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ARAŞTIRMA / RESEARCH

Evaluation of cardiovascular disease risk factors knowledge level, Framingham score, and cardiac markers in a healthy population

Sağlıklı bir popülasyonda kardiyovasküler hastalık risk faktörleri bilgi düzeyi, Framingham skoru ve kardiyak belirteçlerin değerlendirilmesi

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Abstract

Purpose: The iam of this study was to assess the cardiovascular knowledge level of an educated and healthy population and determine how much they transferred it to daily life. In the current study, we first determined Cardiovascular Disease (CVD) Risk Factors Knowledge Level and Framingham score and investigated their relationship between pulse wave velocity (PWV) and laboratory parameters of healthy personal working for Cukurova University.
Materials and Methods: The study was conducted via 192 participants who were selected from the study sample among healthy personnel working for Cukurova University. All participants' knowledge level was determined with the Cardiovascular Disease Risk Factors Knowledge Level (CARRF-KL) scale and the 10-year risk for development of CVD determined by the Framingham risk score. PWV was also determined non-invasively by using an arteriography device. Blood samples were collected from all participants.
Results: The mean age of all participants was 45.3 ± 8.0 years (53.6% woman). The mean CARRF-KL score of the participants was found as 20.4 ± 4.0 and the mean Framingham score was found 6.9±5.6. The average PWV was found 7.9±1.5m/sn. In correlation analyses, PWV was well correlated with both the mean CARRF-KL score and Framingham score. Participants who had the highest CARRF-KL score had also the highest Framingham score and PWV .
Conclusion: Despite the high level of education and knowledge, it is seen that this knowledge is not reflected in daily lives in terms of CVD risk factors. Further studies are needed whether there is a threshold level of CVD knowledge that must be attained for knowledge to

Öz

Amaç: Bu çalışmanın amacı eğitimli ve sağlıklı bir popülasyonun kardiyovasküler hastalık (KVH) bilgi düzeylerini değerlendirmek ve bunu günlük yaşama ne kadar aktardıklarını belirlemektir. Bu çalışmada üniversitemiz bünyesinde çalışan ve sağlıklı görünen katılımcılarda KVH farkındalığı değerlendirilmiş ve 10 yıllık kardiyovasküler hastalık gelişme riski (Framingham Skoru) hesaplanıp Nabız Dalga Hızı (NDH) ve labaratuvar parametreleri arasındaki ilişkilerin incelenmesi amaçlanmıştır.
Gereç ve Yöntem: Çalışma, Çukurova Üniversitesi bünyesinde çalışan sağlıklı 192 gönüllü katılımcı ile yapıldı. Katılımcıların farkındalığı kardiyovasküler hastalık risk faktörleri bilgi düzeyi ölçeği (KARRİF-BD) ile 10 yıllık KVH gelişim riski ise Framingham risk skoru ile değerlendirildi. NDH değerleri invaziv olmayan arteriografi cihazı kullanıldı. Tüm katılımcılardan kan örnekleri alındı.
Bulgular: Tüm katılımcıların yaş ortalaması 45,3 ± 8,0 yıl (% 53,6 kadın) idi. Katılımcıların ortalama KARRİF-BD skoru 20,4 ± 4,0 ve Framingham skoru ortalaması 6,9±5,6 olarak bulundu. NDH ortalaması 7,9±1,5m/sn bulundu. Korelasyon analizlerinde NDH, hem ortalama KARRİF-BD skoru hem de Framingham skoru ile belirgin ilişkili bulundu. En yüksek KARRİF-BD puanına sahip olan katılımcılar aynı zamanda en yüksek Framingham puanına ve NDH' na sahipti.
Sonuç: Eğitim ve bilgi düzeyi yüksek olmasına rağmen bu bilginin KVH risk faktörleri açısından günlük yaşama yansımadığı görülmektedir. Bilginin davranış ve risk faktörü düzeylerini etkilemesi için ulaşılması gereken KVH farkındalığı eşik düzeyi olup olmadığı konusunda daha ileri

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influence behavior and risk factor levels. For effective prevention, knowledge should be supported by behavioral counseling interventions.

Keywords:. CARRF-KL score, framingham score, pulse wave velocity

çalışmalara ihtiyaç vardır. Etkili koruma için, bilgi davranışsal danışmanlık müdahaleleri ile desteklenmelidir.

Anahtar kelimeler: KARRİF-BD skoru, framingham skoru, nabız dalga hızı

INTRODUCTION

Cardiovascular diseases (CVD) are the most common cause of death in the adult population which is responsible for 40.4% of all deaths in Turkey [1]. By 2030, more than 23 million people are expected to die from CVD according to the World Health Organization (WHO, 2013) [2]. It is essential to identify the individuals who are at high risk for CVD as well increase of knowledge of the individuals' awareness of CVD [3]. Thus, the treatment is only palliative when the disease occurs and the morbidity and mortality related to CVD can be reduced by 80-90% by reducing its risk factors.

Framingham Heart Study is a multivariate statistical model to estimate the risk of CVD in a non-clinically ill patient population [4]. 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 Cardiovascular Disease Risk Factors Knowledge Level (CARRF-KL), which can be used to assess the level of knowledge of the Turkish population about CVD risk factors, is a reliable and validated method [5]. In this study, we first objectively investigated CVD status of the study population measured by aortic stiffness, assessed the awareness of CVD and its risk factors using both CARRIF-KL and Framingham score and we compared these parameters with each other among healthy personnel who were working in Cukurova University.

In the current study, we want to investigate whether healthy and educated persons can reflect their knowledge level into daily life on behalf of CVD risk factors. For this purpose, we first evaluated the participants' CARRIF-KL score and Framingham score and compared these two variables with PWVAo which is closely related to CVD in a healthy population [6]. Thus, we want to determine how much they transferred their knowledge and awareness of CAD into daily life in a highly educated population.

MATERIALS AND METHODS

Sample

This prospective case-control study was performed in the Department of Family medicine at Cukurova University between October 2016 and February 2017. One thousand and fifty-five persons working for Cukurova University at academic and administrative staff (except healthy units) were scanned. Participants with age <30 years, 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, familial hypercholesterolemia, diabetes mellitus, and hypertension were excluded from the study. Face-to-face interviews were conducted with 235 participants, 11 of them didn't complete the study, and 32 of them didn't meet the criteria. A total of 192 eligible participants were enrolled in to the current study. The number of participants who met the inclusion criteria was determined using n=t2pq/d2 formula.

Considering the aims of the study, first, a questionnaire was used to determine the patient's age, gender, marital status, educational status, blood pressure, height-weight, medications used, and the presence of an additional comorbid condition. Height and weight were measured in all subjects and Body mass index (BMI) was calculated using the formula (kg)/height^2 (m^2).

Other surveys (CARRIF-KL, Framingham Score) were conducted during the face-to-face interviews, which were made by making an appointment at the date and time convenient to the participants after their consent was obtained and it was confirmed that they met the participation criteria. The study protocol was approved by the local Ethics Committee of Cukurova University, Faculty of Medicine (15 July

2016, No:5), and written informed consent was obtained from study participants.

Measures

Cardiovascular Disease Risk Factors Knowledge Level (CARRF-KL) scale

All participants' knowledge was determined by Cardiovascular Disease Risk Factors Knowledge Level (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 [6].

Framingham risk score

All volunteers' 10-year risk for development of CVD was determined by Framingham risk score [4,7]. 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

PWV was determined non-invasively using an arteriography device (Medexpert Arteriograph). After blood pressure was measured, the arteriography cuff was inflated on at least 35 mmHg of the 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), PWV, aortic systolic blood pressure (SBPao), and heart rate (HR) [8].

Statistical analysis

Continuous variables were expressed as mean ± SD or interquartile range (median and minimum-maximum) in the presence of abnormal distribution, and categorical variables as numbers 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 a general comparison between the two groups. Pearson and Spearman Correlation analyzes were performed for correlation analysis. SPSS statistical software (version 20.0, SPSS, USA) was used.

RESULTS

One thousand and fifty- five healthy persons working for administrative and academic staff at Cukurova University were scanned and 192 of them were included in to the current study. The main characteristics and sociodemographic characteristics of all participants are summarized in Table 1.

A total of 103 (53.6%) participants were male and 89 (46.4%) were female. The mean age of all participants was 45.3 ± 8.0 years old. All participants had graduated from high school or university moreover majority of them (119 students, 60%) had graduated at a master-doctorate level. A total of 79 participants (41.1%) had a normal BMI. A total of 64.1% had chronic disease history in the family (32.8% had CAD, 29.2% DM, 31.3% hypertension). The mean value of the Framingham score was found 7.9±4.3. It was found higher in men than woman (Table 1).

The mean systolic blood pressure was 120.3± 13.7 mmHg, diastolic blood pressure was 75.9 ±11.7 mmHg and mean arterial pressure was 90.8 ±11.7 in all study participants. All of these three values were higher in men than woman. A total of 86 participants (44.8%) had normal blood pressure, 21 participants (10.9%) had class 1 and 3 participants (1.6%) had class 2 hypertension according to current guidelines. None of the participants had class 3 Hypertension. Six participants had isolated systolic hypertension (systolic BP >140 mmHg and diastolic BP<90 mmHg) (Table 1).

CVD Risk Factors Knowledge Level of the study population was determined by CARRIF-KL scala. Participants frequently answered the questions 2, 6, 7, 8, 10, 13, 14, 15,18, 19, 20, 21 as "Yes" and the questions 1, 11, 12, 16, 24 ve 26 as "No".

Table 2 shows the mean value of CARRIF-KL, PWV, and Framingham score according to study parameters. Framingham score was positively correlated with age, blood pressure, lipid profiles including TG, HDL-C, and LDL-C, and smoking duration. On the other hand, there was no correlation of the score with the educational and marital status (p=0.632 and p=0.396). Smokers had a higher Framingham score than no smoke. (<0.01). In addition, fasting plasma glucose and 25-OH Vit D were not correlated with the Framingham score (p=0.150 and p=0.442).

Table 1. Baseline and laboratory characteristics of the all participants

Parameters	Male (n=103)	Female (n=89)	Total	p value*
Age, (year)	45.2 ±7.7	45.5± 8.4	45.3±8.0	0.79
Height, (cm)	162.7± 7.2	174.7± 6.2	168.3±9.1	<0.001
Weight, (kg)	66.9± 11.9	82.0 ±11.6	73.9±13.9	<0.001
Weist circumference, (cm)	81.6± 11.2	94.2± 9.0	87.4±12.0	<0.001
BMI, (kg/m^{2})	25.3± 3.8	26.9 ±3.2	26.1±3.6	0.002
Framingham score	4.3± 2.5	9.9 ±5.7	7.9±4.3	<0.001
Fasting glucose, mg/dl	88.0±8.3	92.1±10.0	90.1±9.4	0.001
Trigliseride, mg/dl	100.3±84.9	135.4±72.5	116.6±81.1	0.003
LDL- C, mg/dl	136.5±35.6	148,4±42,7	142,0±39,4	0.037
HDL-C, mg/dl	55.4±12,3	42.1±10,1	49.2±13.2	<0.001
Total- C, mg/dl	212.4±42.1	217.5±48.0	214.8±9.9	0.440
Hs-CRP, mg/dl	0.31±0.15	0.33±0.11	0.32±0.12	0.589
GGT, mg/dl	15.3±13.6	21.8±12.0	18.3±13.2	0.001
25 OH vitamin D, mg/dl	21.2±15.7	23.0±13.7	22.0±14.7	0.407
Systolic BP, mmHg	116.7± 14.2	124.5± 11.9	120.3±13.7	<0.001
Diastolic BP, mmHg	72.4± 11.6	80.0± 10.5	76.0±11.7	<0.001
MAP, mmHg	87.2 ±11.8	95.0± 10.2	90.8±11.8	<0.001
PWVAo, m/s	8.0±1.7	7.7±1.3	7.9±1.5	0.229
High school, n	9	9	18	
University, n	37	18	55	
Master-Doctora, n	57	62	19	0.055
Total, n	103	89	192	
Underweight (<18.5), n	1	0	1	
Normalweight (18.5-24.9), n	53	26	79	
Overweight (25-29.9), n	37	49	86	0.011
Obese (>30), n	12	14	26	
Total, n	103	89	192	

BMI: Body Mass Index; SD: standard deviation; C: Cholesterol; Hs-CRP: High Sensitive C reactive protein; LDL-C: Low Density Lipoprotein Cholesterol; HDL-C: High Density Lipoprotein Cholesterol; GGT: gama glutamil transferase; BP: Blood pressure; MAP: Mean arterial pressure; PWVAo: pulse wave velocity aorta.
*IndependentSamples T Test

Interestingly smokers had a higher mean value of CARRIF-KL score than non-smokers (19.5±5.2 vs 20.8 ±3.5, p=0.003). Similarly, the older participants (>50 years old) had also higher CARRIF-KL score and had a higher PWVAo level as we expected (both of p=<0.001). The mean value of PWVAo and CARRIF-KL score were not different according to BMI class (p=0.97 and p=0.21, respectively). Also, the educational status was not related to either CARRIF-KL score nor PWVAo level (p=0.47 and p=0.50, respectively). Finally, participants with and without chronic disease history had similar CARRIF-KL score although PWVAo was found mildly elevated in participants with a family history of chronic disease than without (p=0.96 and p=0.059, respectively) (Table 2).

Table 3 shows the propensity of the normal and abnormal value of PWVAo according to study groups and the mean value of Framingham and CARRIF-KL score in both groups (normal and abnormal PWVAo). The mean value of PWVAo was found 7.9±1.5 in all participants. PWVAo values were similar between both genders (Table 1). A total of 180 participants (93.8%) had a normal range served as normal and 12 participants had a higher PWVAo value served as an abnormal group. Participants who had normal and abnormal PWVAo didn't differ according to age, gender, smoking, BMI, marital and educational status. Only Blood pressure and heart rate were different in participants who had normal and abnormal PWVAo. LDL-C was found higher in the abnormal PWVAo group than in the normal group (p<0.004). The mean value of both Framingham and CARRIF-KL score were similar in normal and abnormal PWV Ao (p=192 and p=0.97, respectively) (Table 3).

Table 2. Mean value of CARRIF-KL, PWV and Framingham score according to study parameters

Parameters		Framingham score	p	CARRIF-KL score	p	PWVAo, m/s	p
Gender	Female	4.3± 2.5	<0.001*	20.5±3.9	0.992*	8.0±1.7	0.228*
	Male	9.9 ±5.7		20.5±4.2		7.7±1.3	
Smoke	Yes	10.2±8.3	<0.001*	19.5±5.2	0.003*	7.8±1.7	0.268*
	No	5.8±5.0		20.80±3.5		7.86±1.5	
Menopause	Yes	7.2±6.5	<0.001**	21.6±3.1	0.029**	9.2±1.9	<0.001**
	No	2.8±1.6		19.8±4.1		7.4±1.3	
Age	30-39	2.8±2.2	<0.001***	18.1±4.8	<0.001***	6.9±1.0	<0.001***
	40-49	5.6±3.8		21.0±3.5		7.8±1.3	
	≥ 50	11.6±7.7		21.6±3.2		8.7±1.7	
BMI (kg/m2)	≤ 18,5	2.4±0	0.011***	12±0	0.219***	7.8±0	0.974***
	18,5-24,9	5.3±5.4		20.5±4.3		7.8±1.8	
	25-29,9	8.5±6.8		20.5±3.7		7.9±1.5	
	≥ 30	6.5±5.8		20.6±4.1		7.7±1.1	
Education	High school	8.5±7.3	0.505***	21.2±3.5	0.473***	7.7±1.4	0.503***
	University	6.7±6.6		20.0±4.6		8.1±1.7	
	Master-Doctora	6.7±5.9		20.6±3.8		7.8±1.5	
Chronic Disease	With	6.9±6.2	0.733**	20.4±4.1	0.961**	8.0±1.6	0.059**
	Without	6.9±6.5		20.5±4.1		7.5±1.3	
LDL-C (mg/dl)	(≤ 129)	4.9±5.3	<0.001****	20.2±4.0	0.871****	7.6±1.4	0.243****
	(130-160)	6.4±5.7		20.7±3.5		8.0±1.8	
	(≥ 161)	9.5±6.9		20.5±4.5		8.0±1.4	

PWVAo: pulse wave velocity aorta; CARRIF-KL: Cardiovascular Disease Risk Factors Knowledge Level; BMI: Body Mass Index; LDL-C: Low Density Lipoprotein Cholesterol; SD: standard deviation
*Chi-Square Test; **Mann Whitney U; ***ANOVA; ****Kruskal Wallis Test

Table 3. Mean value of PWV and CARRIF-KL score according to propensity of Framingham score

Parameters (Median±SD)	Framingham score			p value*
	< 10	*10-20*	*> 20*	
PWVAo, m/sn	7.6±1.5	8.3±1.4	9.0±2.4	0.002
CARRIF-KL Score	20.1±4.1	21.4±3.4	22.2 ±5.0	0.024

PWVAo: pulse wave velocity aorta; SD: Standart Deviation
*Kruskal Wallis Test

Table 4. The correlation analyses results between CARRIF-KL, Framingham score and PWVAo

Parameters	Framingham score		PWVAo		CARRIF-KL	
	r	p*	r	p*	r	p*
Framingham score	-	-	0.324	0.001	0.193	0.007
PWVAo	0.324	0.001	-	-	0.186	0.010
CARRIF-KL	0.193	0.007	0.186	0.010	-	-

PWVAo: pulse wave velocity aorta; CARRIF-KL: Cardiovascular Disease Risk Factors Knowledge Level
*Spearman correlation test (r=correlation coefficient)

We found participants who had a higher mean Framingham score had also a higher mean value of PWVAo (p<0.002). Interestingly, this is also the same for the relation between the mean value of Framingham score and CARRIF-KL score (p<0.024). Participants who had higher CARRIF-KL score had also a higher Framingham score. In correlation analyses, all of these three parameters (Framingham score, CARRIF-KL score, and PWVAo) were well correlated with each other (Tables 4).

DISCUSSION

Adequate awareness of cardiovascular diseases (CVD) and their risk factors may help reduce the population's exposure to modifiable risk factors and thereby contribute to prevention and control strategies [9,10]. Thus, Coronary artery disease (CAD) is one of the leading causes of death in worldwide and most of the acute cardiac events occur in a population of patients without any clinical findings. On the other hand, primary prevention still has not reached the desired level despite the recent emphasis on primary treatment approaches.

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, which is closely related to atherosclerosis [11-13]. The average Framingham score of study populations was 6.9 and most of them (141 people, 73.4%) were in a low-risk group due to the low-risk profile. We evaluated the Framingham score due to the mean age of our study population which only 30% of the studied 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.

In our study, we determined the CVD risk factors knowledge level by using the CARRF-KL score which was previously validated in a Turkish population [5]. The questions 2, 6, 8, 14, 15, 18, 19, 20, and 21 had been answered frequently as "Yes", whereas the questions 1, 11, 12, 16, 24, and 26 had been answered frequently as "No". The presence of well-known CAD risk factors such as family history, LDL, and BMI did not have a determining effect on the score. The mean CARRF-KL score was similar in both gender and increase with increased age. CARRF-KL score was not different according to Framingham score. Thus, participants with higher CARRIF-KL score had higher framingham score also. These results show us that well-known about CVD is not transferred to daily practice.

In the current study, we want to investigate PWV which is an objective evidence of atherosclerosis and has been validated especially in middle-risk and young individuals [14]. It was previously demonstrated that PWV is an independent parameter to increase the risk of cardiovascular disease [15]. Similarly, in a meta-analysis of 17.635 patients, PWV is an additional risk factor in determining the risk of CAD. Willum Hansen et al. demonstrated the association of increased PWV with the risk of developing CVD and increased mortality in the general population [16]. Laurent et al. and Vlachopoulos et al. conducted a meta-analysis of 17 studies involving a total of 15.877 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 [17]. In addition, it has been found that PWV can predict high CVD risk in diabetic subjects by risk classification based on Framingham score, and also predict the incidence of CVD events in patients with stable coronary artery disease [18,19]. In our study, the mean PWV of all participants was 7.8 m / s and was similar in both genders (p = 0.229). We found a significant positive correlation between the mean value of PWV and Framingham score (p <0.001). In addition, we found that the mean PWV value was highest (9.0 ± 2.4 m / sec) in the high-risk group which has Framingham score 20 and above. On the other hand, The participants with the lowest mean PWV (7.6 ± 1.5 m / sec) were in the group with Framingham score of 9 and below (p = 0.002). We evaluated the correlation between these two parameters in a healthy population without risk factors for CAD. According to our study results, we can say that additional information such as PWV may be needed in healthy individuals with moderate risk. Because a significant amount of acute coronary events are seen in a healthy population without a coronary lesion and having moderate risk (10-20% risk) according to Framingham score. As we expected, it was found that the score was found lower in smokers than in no-smoke. Interestingly, we found the CARRF-KL score was similar in participants with normal and abnormal PWV.

Another factor we examined in our study is atherogenic dyslipidemia. Dyslipidemia has an important place among the risk factors for coronary artery disease. The main studies investigating the lipid level as a risk factor are TEKHARF (Heart Disease and Risk Factors in Turkish Adults), Turkish Heart Study and METS (Turkey Metabolic Syndrome Research) in our country [20-22]. In TEKHARF study, LDL-cholesterol was found at 114.6 mg/dl in men and 122.4 mg/ dl in women. In METSAR study, LDL-cholesterol was found at 98.5 mg/dl in men and 100.5 mg / dL in women. In our study, the mean LDL cholesterol in men was 148.3 mg/dl and in women was 136.4. Similarly, our study was consistent with the literature. Although the LDL cholesterol level was not included in the Framingham risk scale, there was a positive correlation between the Framingham score and LDL level (p <0.001). On the other hand, there was no correlation between LDL levels and PWV. In our study, the mean HDL cholesterol level was 42.0 mg/dl in men and 55.4 mg/dl in woman, which was above the average of the data of TEKHARF-Turkish Heart Study and the data of the METSAR study. When we analyzed the relationship between Framingham score and HDL level, a total of 60% of participants had a lower average of Framingham score (10 and below) (p <0.002). HDL levels were also similar in participants with normal and abnormal PWV. In addition, the mean triglyceride levels of the study population were found as 148.3 mg/dl in men and as 129.7 mg/dl in woman. Compared to the 2002 study, our participants had lower mean triglyceride level which reported mean triglyceride levels as 195 mg/dl in men and 172 mg/dl in women [22]. On the other hand, the Mediterranean region, which was the region where our study was conducted, was having the highest average value of triglyceride level in the TEKHARF study. We found that the mean Triglyceride level, which is not included in the Framingham score, correlated significantly with Framingham score. Also, there was a significant correlation between the PWV value. In this respective, our finding may suggest that TG measurement may be important in CVD risk analysis as implanted in the latest European European dyslipidemia guide [23].

Obesity is a major risk factor for the development of CVD. In our study, the mean BMI value was 26.9 kg / m2 in male and 25.3 kg / m2 in female. Nguyen et al. showed that the 10-year CVD calculated with the Framingham score was paralely increased with the BMI increase [24]. However, there was no relationship between BMI and Framingham score. Despite this, Brunner et al. reported in Whitehall II study that central obesity was an independent and modifiable risk factor for central aortic stiffness [25]. We didn't find an association between BMI and PWV also. We thought that these results were due to an insufficient number of studied population in our study.

Finally, in our study, we evaluated hs-CRP, GGT, and Vitamin D levels which are complementary risk factors for CAD. The mean Hs-CRP values were determined in the normal range and found similar in both sexes. The mean 25 OH Vit D level was measured as 21 mg/dl and found similar in both sexes too. Only mean GGT values were found different in men and women. When analyzed according to Framingham risk score and PWV, all three parameters were found to be similar in all groups. Finally, there was no correlation between these parameters and CARRIF-KL score. 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.

The major limitation of this study is that 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.

In conclusion, primary prevention is vital to combat the consequences of CVD and our findings clearly indicate that awareness levels of CVD risk factors have to be improved also among educated persons. It is emphasized that primary healthcare workers are very important in the screening of CVD risk factors opportunistically and systematically and in providing consultancy on changing risky behaviors. In addition, some healthy policies may be performed to increase population knowledge such as the use of community health workers, patient navigators, and other allied health professionals to deliver high-quality care, increasing the use of health information technology and tools, improving access to health care for populations with little or no access, educating people to become more involved in their own health care, or using health information technology to improve efficiency and timeliness of public health surveillance..etc. Thus, society-based deficiencies may be addressed and Public health providers may be more effort to explain to the public that the knowledge and proper actions regarding the reduction of risk factors are associated with reduced CVD and mortality.

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