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Retrospective Evaluation of Ankle-Brachial Index and Framingham Risk Scores in Individuals Undergoing Periodic Health Examination

Periyodik Sağlık Muayenesi Yapılan Bireylerin Ankle-Brakial İndeks ve Framingham Risk Skorlarının Retrospektif Olarak İncelenmesi

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ÖZET

Amaç: Ayak bileği-brakial indeksi (ABİ) periferik arter hastalığı tanısının ve genel aterosklerozun bir göstergesi olarak hizmet eder. Framingham risk skoru (FRS) ise 10 yıllık kardiyovasküler hastalık riskini değerlendirmek için kullanılan onaylanmış ölçümler arasında yer almaktadır. Bu çalışmada aile hekimliği polikliniğimize periyodik sağlık muayenesi için başvuran bireylerde ABİ ve FRS birlikte değerlendirilmesi amaçlanmıştır.
Yöntemler: Bu çalışma 25.06.2013 ile 25.06.2016 tarihleri arasında, herhangi bir amaçla Aile Hekimliği Polikliniğine başvuran, yaşı 18 ve üzeri 580 hastanın dosyaları geriye dönük şekilde incelenerek gerçekleştirildi. FRS hesaplanırken hem LDL-kolesterol düzeyi hem de total kolesterol değerleri kullanılarak iki farklı sonuç bulunmuştur ve bu sonuçlar ile FRS1 (LDL tabanlı) ve FRS2 (total kolesterol tabanlı) olarak iki farklı risk faktörü oluşturulmuştur. ABİ ortalama bacak sistolik tansiyonunun kol sistolik tansiyonuna bölünmesi ile hesaplandı.
Bulgular: Çalışmamıza alınan 580 kişinin %58,3'ü (n=338) kadın, %41,7 'si (n=242) erkekti. ABİ ile FRS1 ve FRS2 değerleri arasında istatistiki olarak anlamlı bir ilişki gözlendi ($p<0,001$, $p<0,001$).
Sonuç: Bu çalışmanın sonuçları, ABİ skorunun FRS ile beraber ülkemizde birinci basamakta periyodik sağlık muayeneleri kapsamında kardiyovasküler riskin değerlendirmesinde maliyet etkin ve etkili bir belirteç olarak kullanılabileceğini göstermiştir.

Anahtar Kelimeler: Aile hekimliği, ayak bileği-brakial indeksi, framingham risk skoru, kardiyovasküler hastalıklar, retrospektif çalışmalar.

ABSTRACT

Objective: The Ankle-Brachial Index (ABI) serves as an indicator for the diagnosis of peripheral arterial disease and general atherosclerosis. Framingham risk score (FRS) is among the validated measures used to evaluate 10-year cardiovascular risk. This study aimed to assess the ABI and FRS in patients who presented to our outpatient clinic for periodic health examinations.
Methods: This retrospective study examined the medical files of 580 patients aged ≥18 who presented to the Family Medicine outpatient clinic between June 25, 2013, and June 25, 2016, for any reason. Two distinct FRS values, FRS1 (LDL-based) and FRS2 (total cholesterol-based), were generated by utilizing both LDL cholesterol and total cholesterol levels. The ABI was calculated as the ratio of ankle systolic blood pressure to brachial systolic blood pressure.
Results: Of the 580 patients, 58.3% (n=338) were female, and 41.7% (n=242) were male. Patients with lower ABI values had significantly higher FRS1 and FRS2 scores (p:0.002 and $p<0.001$).
Conclusion: The findings of this study demonstrated that the ABI together with FRS may be used as a cost-effective and useful indicator for evaluating cardiovascular risk during periodic health examinations in primary care in our country.

Key words: Family Practice, Ankle-Brachial Index, Framingham risk score, Cardiovascular diseases, Retrospective studies.

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INTRODUCTION

Periodic health examinations consist of screening of healthy individuals at certain intervals according to gender, age and risk groups using a set of standard procedures such as interview, physical examination, laboratory tests, immunization programs (1). Coronary artery disease (CAD) represents the primary contributing factor to mortality and morbidity on a global scale, including in our country, CAD remains the foremost cause of death (2-4). Peripheral arterial disease (PAD) has been identified as one of the strongest determinants of severe cardiovascular outcomes and cardiovascular-related mortality. These conditions occur due to narrowing or obstruction of the abdominal aorta and its distal arterial branches beyond the aortic bifurcation as a result of progressive atherosclerosis (5). The ankle-brachial index (ABI), obtained by the measurement of ankle systolic pressure as a proportion to systolic pressure, represents a rapid and straightforward diagnostic measure. For a considerable duration, it has been utilized in the domain of vascular practice for the purpose of confirming diagnoses and evaluating the severity of peripheral arterial disease in the lower extremities. Additionally, ABI serves as an indicator of general atherosclerosis (6,7). A multitude of studies have demonstrated an association between an abnormal ankle-brachial index (ABI) and heightened cardiovascular mortality and morbidity, with a range of values proposed to quantify the associated risk (8,9). ABI serves as a non-invasive screening instrument for the population, demonstrating 95% sensitivity and 99% specificity for PAH diagnosed by angiography (10).

The FRS (Framingham Risk Score) is a widely utilised model that was developed to estimate the 10-year risk of major cardiovascular events, including myocardial infarction, stroke, and coronary death, in individuals aged 30–74 years. The model incorporates a range of risk factors, including age, gender, cholesterol levels, systolic blood pressure, smoking status, antihypertensive treatment, and diabetes (11).

The FRS and ABI assess cardiovascular risk from different perspectives; therefore, their combined use provides a more comprehensive risk assessment. The extant literature suggests that the combined use of these two methods enhances the predictive power for cardiovascular events (8).

The present study aims to evaluate the effectiveness of the combined use of FRS and ABI in a different demographic structure. Furthermore, it seeks to contribute to preventive health services by examining the applicability of this integrated approach in family medicine practice and periodic health examinations.

MATERIAL AND METHODS

Research Design, Study Setting, and Sampling Methodology

The present study was designed as a retrospective cross-sectional analytical study. Ethical clearance (approval number 2016/648) was procured from the Non-Invasive Research Ethics Committee of Necmettin Erbakan University's Meram Medical Faculty before the study's initiation. This study was conducted by retrospectively examining the files of 720 patients aged 18 years and older who attended the Family Medicine outpatient clinic between 25.06.2013 and 25.06.2016 for any reason. In our family medicine outpatient clinic, all patients who routinely underwent periodic health examination were measured for waist circumference, height, weight, neck circumference, brachial and ankle systolic blood pressures, fasting blood glucose (FBG), lipid panel, whole blood count, full urine analysis. Blood samples were collected from patients who attended our clinic for periodic health examinations in the early morning hours and after fasting for a minimum of eight hours. The patient files contained records of the person's age, sex, occupation, education, marital status, illnesses, and smoking status. With regard to the evaluation of diabetes, the following criteria were meticulously examined and documented: the existence of a diagnosed diabetes in the patient, the documented utilisation of oral antidiabetic medication or insulin, and the diagnostic criteria for diabetes during the study period. With regard to smoking, individuals who currently smoke or have ceased smoking within the past 12 months were classified as "smokers," while those who have not smoked for more than 12 months were classified as "non-smokers." The minimum required sample size was calculated using the infinite population formula, assuming a 95% confidence level ($Z = 1.96$), a 5% margin of error ($d = 0.05$), and a population proportion of 0.5 ($p = 0.5$). Based on these parameters, the calculated sample size was 385 participants. Records with incomplete data were excluded from the study. The files of 580 eligible patients were examined (580/720). A post-hoc power analysis was performed using the G*Power program to evaluate the statistical power of the study. Assuming a medium effect size ($d = 0.5$) and a significance level of $\alpha = 0.05$, the obtained power value was %48 (0.48). ABI, FRS1 and FRS2 values of the patients were computed automatically and recorded in the electronic database.

Ankle-Brachial Index (ABI)

This ratio is derived by dividing the systolic pressure at the ankle by the systolic pressure in the brachial artery (6). ABI measurements were performed by a single trained and experienced healthcare professional in accordance with international guidelines, thereby eliminating inter-observer variability. Each measurement was conducted once per participant, and no repeated assessments were performed. As a result, intra-observer reliability could not be evaluated. Before the measurements were taken, the patient rested in the supine position for at least five minutes. Systolic blood pressure was measured in both brachial arteries and at each ankle using an oscillometric device (Omron M2). The higher of the two systolic pressures obtained from the brachial arteries was used as the basis; for the ankle, the highest systolic pressure for each extremity was used. The ABI was calculated separately for each leg using the formula (ankle systolic pressure/brachial systolic pressure), and the lowest value was used for the diagnostic evaluation. In our study, the ABI cut-off point for identifying risk of peripheral artery disease (PAD) was set at ≤0.97, as indicated in previous studies (12). ABI≤0.97 shows peripheral artery disease (PAD) and ABI>0.97 is considered normal (13).

Framingham Risk Score (FRS)

Framingham Risk Scores are calculated using an Excel-based algorithm. The risk calculation is based on the ATP III guidelines developed by the National Cholesterol Education Program (NCEP) and estimates the 10-year risk of coronary heart disease (CHD) based on variables such as age, gender, systolic blood pressure, HDL cholesterol, total cholesterol or LDL cholesterol, smoking status, and diabetes status. Since this algorithm allows for the use of both total cholesterol and LDL cholesterol, two separate scores (FRS1 (LDL-C-based) and FRS2 (total cholesterol-based)) were calculated and analyzed separately in the study. These scores indicate the 10-year risk of developing CHD. FRS results are categorized as low risk (<10%), moderate risk (10-19%), and high risk (≥20%) (14).

Anthropometric Measurements

Height and weight data for the participants included in the study were retrieved from their medical records. Body-mass indexes (BMI) were calculated using these values. BMI was calculated using the “Weight (kg) / Length (m)2” formula. BMI classifications were as follows: low weight (≤18.5 kg/m^2), normal weight (18.5-24.9 kg/m^2), overweight (25-29.9 kg/m^2), and obese (≥30 kg/m^2) (15). Based on the World Health Organization's (WHO) classification, individuals with a BMI≥30 were classified as obese and those with a BMI<30 were classified as non-obese.

Statistical analysis

The statistical analyses in this article were performed using the SPSS for Windows v20.0 software package. Frequencies, means, standard deviations, medians, odds ratios and min-max values were calculated. The variables were investigated using visual and analytical methods (Kolmogorov-Smirnov and Shapiro-Wilk’s test) to determine whether or not they are normally distributed. Chi-square test was used to evaluate categorical variables. Furthermore, the Fisher exact test was employed in instances where the expected frequency in certain cells was less than five, while the Monte Carlo simulation chi-square test was utilised for 3x2 tables and larger. In order to undertake a comparison of quantitative variables between two groups, the Student's t-test was employed if the data met the assumption of normality. In instances where this assumption was not met, the Mann-Whitney U test was utilised. Correlations among parameters were examined via Pearson’s correlation analysis. The correlation coefficient (r) was interpreted as follows: 0.00–0.24 indicates a weak correlation, 0.25–0.49 indicates a moderate correlation, 0.50–0.74 indicates a strong correlation, and 0.75–1.00 indicates a very strong correlation. For the purpose of determining statistical significance, a p-value of <0.05 was employed.

RESULTS

General Results

Our study included 580 individuals, of whom 58.3% (n=338) were female and 41.7% (n=242) were male. Mean age of the participants was 46.07±14.33 years, 84.1% (n=488) were married, 43.1% (n=250) had graduated from primary school, 43.3% (n=251) were housewives and 22.9% (n=133) were smokers (Table 1).

Ankle-Brachial Index

The mean value of ABI in our study was 1.13±0.10. Of the participants, 15 patients (2.6%) had ABI≤0.97. No significant relationship was found between ABI and employment status, marital status, gender, level of education, LDL-c, triglycerides, HDL-c, or fasting blood glucose (Table 2 and Table 6). Nevertheless, a statistically significant correlation was observed between ABI and FRS1, FRS2, as well as total cholesterol (p=0.002, p<0.001, and p=0.048, respectively). Patients with lower ABI values had significantly higher FRS1, FRS2, and total cholesterol levels (Table 2 and Table 6).

Framingham Risk Score

The mean values of FRS1 and FRS2 were 8.90±8.52 and 9.22±8.70. FRS1 score was low risk in 69.0%, moderate risk in 22.9%, high risk in 8.1% among individuals. The FRS2 score was low risk in 63.6%, moderate risk in 25.0% and high risk in 11.4% among the participants.

A comparison of FRS1 and FRS2 by gender demonstrated a significantly higher cardiovascular risk in men than in women (p<0.001). FRS1 and FRS2 were statistically significantly higher (p<0.001) among individuals with secondary school and higher education, married individuals, and non-working individuals. In addition, while FRS1 showed a significant relationship with BMI (p=0.002), no significant correlation was identified for FRS2 (p=0.062) (Table 3 and Table 4).

A robust positive correlation was identified between FRS1 and age (r=0.693, p<0.001). In addition, FRS1 and FRS2 exhibited a very strong positive correlation (r=0.963, p<0.001) (Table 5).

Body Mass Index (BMI)

Patients were categorized into two groups, non-obese and obese, based on their BMI measurements. A statistically significant association was identified between BMI and

Table 1. Sociodemographic characteristics of the participants

	n	%
Gender		
Female	338	58.3
Male	242	41.7
Education Status		
Illiterate	43	7.4
Primary school educated	250	43.1
Middle/high school educated	141	24.3
University educated	146	25.2
Marital status		
Married	488	84.1
Single	72	12.4
Widow/Spouse separated	20	3.5
Job		
Housewife	251	43.3
Civil servant	126	21.7
Retired	85	14.7
Worker	83	14.3
Tradesman	31	5.3
Unemployed	4	0.7
Smoking Status		
Smoking	133	22.9
Not smoking	477	77.1
Total	580	100.0

Table 2. Comparison of ankle-brachial index and some parameters

	ABI≤0.97		ABI>0.97		Total			
	n	%	n	%	n	%	χ2	p
Gender								
Female	9	2.7	329	97.3	338	100	0.019	0.891
Male	6	2.5	236	97.5	242	100		
Education Status								
≤Primary school	4	1.6	239	98.4	243	100		0.293
≥Middle School	11	3.3	326	96.7	337	100		
Marital status								
Married	13	2.6	495	97.4	508	100	1.000	
Not married	2	2.8	70	97.2	72	100		
FRS1								
FRS <10%	6	1.5	394	98.5	400	100	10.219	0.001
FRS 10-20%	4	3	129	97.0	133	100		
FRS >20%	5	10.6	42	89.4	47	100		
FRS2								
FRS <10%	5	1.4	364	98.6	369	100	21.598	<0.001
FRS 10-20%	1	0.7	144	99.3	145	100		
FRS >20%	9	13.6	57	86.4	66	100		
Fasting Blood Glucose								
≥ 100 mg/dl	8	4.4	175	95.6	183	100	3.383	0.089
< 100 mg/dl	7	1.8	390	98.2	397	100		
BMI								
≥ 30 kg/m2	6	2.0	287	98.0	293	100,0	0.681	0.409
< 30 kg/m2	9	3.1	278	96.9	287	100,0		
Working status								
Working	5	2.1	235	97.9	240	100	0.411	0.521
Not working	10	2.9	330	97.1	340	100		

ABI: Ankle-Brachial Index FRS: Framingham Risk Score BMI: Body Mass Index

Table 3. Comparison of some parameters with FRS1

	FRS1 <10%		FRS1 10-20%		FRS1 >20%		Total			
	n	%	n	%	n	%	n	%	χ2	p
Gender										
Female	253	74.8	74	21.9	11	3.3	338	100.0	28.170	<0.001
Male	147	60.7	59	24.4	36	14.9	242	100.0		
Education Status										
≤Primary school	185	76.1	44	18.1	14	5.8	243	100.0	10.386	0.006
≥Middle School	215	63.8	89	26.4	33	9.8	337	100.0		
Marital status										
Married	333	65.5	130	25.6	45	8.9	508	100.0	26.170	<0.001
Not married	67	93.1	3	4.2	2	2.7	72	100.0		
Working status										
Working	209	61.5	101	29.7	30	8.8	340	100.0	24.731	<0.001
Not working	191	79.6	32	13.3	17	7.1	240	100.0		
Fasting Blood Glucose										
≥ 100 mg/dl	88	48.1	67	36.6	28	15.3	183	100.0	53.848	<0.001
< 100 mg/dl	312	78.6	66	16.6	19	4.8	397	100.0		
BMI										
≥ 30 kg/m²	190	64.8	84	28.7	19	6.5	293	100.0	11.992	0.002
< 30 kg/m²	210	73.2	49	17.1	28	9.7	287	100.0		
ABI										
≤ 0,97	6	40.0	4	26.7	5	33.3	15	100.0	10.219	0.002
> 0,97	394	69.7	129	22.8	42	7.4	565	100.0		

ABI: Ankle-Brachial Index FRS: Framingham Risk Score BMI: Body Mass Index

Table 4. Comparison of some parameters with FRS1

	FRS2 <10%		FRS2 10-20%		FRS2 >20%		Total			
	n	%	n	%	n	%	n	%	χ2	p
Gender										
Female	239	70.7	78	23.1	21	6.2	338	100.0	26.599	<0.001
Male	130	53.7	67	27.7	45	18.6	242	100.0		
Education Status										
≤Primary school	178	73.3	47	19.3	18	7.4	243	100.0	17.251	<0.001
≥Middle School	191	567	98	29.1	48	14.2	337	100.0		
Marital status										
Married	304	59.8	140	27.6	64	12.6	508	100.0	28.049	<0.001
Not married	65	90.3	5	6.9	2	2.8	72	100.0		
Working status										
Working	192	56.5	102	30.0	46	13.5	340	100.0	18.157	<0.001
Not working	177	73.8	43	17.9	20	8.3	240	100.0		
Fasting Blood Glucose										
≥ 100 mg/dl	80	43.7	66	36.1	37	20.2	183	100.0	46.977	<0.001
< 100 mg/dl	289	72.8	79	19.9	29	7.3	397	100.0		
BMI										
≥ 30 kg/m²	179	61.1	85	29.0	29	9.9	293	100.0	5.546	0.062
< 30 kg/m²	190	66.2	60	20.9	37	12.9	287	100.0		
ABI										
≤ 0,97	5	33.3	1	6.7	9	60.0	15	100.0	21.598	<0.001
> 0,97	364	64.4	144	25.5	57	10.1	575	100.0		

ABI: Ankle-Brachial Index FRS: Framingham Risk Score BMI: Body Mass Index

gender (p<0.001). The odds of obesity were 1.836 times higher in females compared to males [OR=1.836, 95% CI, (1.315-2.564)]. Individuals with secondary school and higher education (p=0.032) and married individuals (p=0.009) were more likely to be obese. The odds of obesity were 1.960 times higher in married individuals compared to unmarried individuals [OR=1.960, 95%Cl, (1.175-3.269)]. A considerable correlation was identified between occupational status and BMI. (p<0.001). The odds of obesity were 2.196 times higher in individuals who were not working

Table 5. Correlations of ABI, FRS and BMI

Parameters		ABI	FRS1	FRS2	BMI
ABI	r	1			
	p				
FRS1	r	-0.015	1		
	p	0.719			
FRS2	r	-0.043	0.963**	1	
	p	0.301	0.000		
BMI	r	0.003	0.008	0.011	1
	p	0.948	0.844	0.798	

ABI: Ankle-Brachial Index FRS: Framingham Risk Score BMI: Body Mass Index
** Correlation is important at 0.01 level.
* Correlation is important at 0.05 level.

Table 6. Comparison of lipid profile with ABI values

	ABI≤0.97 Median (min-max)	ABI>0.97 Median (min-max)	Z	p
HDL-c	38.00 (22.00-73.00)	41.00 (17.00-94.00)	-1.278	0.201
LDL-c	139.00 (95.00-187.00)	122.00 (30.00-301.00)	-1.701	0.089
T. Cholesterol	217.00 (137.00-260.00)	189.00 (83.00-359.00)	-1.980	0.048
Triglycerides	132.00 (60.00-355.00)	111.00 (17.00-482.00)	-1.084	0.278

ABI: Ankle-Brachial Index FRS: Framingham Risk Score BMI: Body Mass Index

[OR=2.196, 95% CI; (1.565-3.071)]. A statistically significant relationship was found among BMI and triglyceride levels ($p<0.001$). In those with high triglyceride levels, the odds of obesity were 2.163 times higher compared to those with normal triglyceride levels [OR=2.163, 95% Cl, (1.507-3.105)]. Individuals exhibiting HDL-C levels less than 40 mg/dl were 1.547 times more likely to be obese than those with HDL-C levels higher than 40 mg/dl [OR=1.547, 95% CI; (1.109-2.159)] ($p=0.010$). A relationship was found between FBG and BMI ($p<0.001$). In patients with FBG≥100, the odds of obesity were 1.821 times higher than patients with FBG<100 [OR =1.821, 95% CI, (1.275 - 2.601)]. A strong correlation was found between FRS1 and BMI ($p=0.002$). Nevertheless, there was no significant relation was found between BMI and FRS2, total cholesterol, or LDL-c ($p=0.062$, $p=0.638$, $p=0.692$).

DISCUSSION

Early detection of modifiable risk factors through screening tests, in conjunction with non-modifiable factors like gender, genetic traits, and age has been demonstrated to be crucial for preventing cardiovascular and cerebrovascular events. For this reason, monitoring risk factors including smoking, hypertension, total cholesterol, HDL-c, and diabetes mellitus is advised (8). The ABI has been identified as a useful measure for predicting cardiovascular disease (CVD) risk (16). As a non-invasive procedure, ABI has the capacity to identify asymptomatic individuals and thereby prevent adverse outcomes. Consequently, a comprehensive understanding of risk factors and proactive management of those that can be modified is crucial. The present study investigates the potential of ABI to serve as a reliable risk predictor for CVD in the context of periodic health examinations, in conjunction with FRS, within the national healthcare framework within our country.

In our study, 580 patients, of whom 58.3% (n=338) were female and 41.7% (n=242) were male, were analyzed to investigate whether ABI could be used as a marker for CVD risk alongside the Framingham Risk Score (FRS). Since the normal lower limit of ABI ranges between 0.90 and 1.10, different studies have adopted varying cut-off values (17). For instance, ABI cut-off values were defined as <0.90 by Papamichael et al. (18), Doobay et al. (19), and Karabay et al. (20); <0.97 by Van der Meer et al. (13) and Ouriel et al. (12); and <0.95 by Çelik et al. (21). In the present study, cut-off value of the ABI was set at ≤0.97, in alignment with the studies conducted by Ouriel and Van der Meer. A total of 15 patients (2.6%) with ABI ≤0.97 were identified.

A substantial body of studies has examined the association between lipid parameters and ABI. Newman et al. reported a significant relationship among high triglyceride levels and low ABI (6). Similarly, the study by Criqui et al. demonstrated a significant correlation between low ABI and low HDL-c levels (22). Tsai et al. also detected significant relationship between total cholesterol and low ABI (23). Nevertheless, no substantial correlation was evident between the parameters of the lipid panel and the ABI values in the studies conducted by Sözmen et al. (24) and Velescu et al. (25). In this study, we identified a significant relationship between low ABI values and high total cholesterol levels, in accordance with the observations of Tsai et al.

In contrast, Tanaka et al. (26), Velescu et al. (25) and Sözmen et al. (24) showed no association between ABI and BMI. However, Miura et al. (9), Tsai et al. (23) and O'Hare et al. (27) found a considerable relationship. The current study identified an association between BMI and ABI. Notably, in all cases with ABI ≤ 0.97, BMI was <30 kg/m². This result was inconsistent with the evidence found in the literature.

ABI has been associated with CAD in numerous studies. In a study by Papamichael et al. (18), a substantial correlation was identified between the presence of CAD and ABI values <0.90, with the likelihood of ABI being below 0.90 increasing as the number of involved coronary arteries increased. Similarly, a study by Çelik et al. (21) showed a significant relationship between low ABI and Framingham Risk Score (FRS). Velescu et al. (25) found that ABI <0.90 was associated with increased coronary and cardiovascular events. In the study conducted by Tanaka (26), borderline ABI (0.9–1.0) was also linked to an increase in mortality and cardiovascular events from cardiovascular causes. According to Noel et al. (28), elevated FRS values over a five-year longitudinal period have been found to be associated with diminished ABI. Tsai et al. (23) demonstrated that parameters associated with ABI were significantly associated with overall and cardiovascular mortality. Furthermore, a meta-analysis by the Ankle Brachial Index Collaboration, which included 16 studies, identified ABI values of 0.90 and below as significantly correlated with an elevated Framingham Risk Score (8). In our study, patients with lower ABI values exhibited significantly higher FRS1 and FRS2 scores, which is consistent with previous literature.

A potential limitation of this study is that the effects of conditions that may cause arterial stiffness, such as diabetes, advanced age, or comorbid diseases, were not taken into account in the analysis. As these factors were not excluded from the analysis, they may have affected the results of the ABI measurements. The extant literature (27,29) suggests that such conditions have the potential to result in arterial calcification, which, in turn, may consequently lead to normal or elevated ABI values despite the presence of peripheral artery disease. This situation has the potential to result in erroneous cardiovascular risk classification for a proportion of participants. Another limitation of this study is that the small number of participants with an ABI ≤ 0.97 (15 participants, or 2.6% of the total sample) may reduce statistical power and increase the probability of a Type II error. A further limitation is that ABI was measured only once per participant, without repeated assessments to evaluate intra-observer reliability. Although the measurements were conducted by trained personnel following standardized protocols, this may have limited the ability to assess measurement precision.

Despite these limitations, our findings, which are similar to those in the literature, suggest that ABI is a useful and cost-effective screening tool in primary care, especially when combined with risk scoring systems such as FRS. Therefore, we emphasized that further multicenter studies involving larger sample groups are needed to validate the findings presented here and to determine the appropriateness of routine use of ABI and FRS as cardiovascular risk indicators in periodic health examinations in the context of family medicine practice in our country.

Etik Kurul: The study was approved by the Necmettin Erbakan University Meram Faculty of Medicine Ethics Committee for Non-Drug and Medical Device Research (Date: 24.06.2016 Decision number: 2016/648).

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