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Prevalence of Metabolic Syndrome Among Healthy Personnel at Cukurova University

Çukurova Üniversitesinde Çalışan Sağlıklı Personelde Metabolik Sendrom Sıklığı

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ABSTRACT

Objective: The aim of this study was to evaluate the frequency of Metabolic Syndrome (MetS) among healthy personal working for Cukurova University. Also, we aimed to evaluate the Framingham risk score and Cardiovascular Disease Risk Factors Knowledge Level (CARRF-KL) scale of participants and investigate the relationship with each other. **Methods:** Total of 155 healthy volunteers working for Cukurova University at academic and administrative staff was included. All participants' socio-demographic characteristics, anthropometric measurements were collected, and blood pressure and serum parameters were measured. MetS was diagnosed using the criteria of the International Diabetes Federation (IDF). All participants' Framingham risk score and CARRF-KL score were also determined. **Results:** The mean age of the subjects was 45.6±7.8 years. We identified 29 (18.7%) subjects with MetS according to IDF criteria. MetS group and control group had similar mean value of CARRIF-KL score (21.2 ±2.7 vs 20.7±3.9, p=0.50). On the other hand, MetS group had a higher Framingham score than the control group. Also, MetS group had mildly elevated Pulse Wave Velocity of Aorta (PWVAo) value than control group (8.4±1.36 vs 7.8±1.57, p=0.063). In linear regression analyses, gender, TG and HDL-C level, BMI and Framingham score were found associated parameters for the presence of MetS in all participants. **Conclusions:** Although there is an acceptable awareness in terms of cardiovascular disease knowledge, it was founded almost a fifth of the studied personnel has MetS. So, the components of MetS should be implied more effectively as well as its importance to the healthy persons in primary care.

Keywords: Metabolic syndrome, Framingham score, CARRIF-KL

ÖZET

Amaç: Bu çalışmanın amacı Çukurova Üniversitesi'nde çalışan sağlıklı personelde MetS sıklığını araştırmaktı. Ayrıca katılımcıların KV risk faktörleri bilgi düzeyini (KARRIF-BD) ve Framingham risk skorunu hesaplayarak bu değişkenlerin birbiriyle olan ilişkilerini incelemeyi amaçladık. **Yöntem:** Çukurova Üniversitesi akademik ve idari kadroda çalışan toplam 155 sağlıklı gönüllü katılımcı çalışmaya dahil edilmiştir. Tüm katılımcıların sosyo-demografik özellikleri, antropometrik ölçümleri, kan basıncı değerleri ve serum parametreleri kaydedildi. Katılımcılarda MetS tanısı için IDF (International Diabetes Foundation) kriterleri kullanıldı. Ayrıca tüm katılımcıların Framingham risk skoru ve KARRIF-BD skoru hesaplandı. **Bulgular:** Tüm katılımcıların ortalama yaşı 45,6 ± 7,8 yıl idi. IDF kriterlerine toplam 29 hastada (% 18,7) MetS tanısı konuldu. MetS grubu ve kontrol grubu KARRIF-KL skoru ortalaması birbirine benzer bulundu (21,2 ± 2,7 ve 20,7 ± 3,9, p = 0,50). Framingham skoru ortalaması ise MetS grubunda kontrol grubuna göre daha yüksekti. Ayrıca MetS grubunda kontrol grubuna göre aortik doku dopler hızı (PWVAo) hafif yüksek saptandı (8,4 ± 1,36 ve 7,8 ± 1,57, p = 0,063). Doğrusal regresyon analizinde cinsiyet, TG ve HDL-Kolesterol düzeyi, Vücut Kitle indeksi (VKI) ve Framingham skoru tüm katılımcılarda MetS varlığı ile ilişkili parametreler olarak saptandı. **Sonuçlar:** Mevcut çalışma sonuçlarına göre, çalışılan personelin yaklaşık beşte birinde MetS bulunmaktadır. Çalışmada kardiyovasküler hastalıklar bilgisi konusunda kabul edilebilir bir farkındalık bulunmasına rağmen, çalışılan personelin yaklaşık beşte birinde MetS saptanmıştır. Bu sebeple MetS önemi kadar bileşenleri de birinci basamakta sağlıklı kişiler için yeterince vurgulanmalıdır.

Anahtar kelimeler: Metabolik sendrom, Framingham skoru, CARRIF-KL

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INTRODUCTION

Metabolic syndrome (MetS) is an important health problem which is described as clustering of cardiovascular disease (CVD) risk factors such as hypertension, dyslipidemia (high triglycerides, low levels of high-density lipoprotein [HDL], and increased small dense low-density lipoprotein [LDL], obesity (central or abdominal obesity), insulin resistance, and impaired glucose tolerance or diabetes mellitus. [1] The syndrome was first described by the World Health Organization (WHO) [2], followed by the European Group for the Study of Insulin Resistance (EGIR) [3], National Cholesterol Education Program (NCEP) Adult Treatment Panel III [4], American College of Endocrinology (ACE) [5], and International Diabetes Federation (IDF).[6]

It is important to identify the individuals who are at high risk for CVD. Thus, MetS affects approximately 20-25% of the total population and is associated with a twofold increase in cardiovascular mortality, a threefold increase in myocardial infarction and stroke and accounts for 49% of all deaths in Europe. [7]

The morbidity and mortality related to CVD can be decreased by 80-90% by reducing risk factors. Multivariate statistical models have been developed to estimate the risk of CVD as the majority of cardiac events occur in a non-clinically ill patient population. For this purpose Framingham Heart Study was developed. [7] This multivariate model includes age, sex, blood pressure, cholesterol-T, HDL-C levels and risk factors such as smoking and diabetes. For a defined process, for example, the risk of coronary heart disease for 10 years can be determined when the individual risk factor profile is entered into the model.

The most important stage in the control of CVD is an increase of knowledge of the individuals' awareness of CVD. [8] The Cardiovascular Disease Risk Factors Knowledge Level (CARRF-KL), which can be used to asses the level of knowledge of the Turkish populations about CVD risk factors, is a reliable and validited for this purpose. [9]

In the current study, first, we want to investigate the frequency of MetS among Cukurova University personnel in healthy population without risk of the factor for CVD. Second, we want to evaluate their Framingham risk score and awareness for CVD using CARRF-KL score and finally we want to show how they transferred this awareness to their real lives.

METHODS

This prospective case-control study was performed in the Department of Family Medicine at Cukurova University between October 2016 and February 2017. Total of 1055 person working for Cukurova University at academic and administrative staff was scanned. Among these, 155 healthy volunteers (>30 years old) were enrolled in the current study.

The clinical and demographic characteristics of the patients were evaluated. Age and gender were recorded. All patients' weight and height were measured and body mass index (BMI) was calculated by the formula: weight (kg)/ height (m2). Waist circumference was measured between the center distance of the last rib and iliac crest as World Health Organization's proposed. Patients fasting blood glucose, cholesterol, triglycerides, LDL and HDL values were measured. According to the NCEP ATP-III criteria, we defined MetS in 29 participants. [4] A total of 29 participants with MetS served as MetS group and 126 participants without MetS criteria served as a control group.

Patients with coronary artery disease, peripheral artery disease, acute or chronic renal and liver disease, chronic autoimmune diseases, acute or chronic infective diseases, chronic obstructive lung disease, chemotherapy or radiotherapy, cancer disease, family hypercholesterolemia, diabetes mellitus, and hypertension were excluded from the study. The Ethics Committee of Cukurova University assessed and approved the study (Approval No:55, Date: 15/07/2016) and written informed consent for participation in the study was obtained from all individuals.

Cardiovascular Disease Risk Factors Knowledge Level (CARRF-KL) scale: All participants' knowledge was determined by CARRF-KL scale. While the first four items in this scale were related to the characteristics of the properties, preventability and age factor of CVD, 15 items were related to CVD risk factors (5, 6, 9-12, 14, 18-20, 23-25, 27, 28) and 9 items (7, 8, 13, 15, 16, 17, 21, 22, 26) were questioning the outcomes of the changing in risk behaviors. [9]

Framingham Risk Score: All volunteers' 10-year risk for the development of CVD was determined by Framingham risk score. [10,11] For this purpose, 9 clinical factors including gender, age, total cholesterol, HDL cholesterol, systolic blood pressure, smoking, hypertension with medication, diabetes mellitus, and any known vascular disease were determined and individual's risk for 10 years for developing of CVD was calculated. All calculations were performed online using by Q calculate program(https://www.mdcalc.com/framingham-risk-score-hard-coronary-heart-disease)

Pulse Wave Velocity Measurements: Finally, PWV was determined non-invasively using an arteriography device (Medexpert Arteriograph). After blood pressure was measured, arteriography cuff was inflated on at least 35 mmHg of patients systolic pressure and measurements were recorded for 8-20 seconds. These values were first amplified and evaluated with the pressure sensor, and all signals received by tonometry were transferred to the computer with TensioMedT Software and documented and reported as systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), Pulse wave velocity (PWV), aortic systolic blood pressure (SBPao), and heart rate (HR). [12]

Statistical Analyses: Continuous variables were expressed as mean ± SD or interquartile range (median and minimum–maximum) in the presence of abnormal distribution, and categorical variables as number and percentages. Comparisons between groups of patients were performed by use of a $\chi 2$ test for categorical variables, an independent-samples t test for normally distributed continuous variables, and a Mann-Whitney U test when the distribution was skewed. The Kruskal-Wallis test was used for general comparison between the two groups. Linear regression analyses were used to determine the MetS associated study parameters. SPSS statistical software (version 20.0, SPSS, USA) was used.

RESULTS

The study was completed with 155 participants who were selected in 1055 healthy population working in administrative and academic staff of Cukurova University. Total of 78 (50.3%) participants was male and 77 (49.7%) were female.

The baseline, sociodemographic and laboratory characteristics of all participants are summarized in Table 1. The mean age of all participants was 45.6±7.8-year-old. A total of 54.2% of participants had higher waist circumference (≥94 cm in male and ≥80 cm in female). Total of 13% of them had impaired fasting glucose (≥100 mg/dl), 15.5% had elevated systolic blood pressure (≥135mmHg), 29% had elevated diastolic blood pressure (≥85 mmHg), 23.1% had high triglyceride levels (≥150mg/dl) and 43.5% had low high-density lipoprotein cholesterol levels (≤40 mg/dl in male and ≤50 mg/dl in female). All participants had graduated from high school or university moreover majority of them (89, 57.4%) had graduated a master-doctorate level (Table 1).

Table 1. Baseline clinical characteristics of all population

Parameters	Values
Age, years, Mean ± SD	45.6±7.8
Male, %	50.3
Smoking, %	21.3
Body mass index, kg/m^2, Mean ± SD	25.9±3.3
Systolic BP, mmHg	120.8±12.6
Diastolic BP, mmHg	76.9±11.2
Heart rate, bpm	68.8±9.5
Fasting glucose, mg/dl	90.3±9.8
HDL-C, mg/dl	48.7±13.5
Triglyceride, mg/dl	115.7±71.7
Total-C, mg/dl	216. 3±45.5
LDL-C, mg/dl	143.4±41.5

BP, Blood Pressure; **HDL-C**, High Density Lipoprotein Cholesterol; **Total-C**, Total Cholesterol; **LDL-C**, Low Density Lipoprotein Cholesterol; **SD**, Standard deviation. *P<0.05 was significant.*

We identified 29 (18.7%) subjects with MetS according to International Diabetes Foundation (IDF) criteria and served as a MetS group. Participants without MetS served as control group (n=126). The baseline,

sociodemographic and laboratory characteristics of the groups are summarized in Table 2. The groups were similar according to mean age (47.6±6.0 vs 45.1±8.0, p=0.11). There were similar number of participants who graduated from high school or university (p=0.33). , groups were similar according to family history for chronic diseases (p=0.41). We evaluated serum Gama Glutamil Transferase (GGT), Vitamin D3 and C-reactive protein as novel cardiovascular risk factors. All of them were similar in both groups (p=0.30, p=0.89 and p=0.62, respectively). As we expected, serum HDL, fasting glucose, and TG level were higher in MetS group than the control group (p<0.001 for all).

Participants frequently answered questions 2, 6, 7, 8, 10, 13, 14, 15,18, 19, 20, 21 as "Yes" and the questions 1, 11, 12, 16, 24 and 26 as "No". When analyses the groups according to CARRIF-KL, Framingham and PWV, both of MetS group and control group had similar mean value of CARRIF-KL score (21.2 ±2.7 vs 20.7±3.9, p=0.50). MetS group had mildly elevated PWVAo value than control group (8.4±1.36 vs 7.8±1.57, p=0.063). On the other, MetS group had higher Framingham score than control group (10.3±5.8 vs 6.1±5.20, p<0.001) (Table 2).

Table 2. Baseline demographic, clinical and laboratory characteristics of the study groups

	MetS group (n=29)	Control group (n=126)	p value
Age, years, Mean ± SD	45.6±7.8	45.1±8.1	0.11
Male, n	18	60	0.21
Smoking, n	7	26	0.8
Family history of CAD, n	10	46	0.8
HT, n	8	46	0.58
DM, n	6	39	0.69
Menapose, n	4	20	0.53
Educational statue, n	15	74	0.33
Body mass index, kg/m^2	28.4±3.9	25.3±2.9	<0.001
Systolic BP, mmHg	127.7±12.5	119.2±12.1	<0.001
Diastolic BP, mmHg	84.0±11.5	75.3±10.6	<0.001
Heart rate, bpm	70.1±8.6	68.4±9.7	0.40
Fasting glucose, mg/dl	94.1±13.5	89.3±8.6	0.01
HDL-C, mg/dl	37.8±6.8	51.2±13.4	<0.001
Triglyceride, mg/dl	164.3±85.1	104.4±62.9	<0.001
Total-C, mg/dl	213.7±47.8	217.1±45.1	0.68
LDL-C, mg/dl	138.1±46.9	144.5±40.2	0.45
Vit D3, mg/dl	21.6±13.7	21.9±13.8	0.89
GGT, mg/dl	20.5±8.2	17.6±14.9	0.30
CARRIF-KL score	21.2±2.7	20.7±4.0	0.50
Framingham score	10.3±5.9	6.0±5.2	<0.001
PWVAo, m/s	8.4±1.3	7.8±1.5	0.065

MetS, Metabolic syndrome; **CAD,** Coronary Artery Disease; **HT,** Hypertension; **DM,** Diabetes Mellitus; **BP**, Blood Pressure; **HDL-C**, High Density Lipoprotein Cholesterol; **Total-C**, Total Cholesterol; **LDL-C**, Low Density Lipoprotein Cholesterol; **GGT**, Gama Glutamil Transpherase; **CARRIF-KL**, Cardiovascular Disease Risk Factors Knowledge Level; **PWVAo**, Pulse Wave Velocity of Aorta; **SD**, Standard deviation. *P<0.05 was significant.*

In linear regression analyses, gender, TG and HDL-C level, BMI and Framingham score were found associated parameters for presence of MetS in all participants (Table 3).

Table 3. The correlation analyses results of study parameters with the presence of MetS

	β	*t*	*p*
Age	0.02	0.18	0.57
Gender	0.29	2.90	*0.004*
Glucose	-0.01	-0.15	0.87
Triglyceride	-0.25	-2.90	*0.004*
HDL-C	0.20	1.98	*0.049*
LDL-C	0.14	1.78	0.077
BMI	-0.26	-3.44	*0.001*
Smoking	-0.06	-0.81	0.41
Educational statue	0.05	0.78	0.43
Marital statue	0.02	0.32	0.74
Family history	-0.10	-0.42	0.15
PWVAo	-0.06	-0.80	0.42
CARRIF-KL	0.05	0.73	0.46
Framingham	-0.34	-2.45	*0.015*

MetS, Metabolic syndrome; **HDL-C**, High Density Lipoprotein Cholesterol; **LDL-C**, Low Density Lipoprotein Cholesterol; **BMI,** Body Mass Index; **PWVAo**, Pulse Wave Velocity of Aorta; **CARRIF-KL**, Cardiovascular Disease Risk Factors Knowledge Level; **SD**, Standard deviation. *P<0.05 was significant.*

DISCUSSION

The current study is a unique report of MetS ever conducted, in which the prevalence of MetS and associated risk factors were analyzed for the first time in Cukurova University healthy personal.

Metabolic Syndrome has become an important health problem of the increasing 21st century. Three large-scale meta-analyzes have reported a two-fold increase in cardiovascular mortality, myocardial infarction and stroke risk in MS patients and a 1.5-fold increase in all-cause. According to TEKHARF study which was conducted in Turkey, there were over 9.2 million MetS persons aged over 30 years. [13] In METSAR study, the prevalence of MetS was reported as 35%. [14] Ozsahin et al. found that the prevalence of MetS in a Turkish adult population of 1,637 inhabitants was 33.4% (39.1 for women and 23.7% for men) in

Adana. [15] In the current study, the prevalence of MetS was found to be 18.7% by using the IDF criteria. The lower prevalence of MetS can be explained in our study by some possible reasons. First of all, our pilot study has limited number of participants. Also, IDF criteria were used to determine MetS presence in current reports which have lower waist circumference limits than NCEP ATPIII or WHO criteria. In addition, educational level of our study population was high when compared to a normal population. The lower frequency of Met in current study may also be due to MetS knowledge level of studied population. Also, our study population had lower mean age than previously reported studies. It is well known that MetS prevalence increases with age. On the other hand, Oğuz et al found that MetS prevalence was 7.9% among healthcare workers in 2008. [16] Similarly, Celepkolu et al. found that MetS prevalence was 19.5% among primary health care professionals in the Southeastern Anatolia. [17]Above mentioned studies support our lower frequency of Mets results. It was also previously demonstrated that the incidence of MetS is higher in women than men. In our study, we found no differences according to MetS prevalence in both genders.

In the current study, we investigated also the population's cardiovascular knowledge level using CARRIF-KL score which can be used to assess the level of knowledge of the Turkish populations about CVD risk factors, is reliable and validated for this purpose. Arıkan I. et al found mean CARRIF-KL score as 19.3±3.2 in their study [9]. We found the mean CARRIF-KL score of all populations was found 20.7±3.7. The participants with MetS and without MetS didn't differ according to mean CARRIF-KL score. As we have known all MetS components are also a major risk factor for CVD development. Thus, it would be expected that MetS group had lower CARRIF- KL score than control subjects. The result showed us that participants didn't reflect enough their CVD knowledge in their real life.
In our study, the atherosclerotic statue of participants was evaluated by PWV. According to our results, MetS group had mildly elevated PWV than the control group (p=0.063). PWV measurement is a technique of non-invasive imaging of subclinical atherosclerosis. It was previously demonstrated that PWV is an independent parameter that increases the risk of cardiovascular disease. [18] Thus, in a meta-analysis of 17,635 patients, PWV is an additional risk factor in determining the risk of CAD. Previously, it was demonstrated that the association of increased PWV with the risk of developing CVD and increased mortality in the general population. [19] In another meta-analysis of 17 studies involving a total of 15877 cases and showed that a 1m / sec increase in PWV or 1 standard deviation increase caused a 10% and 40% increase in CVD-related deaths, respectively. [20] We want to investigate PWV because PWV has been validated especially in middle-risk and young individuals such as our population. [21] Thus, PWV can provide more objective information to clinicians for this purpose.

In our study, we investigated the classical risk factors for atherosclerosis via questioned in the Framingham score. As previously demonstrated, Framingham score was well correlated with coronary calcium score and coronary plaque load evaluated by intravascular ultrasonography, so atherosclerosis. [22-24] We found that MetS group had higher Framingham score than the control group (p<0.001). In addition, the mean Framingham score was well correlated with the presence of MetS in current study (p=0.015). We want to evaluate the Framingham score due to mean age of our study population which only 30% of the study participants were 40 years of age or older. Thus, Framingham score can reveal the 10-year risk of CVD in patients younger than 40 years.

Finally, in our study, we evaluated GGT and Vitamin D3 levels are complementary risk factors for CAD. The mean values of both GGT and Vitamin D3 were determined in the normal range and found similar in both groups. The possible reason to explain these results; all three variables were affected by acute conditions and no participants had a history of acute or chronic disease.

CONCLUSION

Although there is an acceptable awareness in terms of cardiovascular diseases knowledge, the current study results showed us that the awareness for primary prevention against chronic diseases is not adequately transferred to daily practice. So, further efforts are needed to apply it into clinical practice in terms of effective primary care as well to increase the knowledge level for chronic disease among healthy individuals without known cardiovascular disease or risk factors.

Limitations: Small sample size is the major limitation of this study. Also, the studied population does not reflect the general population. In addition, although the logarithms of PWV, KARRIF-KL and Framingham score were obtained, none of them had a normal distribution. Therefore, the regression analysis was not performed.

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