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Research Article
Prevalence of Hypertension and its Association with Nutritional Factors Among University Students in Shah Alam, Malaysia

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Abstract

Objective: This study aimed to examine the association of nutritional and lifestyle factors with the prevalence of hypertension among University students in Shah Alam, Malaysia. **Materials and Methods:** A cross-sectional study was conducted among students from different departments using self-administered questionnaires that concerned socio demographic information, nutritional habits and lifestyle factors. Blood pressure and anthropometric measurements were recorded using calibrated equipment. **Results:** A total of 410 students (111 males and 299 females) participated in the study. The results showed that 41 students (10%) had hypertension and of these 51.2% were male and 48.8% were female. There was no significant association between gender and hypertension ($p \leq 0.001$). However, nutritional status and waist circumference were associated with hypertension status ($p < 0.015$, $p = 0.015$, respectively). After logistic regression analysis, the only two factors found to be associated with hypertension were gender and waist circumference. **Conclusion:** The prevalence of hypertension among University students in this study was 10%. Given the young age of the respondents, this prevalence is relatively high and suggests that health education program about maintaining a healthy lifestyle should be arranged for University students.

Key words: Nutritional factors, young age, hypertension, waist circumference, high risk

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

High blood pressure (hypertension) is a common health problem and a global public health challenge. Hypertension is a silent, invisible killer that can have few symptoms or warning signs. The American Heart Association[1] defines hypertension as a Systolic Blood Pressure (SBP) ≥140 mm Hg or a Diastolic Blood Pressure (DBP) ≥90 mm Hg or the taking antihypertensive medication.

Globally, about one billion people have hypertension with two-thirds of cases occurring in developing countries. Hypertension is a major cause of premature death. The burden of hypertension is increasing and it is projected that by 2025 about 1.5 million people annually in the South-East Asia (SEA) Region will be diagnosed with hypertension[2].

In Malaysia, the overall prevalence of hypertension in individuals ≥18 years is 32.7% (95% CI 31.6-33.7), or about 6.2 million persons. Furthermore, by 2020 the prevalence of hypertension in Malaysia is projected to be about 35.8%, with an estimated 7.6 million Malaysians aged 18 years and above having hypertension[3]. Meanwhile, previous studies conducted with university students in countries such as Egypt[4], Uganda[5], Ethiopia[6] and Kuwait[7] showed lower rates of hypertension (26.5, 14, 7.7 and 7%, respectively).

Being overweight or obese is a leading cause of death and disability in both the United States and globally and is expected to increase in coming years. Over weight and obesity is also a major risk factor for many heart-related diseases, including hypertension[8]. Indeed, the prevalence of hypertension is increased in individuals who have a Body Mass Index (BMI) above 25 kg m^{-2}.

Lifestyle factors such as cigarette smoking also contribute to hypertensive effects, mainly by stimulating the sympathetic nervous system. Smoking reduces artery flexibility and increases wave reflection to affect central blood pressure. Thus, hypertensive smokers are more likely to develop severe forms of hypertension, including malignant and renovascular hypertension[9].

The aim of this study was to determine the prevalence of hypertension among University students in Shah Alam, Malaysia and its association with nutritional factors.

MATERIALS AND METHODS

A cross-sectional study was conducted among private University students in Shah Alam, Malaysia in 2016. Pregnant women were excluded from the study. Data were collected using relevant equipment for measurement of blood pressure, height, weight and waist circumference and self-administered sets of questionnaires. Blood pressure was measured using an automatic sphygmomanometer (Omron, Japan) after respondents were seated and had been at rest at least for 5 min. Participants who had systolic or diastolic readings of ≥140 mm Hg and ≥90 mm Hg, respectively, or were taking antihypertensive medication were classified as having hypertension[10].

The weight (kg), height (m), BMI (kg m^{-2}) and waist circumference (cm) of participants was measured. The Western Pacific Region BMI Classification was used in this study. Normal BMI is between 18.5 to 22.9. Participants with values below this range were classified as underweight, whereas those between 23 and 27.4 were classified as overweight and those with BMI values ≥27.5 were classified as obese[11]. Males and females with waist circumference ≥90 and ≥80 cm, respectively, were classified as having an increased risk of co-morbidities[11].

The questionnaires consisted of 4 parts:

- **Part A:** Socio demographic questionnaire
- **Part B:** Dietary habits questionnaire
- **Part C:** Lifestyle questionnaire
- **Part D:** Hypertension questionnaire

Part A of the questionnaire consisted of demographic information of the students. Questions included age, date of birth, gender, race, department, employment status and for those who were employed how many hours they worked per week. The final question asked the students about their total household income, including their parents' income.

Part B consisted of 7 items to assess the dietary habits of the study subjects and was used to measure the frequency of food consumption over the previous 1 week. The food and dietary habit question were developed on the basis of healthy eating habits. Dietary questionnaires were useful for evaluating average intake of population or categorizing the intake of individuals based on their food consumption[12]. Participants were asked to indicate the frequency of food servings they consumed, how often they ate takeaway food and whether they added salt to the food they ate. The frequency was measured using ratings of "never", followed by "once a week", "2-3 times a week", "more than 3 times a week" and "daily". Every item was given a rating from "0" for unhealthy habit to "4" for healthy habits. The score for each item was added and if the total score was above 13, the participant was considered to have healthy nutritional habits.

Part C was used to evaluate smoking as a lifestyle parameter and hypertension risk factor[13]. Participants were asked whether they smoked and if they had, how may cigarettes they smoked per day and for how many years. Smoking was defined as current use, at the time of the survey, of cigarettes. An ex-smoker was defined as a person who had stopped smoking for the past 6 months and a non-smoker was a person who never smoked[14].

Part D asked whether the participant had previously been diagnosed with hypertension. Those participants who responded "Yes" were asked whether they were prescribed antihypertension medications and whether they had any other chronic diseases.

Approval for this study from the Medical Research Ethics Committee of Management and Science University was obtained prior to initiating the study. Verbal and written consent was obtained from all study participants.

Statistical analysis: All statistical analysis were performed using the Statistical Package for Social Science (SPSS) version 20.0 for windows[15]. Independent t-test was used for continuous variables (age, family income and waist circumference). Chi-square test was used for categorical data and multivariable analysis was performed using binary logistic regression. The significance level was $p<0.05$.

RESULTS

Among the 410 study participants, 299 (72.9%) were female and 111 (27.1%) were male. The majority were Malay (291; 71.0%), followed by Indian (90; 22.0%), other (18; 4.4%) and Chinese (11; 2.7%). Among those who completed the questionnaire, 355 (86.6%) were not working and 55 (13.4%) were employed (Table 1).

In terms of hypertension and history of chronic diseases, 41 (10%) participants had high blood pressure and of these 17 had been previously diagnosed and were taking medication (Table 2). A small percentage (14; 3.4%) had other chronic diseases. The majority of participants (175, 42.7%) had normal BMI, whereas 88 (21.5%) and 75 (18.3%) were overweight and obese, respectively. Meanwhile, 72 (17.6%) of participants were underweight. For nutritional habits, over half (257, 62.7%) of the participants had unhealthy habits (Table 3).

Gender and waist circumferences were significantly associated with hypertension (p value <0.001 and 0.015, respectively) whereas smoking and nutritional status had an insignificant association (Table 4).

After performing a logistic regression analysis for factors associated with hypertension, only gender and waist circumference were associated with hypertension with an

Table 1: Socio-demographic characteristics of the respondents

Variables		N	%
Gender	Male	111	27.1
	Female	299	72.9
Race	Malay	291	71.0
	Chinese	11	2.7
	Indian	90	22.0
	Others	18	4.4
Field of study	Medical	162	39.5
	Non-Medical	248	60.5
Working	Yes	55	13.4
	No	355	86.6
	Minimum	Maximum	Mean±SD
Age (Years)	18.00	31.00	21.73±2.11
Working hours (Hours per week)	0.00	56.00	18.40±15.92
Household Income (Malaysian Ringgit)	250.00	30000.00	5549.05±5476.59

Table 2: Hypertension and history of chronic diseases

Variables		N	%
Hypertension	Yes	41	10
	No	369	90
	Minimum	Maximum	Mean±SD
Systolic BP	86.00	157.00	116.59±14.29
Diastolic BP	47.00	128.00	72.40±10.03
Did you diagnosed with hypertension before	Yes	17	4.1
	No	393	95.9
Medication take for hypertension	Yes	5	29.4
	No	12	70.6
Chronic diseases	Yes	14	3.4
	No	396	96.6

Table 3: Nutritional factors

Variables		N	%
Nutritional status (BMI)	Underweight	72	17.6
	Normal	175	42.7
	Overweight	88	21.5
	Obese	75	18.3
Nutritional habit	Unhealthy	257	62.7
	Healthy	153	37.3
Waist circumference (cm)	Minimum	Maximum	Mean±SD
	56.50	115.80	78.60±11.38
Serving of vegetable per week	Never	12	2.9
	Once a week	67	16.3
	2-3 times per week	137	33.4
	More than 3 times a week	73	17.8
	Daily	121	29.5
Serving of fruits per week	Never	25	6.1
	Once a week	136	33.2
	2-3 times per week	150	36.6
	More than 3 times a week	61	14.9
	Daily	38	9.3
How many cans of soft drinks per week	Daily	36	8.8
	>3 times	32	7.8
	2-3 times a week	92	22.4
	Once a week	182	44.4
	Never	68	16.6

Table 4: Association between nutritional factors, smoking and hypertension among respondents

		Hypertension				
		Yes		No.		
Variables		No.	%	No.	%	p-value
Nutrition status	Underweight	3	4.2	69	95.8	<0.001[a]*
	Normal	11	6.3	164	93.7	
	Overweight	9	10.2	79	89.8	
	Obese	18	24.0	57	76.0	
Nutrition habits	Unhealthy	25	9.7	232	90.3	0.812[a]
	Healthy	16	10.5	137	89.5	
Smoking	No	35	9.3	343	90.7	0.116[a]
	Yes	6	18.8	26	81.3	
		Mean±SD		Mean±SD		
Waist circumferences (cm)		86.17±13.42		77.76±10.83	0.015[b]*	

*Level of significance at p<0.05, [a]Chi Square test was performed, [b]Student's t-test was performed, SD: Standard Deviation

Table 5: Factors related to Hypertension using logistic regression analysis

					96% CI	
	B	WALD	p-value*	Adj. OR	Lower	Upper
Gender	1.036	8.673	0.003	1.050	1.022	1.078
Waist circumference (cm)	0.048	12.339	<0.001	2.817	1.414	5.614

*Binary logistic regression was performed using Forward LR method, Level of significance at p<0.05, Adj. OR: Adjusted odds ratio

adjusted odds ratio of 1.0 and 2.8, respectively, indicating that students who had larger waist circumferences had a 2.8-fold greater chance of being hypertensive compared to those who had normal waist circumference (Table 5).

DISCUSSION

The main finding of this study is that prevalence of hypertension among the Malaysian University students who participated was 10%. Of these, 17 (4.1%) already knew that they had hypertension, whereas 24 participants only learned through this study that they were hypertensive. This result is consistent with a previous study conducted in Nigeria by Tadesse and Alemu[6] who showed that the prevalence of hypertension among college students aged 18 years and above was 7.4%.

In this study, only 5 (29.4%) out of 17 students who were previously diagnosed with hypertension took their

prescribed anti-hypertensive medication, whereas the remainder did not take medication despite being aware of their condition. The compliance of taking anti-hypertensive medication can yield good blood pressure control. This is supported by a study on adherence with anti hypertensive monotherapy in 13 managed care organizations conducted by Bramley *et al.*[16], who found that approximately 270 (43%) of high-adherence patients achieved blood pressure control compared with 56 (34%) and 15 (33%) patients with medium- and low-adherence, respectively.

Our study showed an association between waist circumference and hypertension among students. The results reveal that students with high waist circumference (90 cm and above for males, 80 cm and above for females) also developed hypertension, it can be said that high waist circumference is a risk factor for developing hypertension. The result is supported by a study conducted by Tawfeek[17] in Baghdad that showed waist circumference for men was positively and significantly correlated with systolic and diastolic blood pressure.

In agreement with earlier studies, results of the present study shows that the prevalence of hypertension is higher among males (19.8%) compared to females (6.4%). Male is the most powerful non-modifiable predictor of pre-hypertension among young Israelis [18], where males are almost 2 times more likely to have pre-hypertension compared to females. This finding can be explained by the protective effect of endogenous estradiol in females which does not exist in male. The mechanism of actions is through the activation of vasodilator pathway activated by the sympathetic nervous system and angiotensin[19]. In addition, a study among healthy adults conducted by Oladapo *et al.*[20] found that 20.8% of study subjects being diagnosed as hypertensive with a BP of $\geq$140/90 mm Hg, 42.3% of the men and 36.8% of the women had a BP of $\geq$130/85 mm Hg and could be classified as pre-hypertensive. Thus, our results and those of others showed an association between gender and hypertension.

In term of nutritional status, the prevalence of underweight, normal, overweight and obese are 17.6, 42.7, 21.5 and 18.3%, respectively. The high prevalence of overweight and obese individuals recorded in this study compares well with the reported 35.29% of students who were overweight or obese among students of University Santo Tomas in Chile[21] and is similar to another study performed in the United States that reported a 33% prevalence of overweight and obesity among University students[22]. Similarly, a study conducted in Saudi Arabia also found that 29.8 and 18.6% of students at King Abdul Aziz University, Jeddah were overweight and obese, respectively[23].

Our findings synchronized with the result of Zhang *et al.*[24] that described overweight and obesity were strongly associated with pre-hypertension and hypertension among studied students.

This study discovers that the prevalence of hypertension is high among college-aged students in Malaysia and these findings could be useful for health authorities who are designing strategies to address this issue and to develop materials used to promote adoption of a healthy life style. This study will also help to identify critical populations in younger age groups that are at risk for developing hypertension. These results could provide a basis for new theories for the early prevention and treatment of hypertension in young adults.

CONCLUSION

The prevalence of hypertension among a sample of University students in Malaysia was 10%. Giving the young age of the respondents, this prevalence is considered to be high and indicates that additional effort is needed to promote a healthy lifestyle for University students in Malaysia.

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