

The prevalence of metabolic syndrome among young adults in İzmir, Turkey

İzmir ilinde genç erişkinlerde metabolik sendrom prevalansı

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ABSTRACT

Objective: The aim of this study was to determine the prevalence of metabolic syndrome and its components among the young adult ages in İzmir, Turkey.

Methods: A population-based cross-sectional study was held including 885 subjects aged between 20 to 39 years from 45 primary health care centres in Konak, which is the biggest urban area in İzmir. A stratified sampling method was used to select the participants of 318 males and 567 females. In the study, metabolic syndrome was classified according to NCEP ATP III criterion on the basis of metabolic risk factors evaluated between December 2001 and April 2002.

Results: The crude prevalence of metabolic syndrome (having three or more of the metabolic risk factors) was 3.6% among 20 and 29 years old men and 19.6% among 30 and 39 years old men and the increase by age was significant ($p<0.001$). The results were similar in women and the crude prevalence of metabolic syndrome increased significantly from 7.5 % in 20 and 29 years old women to 24 % in 30 and 39 years old women ($p<0.001$). With regard to the highest prevalences of the first three metabolic risk factors, hypertriglyceridemia, low HDL-cholesterol and high blood pressure, the age-adjusted prevalence of the metabolic syndrome was significantly higher in women than in men and all subjects (15% vs 10.2% vs 13.6%, $p<0.01$) respectively.

Conclusion: This study revealed that the prevalence of metabolic syndrome was extremely high between young adults in urban areas and the most prevalent components of the metabolic syndrome were found to be high triglycerides, low HDL cholesterol, high blood pressure, abdominal obesity and high fasting glucose, respectively. (*Anadolu Kardiyol Derg 2005; 5: 196-201*)

Key words: Prevalence, metabolic syndrome, metabolic risk factors, Turkey

ÖZET

Amaç: Çalışmamızda İzmir ili kentsel alanda genç erişkinler arasındaki metabolik sendrom prevalansını ve metabolik sendromun unsurlarını değerlendirdik.

Yöntemler: Toplum bazlı, kesitsel çalışmaya İzmir'in en büyük ilçesi Konak'ta bulunan 45 sağlık ocağından 20-39 yaşları arasındaki 885 genç erişkin alındı: 318 erkek ve 567 kadından oluşan katılımcılar Aralık 2001 ve Nisan 2002 tarihleri arasında tabakalı örneklem yöntemi ile seçildi. Metabolik sendrom NCEP ATP III kriterlerine göre metabolik risk faktörleri temel alınarak değerlendirildi.

Bulgular: Üç veya daha fazla metabolik risk faktörünün varlığında metabolik sendrom prevalansı 20-29 yaş grubu erkeklerde %3.6, 30-39 yaş grubu erkeklerde %19.6 bulundu ve yaşlanma ile görülen artış anlamlıydı ($p<0.001$). Bulgular kadınlarda da benzerdi ve prevalans 20-29 yaş grubunda %7.6, 30-39 yaş grubunda %24 bulundu ($p<0.001$). Çalışmamızda metabolik risk faktörlerinden en yüksek prevalansa sahip bulunan hipertrigliseridemi, düşük yüksek-dansiteli lipoprotein kolesterol ve yüksek kan basıncı varlığında yaşa göre düzeltilmiş metabolik sendrom prevalansı kadınlarda erkeklere ve tüm katılımcılara göre anlamlı biçimde yüksek saptandı (sırasıyla %15, %10.2 ve %13.6, $p<0.01$).

Sonuç: Bu çalışma kentsel alandaki genç erişkinler arasında metabolik sendrom prevalansının oldukça yüksek olduğunu gösterdi ve metabolik unsurların sıklığı sırasıyla, yüksek serum trigliseridleri, düşük HDL kolesterolü, yüksek kan basıncı, abdominal obezite ve yüksek açlık kan glükozu olarak saptandı. (*Anadolu Kardiyol Derg 2005; 5: 196-201*)

Anahtar kelimeler: Prevalans, metabolik sendrom, metabolik risk faktörleri, Türkiye

Introduction

The metabolic syndrome is a condition characterized by a clustering of lifestyle behaviors, major risk factors and emerging risk factors. As defined by the guidelines, the metabolic syndrome includes insulin resistance and/or impaired glucose toleran-

ce (or elevated fasting plasma glucose), abdominal obesity, elevated triglycerides, low high-density lipoprotein (HDL) cholesterol and high blood pressure (1).

There is some evidence that the syndrome could originate in a generalized imbalance in the metabolism of carbohydrate and lipids. Contributing factors include obesity (especially abdomi-

nal obesity), diet (high intake of saturated fatty acids, excess calories), physical inactivity, aging and genetic factors. The combination of low HDL cholesterol, and elevated small, dense low-density lipoprotein (LDL) cholesterol and triglycerides is called "atherogenic dyslipidemia" and is typical of the syndrome (2).

The metabolic syndrome is quite common in the United States, European and Asian populations. Using the data in the Turkish Heart Study 2000 (TEKHARF), Onat et al. (3) analysed the prevalence of metabolic syndrome among subjects aged 30 years and over with respect to NCEP guidelines. The results were: a- the prevalence of metabolic syndrome among subjects aged 30 years and over was 28% in men and 45% in women, b- low serum HDL cholesterol concentration and high blood pressure was present in approximately 90% of all the subjects, c- overweight or obesity was present in approximately 90% of women and much lower in men with a prevalence of 36%, d- hypertriglyceridemia was present in 56% of women and 81% of men, e- Impaired glucose tolerance (IGT) or type 2 diabetes was present in one fifth of all patients in the study (3). Evidence suggests that the metabolic syndrome significantly increases the risk of coronary heart disease (CHD) and subjects with the metabolic syndrome have two times the risk of CHD than those without the syndrome (3).

İzmir is the third biggest city on the Aegean region of Turkey and in spite of the large scale of immigration from the east, the Mediterranean diet and lifestyle is still dominating in this part of Turkey (4). The aim of the present study was to establish the prevalence of metabolic syndrome and its related components among young adults in the biggest urban area of İzmir.

Methods

Study population: The study was held in Konak, the 3rd biggest urban district in Turkey (4). The total population of Konak was 867,825. The population of individuals aged between 20 and 39 years were 302,546 with a men-to-women ratio of 49 / 51 (4).

In order to determine the sample size, Epi-info package program was used by 2% of error and 7% of expected prevalence with 99 % CI that resulted in 1076 people

Study centers: Forty five primary health care centres in Konak were scored according to the socioeconomic status of the area. Social security, education level, crude birth rate, household size of each family registered to that health care centre, and crude patient ratio for each doctor were used for socioeconomic scoring. Five strata based on these socioeconomic scores were determined as very poor, poor, fair, good and very good. Weighted samples aged 20 through 39 years old and male to female ratio for each strata were calculated according to the household registration cards in the health centres, and one health centre was selected for each stratum to take place in the study. The distribution of the study population to each strata was; 102 (9.5 %) for very poor, 268 (24.9 %) for poor, 374 (34.8 %) for fair, 210 (19.5 %) for good and 122 (11.3 %) for very good. Every person in the sample population was invited to the health centre by house visits two days before the survey and participation was confirmed by telephone the next day by the survey team. Among these 1076 people (509 men and 567 women), 885 subjects (318 men and 567 women) were included into the study. The response rate was 82.3%; 62.5% for men and 100.0% for women. Missing or incorrect data in the main variables or

who would not be able to attend the study for any reason were excluded.

Measurements: After completion of a questionnaire that was consisted of sociodemographic variables including age, gender, education, marital status, number of children, occupation, economic status, social security, personal and lifestyle factors including smoking habit, alcohol consumption, leisure time physical activity, current drug therapy and personal and family history of CHD, each subject was examined. The questionnaire was defined by Dokuz Eylül University, faculty of medicine, department of Community Health. Height, body weight (without shoes and light indoor clothes) and blood pressure were measured and a rest electrocardiogram was obtained. Myocardial infarction, angina pectoris, stroke and peripheral vascular disease for claudication were defined by doctor's diagnosis of these conditions.. None of the subjects had stroke or peripheral vascular disease.

Metabolic syndrome was defined according to the third report of the National Cholesterol Education Program (NCEP) expert panel on detection, evaluation and treatment of high blood cholesterol in adults (ATP III) (1). Body mass index (BMI) was calculated as weight in kg divided by height in m² and obesity (30 kg/m² or over) was categorized according to WHO recommendations (6). As the presence of abdominal obesity is emphasized more highly correlated with the metabolic risk factors than is an elevated body mass index, waist circumference (>102 cm in men and > 88 cm in women) was measured and used a priori for metabolic syndrome as with BMI (1). Blood pressure was measured in accordance with the 1999 report of WHO guidelines (5), based on the average of two or more readings separated by two minutes or hypertension was defined as being on antihypertensive treatment. Subjects with systolic and diastolic blood pressures of 130 mmHg and 85 mmHg or more were classified as having high blood pressure due to NCEP-ATP III (1). Type 2 diabetes, impaired fasting glucose (IFG) and impaired glucose tolerance (IGT) were defined using the American Diabetes Association (ADA) and WHO criterion (7, 8). In this study fasting plasma glucose level \geq 126 mg/dl (fasting is defined as no caloric intake for at least 8 h) was referred as type 2 diabetes. The IFG was defined if subjects had no history of diagnosed type 2 diabetes, and if the fasting plasma glucose level was between 110 mg/dl and 126 mg/dl. Subjects with type 1 diabetes were beyond the scope of this study. Serum HDL cholesterol level <40 mg/dl in men and <50 mg/dl in women, and, serum triglycerides \geq 150 mg/dl both in men and women were defined as metabolic risk factors (1).

Duration of education was used as a proxy for socioeconomic situation. Low education was defined as \leq 8 years, middle as 9-11 years, and high education as \geq 12 years of school training. Two hundred and forty three subjects (27.5 %) were educated over 8 years and 642 (72.5 %) were educated at least or less than 8 years.

Subjects were classified as current smokers, past smokers and nonsmokers. Out of 885 subjects 355 (40.0%) were current smokers. Alcohol consumption was classified on the basis of weekly intake, and the type of alcoholic beverage. One hundred and eleven subjects (12.5%) were alcohol consumers with an equal to or more than 14 hard drinks, especially of raki, a week. Physical activity was recorded as minutes spent per week and categorised as; none, occasional and if occasional than light or active. Seven hundred and ninety five subjects (89.8 %) did not define any physical activity.

Laboratory Measurements: All variables including fasting plasma glucose, triglycerides and HDL cholesterol were measured using standardized protocols by the Department of Biochemistry at Atatürk Research Hospital. Blood samples were collected into sample tubes containing EDTA after an overnight fasting. Serum was separated, frozen and stored at below minus 70° Celsius and studied all at once.

Statistical Analysis: Data were analysed using SPSS version 10.0 for Windows. Prevalence rates of metabolic syndrome by means of its determinants were calculated using the point prevalence rate formula: Number of patients per number of all subjects at the time of the study x 100. Results were expressed as percentages. Student's t test was used in the comparison of means (SD) and a Chi-square test was used in the comparison of proportions. Whenever the difference between two of the three subgroups was tested, Bonferroni correction was applied. Because of skewed distributions, serum triglyceride and uric acid levels were log-transformed in analyses and retransformed for tabulations. Age adjustment was accomplished with direct standardization on the basis of the world standard population. Pearson's correlation analysis was used to evaluate the relationship between age and the metabolic risk factors.

Results

Age-and-sex specific prevalence of metabolic risk factors of the metabolic syndrome: The study population was comprised of 885 subjects with 567 women and 318 men. The mean age was 32 ± 6 years (Table 1). Irrespective of age; abdominal obesity was more prevalent in women than in corresponding men (6.4 % vs 1.2 %, p=0.045 for age 20 through 29 years and 18.6 % vs 10.0%, p=0.025 for age 30 through 39 years), low serum HDL cholesterol concentration was more prevalent in men than in corresponding women (26.2 % vs 9.2 %, p=0.002 for age 20 through 29 years and 35.1 % vs 13.7%, p<0.001 for age 30 through 39 years), respectively. Hypertriglyceridemia and high blood pressure were more prevalent in 30 through 39 years old men than in corresponding women (46.6% vs 26.8 %, p< 0.001 and 28.6% vs 19.4 %, p=0.009), respectively. There were no significant differences in the proportions with high fasting glucose in men and women (p=0.182 for age 20 through 29 years and p=0.324 for age 30 through 39 years) and in the proportions with hypertriglyceridemia and high blood pressure in 20 through 29 years old men and women (p=0.124 and p=0.399), respectively (Table 2).

In the comparison of crude prevalences of metabolic risk factors among men and among women of different age groups, abdominal obesity, hypertriglyceridemia, high blood pressure and

Table 1. Clinical characteristics of the study population

Variables	All Subjects (n=885)	Men (n=318)	Women (n=567)	t	p
Age, years	32.2 ± 5.8	33.4 ± 5.6	31.5 ± 5.8	4.71	0.001
Waist girth, cm	85.0 ± 12.1	89.0 ± 10.8	82.0 ± 12.4	4.74	0.001
BMI, kg/m ²	25.10 ± 4.33	25.19 ± 3.48	25.05 ± 4.74	0.47	0.638
HDL cholesterol,mg/dl	48.46 ± 9.96	44.24 ± 8.40	50.83 ± 9.98	9.94	0.001
Triglycerides, mg/dl *	139.39 ± 102.83	166.0 ± 115.57	124.51 ± 91.77	5.86	0.001
Fasting plasma glucose, mg/dl	102.49 ± 16.8	103.78 ± 22.88	101.76 ± 11.7	1.76	0.077
SBP,mmHg	108.19 ± 15.0	111.75 ± 14.5	106.2 ± 14.9	5.35	0.001
DBP,mmHg	75.75 ± 10.16	77.88 ± 10.70	74.56 ± 10.02	4.71	0.001
Uric acid, mg/dl *	5.28 ± 2.56	6.53 ± 3.73	4.59 ± 1.06	11.57	0.001

Data are mean ± SD or n (%). A t test and χ^2 test was used in the comparison of means and proportions.* Triglycerides and uric acid were log-transformed before analysis. Whenever the difference between two of the three subgroups was tested, Bonferroni correction was applied. A p value < 0.05 was considered to be significant.
BMI – body mass index, DBP- diastolic blood pressure, HDL – high-density lipoprotein cholesterol, SBP- systolic blood pressure,

Table 2 . Age specific prevalences of metabolic risk factors of the metabolic syndrome among men and women

Characteristics	Age groups			
	0 - 29 years old (n=285)		30 -39 years old (n=600)	
	84/201	χ^2, p	234/366	χ^2, p
Abdominal Obesity, n(%)	Male: 1 (1.2) Female : 13(6.4)	4,39 0.045	Male : 23(10.0) Female : 68(18.6)	5.40 0.025
Hypertriglyceridemia, n (%)	Male : 17(20.2) Female : 98(26.8)	2.46 0.124	Male : 109(46.6) Female : 27(13.4)	27.3 <0.001
Low HDL-C, n (%)	Male : 22(26.2) Female : 18(9.2)	9.92 0.002	Male : 82(35.1) Female : 50(13.7)	16.25 <0.001
High Blood Pressure, n (%)	Male : 9(11.0) Female : 16(8.1)	0.83 0.399	Male : 67(28.6) Female : 71(19.4)	7.24 0.009
High Fasting Glucose, n(%)	Male : 5(6.1) Female : 8(3.8)	2.07 0.182	Male : 46(19.7) Female : 55(15.0)	1.04 0.324

Data are presented as n (%). A χ^2 test was used in the comparison of proportions. The first column is the comparison of males with females aged 20 through 29 years. The second column is the comparison of males with females aged 30 through 39 years. The comparison of males with males and females with females of different age groups were defined in the results section of the study.
HDL – high-density lipoprotein cholesterol

high fasting glucose were significantly more common in 30 and 39 years old men and women than in 20 and 29 years old men and women, (for abdominal obesity; χ^2 : 49.3, $p < 0.001$ among men and χ^2 : 38.7, $p < 0.001$ among women, for hypertriglyceridemia; χ^2 : 17.5, $p < 0.001$ among men and χ^2 : 12.1, $p < 0.001$ among women, for high blood pressure; χ^2 : 24.14, $p < 0.001$ among men and χ^2 : 21.56, $p < 0.001$ among women, and, for high fasting glucose; χ^2 : 5.65, $p = 0.017$ among men and χ^2 : 6.13, $p = 0.013$ among women) (Fig. 1 and 2). There were no significant differences in low HDL cholesterol concentrations between age groups in men and women.

The crude prevalence of metabolic syndrome (having three or more of the metabolic risk factors) was 3.6 % among 20 and 29 years old men and 19.6 % among 30 and 39 years old men ($p < 0.001$). The results were similar in women and the crude prevalence of metabolic syndrome increased significantly from 7.5 % in 20 and 29 years old women to 24 % among 30 and 39 years old women ($p < 0.001$), (Fig. 1 and 2).

In the whole sample age was moderately associated with abdominal obesity ($r = 0.42$), and poorly associated with fasting glucose $r = 0.21$, triglycerides $r = 0.27$, systolic blood pressure $r = 0.27$ and diastolic blood pressure $r = 0.25$. Age and HDL cholesterol levels were not correlated ($r = -0.08$).

The prevalence of metabolic risk factors and the metabolic syndrome after adjustment for age: Age adjusted prevalence of metabolic risk factors and the metabolic syndrome by sex is presented in Figure 3.

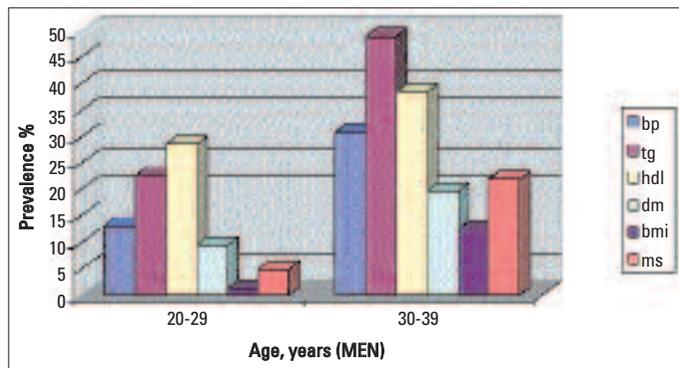


Figure 1. Age- and- sex specific (crude) prevalences of metabolic risk factors of the metabolic syndrome among 318 men of age 20 to 29 years and 30 to 39 years

BMI – body mass index, BP-blood pressure, DM –diabetes mellitus, HDL – high-density lipoprotein cholesterol, MS – metabolic syndrome, TG – triglycerides.

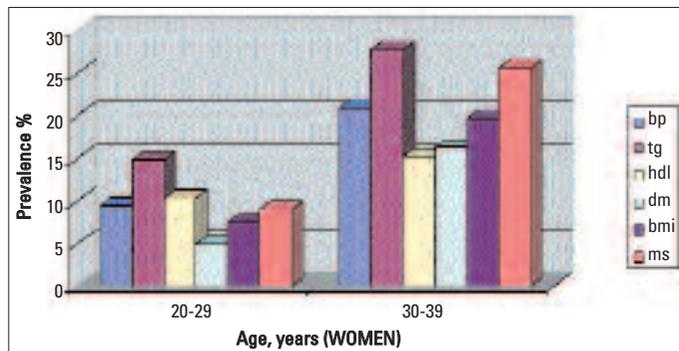


Figure 2. Age- and- sex specific (crude) prevalences of metabolic risk factors of the metabolic syndrome among 567 women of age 20 to 29 years and 30 to 39 years

BMI – body mass index, BP-blood pressure, DM –diabetes mellitus, HDL – high-density lipoprotein cholesterol, MS – metabolic syndrome, TG – triglycerides

The age-adjusted prevalences of hypertriglyceridemia, low HDL-cholesterol concentrations, high blood pressure and high fasting glucose were significantly higher in men than in women, (33% vs 19.1%, $p < 0.001$, 30% vs 12%, $p < 0.001$, 19.5% vs 13%, $p < 0.01$ and 12% vs 7.8%, $p < 0.01$) respectively. However, the age-adjusted prevalence of abdominal obesity was significantly lower in men than in women (4.3% vs 11%, $p < 0.001$). With regard to the highest prevalences of the first three metabolic risk factors, hypertriglyceridemia, low HDL-cholesterol concentrations and high blood pressure, the age-adjusted prevalence of the metabolic syndrome was significantly higher in women than in men and all subjects (15% vs 10.2% vs 13.6%, $p < 0.01$), respectively.

Age adjusted prevalence of metabolic risk factors in the whole sample is presented in Figure 4. All of the metabolic risk factors were significantly higher in the elder group ($p < 0.001$), except HDL cholesterol level ($p = 0.781$).

Overall, the unadjusted and age-adjusted prevalences of the metabolic syndrome were 11.3% and 13.6%, respectively. The age-adjusted prevalence rates decreased when more than 3 components of the metabolic syndrome were taken into account (Table 3).

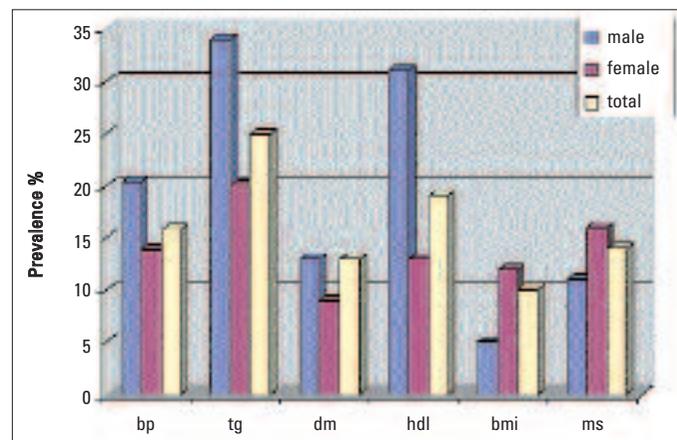


Figure 3. Age-adjusted prevalence of metabolic risk factors of the metabolic syndrome among 885 adults, aged between 20 and 39 years, by sex

BMI – body mass index, BP-blood pressure, DM –diabetes mellitus, HDL – high-density lipoprotein cholesterol, MS – metabolic syndrome, TG – triglycerides.

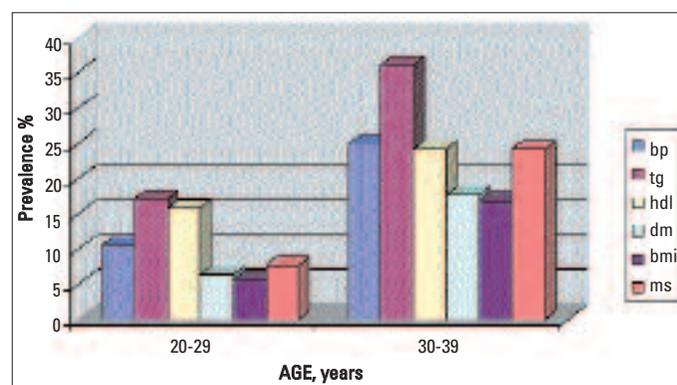


Figure 4. Age-adjusted prevalence of metabolic risk factors of the metabolic syndrome among study population according to age groups

BMI – body mass index, BP-blood pressure, DM –diabetes mellitus, HDL – high-density lipoprotein cholesterol, MS – metabolic syndrome, TG – triglycerides

Discussion

This study revealed that the prevalence of metabolic syndrome or of at least having one of its components were extremely high between young adults in urban areas. Although, high triglycerides, low HDL cholesterol, high blood pressure, abdominal obesity and high fasting glucose were in appropriate order of importance according to this study, abdominal obesity can be considered as principal part of the metabolic syndrome. A small increase in body weight can provoke a marked metabolic disturbance (9). An android type of fat distribution with abdominal adiposity is closely connected with insulin resistance and has been recognized as independent cardiovascular risk factor both in men and in women (10). In this study, although BMI did not differ between the two sexes, abdominal obesity based on waist circumference was more prevalent among women than among men in the age-adjusted and unadjusted groups, irrespective of age. The age-specific prevalence of abdominal obesity was higher both in men and women of 30 and 39 years old than in men and women of 20 and 29 years old. In the German VERA study (11), there was a dramatic increase in the prevalence of BMI from 15% in the young age group of 18 and 24 years to 50% in the age group of over 55 years. In the TURDEP study (12), obesity was significantly higher in women than in men and the lack of employment outside the home was contributed to the higher frequency of obesity and glucose intolerance among Turkish women.

Metabolic studies show that overweight is associated with insulin resistance and impaired glucose tolerance and connected with an unfavorable profile of serum lipids. The characteristic dyslipoproteinemia with elevated triglycerides and reduced HDL cholesterol levels is regarded as the cardinal finding of insulin resistance (13). In the study, the crude prevalence of hypertriglyceridemia between men and women did not differ in the age group of 20 and 29 years, however, it was higher in men than in women in the age group of 30 and 39 years and the crude prevalence of low HDL cholesterol concentration was higher in men than in women irrespective of age. The age-adjusted prevalence of hypertriglyceridemia and low HDL cholesterol concentration was higher in men than in women. According to the data used from the Turkish Heart Study 2000 (3), the prevalence of hypertriglyceridemia was 56% in women, and 81% in men and the prevalence of low HDL cholesterol concentration was 80% in women and about 90% in men of 30 years old and over.

In another epidemiological study based on shift work and associated metabolic risk factors of the metabolic syndrome, obesity, high triglycerides and hypertension were significantly more common in men and women working shifts, after adjustment was made for age. The low HDL cholesterol level among shift workers was common in the youngest groups of both sexes. In women working shifts the risk of having low HDL choles-

terol persisted even after adjustment for age and socioeconomic factors were made (14).

Recent prospective studies have clearly demonstrated that both elevated triglycerides and a low HDL cholesterol are potent predictors of type 2 diabetes later in life (15,16). The prevalence rates of hypertriglyceridemia and low serum HDL concentrations increased by age in our study, however the prevalence of high fasting glucose did not differ in men and women aged 20 through 29 years old and 30 through 39 years old, although after adjustment was made for age the prevalence of high fasting glucose increased among men with respect to their corresponding women. In the TURDEP study (12), data showed that the overall crude prevalence of diabetes was 7.2 % and IGT was 6.7 % and women were more prevalent to IGT and diabetes mellitus than men (8 % vs 6.2 %). Glucose intolerance increased with age, and the rate of increment was greater in the younger age group (20-40 years) than in the middle-aged or elderly population and was more prominent for diabetes than for IGT, in both sexes (12). In a study evaluating cardiovascular morbidity and mortality associated with the metabolic syndrome (BOTNIA study) (17), the prevalence of metabolic syndrome was present in approximately 10% of patients with normal glucose tolerance, 50% of patients with impaired fasting glucose or impaired glucose tolerance, and 80% of patients with type 2 diabetes mellitus.

There was no significant difference in the prevalence of high blood pressure between men and women aged 20 through 29 years old, however, the prevalence was significantly higher in men than in women aged 30 through 39 years old, and, the age-adjusted prevalence was also higher in men than in women. The data from the Turkish Heart Study 2000 (3) showed that both men and women of 30 years old and over had high prevalences of high blood pressure (85% and 80%), respectively. As in our study high blood pressure was defined if SBP was ≥ 130 mmHg or DBP was ≥ 85 mmHg in this study. In the TURDEP study (12) overall frequency of hypertension was 29% and high blood pressure was defined if SBP was ≥ 140 mmHg or DBP was ≥ 90 mmHg. The prevalence rates were higher in both of the studies than we found in our study.

In the third National Health and Nutrition Examination Survey (NHANES) (18), age-adjusted prevalence of individual metabolic abnormalities of the metabolic syndrome among 8814 US adults aged ≥ 20 years were evaluated. Age-adjusted prevalence of abdominal obesity was 29.8%, hypertriglyceridemia was 35.1%, low HDL cholesterol concentration was 35.2%, high blood pressure was 38.2% and high fasting glucose was 15.6% among men and 46.3%, 24.7%, 39.3%, 29.3% and 10.0%, respectively, among women. The results showed that the age-adjusted prevalences of abdominal obesity, low HDL cholesterol and high blood pressure were significantly higher in the US adults than in our young adults in the urban area. Overall, the unadjusted and age-adjusted prevalences of the metabolic syndrome were 11.3% and 13.6%, respectively, in our study, and in the NHANES,

Table 3. Age-adjusted prevalences of the metabolic syndrome in men, women and all subjects with respect to the number of contributing metabolic risk factors

Number of metabolic risk factors	Men (%)	Women (%)	Total (%)
3	10.2	15.0	13.6
4	3.5	4.6	4.2
5	1.3	0.9	1.0

Data are presented as n(%). Description of the contributing 5 criteria of the metabolic syndrome is made in the results section.

the unadjusted and age-adjusted prevalences of the metabolic syndrome were 21.8% and 23.7% among adults of 20 years or older. If only 3 components of the syndrome were taken into account, the prevalence of metabolic syndrome found in TEKHARF study vs the prevalence of metabolic syndrome in our study by 28% in men and 45% in women of age 30 years and over, and, 10.2% in men and 15% in women of age 20 through 39 years, respectively. In the Women's Health Study, the proportion of women with 3 or more characteristics of the metabolic syndrome was 24.4% compared with 23.4% in NHANES(19). In the NHANES III (18) age-adjusted prevalence of metabolic syndrome in the US was 24% in men and 23.4% in women. Prevalence increased with age, from approximately 7% among subjects aged 20 to 29 years to approximately 44% in subjects aged 60 to 69 years in the NHANES III and from 5.2% in subjects aged 20 to 29 years to 22% in subjects aged 30 to 39 years in our study.

In the Kuopio Ischaemic Heart Disease Risk Factor study (20), Finnish men initially free of cardiovascular disease or diabetes, but those with the metabolic syndrome had the risk of coronary heart disease mortality 2.4 to 3.4 times higher than men without the syndrome over an 11-year follow-up period. In the cohort of Turkish Adult Risk Factor Study, one out of 30 adults designated to have the full metabolic syndrome were found with excess coronary risk when compared with the remainders, regardless of gender (21).

Conclusion: This study revealed that the prevalence of metabolic syndrome was extremely high between young adults in urban areas and the most prevalent components of the metabolic syndrome were found to be high triglycerides, low HDL cholesterol, high blood pressure, abdominal obesity and high fasting glucose, respectively. Education and training are one of the cornerstones in the management of patients with the metabolic syndrome (17,21,22) and that dietary modification and enhanced physical activity provided treatment for patients with the metabolic syndrome (21,22).

Limitation: The study population was comprised of 567 females and 318 males. Although the study was carried on Saturday and Sundays, there was significantly higher proportion of women in the study group owing to the large number of day working men. Therefore, the statistical analyses were done separately among men and women not to fall into a statistical error in the study.

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