Original article

Evaluation of cardiovascular risk factors among university students in Turkey: a cross-sectional survey

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Abstract: *Background* — Recent data indicate increasing rates of mortality from cardiovascular (CV) disease in Turkey. This study aimed to evaluate CV disease risk factors among university students in Northern Turkey.
Methods — In this cross sectional descriptive study, 302 students were randomly recruited (171 females (57%) and 131 males (43%), mean age of 20±2.1 years). Blood glucose, cholesterol profile (total, high density lipoprotein (HDL) and low density lipoprotein (LDL) cholesterols), triglyceride, glycosylated haemoglobin, resting blood pressure, and body mass index were measured using standard protocols. All participants were asked to complete a questionnaire including questions on lifestyle, genetic predisposition, smoking habit, and psychosocial factors.
Results — The mean systolic and diastolic blood pressure of students were 127.1±13.5 mmHg and 78.3±12.4 mmHg. The mean values were 98.4±14.2 mg/dL for fasting blood glucose value, 5.4±0.4 for HbA_{1C}, 80.0±10.3 beats/min for heart rate, for total cholesterol 199.1±24.6 mg/dL, 43.8±9.9 mg/dL for HDL, 114.7±24.1 mg/dL for LDL, 199.1±24.6 mg/dL for trygliceride, 24.8±3.6 kg/m^2 for body mass index, 97.6±17.9 cm for waist circumference. No significant difference was observed between gender according to CV risk factors' values statistically. It was observed that 111 (36.8%) students were overweight, 32 (10.6%) were obes. About 135 (44.0%) of students had abnormally unacceptable WC value. Smoking habit was seen in 130 (43.0%) students [73 (24.2%) male and 57 (18.9%) female].
Conclusion — A substantial proportion of Turkish students were overweight or obese, and had smoking habit. Our results underscore the need to implement health promotion programmes and perform large-scale epidemiological studies within the general Turkish young adult population.

Keywords: cardiovascular disease, risk factors, university, students

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Introduction

Cardiovascular (CV) diseases are the leading cause of mortality and morbidity in the world even in the developing countries [1]. The manifestations of the diseases increase in middle-aged adults, however, many studies reported signs of atherosclerotic pathogenesis in younger adults and children as young as 5-6 years old [2-4].

The finding that atherosclerotic disease begins at an early stage of life reveals childhood and adolescence as critical periods for the detection of risk factors for CV disease and the prevention of future complications. Monitoring these factors would help identify early signs that when modifed can mitigate or even reverse the progression of those dysfunctions. A range of risk factors, including genetic factors, hypertension, dyslipidemia, obesity, metabolic syndrome (MS), an atherogenic diet, and physical inactivity, is associated with CV disease, and the prevalence of these factors is increasing among children and adolescents [5, 6].

In this study, we reported the prevalence of CV disease risk factors among university students in Turkey.

Material and Methods

Study population

Three hundred eighty students attending the University of Gümüşhane (Gümüşhane, Turkey) were randomly selected, and invited to participate in the study. 302 students (171 females (57%) and 131 males (43%), mean age of 20±2.1 years) voluntarily accepted the invitation. Written consent to participate was obtained before data collection. All participants were asked to complete a questionnaire assessing CV risk factors (genetic predisposition, smoking habit, and psychosocial factors). The anthropometric, body composition, blood pressure measurement, and laboratory tests were performed on all subjects in Cardiology Department. The study was approved by the local ethics committee.

To measure resting blood pressure, subjects were seated in a semireclined position with arms relaxed and supported and with

the mid point of the upper arm at the level of the heart. After a resting period of at least 5 minutes, blood pressure was measured with a mercury manometer (Riester, Jungingen, Germany).

Reference ranges in the study were for total cholesterol (TC) >5.0 mmol/L (190 mg/dL); low density lipoprotein (LDL) >3.0 mmol/L (115 mg/dL); high density lipoprotein (HDL) <1.0 mmol/L (40 mg/dL) for male and <1.2 mmol/L (46 mg/dL) for female; triglyceride (TG) >1.7 mmol/L (150 mg/ dL); fasting plasma glucose level for healthy inviduals 5.5-6.9 mmol/L (100-125 mg/dL); glycosylated haemoglobin (HbA_{1c}) 7.0-7.9% (53-63 mmol/L) [7].

Reference values for blood pressure that we have included in the study were based on 'Society of Hypertension World Health Organisation' (WHO-HT) values [7].

The weight and height of students were measured, and the associated body mass index (BMI) was calculated. The reference values participated in the study for BMI were categorised as poor weight (<18.5 kg/m^2), normal (18.5-24.9 kg/m^2), overweight (25-29.9 kg/m^2), and obese (≥30 kg/m^2) [7].

Students' waist circumferences (WCs) were measured. WC was measured to the nearest 0.1 cm, directly on the landmarked skin with a flexible, inelastic measuring tape with a tension meter attached, he measure is taken at the highest point of the iliac crest [8]. Reference WC value for men was 102 cm, and for females was 88 cm [7].

Blood samples were drawn from the antecubital vein by careful venipuncture using a 21-gauge needle attached to sterile syringe without stasis at 8.00 to 10.00 AM, after a fasting period of 12 hours. Participants' lipid levels, fasting blood glucose and HbA1c levels were measured. The standard 12 lead electrocardiogram (ECG) was carried out for all participants who have at least one risk factor.

Statistical Analysis

All statistical data were obtained from the "Microsoft Office Excel 2007" and analyzed with "Statistica 10" programs. Non-parametric criteria was used for comparisons between groups statistically. The Wilcoxon Matched Pairs Signed Ranks Test was used to determine the magnitude of difference between matched groups. For statistical analysis, non-normally distributed data were analyzed with Mann-Whitney U-test (for two-group comparison. The Correlation Coefficient (Pearson's r) Formula was used to analyze and determine the correlation coefficient between groups. P values smaller than 0.05 were accepted significant statistically.

Results

Type 1 diabetes mellitus was seen in 2 (0.7%) participants. Secondary hypertension was seen in 1 (0.4%) participant. The dispersion of cardiovascular risk factors among university students according to gender is shown in *Table* 1.

No significant difference was observed between genders according to cardiovascular risk factors' values statistically (*Table* 1).

The mean systolic and diastolic blood pressures of students were 127.1±13.5 mmHg and 78.3±12.4 mmHg.The mean values were 98.4±14.2 mg/dL for fasting blood glucose value, 5.4±0.4 for HbA_{1C}, 80.0±10.3 beats/min for heart rate, for total cholesterol 199.1±24.6 mg/dL, 43.8±9.9 mg/dL for HDL, 114.7±24.1 mg/dL for LDL, 199.1±24.6 mg/dL for trygliceride, 24.8±3.6 kg/m^2 for BMI, 97.6±17.9 for WC.

The mean trygliceride value for males was 200.1±25.2 mg/dL, and 197.8±24.0 mg/dL for females. Mean WC value for males was 101.6±16.6 cm, and 94.4±18.2 for females.

The distribution of cardiovascular risk factors' values (%) between genders is shown in *Table* 2. The number of participants with fasting blood glucose values ≥126 mg/dL was 9 (3.0%), (2 (0.7%) male and 7 (2.2%) female). There was one male participant (0.3%) with type I diabetes mellitus whose HbA_{1C} value ≥8.0.

According to *Table* 2, it was observed that 111 (36.8%) students were overweight, 32 (10.6%) were obes. About 135 (44%) of students had abnormally unacceptable WC value. The distribution of cardiovascular risk factors' ratios (%) between genders is shown in *Table* 3.

In females, number of patients with heart rate ≥ 90 beats/min (8.6%), having total cholesterol value ≥190 mg/dl (22.5%), HDL ≤ 39mg/dl (26.2%), triglyceride ≥150 mg/dl (12.3%), BMI 25.0-29.9 (20.9%), waist circumference ≤88 cm (30.5%), systolic blood pressure ≥ 140 mmHg (8.6%), diastolic blood pressure ≥90 mmHg (9.0%), genetic predisposition (20.5%), sedentary life style (27.8%), overweight (20.9%), obesity (6.3%), abdominal obesity (26.2%), and hyperglycemia (2.3%) were higher than males.

Smoking habit was seen in 130 (43.0%) students [73 (24.2%) male, 57 (18.9%) female].

In males, number of patients having waist circumference value 89-102 (15.2%) cm, and >102 cm (18.5%), and smoking habit (24.2%) were higher than females.

Table 1.The distribution of cardiovascular risk factors' mean values between genders (mean±SD)

Risk Factors	*Total (n=302)*	*Gender*		*P-level*
		Male (n=131)	*Female (n=171)*	
Age (years)	20.3±2.1	20.3±2.2	20.2±2.1	> 0.05
Glucose (mg/dL)	98.4±14.2	97.0±8.7	99.4±17.2	> 0.05
HbA_{1C} (%)	5.4±0.4	5.3±0.3	5.4±0.4	> 0.05
Heart rate (bpm)	80.0±10.3	80.3±9.7	79.7±10.8	> 0.05
Total cholesterol (mg/dL)	199.1±24.6	200.1±25.2	197.8±24.0	> 0.05
HDL (mg/dL)	43.8±9.9	43.1±10.2	44.4±10.0	> 0.05
LDL (mg/dL)	114.7±24.1	114.3±25.5	115.0±23.0	> 0.05
TG (mg/dL)	185.2±37.9	188.1±41.9	183.0±34.3	> 0.05
BMİ (kg/m^2)	24.8±3.6	24.6±3.6	24.9±3.6	> 0.05
Waist Circumference (cm)	97.6±17.9	101.6±16.6	94.4±18.2	> 0.05
Systolic blood pressure (mmHg)	127.1±13.5	127.1±12.5	127.2±14.3	> 0.05
Diastolic blood pressure(mmHg)	78.3±12.4	77.6±12.0	79.0±13.0	> 0.05

TG is triglyceride; HDL is high density lipoprotein; LDL is low density lipoprotein; BMI is body mass index; HbA_{1c} is glycated hemoglobin.

Table 2. The distribution of cardiovascular risk factors' values between genders

Risk Factors	*Total (n=302)*	*Gender*		*P-level*
		Male (n=131)	*Female (n=171)*	
Glucose (mg/dL)				
≤99	207 (68.5%)	95 (31,5%)	112 (37.1%)	> 0.05
100-125	86 (28.5%)	34 (11.3%)	52 (17.2%)	> 0.05
≥126	9 (3.0%)	2 (0.7%)	7 (2.2%)	> 0.05
HbA1C (%)				
≤ 6.9	298 (98.7%)	129 (42.7%)	169 (56.0%)	< 0.05
7.0-7.9	3 (1.0%)	1 (0.3%)	2 (0.7%)	> 0.05
≥8.0	1 (0.3%)	1 (0.3%)	0 (0%)	-
Heart rate (bpm)				
≤59	12 (4.0%)	6 (2.0%)	6 (2.0%)	> 0.05
60-89	246 (82.4%)	107 (35.4%)	139 (46.0%)	< 0.05
≥90	44 (13.6%)	18 (6.0%)	26 (8.6%)	> 0.05
Total cholesterol (mg/dL)				
≤189	203 (67.2%)	100 (33.1%)	103 (34.1%)	> 0.05
≥190	99 (32.8%)	31 (10.3%)	68 (22.5%)	< 0.05
HDL (mg/dL)				
≤39	139 (46.0%)	60 (19.9%)	79 (26.2%)	> 0.05
40-46	41 (13.6%)	19 (6.3%)	22 (7.3%)	> 0.05
≥47	122 (40.4%)	52 (17.2%)	70 (23.1%)	< 0.05
LDL (mg/dL)				
≤114	253 (83.8%)	110 (36.4%)	143 (47.3%)	< 0.05
≥115	49 (16.2%)	21 (7.0%)	28 (9.3%)	> 0.05
TG (mg/dL)				
≤149	246 (81.5%)	112 (37.1%)	134 (44.3%)	< 0.05
≥150	56 (18.5%)	19 (6.3%)	37(12.3%)	< 0.05
BMI (kg/m^2)				
≤18.4	1 (0.3%)	0 (0%)	1 (0.3%)	-
18.5-24.9	158 (52.3%)	70 (23.2%)	88 (29.1%)	> 0.05
25.0-29.9	111 (36.8%)	48 (15.9%)	63 (20.9%)	> 0.05
≥30	32 (10.6%)	13 (4.3%)	19 (6.3%)	< 0.05
Waist Circumference (cm)				
≤88	121 (40.1%)	29 (9.6%)	92 (30.5%)	< 0.05
89-102	71 (23.5%)	46 (15.2%)	25 (8.3%)	< 0.05
≥103	110 (36.4%)	56 (18.5%)	54 (17.9%)	> 0.05
SBP (mmHg)				
≤139	261 (86.4%)	116 (38.4%)	145 (48.0%)	< 0.05
≥140	41 (13.6%)	15 (5.0%)	26 (8.6%)	< 0.05
DBP (mmHg)				
≤89	259 (85.8%)	115 (38.1%)	144 (47.6%)	< 0.05
≥90	43 (14.2%)	16 (5.3%)	27 (9.0%)	< 0.05

SBP is systolic blood pressure; DBP is diastolic blood pressure; TG is triglyceride; HDL is high density lipoprotein; LDL is low density lipoprotein; BMI is body mass index, HbA_{1c} is glycated hemoglobin.

Table 3. The distribution of cardiovascular risk factors' ratios (%) between genders

Risk Factors	*Total (n=302)*	*Gender*		*P-level*
		Male (n=131)	*Female (n=171)*	
Genetic predisposition	109 (36.1%)	47 (15.6%)	62 (20.5%)	< 0.05
Hipodinamia	161 (53.3%)	77 (25.5%)	84 (27.8%)	> 0.05
Smoking	130 (43.0%)	73 (24.2%)	57 (18.9%)	> 0.05
Psychosocial factors (stress)	174 (57.6%)	82 (27.2%)	9 (3.0%)	< 0.05
Overweight	111 (36.8%)	48 (15.9%)	63 (20.9%)	< 0.05
Obesity	32 (10.6%)	13 (4.3%)	19 (6.3%)	> 0.05
Abdominal obesity	135 (44.7%)	56 (18.5%)	79 (26.2%)	< 0.05
Hyperglycemia	9 (3.0%)	2 (0.7%)	7 (2.3%)	< 0.05
Hypertension	38 (12.6%)	17 (5.6%)	21 (7.0%)	> 0.05
Tachycardia	44 (14.6%)	18 (6.0%)	26 (8.6%)	> 0.05

Participants having high value of blood pressure, hyperlipidemia, hyperglycemia, overweight, waist circumference which is above the normal range, and obesity were asked to consultation with a dietician.

Discussion

For successful prevention programs, several studies have suggested the importance of targeting young adults and identification of risk factors in this population [9-15]. Risk factors of CV diseases in young adults from various countries including

Portugal [9], Columbia [10], Japan [11], Brazil [12], Chile [13],and Serbia [14, 15] has been reported.

Inspite of their high level of education, first year university students did not have better nutritional habits than the general population, as has been reported in other studies [16].

A prospective population-based Turkish Adult Risk Factor (TEKHARF) Study [17], a prevalence of metabolic syndrome in 3 out of 8 Turkish adults, Turks have low levels of total cholesterol (mean is 185 mg/dl), LDL-cholesterol (mean is 116 mg/dl), and HDL-cholesterol (mean is 37 and 45 mg/dl in men and women). The latter is associated with comparatively high concentrations of triglycerides (mean 143 mg/dl) and of apo B (mean is 115 mg/dl). In TEKHARF study [17], it is remarkable that women exhibit identical LDL-cholesterol levels as men. Although our results are similar to TEKHARF Study [17], this study's main differences are young study population, and significant high mean triglyceride value especially in females.

Prevalence of cigarette smoking in Turkey is 33.4% for adults, and 6.9% for adults [18]. The prevalence of current smokers among university students in the present study was 43%. In terms of both male (24.2%) and female (18.9%) students, we found a high smoking incidence regarding previous studies [19].

Obesity has become a worldwide phenomenon cutting across regional and economic barriers. Childhood and adolescent obesity has emerged as an epidemic in both the developed countries and developing countries [20].

A high proportion of university students in the present study were overweight. The prevalences of overweight and obesity (BMI ≥30) in the present study were 36.8% and 10.6 %. The prevalences of overweight and obesity in a study done in North Carolina, USA among 582 students aged 18-25 years were 21.3% and 10.8% [21].

The problem of obesity among university students is alarming. The high prevalence of overweight and obesity is probably due to the recent trend of male youths of eating fast food,

which is high in saturated fats, in restaurants, most of the days of the week, and the inadequate practice of physical activity [22].

Among men who were students at Glasgow University during 1948 to 1968, a 10 mmHg increase in systolic blood pressure measured at around age 20 years was associated with a 15% increased risk of cardiovascular mortality [23].

The prevalences of stage I hypertension (systolic blood pressure is 140-159 mmHg, diastolic blood pressure is 90-99 mmHg), in a large population study among 18,881 students aged with a mean of 18.4±1.8 years were 2% [24]. The prevalence of stage I hypertension among university students in the present study was 12.6%.

The striking results of this study are that smoking, and obesity are widespread among male and female university students in Northern Turkey. This must be considered in deterrent campaigns targeting this age group.

Conclusion

To prevent and reduce cardiovascular diseases in the young, further research should be carried out to develop more effective obesity, and smoking cessation programs.

Conflict of interest: none declared.

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