High prevalence of cardiovascular risk factors in a Western urban Turkish population: a community-based study

Batı ve kentsel bir Türk toplumunda kardiyovasküler risk etmenlerinin yüksek prevalansı: Toplum tabanlı bir çalışma

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Abstract

Objective: Cardiovascular diseases (CVD) are the largest cause of morbidity and mortality in Turkey and in the World. Heart of Balçova Project is a community- based health promotion project that aims to reduce CVD incidence and prevalence through risk factor modification in the individual and population level. This paper presents results of the baseline survey that aimed to define CVD risk factors and risk of developing coronary heart disease (CHD) in the Balçova population.

Methods: The study population included 36,187 people over 30 years of age residing in Balçova in 2007. Individuals were interviewed at their homes. Anthropometrics and blood pressure were measured and in total 12914 fasting blood samples were collected for lipid and glucose analyses. CHD risk was estimated using Framingham risk equation. Student's t test, Chi-square for trend test and ANOVA were used to compare mean levels and percentages of risk factors between age groups and gender.

Results: In total 5552 men and 10528 women participated in the study. Smoking prevalence was 38.6% in men and 26.8% in women. The prevalence of obesity was 29.4% among men and 44.2% among women and obesity prevalence increased until the age group 75 years old. While 14.6% of men and 12.6% of women had diabetes, 39.8% of men and 41.8% of women had hypertension. The prevalence of high total cholesterol was 56.0% in men and 50.6% in women. Men had a higher risk of developing CHD compared to women in the following 10 years (13.4% vs 2.5%).

Conclusion: The prevalence of preventable risk factors for CHD is very high in Balçova population. Community-based interventions should be planned and implemented targeting both the high-risk individuals and whole population. *(Anadolu Kardiyol Derg 2013; 13: 9-17)*

Key words: Diabetes mellitus, obesity, smoking, Framingham risk score, coronary heart disease, prevalence

ÖZET

Amaç: Kardiyovasküler hastalıklar Türkiye'de ve dünyada morbidite ve mortalitenin en sık nedenidir. Balçova'nın Kalbi Projesi, toplum ve birey düzeyinde risk etmenlerine yönelik girişimlerle KVH'ların insidans ve prevalansını azaltmayı hedefleyen toplum sağlığını geliştirme projesidir. Bu çalışma Balçova'da yaşayan bireylerde kardiyovasküler risk etmenlerinin düzeyi ve koroner kalp hastalığı (KKH) gelişme riskini belirlemeyi amaçlamaktadır.

Yöntemler: Çalışma evrenini 2007 yılında Balçova'da yaşayan 30 yaş üstü 36187 birey oluşturmaktadır. Anketör görüşmeleri bireylerin evlerinde yapılmıştır. Antropometrik ve kan basıncı ölçümleri yapılmış, açlık lipit ve kan şekeri analizi için 12914 kan örneği toplanmıştır. KKH riski Framingham risk eşitliği kullanılarak tahmin edilmiştir. Yaş grupları ve cinsiyetler arasında risk faktörü ortalamalarının karşılaştırılmasında t-testi, eğimde Ki-kare ve ANOVA kullanılmıştır.

Bulgular: Çalışmaya toplamda 5552 erkek ve 10528 kadın katılmıştır. Sigara kullanım sıklığı erkeklerde %38.6, kadınlarda %26.8'dir. Obezite sıklığı erkeklerde %29.4, kadınlarda %44.2'dir. Erkeklerin %14.6'sında ve kadınların %12.6'sında diyabet var iken, erkeklerin %39.8'i ve kadınların

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%41.8'inde hipertansiyon vardır. Yüksek total kolesterol sıklığı erkeklerde %56.0, kadınlarda %50.6'dır. Erkeklerin %13.4'ü ve kadınların %2.5'inde önümüzdeki 10 yılda KKH gelişme riski %20'nin üzerindedir.
Sonuç: KKH için önlenebilir risk etmenlerinin Balçova'da yaşayan bireylerde görülme sıklığı oldukça yüksektir. Tüm toplumu ve yüksek riskli bireyleri hedefleyen toplum-temelli sağlığı geliştirici girişimler planlanmalı ve uygulanmalıdır. *(Anadolu Kardiyol Derg 2013; 13: 9-17)*
Anahtar kelimeler: Diyabetes mellitus, obezite, sigara kullanımı, Framingham risk skoru, koroner kalp hastalığı, prevalans

Introduction

Cardiovascular diseases (CVD) are the most common cause of morbidity and mortality in Turkey and in the world (1). CVD accounts approximately 48% of the total deaths in Turkey and 19% of the national burden of diseases is attributed to CVD (1). Cardiovascular risk factors including cigarette smoking, lipid disorders, elevated blood pressure, diabetes mellitus and obesity are associated with cardiovascular morbidity and mortality (2). Cardiovascular morbidity and mortality can be reduced by changing these risk factors by effective interventions at population and individual level (3, 4).

Although the burden of CVD is high in Turkey, policies to control this burden have only recently been put on the agenda and action plans were developed (5). However a comprehensive nationwide control program has not started yet. CVD and risk factor surveillance system infrastructure to implement effective community based interventions and evaluate the outcomes regularly has not developed yet. In addition to this, the number of health professionals trained for effective primary and secondary prevention of CVDs is quite limited (6).

Balçova is an urban settlement on the Aegean Coast with a population of approximately 75000 people. *Balçova Heart Study* initiated in 2007 with the collaboration between Balçova Municipality and Dokuz Eylül University Faculty of Medicine, Department of Public Health. Balçova Heart Project is a community health project that aims to reduce CVD incidence and prevalence through risk factor modification in the individual and population level (7). The baseline survey was conducted as a community screening program between October 2007 and January 2009 to obtain information on cardiovascular risk factors, including obesity, hypertension, diabetes mellitus, lipid disorder and current smoking. Risk of developing coronary heart disease in the following 10 years was calculated for each individual participated in the study. Description and the details of the Balçova Heart Study published elsewhere (7).

The aim of this study is to present results of baseline survey that aimed to define CVD risk factors and risk of developing coronary heart disease (CHD) in the Balçova population.

Methods

Study design

A cross-sectional population survey.

Study population

The study population was 36187 people over 30 years of age residing in Balçova District of İzmir, Turkey in 2007. All the study population were invited to participate the survey and data of 16080 people were evaluated in this study.

Data collection method

In total 10 interviewers were recruited for data collection and trained by the Project team. All the households were visited by interviewers and a questionnaire was applied after getting an informed consent.

The questionnaire included information on the demographic, socioeconomic characteristics, education, profession, marital status and income. Data on dietary habits, physical activity, smoking, disease history of the participants were also collected. Participants were then invited to the Neighborhood Community Centers (7), that were reorganized during data collection phase and divided to four stations for short interview by a physician, anthropometric and blood pressure measurements and collection of fasting blood sample for blood lipids and glucose analyses. After anthropometric and blood pressure measurements and blood sampling an appointment was given to the participants in the following three or five days to inform them about their measurements, laboratory test results and Framingham risk score status. Report cards, detailed information on the methods are provided elsewhere (7). All participants were individually informed by the residents of the Dokuz Eylül University Faculty of Medicine Department of Public Health and were advised to consult their family doctor if necessary.

Definitions and measurement methods for cardiovascular risk factors

Blood pressure measurement and hypertension

Blood pressure was measured after at least 5 minutes of resting and average of the two readings was used in the analysis. Hypertension was defined as systolic blood pressure (SBP) ≥ 140 mmHg and/or diastolic blood pressure (DBP) ≥90 mmHg or use of any antihypertensive (8). Blood pressure was measured using sphygmomanometer (Erka perfect aneroid, Germany).

Anthropometric measurements and obesity definitions

Body weight (kg) was measured and recorded with an accuracy of±100 g by using a calibrated digital scale, with subject wearing light clothes and no shoes. Body height was measured with a portable wall stadiometer (KaWe Medizintechnik, Asperg, Germany) in standing erect position, without shoes, heels together, shoulders in relaxed position and arms hanging freely. Body mass index (BMI) was calculated as body weight (kg)/ height^2 (m). Obesity was defined as BMI ≥30 kg/m^2 in both men

and women (9). Waist circumference (WC) was measured in the standing position at a level midway between the lowest rib and the iliac crest using a flexible but non-distensible tape. WC was categorized as high if it is ≥102 cm in men and ≥88cm in women (10). Hip circumference was measured at the widest point over the trochanters to the nearest millimeter. A high waist -to- hip ratio (WHR) was defined as ≥0.90 for men and ≥0.85 for women, and a normal WHR as below these cut off (7).

Hypercholesterolemia and diabetes mellitus

A venous blood sample was drawn from the arm of each subject by antecubital vein puncture, after an overnight 8-hour fasting by a trained nurse. Blood samples were transferred to the Dokuz Eylül University Central Laboratory which is an accredited laboratory that applies strict standard quality control techniques. Blood samples were centrifuged within maximum 4 hours after extraction and then immediately analyzed.

Diabetes was defined as having a fasting blood glucose level >126 mg/dL or being on any diabetes treatment (11).

Blood lipids including triglycerides (TG, mg/dL), total cholesterol (TC, mg/dL), low-density lipoprotein cholesterol (LDL-C, mg/dL) and high-density lipoprotein cholesterol (HDL-C, mg/dL) were determined using Abbott Architecht c16000 auto-analyser (Abbott Diagnostics, Abbott Park, IL, USA). Dyslipidemias were defined according to European Guidelines criteria: high LDL cholesterol as ≥130 mg/dL, hypertriglyceridemia as >150 mg/dL, low HDL cholesterol as <40 mg/dL in males and <50 mg/dL in females, and high TC as ≥200 mg/dL (12).

Smoking status was evaluated by the self-reported questionnaire. Each participant was classified as current smoker, ex-smoker or non-smoker. Current smokers were those who smoked at least one cigarette per day.

Coronary heart disease risk was estimated using the Framingham risk equation. Data on age, gender, smoking status, total cholesterol, HDL-C, blood pressure and diabetes history were used to estimate risk of developing CHD in the following ten years (13). Individuals were grouped based on risk scores <10% as low, 10-20% as medium and >20% as high risk (13).

Statistical analysis

The data analyses were performed using the SPSS software (SPSS for Windows, version 15.0; 1999, SPSS Inc, Chicago, IL, USA). Results are presented as mean±SE for quantitative variables and as count and percentages (%) for categorical variables. Mean values of cardiovascular risk factors in age groups were compared using one-way ANOVA followed by post-hoc Bonferroni test. Student t-test was used to compare mean levels of variables between men and women. Chi-square test was used to compare men and women for categorized anthropometric and biochemical characteristics. Chi-square for trend test was used to check trend in prevalence of risk factors in age groups.

Results

In total 16080 people out of 36187 responded to the invitation and were included in this baseline survey and in total 12914 blood samples were collected.

Mean values of CVD risk factors by age and gender

Anthropometric, clinical and biochemical characteristics of the participants are presented in Table 1 by age groups and gender.

Mean values of BMI, WC, hip circumference and WHR increases with age both in men and women until age group over 75. In age group over 75, mean levels of all the anthropometric measures are lower than the younger age groups. Mean BMI level is higher in women whereas mean WC and WHR levels are higher in men than women.

Mean SBP and DBP levels are higher in men than women ($p<0.001$) and show an increase with age both in men and in women ($p<0.001$). Fasting blood glucose levels are higher than the first two age groups both in men and in women ($p<0.001$).

Mean TC and LDL-C levels show an inverse U shape relation with age in men and women. Women have higher mean TC levels than men ($p=0.001$). Men had higher mean TG level than women ($p<0.001$). There was no statistically significant difference between men and women regarding mean LDL- C ($p=0.58$). HDL levels were stable within the age groups but increased in the oldest age. Mean HDL-C was higher in women compared to men ($p<0.001$).

Mean levels of Framingham risk score increased with age both in men and in women. Men had higher risk scores than women ($p<0.001$).

Prevalence of CVD risk factors by age and gender

Prevalence of current smoking is 52.5% in men aged 35-44 years and decreases to 9.7% in the oldest group (Table 2, Fig. 1). Smoking prevalence is close to men in younger women and declines in older age groups. Smoking prevalence is higher in men (38.6%) than women (26.8%) ($p<0.001$).

Approximately one fourth of the men and women are obese in the youngest age group. Obesity then increases substantially in women with age and reaches to 63.5% in age group 65-74. Obesity and high WC increases with age in women ($p<0.001$). Women are more obese than men either measured with BMI or waist circumference. However, men had higher prevalence of high WHR than women (63.4% versus 29.3%, $p<0.001$). Prevalence of high WHR increases with age in both men and women.

Prevalence of hypertension increases with age both in men and in women ($p<0.001$) but women have significantly higher prevalence of hypertension ($p=0.032$). Diabetes is higher in men than women ($p=0.002$) and shows an increase with age in both men and women (Table 2, Fig.1, 2).

High TC and high LDL-C do not show an age pattern in men ($p=0.060$, $p=0.797$). Prevalence of low HDL-C decreases with age in men and women and low HDL is more common in women than men (44.4% versus 38.0%, $p<0.001$).

CHD history is more common in men than women ($p<0.001$) but the prevalence of stroke history is close in both sex. ($p=0.160$).

In Balçova population 13.4% of men and 2.5% of the women have high risk of developing CHD in the next 10 years($p<0.001$) and the risk increases with age in both groups.

Table 1. Mean values and standard errors of cardiovascular risk factors and CHD risk score of the population by age and gender in Balçova Heart Study, 2009

Variables		Age groups						*p	**F	**p
Number of subjects (men/women)		30-44 (1)	45-54 (2)	55-64 (3)	65-74 (4)	75+ (5)	Total			
		1145/2821	1153/2397	1025/1831	731/1068	263/480	4317/8597			
Body mass index, kg/m^2	Men	27.68±0.12	28.25±0.12	28.21±0.13	28.42±0.15[a]	26.76±0.26	28.03±0.06	0.001	11.04	0.001
	Women	27.20±0.10	29.87±0.11	31.60±0.13	31.92±0.16[b]	30.23±0.22	29.63±0.06		260.51	0.001
Waist circumference, cm	Men	91.70±0.30	94.25±0.31	95.14±0.32	96.95±0.39[c]	94.22±0.60	94.24±0.16	0.001	31.61	0.001
	Women	79.70±0.21	85.94±0.24	90.88±0.27	93.35±0.33[d]	93.10±0.47	86.26±0.13		463.79	0.001
Hip circumference, cm	Men	102.48±0.22	102.67±0.22	102.12±0.23	102.73±0.27[e]	100.52±0.43	102.37±0.11	0.001	5.34	0.001
	Women	102.26±0.18	106.24±0.21	108.56±0.25	109.51±0.32[f]	106.69±0.44	105.86±0.11		155.88	0.001
Waist- to- hip ratio	Men	0.89±0.00	0.93±0.00	0.93±0.00	0.94±0.00	0.94±0.00[g]	0.91±0.00	0.001	93.65	0.001
	Women	0.77±0.00	0.80±0.00	0.84±0.00	0.85±0.00	0.87±0.00[h]	0.81±0.00		477.14	0.001
Systolic blood pressure, mmHg	Men	113.26±0.39	120.27±0.51	126.99±0.57	135.87±0.77	140.81±1.26[h]	123.90±0.29	0.001	272.46	0.001
	Women	107.43±0.26	117.96±0.35	129.84±0.47	139.18±0.66	144.87±0.96[h]	121.17±0.23		1057.46	0.001
Diastolic blood pressure, mmHg	Men	75.49±0.28	78.91±0.31	80.59±0.32	82.07±0.39[d]	81.88±.0.64	79.12±0.16	0.001	62.95	0.001
	Women	72.17±0.17	77.54±0.20	82.1±0.24	83.82±0.33	84.00±0.44[d]	77.88±0.12		471.05	0.001
Fasting blood glucose, mg/dL	Men	86.46±0.66	94.26±0.96	99.39±1.10	100.63±1.26[g]	98.99±1.86	94.77±0.48	0.001	34.10	0.001
	Women	83.39±0.29	90.31±0.47	100.00±0.83	102.80±1.18[g]	100.47±1.52	92.39±0.30		158.75	0.001
Total cholesterol, mg/dL	Men	204.73±1.22	214.47±1.21[i]	210.43±1.29	205.22±1.55	199.44±2.19	208.36±0.63	0.001	13.90	0.001
	Women	194.07±0.71	216.82±0.83	223.94±0.93[f]	220.38±1.20	216.70±1.85	211.32±0.44		212.31	0.001
Low-density lipoprotein cholesterol, mg/dL	Men	128.90±0.99	135.8±1.01[i]	133.12±1.06	131.04±1.27	127.73±1.89	132.03±0.52	0.58	7.46	0.001
	Women	119.63±0.59	137.17±0.70	141.05±0.80[j]	139.00±1.05	135.37±1.61	132.38±0.37		155.89	0.001
Triglycerides, mg/dL	Men	171.17±3.78	182.46±4.03[k]	164.18±3.58	144.63±2.69	126.70±3.85	165.57±1.79	0.001	19.87	0.001
	Women	115.27±1.43	136.97±1.54	152.00±2.14[l]	141.63±2.17	139.63±3.29	133.78±0.86		67.74	0.001
High-density lipoprotein cholesterol, mg/dL	Men	41.80±0.28	43.04±0.31	44.48±0.33	45.18±0.40	46.05±0.64[g]	43.59±0.16	0.001	19.24	0.001
	Women	51.61±0.23	52.36±0.25	52.78±0.28	52.97±0.37	53.36±0.57[m]	52.34±0.13		4.72	0.001
Framingham risk score	Men	5.73±0.10	10.56±0.18	15.78±0.27	24.21±0.47[c]	-	12.42±0.16	0.001	983.68	0.001
	Women	1.60±0.23	5.59±0.81	10.27±0.14	11.90±0.21[c]	-	5.88±0.06		2272.58	0.001

Data are presented as mean±SE
*compares mean values of risk factors in total men and women
**Analysis of Variance- compares mean values of risk factors between age groups within men and women separately
[a]significantly higher than groups 1,5, [b]significantly higher than groups 1,2,5, [c]significantly higher than group 1,2,3,5, [d]significantly lower than group 1,2,3, [e]significantly higher than 5, [f]significantly higher than 1,2,5, [g]significantly higher than 1,2, [h]significantly higher than 1,2,3,4, [i]significantly higher than 1,4,5, [j]significantly higher than 1,5, [k]significantly higher than 3,4,5, [l]significantly higher than 1,2,4,5, [m]significantly higher than 1

Discussion

This paper presents the baseline results of the Balçova Heart Study, which was planned to intervene CVDs through primary and secondary prevention actions with the collaboration of Dokuz Eylül University and Balçova Municipality. Baseline survey included over 16000 people who responded to the initial screening program. Our findings indicate that cardiovascular risk factors are highly prevalent in this Turkish urban population including lipid disorder, hypertension, obesity, smoking, and diabetes.

In the current survey, smoking prevalence is 42% in men and 31% in women in Balçova. These figures are higher than most of the western countries including Finland, Spain, Italy, UK, (14) and USA (15). Smoking prevalence is 21% in both men and women in UK (16), 23% in men and 18% in women over 18 in USA (15).

Smoking prevalence in Balçova population is also higher than prevalence reported in national surveys in Turkey. In Turkish Diabetes Epidemiology Study (TURDEP I) smoking prevalence was 50.5% in men and 11% in women over 25 years of age in 1998 (17). In the Global Adult Tobacco Survey (GATS 2008) smoking prevalence was 47.9% in men and 15.2% in women over 15 years of age (18). In the second TURDEP Survey in 2010, smoking prevalence was 31% in men and 10% in women over 25 years of age (19). In the GATS survey younger age groups, males and urban population had higher prevalence of smoking (18). Balçova Heart Project baseline survey includes only urban and

Table 2. Prevalence of cardiovascular risk factors and CHD risk status of the population by age and gender in Balçova Heart Study, 2009

Variables		Age groups							
Number of subjects (men/women)		30-44 (1) 1145/2821	45-54 (2) 1153/2397	55-64 (3) 1025/1831	65-74 (4) 731/1068	75+ (5) 263/480	Total 4317/8597	Chi square* p	Chi square for trend** p
Current smoking***	Men	52.5	44.1	34.1	21.6	9.7	38.6	0.001	0.001
	Women	39.2	31.6	17.8	7.8	3.8	26.8		0.001
Overweight , BMI 25-29kg/m^2	Men	49.3	47.7	50.1	48.1	46.7	48.7	0.001	0.676
	Women	34.7	38.2	31.4	28.6	32.3	31.4		0.001
Obesity, BMİ ≥30 kg/m^2	Men	25.2	32.0	31.0	33.3	19.5	29.4	0.001	0.238
	Women	25.9	44.1	58.7	63.5	53.7	44.2		0.001
Waist circumference ≥102 cm in men	Men	16.1	23.0	25.0	32.9	22.9	29.4	0.001	0.001
≥ 88 cm in women	Women	23.0	42.6	60.7	71.8	72.1	45.3		0.001
Waist-to-hip ratio ≥0.90 in men	Men	47.2	63.6	70.2	75.8	72.9	63.4	0.001	0.001
≥0.85 in women	Women	12.8	24.8	39.7	51.3	60.2	29.3		0.001
Hypertension (SBP >140 mmHg or DBP >90 mmHg or using medication)	Men	14.2	31.4	49.3	65.7	77.9	39.8	0.032	0.001
	Women	9.8	35.5	62.6	81.9	88.5	41.8		0.001
Diabetes mellitus (>126 mg/dL or diabetes history)	Men	4.0	11.7	19.2	25.4	25.5	14.6	0.002	0.001
	Women	3.0	8.7	21.3	26.7	23.9	12.6		0.001
High total cholesterol, ≥200mg/dL	Men	51.4	61.5	58.3	54.3	46.4	56.0	0.001	0.559
	Women	40.6	65.6	72.6	69.2	65.4	59.3		0.001
High LDL-C ,≥130mg/dL	Men	46.6	55.5	53.3	50.6	44.1	51.1	0.621	0.753
	Women	33.8	56.6	62.3	60.5	52.9	50.6		0.001
High triglycerides, ≥150mg/dL	Men	45.1	49.8	45.2	36.1	25.9	43.7	0.001	0.001
	Women	19.8	31.5	38.7	34.0	31.5	29.5		0.001
Low HDL-C men <40mg/dL	Men	45.2	39.4	33.2	33.7	30.0	38.0	0.001	0.001
women <50mg/dL	Women	45.9	45.5	42.5	42.5	41.3	44.4		0.004
Framingham risk score, 10-20%	Men	5.7	28.3	49.8	38.4	--	41.3	0.001	0.001
	Women	0.3	11.4	32.1	31.5	--	13.5		0.001
Framingham risk score >20%	Men	0.3	4.5	17.8	49.7	--	13.4	0.001	0.001
	Women	0.0	0.6	5.8	9.1	--	2.5		0.001
Coronary heart disease history	Men	1.3	6.0	15.5	20.6	27.1	10.8	0.001	0.001
	Women	0.7	3.2	7.2	16.2	20.0	5.8		0.001
Stroke history	Men	0.2	0.7	2.1	4.2	4.3	1.7	0.160	0.001
	Women	0.5	1.3	2.7	4.7	6.4	2.1		0.001
Family history for coronary heart disease	Men	49.7	50.7	60.3	65.8	66.4	56.2	0.001	0.001
	Women	45.5	54.1	65.2	74.9	812	57.8		0.001

Data are presented as percentage
Chi-square test - *compares prevalence between men and women, **compares prevalence between age groups within men and women separately, ***Number of subjects in age groups by gender (men/women) are as follows (1) 1602/3637, (2) 1473/2819, (3) 1245/2124, (4) 856/1276,(5) 349/650, (Total) 5525/10506
BMI - body mass index, DBP - diastolic blood pressure, HDL-C - high density lipoprotein cholesterol, LDL-C - low density lipoprotein-cholesterol, SBP - systolic blood pressure

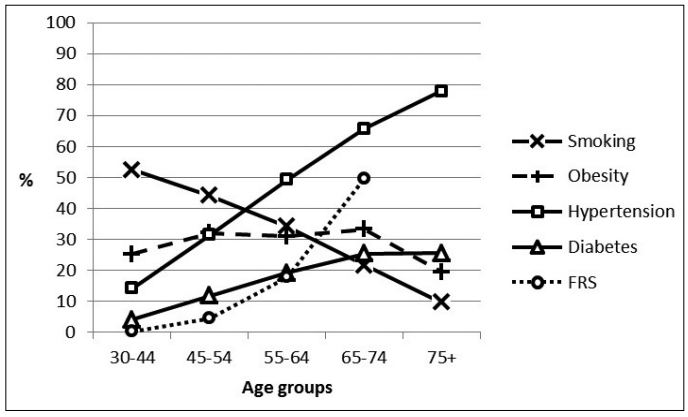

Figure 1. Prevalence of main CVD risk factors by age groups in men
FRS - Framingham risk score≥20%

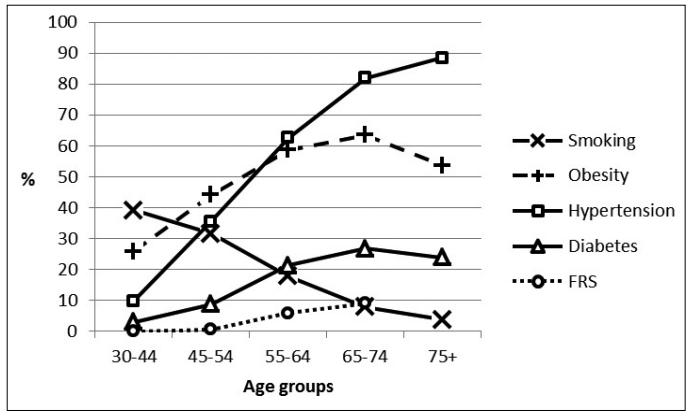

Figure 2. Prevalence of main CVD risk factors by age groups in women
FRS - Framingham risk score≥20%

western population, this may partly explain the high prevalence of smoking in the current study especially in women.

Most of the western countries succeeded to halve the smoking prevalence over the past 20 years (14). The National Tobacco Control Program started in year 2008 in Turkey. The programme aims to increase awareness of the damaging health effects of smoking, together with the anti-smoking measures of the government, including banning smoking in the public places, intensified antismoking campaigns, the banning of advertising and taxation (20). Impact of this program should be evaluated regularly.

In our baseline survey in Balcova, lipid disorder was the most common risk factor for both men and women in all age categories. Overall 56% men and 58% women have cholesterol levels higher than 200 mg/dL. These figures are close to prevalence reported in England in 2008 where, 58% of men and 61% of women had high cholesterol (>5 mmol/L) level (16) and higher than national study findings (21). The traditional Turkish diet is based on relatively high fresh fruit and vegetables content however it is changing to western diet rapidly with urbanisation. High glicemic foods rich from fructose based sugar, saturated fat, trans fatty acids and starch were largely promoted by the industry. For example bread constitutes a large proportion of Turkish diet, however consumption of fiber rich, low glycemic index, whole meal bread is quite low (7). Low levels of physical activity is also contributes to this condition. According to the "Let's eat healthy, Let's save our hearts" Survey conducted by the Ministry of Health in 15468 individuals over 30 years, it was found that the percentage of the individuals who had regular physical activity was just about 3.5% (22). In the National Burden of Disease study, it was found that 20% of the participants had a sedentary life, and 16% of them had inadequate physical activity (1). The challenge should be to create community-based nutrition and lifestyle interventions that may target food policy, environmental factors and/or nutrition education. School-based nutrition interventions need to be implemented in school settings to promote healthy nutritional attitudes, knowledge and behavior and physical activity among school-aged children and adolescents. Increasing fiber in bread by legislation and promoting consumption of whole meal products are other efficient policy interventions.

High prevalence of dyslipidemia calls for an early screening of lipid disorders in the primary care level. Creating awareness for the importance of healthy lifestyle including healthy diet, physical activity and smoking cessation should be emphasized at each care level.

In this study, men had higher prevalence of diabetes than women (14.6% compared to 12.6%). Frequency of diabetes increased with age until the age group 65-74. In the (TURDEP), the prevalence of diabetes was 7.4% in 1997 (6.2% in men and 8.0% in women) (14). In a national survey in 2000, the prevalence of diabetes was reported to be 4.2% (5.2% in men and 3.7% in women) (23). In the second TURDEP study in 2010 higher prevalence of diabetes were reported 16% for men and 17% for women over 20 years of age (19). Slightly higher prevalence in TURDEP Studies can partly be attributed to the oral glucose tolerance test (OGTT) that was used to determine diabetics. In the Balçova Heart Study, diabetes was based on patient history and fasting blood glucose. Overall findings from national surveys indicate that diabetes prevalence is increasing in Turkey parallel to obesity.

Obesity prevalence is substantially high both in men and in women in Balçova population. Approximately 30% of the men and 45% of the women are obese. These figures are comparable with the current obesity prevalence in the United States that are higher than 30% in most sex and age groups (15). High obesity prevalence were reported from previous surveys carried out in Turkey. In TEKHARF Study in 1990 obesity prevalence was approximately 13% in men and 32% in women aged over 20 (24). In 2000 the prevalence reported in a national survey was 21% in men and 41% in women over 30 (23). According to another national study, obesity prevalence was 30.4% (20.6% in men and 39.9% in women) (25).

Overall obesity prevalence is increasing in Turkey like most of the populations in the world and women seem to be more affected by this trend. In Balçova Heart Study it is striking that mean BMI levels are even higher than the cut-off for obesity (BMI>30 kg/m^2) in women aged 55 and over.

Obesity is increasing in developing countries. In a systematic review included studies from Middle East overall preva-

lence of obesity was 30.6% in women and 16.6% in men (26). The prevalence of overweight and obesity increased in all gender and age groups and in all geographic areas in China in last 20 years. The overall prevalence of overweight and obesity increased from 14.6 to 21.8% between 1992 and 2002 (27).

In general, high cardiovascular risk factor prevalence rates were reported in industrialized western countries. In the USA 34% had high blood pressure and 9.6% had diabetes (15). In the UK, 32% of men and 29% of women have high blood pressure or were being treated for high blood pressure. Around 6% of men and 4% of women in the UK have doctor-diagnosed diabetes (16). However higher prevalence of hypertension and diabetes were detected in the Balçova population.

In many studies men are reported to have higher prevalence of obesity, hypertension and hyperlipidemia (28-30) than women. However, in our study women have worse risk factor profile than men except for smoking. Especially prevalence of hypertension, obesity, low HDL-C and high cholesterol are higher in women than men in Balçova Heart Study.

The prevalence of people with CHD risk over 10% in next 10 years was quite high in Balçova population (54.7% in men and 16.0% in women 30-74 years). Risk scoring equations could be useful to predict the future events in the populations that they were based. An overestimation of risk by the Framingham function has been reported for Mediterranean and European countries (31-33). In the UK an overestimation of about 60% was observed while 260% overestimation was observed in Spain (31). Therefore many countries either adapted Framingham equation or developed their own risk functions based on cohort studies (31, 32, 34). However in a previous prospective study in Turkey it was emphasized that Framingham risk score underestimated CHD events especially in high-risk group (35). However, this result should be evaluated cautiously because of high possibility of selection and response biases in the initial study group. The large cohort of Balçova Heart study will provide a new opportunity to evaluate the predictive power of Framingham equation and other risk equations such as SCORE (36), Dundee (37), PROCAM (38).

Study strengths and limitations

One of the strengths of the Balçova Heart Survey is that we intended to include the whole population of Balçova and invited each household one by one for participation. Substantial efforts were made to increase response rate in this survey. Balçova municipality took an active role in media campaigning and communicating with the local representatives in the neighborhoods. Trained interviewers visited households at least 3 times on different days of the week. However, response rates are coming down in many population-based surveys in many countries. Although the study group is quite large compared to many studies in the field of CVD epidemiology, the participants may still be different than nonparticipants. Usually people with high level of risk factors or those who have health concerns might be more likely to respond to the invitation for participation to a survey.

Our study group is based on an urban population therefore, results can be cautiously generalized to the urban population only. The conception of the survey was consistent with the WHO stepwise approach, which recommends measuring chronic diseases risk factors by using questionnaire, physical measurements and laboratory methods (39).

Study implications

Cardiovascular diseases are the major cause of mortality and morbidity in Turkey. A country with a large aging population, Turkey should set and implement policies and strategies to control CVD epidemic. Although it is known that individual level interventions to cardiovascular risk factors including lifestyle changes and/or medical interventions reduce the mortality, morbidity, and disability (40). Population level health promotion interventions including legislative interventions such as smoking bans in public area or mass-media campaigns or salt reduction also have large impact on disease burden (40). Good quality epidemiological data are necessary for planning and evaluating disease control programs that will be based on 'population' and 'high-risk' strategies of primary prevention. Results of the Balçova Heart Study will also help to follow up the impact of national population based interventions beside a routine surveillance system that designed to provide data on CVD mortality, morbidity and risk factors.

Conclusion

In conclusion, the baseline survey of Balçova Heart Study showed a substantially high prevalence of preventable risk factors for CHD among the adult population of an urban settlement in Turkey. The survey results also highlighted the disadvantage of women population compared to men. The survey results provided crucial and timely information on the extent and determinants of CVDs to plan detailed community-based health promotion interventions targeting the whole population.

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