly different between the two groups.

The crude prevalence of MES according to the ATPIII and IDF criteria was 38.1% and 41.4% for total; 41.4% and 46.2% in women, and 33.3% and 34.3% in men, respectively. The prevalence of MES was higher in women than in men using both definitions; however, this difference was not statistically significant (P = 0.204 for ATPIII and p = 0.065 for IDF).

The prevalence of MES using both the ATPIII and IDF criteria increased significantly with age 50 in both genders - in women from 30.3% to 58.9% and 34.8% to 64.3%, respectively; and in men from 17.6% to 50.0% and 19.6% to 50.0%, respectively (P < 0.001 for all). The prevalence of MES increased with ageing and this finding is shown in Figure.

The prevalence rates of the individual components and number of items of MES according to the two different criteria are listed in Table 2. Low HDL-C and abdominal obesity was the most common abnormality in men (78.8%) and in women (82.1%), respectively, by the IDF definition. According to ATPIII, low HDL-C was the most common abnormality for both men (78.8%) and women (79.3%). Abdominal obesity was markedly higher in women than men using both definitions (P < 0.001). Only 9.8% and 6.3% of the population had none of the components according to ATPIII and IDF, respectively, and of the total, 52.1% and 61.2% had one or two components of the syndrome by ATPIII and IDF, respectively.

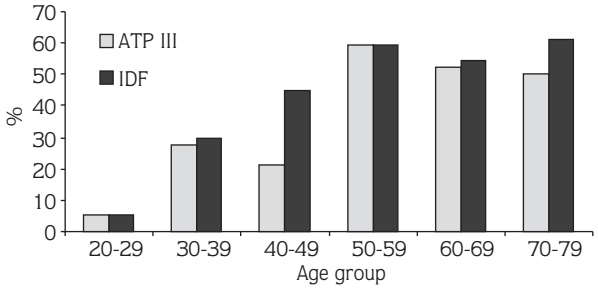

Figure. Prevalence of metabolic syndrome with ATP III and IDF definitions according to age groups.

The number of subjects identified by only ATPIII, only IDF or both criteria were 93, 101 and 86, respectively. The agreement rate, which is the percentage of participants who were classified as either having or not having the MES by both definitions, was 91.1% ± 0.04% (Kappa = 0.812, P < 0.001). Regarding gender, the agreement rate between the IDF and ATPIII definitions was 84.8% ± 0.08% in men (Kappa = 0.662, P <

Table 1. Characteristics of the subjects by gender.

	Women (n = 145)	Men (n = 99)	Total (n = 244)
Age (years)	46.6 ± 14.6	47.6 ± 15.4	46.9 ± 14.9
WC (cm)	93.9 ± 15.4	92.1 ± 11.9	93.1 ± 14.1
BMI (kg/m^2)	29.4 ± 5.7*	26.5 ± 4.6	28.2 ± 5.5
SBP (mmHg)	124.6 ± 23.2	126.0 ± 24.7	125.2 ± 23.8
DBP (mmHg)	80.3 ± 13.7	82.1 ± 15.6	81.0 ± 14.5
FBG (mg/dl)	95.1 ± 29.8	97.7 ± 26.6	96.2 ± 28.5
Triglyceride (mg/dl)	118.9 ± 66.3	142.2 ± 81.7**	128.4 ± 73.7
HDL-C (mg/dl)	40.9 ± 11.5*	33.4 ± 9.7	37.9 ± 11.4

Results are expressed as means ± SD. WC: Waist circumference. BMI: Body mass index. SBP: Systolic blood pressure. DBP: Diastolic blood pressure. FBG: Fasting blood glucose. HDL-C: High-density lipoprotein cholesterol.
*Comparison by gender, P < 0.001; ** Comparison by gender, P < 0.05.

Table 2. Prevalence of the metabolic syndrome components according to two definitions of the metabolic syndrome, by gender.

Factor	Women (n = 145)	Men (n = 99)	Total (n = 244)
ATP III criteria			
Central obesity	66.9% (97)*	26.3% (26)	50.4% (123)
Hypertriglyceridemia	26.2% (38)	35.4% (35)	29.9% (73)
Low HDL-cholesterol	79.3% (115)	78.8% (78)	79.1% (193)
Hypertension	43.4% (63)	44.4% (44)	43.9% (107)
Hyperglycemia	10.3% (15)	12.1% (12)	11.1% (27)
Metabolic syndrome	41.4% (60)	33.3% (33)	38.1% (93)
ATP III items			
None	8.3% (12)	12.1% (12)	9.8% (24)
One	21.4% (31)	26.3% (26)	23.4% (57)
Two	29.0% (42)	28.3% (28)	28.7% (70)
Three or more	41.4% (60)	33.3% (33)	38.1% (93)
IDF criteria			
Central obesity	82.1% (119)*	41.4% (41)	65.6% (160)
Hypertriglyceridemia	26.2% (38)	35.4% (35)	29.9% (73)
Low HDL-cholesterol	79.3% (115)	78.8% (78)	79.1% (193)
Hypertension	43.4% (63)	44.4% (44)	43.9% (107)
Hyperglycemia	22.1% (32)	25.3% (25)	23.4% (57)
Metabolic syndrome	46.2% (67)	34.3% (34)	41.4% (101)
IDF items **			
None	7.6% (9)	2.4% (1)	6.3% (10)
One	36.1% (43)	14.6% (6)	30.6% (49)
Two	27.7% (33)	39.0% (16)	30.6% (49)
Three or more	28.5% (34)	43.9% (18)	32.5% (52)

*Comparison by gender $P < 0.001$; ** Out of central obesity.

0.001) and 95.2% ± 0.03% in women (Kappa = 0.902, $P < 0.001$), as shown in Table 3.

Clinical parameters of the three groups are compared in Table 4. The seven subjects in Group 2 were all men (as seen in Table 3) and they fulfilled at least three of the other criteria. These men in Group 2 had lower BMI and WC than subjects in Group 3.

Discussion

This was the first study in our population to compare the prevalence of MES according to ATPIII and IDF and determine the concordance of these definitions. Of the total, more than one-third had MES and these two definitions showed good agreement for diagnosis, except that some leaner men with metabolic abnormalities were undetected using IDF.

In this study, although the prevalence of MES was higher in women than in men using both definitions, a significant difference was not observed. This finding is consistent with the results of a study from Vietnam (12) but not concordant with the literature, which generally reveals significantly higher MES rates in women (13-16). This might be related to central obesity, lower HDL-C and higher triglyceride levels in men in our group than the others (17).

Table 3. Agreement between ATP III and IDF definitions in diagnosing metabolic syndrome.

All (n = 244)		ATP III definition			Kappa
		Metabolic syndrome			
IDF definition	Metabolic syndrome	Present	Absent	Total	
	Present	86	15	101	0.812
	Absent	7	136	143	
	Total	93	151	244	
Women (n = 145)		ATP III definition			Kappa
		Metabolic syndrome			
IDF definition	Metabolic syndrome	Present	Absent	Total	
	Present	60	7	67	0.902
	Absent	0	78	78	
	Total	60	85	145	
Men (n = 99)		ATP III definition			Kappa
		Metabolic syndrome			
IDF definition	Metabolic syndrome	Present	Absent	Total	
	Present	26	8	34	0.662
	Absent	7	58	65	
	Total	33	66	99	

In our study, the prevalence rate of the MES according to the IDF criteria was higher than the rate using the ATPIII, and this could be attributed to the more stringent cut-off points for waist circumference, which is the first most common abnormality in our population. Some other studies also reported higher MES prevalence rates with IDF than ATPIII (14,15).

We found the prevalence of MES diagnosed using both definitions increased significantly with age 50 in both genders. Many other studies have also reported that MES prevalence increases with age (12,13,16,18-22).

According to the IDF, the most common abnormalities were abdominal obesity and low HDL-C in women and men, respectively, and this finding is parallel with results of other studies (23,24). Low HDL-C was the most common abnormality in both genders by ATPIII and this was also shown in other Turkish studies (24,25), which may be explained by the low mean level of HDL-C in Turks (17).

As our results reveal that less than 10% of the population had none of the components and more than half are at great risk for developing MES, with the presence of at least one or two criteria, it is important to increase awareness and take preventive steps on this issue.

These two definitions had a good agreement in identifying subjects with MES in our population. Our results present higher agreement rates than the other studies (15,26). The agreement between the definitions was poorer in men than in women and this might be related to the fact that lean men went undetected by IDF.

This study showed that subjects with MES defined only by ATPIII and not IDF had lower BMI and WC compared to subjects defined with both ATPIII and IDF. This could be interpreted as indicating that the IDF definition may not be sufficient to identify some leaner subjects, especially men, with other metabolic abnormalities. Some recent studies also pointed out this finding (15,26-29).

Table 4. Clinical parameters of the subjects having IDF- and/or ATPIII-defined metabolic syndrome.

	Group 1 (n = 15) IDF+/ATPIII-	Group 2 (n = 7) IDF-/ATPIII+	Group 3 (n = 86) IDF+/ATPIII+
Age (years)	57.1 ± 11.9	60.7 ± 6.9	52.8 ± 12.3
WC (cm)	98.5 ± 11.4	87.4 ± 4.0*	104.1 ± 10.4
BMI (kg/m^2)	29.7 ± 3.9	24.8 ± 3.8*	32.0 ± 4.6
SBP (mmHg)	132.5 ± 17.8	145.0 ± 23.1	139.3 ± 24.7
DBP (mmHg)	83.2 ± 12.5	90.7 ± 13.4	88.6 ± 17.5
FBG (mg/dl)	97.2 ± 12.5	127.0 ± 60.7	106.9 ± 37.1
Triglyceride (mg/dl)	127.5 ± 75.4	221.0 ± 105.8	169.5 ± 84.1
HDL-C (mg/dl)	35.7 ± 9.1	30.9 ± 5.7	33.5 ± 8.8

* Comparison of Group 2 and Group 3, $P < 0.001$.

In summary, MES is common among our population according to both definitions, and the agreement between ATPIII and IDF definitions was very good, especially in women. IDF definition may miss some non-obese men with other metabolic abnormalities. Knowledge of the high prevalence of MES in our population makes it critical to plan prevention and health care interventions.

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