Risk of hypertension in Yozgat Province, Central Anatolia: application of Framingham Hypertension Prediction Risk Score

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احتمال خطر الإصابة بارتفاع ضغط الدم في ولاية يوزجات، وسط الأناضول: تطبيق سلم درجات فرامنجهام للتنبؤ بخطر الإصابة بارتفاع ضغط الدم

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الخلاصة: كان الهدف من هذه الدراسة المقطعية تقدير احتمال خطر الإصابة بفرط ضغط الدم لدى 1106 من القوقازيين الذين تتراوح أعمارهم ما بين 20 و69 سنة في ولاية يوزجات، وذلك باستخدام سلم درجات فرامنجهام للتنبؤ بخطر الإصابة بارتفاع ضغط الدم. فكان – وفقاً لهذا السلم – ومتوسط خطر الإصابة بارتفاع ضغط الدم على مدى 4 سنوات ٪6.2. وتم تصنيف المشاركين ضمن ثلاث فئات: منخفضة الخطورة (٪5>)، ومتوسطة الخطورة (٪5 إلى ٪10)، وعالية الخطورة (٪10>). وكانت النسبة المئوية لتوزيع المشاركين على هذه الفئات ٪59.4 و٪19.8 و٪20.8 على التوالي. وكانت نسبة المشاركين في الفئة عالية الخطورة مماثلة لوقوع ارتفاع ضغط الدم على مدى 4 سنوات (٪21.3) لدى الشعب التركي. وأظهر تحليل التحوُّف أن ارتفاع معدل استهلاك الملح وانخفاض المستوى التعليمي قد زادا من خطر الإصابة بارتفاع ضغط الدم زيادة كبيرة. ولم يكن هناك ارتباط بين المستوى الاقتصادي واستهلاك الدهون والرضا عن الحياة والنشاط البدني واستهلاك الفواكه والخضروات وبين خطر الإصابة بارتفاع ضغط الدم. إن هذه الدراسة تبين أن سلم درجات فرامنجهام للتنبؤ بخطر الإصابة بارتفاع ضغط الدم يمكن أن يستخدم أيضاً للتنبؤ بخطر الإصابة بارتفاع ضغط الدم في وسط الأناضول.

ABSTRACT The aim of this cross-sectional study was to estimate the risk of hypertension in 1106 Caucasian individuals aged 20–69 years in Yozgat Province, using the Framingham Hypertension Risk Prediction Score (FHRPS). According to FHRPS, average risk of developing hypertension over 4 years was 6.2%. The participants were classified into low- (<5%), moderate- (5% to 10%) and high- (>10%) risk groups. The percentage of participants that fell into these groups was 59.4%, 19.8% and 20.8% respectively. The proportion of participants in the high-risk group was similar to the 4-year incidence of hypertension (21.3%) in the Turkish population. Regression analysis showed that high salt consumption and low educational level significantly increased the risk of hypertension. Economic level, fat consumption, life satisfaction, physical activity, and fruit and vegetable consumption were not correlated with risk of hypertension. This study shows that FHRPS can also be used for predicting risk of hypertension in Central Anatolia.

Risques d'hypertension dans la Province de Yozgat en Anatolie centrale : application de l'indice de risque de Framingham pour la prédiction de l'hypertension

RÉSUMÉ La présente étude transversale avait pour objectif d'estimer le risque d'hypertension de 1 106 Caucasiens âgés de 20 à 69 ans dans la province de Yozgat, sur la base de l'indice de risque de Framingham pour la prédiction de l'hypertension. Selon l'indice, le risque moyen de développer une hypertension sur 4 ans était de 6,2 %. Les participants ont été classés en groupes à risque faible (< 5 %), modéré (5 % à 10 %) et élevé (>10 %). Les pourcentages de participants qui correspondaient à ces groupes étaient de 59,4 %, 19,8 % et 20,8 % respectivement. La proportion de participants dans le groupe à risque élevé était similaire à l'incidence de l'hypertension sur 4 ans (21,3 %) dans la population turque. L'analyse de régression a montré qu'une consommation excessive de sel et qu'un faible niveau d'éducation augmentaient considérablement le risque d'hypertension. Le niveau économique, la consommation de graisse, le niveau de satisfaction dans la vie, l'activité physique, et la consommation de fruits et de légumes n'étaient pas corrélés au risque d'hypertension. L'étude montre que l'indice de Framingham peut aussi être utilisé pour la prédiction du risque d'hypertension en Anatolie centrale.

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Received: 03/04/15; accepted: 24/03/16

Introduction

About 63% of deaths result from noncommunicable diseases and one of the most important is cardiovascular disease. Eighty-percent of deaths caused by noncommunicable diseases occur in countries with low and middle income. According to the 2010 World Health Organization (WHO) Global Status Report on Noncommunicable Diseases, hypertension is a leading risk factor for chronic diseases and related deaths. The number of patients with hypertension increased from 600 million in 1980 to ~1 billion in 2008 worldwide. In parallel to this finding, prevalence of hypertension among people aged > 25 years is nearly 40% and ~7.5 million people die from hypertension-related diseases annually, which accounts for 12.8% of all deaths. Hypertension is a major risk factor for coronary heart disease and stroke, and comprises 3.7% of disability-adjusted life years (DALYs) (*1*).

According to the Turkey Burden of Disease Study, 79% of all deaths are caused by noncommunicable diseases. In Turkey, hypertension is a leading cause of DALYs among 7 associated risk factors. It is estimated that 1 out of 4 deaths, one could be prevented if hypertension were controlled (*2*). The American College of Cardiology advises that blood pressure (BP) should be measured once every 2 years in adults with normotension and annually in prehypertensive individuals (*3*). It is reported that 86% of outpatients attending any primary healthcare centre in Yozgat Province measured their BP once in 2 years (*4*).

The prevalence and awareness of hypertension in developing countries are 32.2% and 40.6% for men and 30.5% and 52.7% for women, respectively. In comparison, these values in developed countries are 40.8% and 49.2% for men and 33.0% and 61.7% for women (*5*). According to the PatenT2 study of the Turkish Society of Hypertension and Kidney Disease (*6*), prevalence of hypertension among people aged > 18 years in Turkey was 30.3% in 2012. This compares with 35.1% in the SALTurk study in 2008 (*7*). Prevalence of hypertension in Finland decreased from 63.3% to 52.1% among men and from 48.1% to 33.6% among women, after measures were taken from 1982 to 2007 (*8*). Awareness of hypertension ranges between 40.7% and 49% according to the prevalence studies held in Turkey (*7,9*). Awareness of hypertension is higher among men than women in developing (52.7% vs 40.6%) and developed countries (61.7% vs 49.2%) (*5*). Awareness of hypertension is vital for adherence to antihypertensive medication. Blood pressure is only controlled in 28.7% of patients with hypertension in Turkey (*6*), compared with 29.6% of men and 34% of women in developing countries, and 33.2% of men and 38.4% of women in developed countries (*5*). According to the Turkish incidence of hypertension (HinT) study, the 4-year incidence of hypertension was 21.3% (*10*).

The lifelong risk of developing hypertension among individuals aged 55–65 years was 90% in the Framingham Heart Study (FHS) (*11*). That study in the United States (US) reported that the risk of developing hypertension was 35.8% for men until age 65 years and 69.2% until age 81 years (*12*). Age, gender, cigarette smoking, family history of hypertension and body mass index are risk factors for hypertension according to FHS (*13*).

To date, no study has estimated the risk of hypertension in Turkey. The aim of this study was to estimate the risk of hypertension in the community using the Framingham Hypertension Risk Prediction Score (FHRPS).

Methods

Study population

This was a cross-sectional study of individuals aged 20–69 years residing in Yozgat Province between March and May 2011. The records of the Turkish Statistical Institute for 2010 showed 75,012 people living in Yozgat Province (*14*) and 51,000 residents were aged ≥ 18 years. The random systematic sampling method was used when selecting the sample. One out of 25 houses and workplaces was included in the study sample. When there were ≤ 25 employees in a workplace, all of them were enrolled. When there were > 25 people, only 25 of them were included through simple random sampling. The data were collected through BP measurements and a literature-based (*13,15*) questionnaire that was prepared by the investigator. The questionnaire was administered to the participants by the nurse interviewers.

We excluded participants who had prevalent hypertension [systolic BP (SBP) ≥ 140 mmHg or diastolic BP (DBP) ≥ 90 mmHg], cardiovascular disease, diabetes mellitus and a history of any degree of renal failure. After we applied the exclusion criteria, 1106 of 1837 individuals remained eligible for analysis.

Survey

Presence of hypertension among parents, cigarette smoking, salt and fat consumption, educational status, income, quality of life, physical activity, and fruit and vegetable consumption were all recorded in the questionnaire. Informed consent was obtained from each participant. Ethical approval was provided by the local ethical committee and the study was carried out in accordance with the Declaration of Helsinki.

Trained health workers blinded to the study measured body height and weight of study participants in the erect position without shoes and wearing casual clothing, using a digital electronic scale. BMI values were classified according to WHO criteria (*16*). A trained health worker blinded to the study measured BP from the right and left arms of the participants in the sitting position after a 10-min rest. BP

was measured twice at a 5-min interval. SBP and DBP were recorded at the 1st and 5th Korotkoff phases, respectively, using a mercury sphygmomanometer. The average of 4 BP measurements was used for analysis. BP was classified according to the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure as follows: normal BP: SBP < 120 mmHg and DBP < 80 mmHg; prehypertension: SBP 120–139 mmHg or DBP 80–89 mmHg; hypertension: SBP ≥ 140 mmHg or DBP ≥ 90 mmHg (*17*).

Calculation of hypertension risk prediction score

The hypertension risk prediction score for each individual was calculated using the FHRPS formula described by Parikh et al. (*13*) using a ready-made Microsoft Excel program downloaded from https://www.framinghamheartstudy.org/risk-functions/hypertension/index.php#. They found that age, gender, SBP, DBP, BMI, smoking, history of parental hypertension and DBP values corrected for age were significantly important in predicting development of hypertension (*13*). Thus, hypertension risk score was calculated by coding: gender (male = 0, female = 1), age, SBP, DBP, BMI, smoking status (current smoker = 1, non-smoker = 0) and presence of parental hypertension (none = 0, 1 parent has hypertension = 1, both have hypertension = 2). The β coefficient of risk predictors was as follows: age, –0.15641; gender, –0.20293; BMI, –0.03388; SBP, –0,0593; DBP, –0,12847; cigarette smoking, –0,19073; history of parental hypertension, –0.16612; DBP values corrected for age, 0.00162. The FHRPS formula was validated and found to be statistically excellent in a study held in the United Kingdom (UK) (*18*). Hypertension risk prediction score was calculated separately as an estimated risk and optimal risk for 1, 2 and 4 years. Estimated risk indicated real risk of the individuals and was calculated in relation to the individual's own parameters. Optimal risk indicated risk of individuals at the same age and gender with BMI < 25 kg/m^2, no smoking, SBP < 120 mmHg, DBP < 80 mmHg and without parental history of hypertension. Estimated risk and optimal risk were calculated by the formula automatically. A difference in 4-year estimated risk and optimal risk was accepted as a risk difference. Estimated risk and risk difference values were classified into low risk if < 5%; moderate risk if between 5 and 10% and high risk if > 10% (*13*).

The data were analysed with *SPSS* version 15.0 software (SPSS, Chicago, IL, USA). Statistical analyses were carried out by χ^2 test, analysis of variance (ANOVA) and multivariate linear regression analysis (*19*). Factors that were not in the formula but had the potential to affect indirectly parameters related to hypertension were also included in the analyses. Among these independent variables that were taken as ordinal variables, the effect of educational and economic status, quality of the life, and salt and fat consumptions were categorized using a 5-point Likert-type scale model. The effect of physical activity, and fruit and vegetable consumption were categorized using a 3-point Likert-type scale model. All these ordinal variables were coded as dummy variables.

Results

Five hundred and seventy-six (51.2%) participants were female. The mean age was 35.1 ± 9.4 years and 29.7% of all participants were < 30 years old. Thirty-seven point seven percent of participants were cigarette smokers; 23.2% claimed that 1 or both parents had hypertension; 35.5% were prehypertensive; and 37.9% were overweight, while 18.4% were obese (Table 1).

After calculating hypertension risk prediction score, average 1, 2 and 4-year estimated risk values and their 95% confidence intervals (CIs) were as follows: 1.4% (1.25–1.45%), 2.9% (2.71–3.13%) and 6.2% (5.73–6.59%), respectively. Average risk differences (95% CI) were as follows: 1.0% (0.92–1.11%), 2.2% (1.97–2.37%) and 4.5% (4.10–4.91%), respectively (Table 2). Characteristics of participants with high 4-year estimated risk scores were determined to be age ≥ 50 years (13.4%), prehypertension (13.3%), obesity (12.1%), history of hypertension in both parents (10.2%), current cigarette smoking (6.3%) (Table 1).

The frequencies of low, moderate and high 4-year estimated risk scores were 59.4%, 19.8% and 20.8%, respectively. The number of participants with moderate 4-year estimated risk score was 4 times more than the number with moderate 1-year estimated risk score (Table 3). The number of participants with high 4-year estimated risk score was 20 times more than the number of participants with high 1-year estimated risk score (Table 3). The frequencies of low, moderate and high 4-year risk difference score were 68.7%, 13.8% and 17.4%, respectively.

Among the risk predictors that were thought to have a potential effect on hypertension risk prediction, only educational status had a significant relationship with 4-year estimated risk. Average 4-year estimated risk score was significantly correlated with educational status, income and salt consumption, but fat consumption, quality of life and fruit and vegetable consumption were not (Table 3). Educational status was not distributed homogeneously according to Levene's test, thus the Tamhane's T2 test was used for post-ANOVA evaluation. Accordingly, there were no differences among participants with secondary school education, undergraduate education and bachelor's degree ($P > 0.05$). However, there was a significant difference between the participants with elementary school or lower education and those

Table 1 **Frequencies of 1- and 4-year estimated risk (ER) and risk difference (RD) according to hypertension risk predictors**

Risk predictors		ER		RD	
	n (%)	1-year	4-year	1-year	4-year
Gender					
Male	530 (47.9)	1.4 (1.3–1.5)	6.5 (5.9–7.0)	1.1 (1.0–1.2)	4.9 (4.4–5.4)
Female	576 (52.1)	1.3 (1.1–1.5)	5.9 (5.2–6.5)	0.9 (0.8–1.1)	4.2 (3.5–4.8)
Age group (years)					
1–29	328 (29.7)	0.6 (0.5–0.7)	2.9 (2.5–3.3)	0.4 (0.3–0.5)	1.9 (1.6–2.3)
30–39	447 (40.4)	1.1 (1.0–1.2)	5.0 (4.5–5.6)	0.8 (0.7–0.9)	3.3 (3.1–4.2)
40–49	248 (22.4)	2.2 (2.0–2.5)	10.1 (9.0–11.1)	1.8 (1.5–2.0)	7.9 (6.8–8.9)
≥ 50	83 (7.5)	3.0 (2.5–3.6)	13.4 (11.0–15.7)	2.2 (1.6–2.8)	9.4 (7.1–11.7)
Body mass index (kg/m²)					
< 25	484 (43.8)	0.7 (0.7-0.8)	3.5 (3.1–3.9)	0.5 (0.4–0.5)	2.1 (1.8–2.5)
25–29.9	419 (37.9)	1.4 (1.2–1.5)	6.3 (5.7–7.0)	1.0 (0.9–1.2)	4.6 (4.0–5.3)
≥ 30	203 (18.4)	2.7 (2.4–3.0)	12.1 (10.7–13.4)	2.2 (1.9–2.6)	9.9 (8.5–11.2)
Blood pressure					
Normal	713 (64.5)	0.5 (0.4-0.5)	2.3 (2.2-2.5)	0.2 (0.1-0.2)	0.7 (0.6-0.9)
Prehypertension	393 (35.5)	3.0 (2.8-3.2)	13.3 (12.5-14.1)	2.6 (2.4-2.8)	11.4(10.7-12.1)
Cigarette smoking					
Current smoker	417 (37.7)	1.4 (1.2–1.5)	6.3 (5.7–7.0)	1.1 (0.9–1.2)	4.7 (4.1–5.4)
Ex-smoker	135 (12.2)	1.5 (1.2–1.7)	6.4 (5.4–7.9)	1.1 (0.8–1.4)	4.8 (3.6–6.0)
Non-smoker	554 (50.1)	1.3 (1.2–1.4)	5.9 (5.3–6.5)	1.0 (0.8–1.1)	4.3 (3.7–4.8)
Family history of hypertension					
None	849 (76.8)	1.2 (1.1–1.3)	5.5 (5.1–5.9)	0.9 (0.8–0.9)	3.8 (3.4–4.3)
One of parents	210 (19.0)	1.8 (1.5–2.0)	7.9 (6.7–9.1)	1.4 (1.2–1.7)	6.3 (5.2–7.4)
Both parents	47 (4.2)	2.3 (1.6–3.0)	10.2 (7.0–13.3)	1.9 (1.2–1.6)	8.3 (5.4–11.3)
Total	1106 (100.0)	1.4 (1.3–1.5)	6.2 (5.7–6.6)	1.0 (0.9–1.1)	4.5 (4.1–4.9)

Results are expressed as mean % (95% confidence interval).

Table 2 **Calculated estimated risk (ER), optimal risk (OR) and risk difference (RD) and their frequencies**

Risk levels	ER	OR	RD
1-year			
Very low risk (< 1.0%)	637 (57.6)	1088 (98.4)	733 (66.3)
Low risk (1.0–4.9%)	418 (37.8)	18 (1.6)	330 (29.8)
Moderate risk (5.0–10.0%)	50 (4.5)	0 (0.0)	43 (3.9)
High risk (> 10.0%)	1 (0.1)	0 (0.0)	0 (0.0)
Mean (95% CI)	1.4 (1.25–1.45)	0.3 (0.33–0.35)	1.0 (0.92–1.11)
2-year			
Very low risk (< 1.0%)	421 (38.1)	846 (76.5)	575 (52.0)
Low risk (1.0–4.9%)	460 (41.6)	260 (23.5)	346 (31.3)
Moderate risk (5.0–10.0%)	161 (14.6)	0 (0.0)	138 (12.5)
High risk (> 10.0%)	64 (5.7)	0 (0.0)	47 (4.2)
Mean (95% CI)	2.9 (2.71–3.13)	0.8 (0.73–0.78)	2.2 (1.97–2.37)
4-year			
Very low risk (< 1.0%)	266 (24.1)	214 (19.3)	467 (42.2)
Low risk (1.0–4.9%)	391 (35.4)	876 (79.2)	293 (26.5)
Moderate risk (5.0–10.0%)	219 (19.8)	16 (1.4)	153 (13.8)
High risk (> 10.0%)	230 (20.8)	0 (0.0)	193 (17.4)
Mean (95% CI)	6.2 (5.73–6.59)	1.6 (1.59–1.70)	4.5 (4.10–4.91)
Total	1106 (100.0)	1106 (100.0)	1106 (100.0)

Results expressed as No. (%). CI = confidence interval

Table 3 Four-year ER values of patients according to variables that may affect presence of hypertension but are not included in FHRPS formula

Correlates	Total	Low risk (< 5%)	Moderate risk (5–10%)	High risk (> 10%)	ER
	No. (%)	No. (%)	No. (%)	No. (%)	Mean (SD)
Educational status					
≤ Elementary school	281 (25.4)	119 (42.3)	59 (21.0)	103 (36.7)	9.7 (9.4)
Primary school	143 (12.9)	70 (49.0)	33 (23.1)	40 (28.0)	7.3 (7.5)
Secondary school	248 (22.4)	164 (66.1)	54 (21.8)	30 (12.1)	4.7 (5.8)
Undergraduate	131 (11.8)	90 (68.7)	18 (13.7)	23 (17.6)	4.8 (5.6)
Graduate	303 (27.4)	214 (70.6)	55 (18.2)	34 (11.2)	4.1 (4.9)
			$\chi^2 = 91.5$, $P < 0.001$		$F = 30.8$, $P < 0.001$
Economic status					
Good income	255 (23.1)	165 (64.7)	49 (19.2)	41 (16.1)	4.8 (5.7)
Moderate income	743 (67.2)	434 (58.4)	148 (19.9)	161 (21.7)	6.5 (7.5)
Poor income	108 (9.8)	58 (53.7)	22 (20.4)	28 (25.9)	7.3 (8.3)
			$\chi^2 = 6.4$, $P = 0.174$		$F = 6.3$, $P = 0.002$
Quality of life					
Satisfied enough	821 (74.2)	483 (58.8)	163 (19.9)	175 (21.3)	6.1 (7.2)
Moderately or not satisfied	285 (25.8)	174 (61.1)	56 (19.6)	55 (19.3)	6.3 (7.5)
			$\chi^2 = 0.6$, $P = 0.743$		$F = 0.3$, $P = 0.728$
Fruit/vegetable consumption					
< 1 meal per day	239 (21.6)	139 (58.2)	43 (18.0)	57 (23.8)	6.6 (7.6)
1-2 meals per day	548 (49.5)	332 (60.6)	105 (19.2)	111 (20.3)	6.0 (7.1)
≥ 3 meals per day	319 (28.8)	186 (58.3)	71 (22.3)	62 (19.4)	6.1 (7.3)
			$\chi^2 = 3.2$, $P = 0.530$;		$F = 0.5$, $P = 0.609$
Physical activity					
None	572 (51.7)	328 (57.3)	114 (19.9)	130 (22.7)	6.6 (7.7)
Insufficient	275 (24.9)	170 (61.8)	59 (21.5)	46 (16.7)	5.6 (6.9)
Sufficient	259 (23.4)	159 (61.4)	46 (17.8)	54 (20.8)	5.7 (6.6)
			$\chi^2 = 5.0$, $P = 0.288$		$F = 2.3$, $P = 0.101$
Salt consumption					
High-salt content	209 (18.9)	134 (64.1)	43 (20.6)	32 (15.3)	5.0 (5.8)
Moderate-salt content	672 (60.8)	392 (58.3)	130 (19.3)	150 (22.3)	6.4 (7.5)
Low-salt content/no salt	225 (20.3)	131 (58.2)	46 (20.4)	48 (21.3)	6.5 (7.8)
			$\chi^2 = 4.9$, $P = 0.292$		$F = 3.2$, $P = 0.043$
Fat consumption					
High fat content	129 (11.7)	76 (58.9)	20 (15.5)	33 (25.6)	7.1 (8.7)
Moderate fat content	743 (67.2)	448 (60.3)	147 (19.8)	148 (19.9)	5.9 (6.7)
Low fat content/no fat	234 (21.2)	133 (56.8)	52 (22.2)	49 (20.9)	6.6 (8.1)
			$\chi^2 = 4.0$, $P = 0.412$		$F = 2.1$, $P = 0.129$
Total	1106 (100.0)	657 (59.4)	219 (19.8)	230 (20.8)	6.2 (7.3)

ER = estimated risk; FHRPS = Framingham Hypertension Risk Prediction Score; SD = standard deviation

with primary school education, and both educational levels differed significantly from the other educational levels ($P < 0.05$). In multivariate linear regression analyses, lower educational level and higher salt consumption were significantly associated with a higher hypertension prediction risk score. However, the effect of these variables (R^2) on hypertension prediction risk was < 1% (Table 4). There was an inverse relationship between educational status and salt consumption ($r = -0.32$, $P < 0.001$). When age was included in the regression analysis, educational status was still found to be significant in calculating hypertension prediction risk score.

Discussion

There are few studies dealing with community-based hypertension risk prediction. In this study, we aimed at predicting hypertension risk using the FHRPS method among adults without previous heart disease, diabetes, any renal failure or hypertension.

The frequency of patients with 4-year moderate hypertension risk prediction in our study (19.8%) was similar to that of patients enrolled in FHS (19%), while frequency of high-risk patients (20.8%) was lower than that in FHS (47%) (*13*). This might have resulted from younger average age (35 years) and lower frequency of family history for hypertension (23.2%) in our study compared to FHS (42 years and 60%, respectively). In our study, the frequency of the population with 4-year hypertension risk prediction (20.8%) was similar to that of patients (21.3%) enrolled in the HinT study (*10*).

Average 4-year hypertension risk prediction in participants with prehypertension at the time of measurement was 5.8 times higher than that of those with normal BP. In a validation study of FHRPS held in England, the relevant value was 5.7 for 5-year predicted hypertension risk (*18*). Our results were similar to those of the study held in England.

In a meta-analysis, it was found that patients with prehypertension had a greater risk of cardiovascular disease, coronary heart disease and stroke compared to patients with normal BP (*20,21*). The four-year average hypertension risk of participants with a history of hypertension in both parents (10.2%) was nearly 2 times higher than that of participants without a history in both parents (5.5%) (Table 1).

A study from the US revealed that 60.4% of men with hypertension had a family history of hypertension in at least 1 parent and men with a family history had a 6.2 times higher risk of developing hypertension before age 55 years compared with those without a family history (*12*). According to FHS, 10-year risk for developing hypertension in men and women > 55 years old was 56% and 52%, respectively (*11*). Additionally, the CARDIA study (*22*) from the US revealed that 5- and 20-year cumulative incidence of hypertension in people aged 18–30 years was 3.2% and 25.7%, respectively (Caucasian men had an incidence of 3.2% and 21.4%, respectively vs 1% and 12.3% in women). In the Brazilian population aged 18–30 years, the 5.6-year incidence of hypertension was 21.5% (*23*) and the 5-year incidence in South Korea was 22.9% (*24*). In our study, the 4-year risk of hypertension (20.8%) was similar to the levels detected in Brazil and South Korea. In the Whitehall II trial in the UK, testing validation of FHRPS, the predicted hypertension risk was similar to the observed incidence of hypertension (*18*). A similar situation was found in our study, in which the predicted hypertension risk was similar to the observed incidence of hypertension in the HinT study (*10*).

Average salt consumption in Turkey was found to be 14.82 g/day (*25*). Excessive salt intake leads to high BP and uncontrolled hypertension. With a mean reduction of 4.4 g/day salt intake, there would be mean changes of −4.18 mm Hg for SBP and −2.06 mm Hg for DBP (*26*). In our study, we also confirmed that participants with high salt consumption had a high hypertension risk score (Table 4). Educational level was shown to be important in medication adherence, better lifestyle modification, and greater awareness and control of hypertension. Therefore, educational status is important in follow-up of hypertension for better clinical outcomes. In our study, we found that low educational status was significantly related to high hypertension risk score. We suggest that social policies should be developed to improve awareness about hypertension among people with low educational status and high hypertension risk score.

There were some limitations to our study. The study was carried out in an urban region and did not therefore

Table 4 Linear regression analysis of hypertension determinants related to 4-year estimated risk

Independent variables	*β*	95% CI	*t*	*P*	Correlation *r*
(Constant)	9.866	(6.827 to 12.905)	6.370	<0.001	
Education status[a]	−1.528	(−1.832 to −1.224)	−9.863	<0.001	−0.295
Economic status[a]	0.345	(−0.066 to 0.757)	1.648	0.100	−0.090
Quality of life[a]	0.371	(−0.180 to 0.922)	1.320	0.187	−0.010
Salt consumption[a]	0.564	(0.002 to 1.126)	1.969	0.049	0.064
Fat consumption[a]	−0.046	(−0.734 to 0.643)	−0.130	0.897	0.011
Physical activity[b]	−0.336	(−0.845 to 0.174)	−1.293	0.196	−0.057
Fruit/vegetable consumption[b]	−0.332	(−0.932 to 0.268)	−1.087	0.277	−0.019
Validity of the model			$F = 16.7$	< 0.001	$R^2 = 0.096$

[a] *Evaluated with 5-point model*
[b] *Evaluated with 3-point model; taken as ordinal variables.*

include rural residents. Additionally, the data reflected only the Yozgat Province.

As shown by relevant studies, estimated hypertension risk can be used to predict the incidence of hypertension in the community. Accordingly, provisional health policies can be developed using data for hypertension risk in the population of concern. Our study has shown that FHPRS can be applied to the population in Yozgat Province to estimate hypertension risk. Therefore, this preliminary study could pave the way for further, large studies in Turkey, and public health policies could be developed for the Turkish community accordingly.

Acknowledgements

This study was a poster presentation at the 6th European Public Health Conference, 13–16 November 2013, Brussels, Belgium and the abstract published (Eur J Public Health 2013; 23 (Suppl. 1).

Funding: None.

Competing interests: None declared.

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