Risk Factors of Hypertension and Correlates of Blood Pressure and Mean Arterial Pressure among Patients Receiving Health Exams at the Preventive Medicine Clinic, King Chulalongkorn Memorial Hospital, Thailand

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Objective: *The purpose of the present cross-sectional study was to determine the relevance of several risk factors for hypertension in a Thai population.*
Material and Method: *The authors used multiple linear regression to identify factors that influenced systolic blood pressure(SBP), diastolic blood pressure (DBP), and mean arterial blood pressure (MAP) in a study of 1,398 patients.*
Results: *Hypertensive risk factors were similar among men and women. Increased age, body mass index (BMI), and low educational attainment, were statistically significant risk factors for hypertension in men. For example, overweight men (BMI = 25.0-29.9 kg/m^2) were 1.88 times more likely to be hypertensive (OR = 1.88, 95%CI = 1.02-3.47) as compared with men who had a normal BMI (20.0-24.9 kg/m^2). Obese men ($\geq$ 30.0 kg/m^2) had an increased risk, but this association was not significant (OR = 1.40, 95%CI = 0.34-5.69). Similar risk factors were identified among women. Overweight women had a 1.74-increased risk for hypertension (OR = 1.74, 95%CI = 1.13-2.69). The corresponding risk was increased 3-fold among obese women (OR = 3.05, 95%CI = 1.76-5.29). Among men, age and BMI were positively associated with increased SBP, DBP, and MAP. Men $\geq$60 years of age had an increase in SBP (β = 18.89, $p < 0.001$), DBP (β = 5.53, $p < 0.001$), and MAP (β = 9.89, $p < 0.001$) values as compared with the referent group (< 40 years). Similar associations were noted among women.*
Conclusion: *Hypertension risk factors observed in this Thai population are similar to those found in Western populations. Prospective studies are needed to evaluate rigorously causal relationships between risk factors and hypertension.*

Keywords: *Blood pressure, Hypertension, Mean arterial pressure, Risk factors*

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Once an agriculturally based society, Thailand has blossomed into an industrious, developing nation[1]. Economic growth, as well as dramatic alterations in dietary and physical activity profiles of Thais has fueled the current epidemiological transition witnessed in Thailand. Infectious diseases such as malaria and tuberculosis, which were once leading causes of morbidity, have been replaced by non-infectious chronic conditions such as diabetes mellitus, coronary heart disease (CHD), and other vascular disorders[1].

Known as the silent killer, hypertension is typically defined as a systolic blood pressure (SBP)

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value ≥ 140 mm Hg and/or a diastolic blood pressure (DBP) value ≥ 90 mm Hg[2]. Left untreated, hypertension contributes to considerable morbidity including end-organ damage such as arterial and renal diseases[3]. Hypertension risk factors include increased age, non-white race, high sodium and total fat intake, family history of hypertension, physical inactivity, excessive alcohol consumption, and smoking[2]. Other factors include low educational attainment, psychosocial stress, and depression. To date, few studies have evaluated similar risk factors in relation to hypertension risk among Thais. Available data, however, suggest that an aging population, increases in dietary fat consumption, and increasing prevalence of obesity among Thais may fuel important increases in the prevalence of hypertension in Thailand[4]. The authors sought to identify risk factors of hypertension and correlate them to SBP, DBP, and Mean Arterial blood Pressures (MAP) among Thai men and women.

Material and Method

Study Population and Data Collection

The authors conducted a cross-sectional study of 1,398 patients (382 men and 1,016 women) who participated in annual health examinations at the Preventive Medicine Clinic of the King Chulalongkorn Memorial Hospital in Bangkok, Thailand during the period of July 1999 through February 2000.

During routine clinic visits participants were asked to provide information about their age, marital status, occupation, educational attainment, medical history, smoking status, alcohol consumption habits, participation in regular weekly physical exercise and other leisure activities. Participants were also asked to report on family history of hypertension, type 2 diabetes mellitus, dyslipidemia, and cardiovascular disorders.

Participants underwent routine physical examinations that included determining their height, weight, resting blood pressure, and collecting an overnight fasting venous blood sample. Standing height was measured without shoes to the nearest 0.5 centimeter. Weight was determined without shoes and with participants lightly clothed. Weight was measured using an automatic electronic scale (Seca, Inc, Germany) to the nearest 100 grams. Blood pressure was determined using an automatic sphygmomanometer (UDEX-IIa, UEDA, Corp., Japan). Participants were instructed to sit resting for 5 minutes before blood pressure measurements were determined.

All participants provided informed consent and the research protocol was reviewed and approved by the Ethical Committee of the Faculty of Medicine, Chulalongkorn University, and the Division of Human Subjects Research, University of Washington.

Analytical Variable Specification

Participant Body Mass Index (BMI) was calculated by expressing weight (kilograms) divided by height (meters) squared. BMI was evaluated both as a continuous variable and as a categorical variable. The authors used the World Health Organization criteria[5] to classify subjects according to lean, normal, overweight and obese status, respectively (BMI: < 20.0, 20.0-24.9, 25.0-29.9, and > 30 kg/m2, respectively).

Hypertension was defined according to the Seventh Report of the Joint National Committee on the Detection, Evaluation, and Treatment for High Blood Pressure (JNC VII)(6). Subjects with SBP and/or DBP exceeding the prescribed cutpoints (> 140 mm Hg for SBP and/or > 90 mm Hg for DBP) were classified as being hypertensive. MAP is considered an integrated parameter of blood pressure. It is also known to be more reproducible than individual SBP and DBP(7). The authors computed MAP for each subject and calculated it according to the following formula: MAP = DBP + 1/3 (SBP - DBP).

For initial analyses, the authors categorized age according to decade (< 20, 20-29, 30-39, 40-49, 50-59, 60-69 and ≥ 70 years). For multivariable analyses the authors collapsed the categories to represent three groups (< 40, 40-59, and ≥ 60 years). Other variables were categorized as follows: education (primary school only, in-complete bachelor degree, bachelor degree or higher); manual laborer (no vs yes); participants in regular weekly exerciser (no vs yes); participant in leisure time activities (no vs yes); cigarette smoking history (never, past and current) and (never vs ever); alcohol consumption (never, past and current). The authors also assessed family history of chronic disorders (no vs yes) for hypertension, type 2 diabetes, cardio-vascular disease and dyslipidemia, respectively.

Statistical analysis

The authors first explored frequency distributions of sociodemographic, behavioral characteristics and medical histories. For categorical variables the Chi Square test was used to evaluate differences in distribution of covariates for affected and unaffected patients. The authors also examined the distribution of continuous variables, such as blood pressure values, and found them to be approximately normal. The Student's t test was used to assess differences in mean values for covariates of interest among affected and unaffected subjects.

Logistic regression procedures were used to examine the risks of having hypertension. Univariate and multiple variable logistic regression procedures were employed to calculate unadjusted Odd Ratios (OR) of potential risk factors associated with hypertension. Confidence Intervals (CI), at the 95% level were also reported for each OR. Confounding factors were evaluated on the basis of their hypothesized relationship with the covariates of interest and with hypertension. Confounding was assessed by entering potential co-founders into a logistic regression model one at a time, and by comparing the adjusted and unadjusted ORs[8]. Final logistic regression models including covariates that altered unadjusted ORs by at least 10%[8]. Forward logistic regression modeling procedures combined with the change-in-estimate approach was used to identify the final models.

The authors used multiple linear regression models to assess the impact of several covariates on each blood pressure value (i.e., SBP, DBP, and MAP). To assess confounding, the authors entered variables into a linear regression model one at a time and then compared the coefficients. Final linear regression models included covariates that altered unadjusted coefficients by at least 10%, as well as those covariates of *a priori* interest (e.g., alcohol consumption and BMI). Adjusted R^2 values are reported for each model and represent the total variation of the dependent variable (e.g., SBP or DBP) explained by that model.

All analyses were completed separately for male and female patients. Statistical analyses were performed using SPSS (version 13.0, SPSS Inc. Chicago, IL, USA) software. All reported p-values were two tailed, and CI was calculated at the 95% level. A p-value of less than 0.05 was considered significant.

Results

Characteristics of the study population according to hypertension status and gender are shown in Table 1. Among men, hypertensives were older ($p < 0.001$), heavier ($p = 0.003$), had a lower educational attainment ($p = 0.008$), and were more likely to exercise ($p = 0.022$) compared with their normotensive counterparts. Hypertensive women were more likely to be older ($p < 0.001$), heavier ($p < 0.001$), to have a lower educational attainment ($p < 0.001$), exercise ($p = 0.031$), and have a positive family history of cardiovascular disease ($p = 0.086$) as compared with those who were normotensive. Overall, hypertensive and normotensive patients were similar in regards to occupational and smoking status, alcohol consumption, and participation in leisure time activity.

Table 1. Characteristics of study population according to high blood pressure status. Bangkok, Thailand, July 1999-February 2000

Covariates	Among Men High Blood Pressure No (n = 297) n	%	Yes (n = 85) n	%	p-value	Among Women High Blood Pressure No (n = 857) n	%	Yes (n = 159) n	%	p-value
Age Group (Years)					0.000					0.000
< 20	5	1.7	2	2.4		10	1.2	0	0.0	
20-29	56	18.9	3	3.5		136	15.9	3	1.9	
30-39	84	28.3	13	15.3		223	26.0	21	13.2	
40-49	71	23.9	13	15.3		260	30.3	38	23.9	
50-59	50	16.8	17	20.0		155	18.1	57	35.8	
60-69	19	6.4	33	38.8		66	7.7	30	8.9	
≥ 70	12	4.0	4	4.7		7	0.8	10	6.3	
Education					0.008					0.000
≥ Primary education	78	26.3	27	31.8		390	45.5	103	64.8	
< Bachelor degree	113	38.0	41	48.2		235	27.4	37	23.3	
≥ Bachelor degree	103	34.7	14	16.5		219	25.6	12	7.5	
Missing	3	1.0	3	3.5		13	1.5	7	4.4	
Labor work					0.439					0.492
Yes	39	13.1	14	16.5		114	13.3	18	11.3	
No	257	86.5	71	83.5		742	86.6	141	88.7	
Missing	1	0.3	0	0.0		1	0.1	0	0.0	

Table 1. Characteristics of study population according to high blood pressure status. Bangkok, Thailand, July 1999-February 2000 (Continued)

Covariates	Among Men High Blood Pressure					Among Women High Blood Pressure				
	No (n = 297)		Yes (n = 85)			No (n = 857)		Yes (n = 159)		
	n	%	n	%	p-value	n	%	n	%	p-value
Body Mass Index (Kg/m^2)					0.003					0.000
Underweight (< 20.0)	49	16.5	9	10.6		197	22.9	13	8.2	
Normal (20.0-24.9)	158	53.2	32	37.6		418	48.9	60	37.7	
Overweight (25.0-29.9)	78	26.3	40	47.1		186	21.7	53	33.3	
Obesity (≥ 30.0)	12	4.0	4	4.7		55	6.4	32	20.1	
Missing	0	0.0	0	0.0		1	0.1	1	0.6	
Smoking status					0.232					0.647
Never smoker	152	51.2	41	48.2		805	93.9	146	91.8	
Previous smoker	88	29.6	32	37.6		36	4.2	7	4.4	
Current smoker	57	19.2	11	12.9		13	1.5	4	2.5	
Missing	0	0.0	1	1.2		3	0.4	2	1.3	
Ever smoke					0.701					0.536
Never	152	51.2	41	48.2		805	93.91	46	91.8	
Ever	145	48.8	43	50.6		49	5.7	11	6.9	
Missing	0	0.0	1	1.2		3	0.4	2	1.3	
Drinking status					0.229					0.903
Never drinker	105	35.4	28	32.9		660	77.0	120	75.5	
Previous drinker	94	31.6	21	24.7		138	16.1	26	16.4	
Current drinker	97	32.7	36	42.4		57	6.7	12	7.5	
Missing	1	0.3	0	0.0		2	0.2	1	0.6	
Exercise					0.022					0.031
Yes	139	46.8	52	61.2		293	34.2	68	42.8	
No	156	52.5	33	38.8		560	65.3	89	56.0	
Missing	2	0.7	0	0.0		4	0.5	2	1.3	
Leisure time activities					0.323					0.311
Yes	197	66.3	60	70.6		537	62.7	93	8.5	
No	99	33.3	23	27.1		319	37.2	66	41.5	
Missing	1	0.3	2	2.4		1	0.1	0	0.0	
Family history of high blood pressure					0.528					0.730
Yes	65	21.9	16	18.8		203	23.7	37	23.3	
No	176	59.3	53	62.4		500	58.3	98	61.6	
Unknown	56	18.9	16	18.8		154	18.0	24	15.1	
Family history of diabetes mellitus					0.530					0.341
Yes	81	27.3	21	24.7		204	23.8	43	27.0	
No	167	56.2	52	61.2		529	61.7	92	57.9	
Unknown	49	16.5	12	14.1		124	14.5	24	15.1	
Family history of cardiovascular disease					0.173					0.086
Yes	37	12.5	16	18.8		159	18.6	21	13.2	
No	204	68.7	56	65.9		560	65.3	114	71.7	
Unknown	56	18.9	13	15.3		138	16.1	24	15.1	
Family history of dyslipidemia					0.326					0.191
Yes	39	13.1	8	9.4		119	13.9	17	10.7	
No	195	65.7	60	70.6		575	67.1	118	74.2	
Unknown	63	21.2	17	20.0		163	19.0	24	15.1	

Table 2 summarizes the results from multivariable logistic regression models estimated to identify risk factors for hypertension among men and women, respectively. Increased age, increased BMI, and low educational attainment, were found to be statistically significant risk factors for hypertension in men. Those

Table 2. Odds ratio (OR) and 95%confidence intervals (CI) of selected risk factors of high blood pressure among Thai men and women. Bangkok, Thailand, July 1999-February 2000

	Men		Women	
	OR	95%CI	OR	95%CI
Age (Years)				
< 40	1.00	Ref	1.00	Ref
40-59	1.46	0.75-2.86	2.15	1.29-3.57
$\geq$ 60	6.83	3.24-14.40	4.47	2.40-8.33
Body Mass Index (Kg/m^2)				
Underweight (< 20.0)	0.96	0.40-2.30	0.75	0.39-1.44
Normal (20.0-24.9)	1.00	Ref	1.00	Ref
Overweight (25.0-29.9)	1.88	1.02-3.47	1.74	1.13-2.69
Obesity ($\geq$ 30.0)	1.40	0.34-5.69	3.05	76-5.29
Smoking status				
Never smoker	1.00	Ref	1.00	Ref
Ever smoker	1.04	0.61-1.79	0.96	0.44-2.11
Education				
$\leq$ Primary education	1.40	0.63-3.14	2.84	1.23-5.16
< Bachelor degree	2.01	0.97-4.15	2.52	1.45-5.56
$\geq$ Bachelor degree	1.00	Ref	1.00	Ref

All OR adjusted for all other covariates in the model
Separate models were estimated for men and women

men who were 60 years or older were 6.83 times more likely to be hypertensive (OR = 6.83, 95%CI = 3.24-14.40) than men less than 40 years of age. Overweight men (BMI = 25.0-29.9 kg/m^2) were 1.88 times more likely to be hypertensive (OR = 1.88, 95%CI = 1.02-3.47) compared with men who had a normal BMI of 20.0-24.9 kg/m^2. Obese men (BMI $\geq$ 30.0 kg/m^2) had an increased risk, but this association did not reach statistical significance (OR = 1.40, 95%CI = 0.34-5.69). Men with some education, but who did not complete a bachelors degree as compared to those with at least a bachelors degree had a 2-fold increased risk of hypertension (OR = 2.01, 95%CI = 0.97-4.15). Men with $\leq$ than a primary school education had a slight increased risk of hypertension (OR = 1.40, 95%CI = 0.63-3.14), though the association did not reach statistical significance.

Similar risk factors were identified for hypertension in women. Women 60 years or older, had a 4.47-fold increased risk for hypertension (OR = 4.47, 95%CI = 2.40-8.33), as compared with younger women (< 40 years). Women 40-59 also had an increased risk (OR = 2.15, CI = 1.29-3.57). Overweight women compared to women with a normal BMI had a 1.74-increased risk for hypertension (OR = 1.74, 95%CI = 1.13-2.69). Obese women had a 3-fold increased risk for hypertension (OR = 3.05, 95%CI = 1.76-5.29) compared with the referent group. Low educational attainment was also a risk factor for hypertension in women. Those with only a primary school education had almost a 3-fold increased risk (OR = 2.84, 95%CI = 1.23-5.16) as compared with those who completed a bachelors degree.

In Table 3, the authors summarized the results from multiple linear regression models estimated to evaluate the influence of selective risk factors on mean SBP, DBP, and MAP among men and women respectively. Among men, age and BMI were positively associated with increased SBP, DBP, and MAP. Men who were $\geq$ 60 years of age had mean SBP values that were 18.89 mm Hg higher than men < 40 years of age (β = 18.89, p < 0.001). DBP and MAP were also significantly higher among men $\geq$ 60 years of age as compared with those < 40 years of age (β = 5.53, p < 0.001 for DBP; β = 9.89, p < 0.001 for MAP). Overweight men had significant increases in SBP (β = 4.40, p = 0.016), DBP (β = 5.42, p < 0.001), and MAP (β = 5.12, p < 0.001) as compared with the referent group. Although there was an inverse relationship in obesity for SBP (β = -0.30, p = 0.940), it was not statistically significant. Smoking and educational attainment were not statistically significant determinants of blood pressure values in this population. Estimated models explained 21.9%, 13.4%, and 19.5% of systolic, diastolic, and mean arterial blood pressures, respectively among men.

Table 3. Relationship between risk factor and blood pressure values: estimated linear regression coefficients (β), standard errors (SE), and p-values. Bangkok, Thailand, July 1999-February 2000

Independent Covariates	Systolic Blood Pressure (mm Hg)		Diastolic Blood Pressure (mm Hg)		Mean Arterial Pressure (mm Hg)	
	β ± SE	p-value	β ± SE	p-value	β ± SE	p-value
Among men						
Age 40-59	4.51 ± 1.75	0.010	1.79 ± 1.15	0.121	2.69 ± 1.20	0.025
Age ≥ 60	18.89 ± 2.34	0.000	5.53 ± 1.55	0.000	9.89 ± 1.61	0.000
BMI (kg/m²)						
< 20.0	-2.95 ± 2.23	0.187	-2.67 ± 1.47	0.071	-2.74 ± 1.53	0.075
20.0-24.9	Ref		Ref		Ref	
25.0-29.9	4.40 ± 1.82	0.016	5.42 ± 1.20	0.000	5.12 ± 1.25	0.000
≥ 30.0	-0.30 ± 3.97	0.940	4.51 ± 2.62	0.086	2.93 ± 2.72	0.282
Ever Smoker	0.07 ± 1.53	0.963	-0.57 ± 1.01	0.570	-0.39 ± 1.05	0.712
≤ Primary Education	3.20 ± 2.09	0.127	0.35 ± 1.38	0.800	1.32 ± 1.43	0.185
< Bachelor's Degree	1.95 ± 1.87	0.298	1.61 ± 1.24	0.194	1.71 ± 1.29	0.360
Adjusted R^2	*21.90%*		*13.40%*		*19.5%*	
Among women						
Age 40-59	4.85 ± 1.15	0.000	2.81 ± 0.73	0.000	3.49 ± 0.77	0.000
Age ≥ 60	13.91 ± 1.82	0.000	5.03 ± 1.15	0.000	7.99 ± 1.22	0.000
BMI (kg/m²)						
< 20.0	-2.97 ± 1.34	0.026	-0.29 ± 0.85	0.732	-1.18 ± 0.89	0.185
20.0-24.9	Ref		Ref		Ref	
25.0-29.9	5.20 ± 1.26	0.000	3.00 ± 0.80	0.000	3.73 ± 0.84	0.000
≥ 30.0	8.25 ± 1.85	0.000	6.33 ± 1.17	0.000	6.97 ± 1.24	0.000
Ever Smoker	-4.88 ± 2.10	0.021	-1.01 ± 1.33	0.447	-2.30 ± 1.41	0.102
≤ Primary Education	2.39 ± 1.32	0.071	1.66 ± 0.84	0.047	1.91 ± 0.89	0.032
< Bachelor's Degree	1.72 ± 1.39	0.217	1.33 ± 0.88	0.132	1.46 ± 0.93	0.118
Adjusted R^2	*15.20%*		*9.70%*		*14.70%*	

All coefficients and standard errors (b ± SE**)** adjusted for all other covariates in the model
Separate models were estimated for men and women

Among women, age and BMI were positively associated with each blood pressure parameter. Women ≥ 60 years of age had mean SBP values that were 13.9 mm Hg higher as compared with values in the referent group (β = 13.91, p < 0.001). Women 40-59 years of age had higher SBP values as well (β = 4.85, p < 0.001). Overweight women had statistically significant increases in SBP (β = 5.20, p < 0.001), DBP (β = 3.00, p < 0.001), and MAP (β = 3.73, p < 0.001) as compared with women in the referent group. Obese women had statistically significant increases in SBP (β = 8.25, p < 0.001), DBP (β = 6.33, p < 0.001), and MAP (β = 6.97, p<0.001) as compared with women in the referent group. Additionally, smoking status was inversely related with SBP (β = -4.88, p = 0.021), but not associated with DBP (β = -1.01, p = 0.447) and MAP (β = -2.30, p = 0.102). On average, women with the lowest educational attainment (≤ primary school education) had higher DBP (β = 1.66, p = 0.047) and MAP (β = 1.91, p = 0.032) compared with women who completed at least a bachelors degree education. Estimated models accounted for 15.2% of SBP, 9.7% of DBP, and 14.7% of MAP among women.

Discussion

Hypertension risk factors observed in this Thai population are similar to those found in Western populations. In the authors' study, hypertension risk was positively associated with increasing age. Men ≥ 60 years of age were 7-times more likely to be hypertensive as compared with younger men (< 40 years of age). Notably, MAP values were almost 10 mm Hg higher in older men compared with the younger men. Hypertension risk was 5-fold higher in older women (≥ 60 years of age) as compared with women < 40 years of age. Likewise, MAP values were 8 mm higher, on average, among older women compared with their younger counterparts.

Obesity is an increasing relevant public health problem that now threatens to overwhelm existing health care systems in developed and developing countries[9]. Increased BMI was noted to be an important factor for hypertension in the presented study population. Overweight men had double the risk of hypertension as compared with leaner men; and MAP values were 5 mm Hg units higher among overweight men. Obesity among Thai women was associated with a 3-fold increased hypertension risk; and MAP was increased by approximately 7 mm Hg units, on average, among obese women compared with those who had a normal BMI. Although increased BMI is an easily controllable risk factor for hypertension, it has low priority on Thailand's health agenda[4]. With easier, more convenient access to fast foods, traditional low-fat Thai meals are being replaced[4]. On the basis of available data, it appears that public health nutrition education and physical fitness programs are needed to motivate increased attention to adopting and maintaining healthful eating habits and adult weight maintenance. Additionally, focused attention towards developing and promoting foods that are both convenient and healthy are needed.

Low educational attainment was shown to be a significant risk factor of hypertension in this study population. Men with the least amount of education (i.e., less than a secondary school education) had a 1.4 increased risk of hypertension than men who had attained at least a bachelor's degree. Low educational attainment was an even stronger hypertension risk factor among Thai women. Hypertension risk was increased almost 3-fold among women with less than a secondary school education as compared with women who had attained at least a bachelor's degree. The precise role of education in increasing hypertensive risk is not known. However, the associations are likely to reflect increased socioeconomic status, access to health care, and facility with adopting healthful dietary and lifestyle habits that promote health and prevent morbidities such as hypertension and glucose intolerance. The authors' findings with regards to the association between low educational attainment and increased risk of hypertension underscored the important role public health campaigns may play in promoting health among Thais across the broad economic, social, and geographical gradients.

Several limitations of the authors' study merit consideration. First, information concerning subjects' behavioral and lifestyle characteristics were collected at the time of physical exam. Because of this cross sectional data collection design, the authors cannot be certain of the temporal relation between risk factors and the health indicators of interest. Second, information concerning lifestyle and behavioral characteristics (e.g., alcohol consumption and physical activity) was based upon self-reports. Therefore, the authors cannot exclude the possibility that some misclassifications may have occurred. Third, precise details of potentially important covariates such as the frequency, amount, duration, and intensity of physical activity, for example, were not collected. Therefore, inferences from the authors' study are limited by the relatively imprecise data collection procedures used.

Fourth, the number of men included in the present analyses is relatively small; hence, estimated ORs were often imprecise, as reflected by the wide 95%CI. The concordance of the present findings with those from other investigations[9-12] attenuates some concerns about study limitations, and suggests that valid inferences may be drawn from the present study. A carefully designed and conducted prospective cohort study that employs validated data collection instruments and objective measures of fitness and other metabolic parameters including endothelial function and chronic systemic inflammation will overcome many of the noted limitations and expand the current literature.

In summary, several risk factors for hypertension were identified in this population of Thai adults receiving annual health exams at the Preventive Medicine Clinic of the King Chulalongkorn Memorial Hospital in Bangkok. The results from the present study may be used to guide the development of programs geared towards preventing and mitigating specific risk factors of hypertension among Thais living in urban settings. Health promotion and disease prevention efforts are required if Thailand is to avoid the obesity-related chronic disease epidemic that is now prevalent in Western societies.

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ปัจจัยเสี่ยงของความดันโลหิตสูงและความสัมพันธ์กับความดันโลหิตและค่าเฉลี่ยความดันโลหิต ในผู้มารับการตรวจสุขภาพที่คลินิกเวชศาสตร์ป้องกัน โรงพยาบาลจุฬาลงกรณ์

Marshala Lee, Laketa Entzminger, **วิฑูรย์ โล่ห์สุนทร**, Michelle A Williams

***วัตถุประสงค์**: การศึกษาระยะสั้นนี้มีวัตถุประสงค์เพื่อศึกษาปัจจัยเสี่ยงของความดันโลหิตสูงในผู้มารับการตรวจสุขภาพ*

***วัสดุและวิธีการ**: ใช้พหุสมการถดถอยในการค้นหาปัจจัยที่มีอิทธิพลต่อความดันโลหิตขณะบีบตัว คลายตัวและค่าเฉลี่ยความดันโลหิตในผู้มารับการตรวจสุขภาพ 1,398 คน*

***ผลการศึกษา**: ปัจจัยเสี่ยงของความดันโลหิตสูงระหว่างเพศชายและเพศหญิงมีลักษณะคล้ายคลึงกัน อายุที่เพิ่มขึ้น ดัชนีมวลกายและระดับการศึกษาต่ำเป็นปัจจัยที่มีนัยสำคัญทางสถิติในเพศชาย ผู้ชายที่มีน้ำหนักมากกว่าปกติ (ดัชนีมวลกายระหว่าง 25.0 - 29.9 กก./ม.^{2}) (OR = 1.88, 95%CI = 1.02-3.47) ผู้ชายที่อ้วน ($\geq$ 30.0 กก./ม.^{2}) มีความเสี่ยงเพิ่มขึ้นแต่ไม่มีนัยสำคัญทางสถิติ (OR = 1.40, 95%CI = 0.34-5.69) พบปัจจัยเสี่ยงที่เหมือนกันนี้ในเพศหญิง หญิงที่มีน้ำหนักมากกว่าปกติมีความเสี่ยงต่อความดันโลหิตสูง 1.74 เท่า (OR = 1.74, 95%CI = 1.13-2.69) ความเสี่ยงเช่นเดียวกันนี้พบเป็น 3 เท่า ในหญิงที่อ้วน (OR = 3.05, 95%CI = 1.76-5.29) ในผู้ชาย อายุ และดัชนีมวลกายมีความสัมพันธ์เชิงบวกกับความดันโลหิตขณะบีบตัว, คลายตัวและค่าเฉลี่ยความดันโลหิตผู้ชายที่มีอายุ 60 ปีขึ้นไป เมื่อเทียบกับกลุ่มอ้างอิงที่อายุน้อยกว่า 40 ปี มีการเพิ่มขึ้นของความดันโลหิตขณะบีบตัว (β = 18.89, $p < 0.001$), ความดันโลหิตขณะคลายตัว (β = 5.53, $p < 0.001$), และค่าเฉลี่ยความดันโลหิต (β = 9.89, $p < 0.001$), ความสัมพันธ์ที่คล้ายคลึงกันนี้ก็พบในเพศหญิง*

***สรุป**: ปัจจัยเสี่ยงของความดันโลหิตสูงที่พบในประชากรไทยมีลักษณะคล้ายคลึงกับประชากรในซีกโลกตะวันตก มีความจำเป็นต้องใช้การศึกษาไปข้างหน้าในการประเมินความสัมพันธ์เชิงสาเหตุของปัจจัยเสี่ยงของความดันโลหิตสูง*