

ORIGINAL ARTICLE

PSYCHOLOGICAL DETERMINANTS OF PRE-HYPERTENSION AMONG FIRST YEAR UNDERGRADUATE STUDENTS IN A PUBLIC UNIVERSITY IN MALAYSIA

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ABSTRACT

Pre-hypertension increased the risk of morbidity and mortality from non-communicable diseases. Whereas, psychological factors such as depression, anxiety and stress have been associated with increased in blood pressure. However, previous studies more focuses on psychological determinants of hypertension than prehypertension. Thus, this study aims to determine the association between these psychological factors with pre-hypertension. A cross-sectional study was conducted in 2012 among first year students of a public Malaysian university. A random cluster sampling was used to select 5 out of 15 faculties and a total of 495 students participated in this study. The Malay version of DASS-21 was used to elicit their levels of depression, anxiety and stress. Blood pressures were measured twice using sphygmomanometer and the averages were taken. Data analyses used chi-square test and binary multiple logistic regression. The prevalence of pre-hypertension was 30.1%. The percentage of severe and extremely severe depression was 3.8% and 1.2%; both severe and extremely severe anxiety was 16.4%; and severe and extremely severe stress was 4.2% and 0.2% respectively. Severe/extremely severe depression had more than 3 times higher in getting pre-hypertension than no depression. In conclusions, almost one third of respondents had pre-hypertension and only severe/extremely depression was associated with pre-hypertension.

Keywords: pre-hypertension, DASS-21, university students, Malaysia

INTRODUCTION

Pre-hypertension is defined as a systolic blood pressure of 120-139 mmHg and or a diastolic blood pressure of 80-89 mmHg¹. The prevalence of pre-hypertension among undergraduate university students in a Malaysian government university was reported as 42.9%². Whereas, the prevalence of pre-hypertension among university students in Columbia³, Kuwait⁴, Palestine⁵ and Slovakia⁶ was 40.0%, 39.5%, 27.1% and 22.1% respectively.

Individuals with pre-hypertension have higher risk of getting hypertension and also higher risk of strokes and cardiovascular diseases. In a study, the conversion rate of developing hypertension was 37% in 4 years for individuals with high normal blood pressures⁷. An even higher conversion rate was reported in the Trial of Preventing Hypertension (TROPHY) study in which over a period of 4 years, nearly two thirds of patients with untreated pre-hypertension developed stage 1

hypertension⁸. The population-attributable fractions of pre-hypertension for myocardial infarction and coronary artery disease were 47% and 20% respectively⁹. Adult with prehypertension were about twice more likely to have chronic kidney disease compared to normotensives¹⁰.

For psychological factors, previous study indicated that the overall prevalence (moderate, severe and extremely severe) of depression, anxiety and stress among Turkish university students was 27.1%, 47.1% and 27.0% respectively¹¹. Whereas in Malaysia, a study among undergraduate students from 4 universities indicated that the prevalence of moderate and severe or extremely severe depression was 27.5% and 9.7% respectively; while moderate and severe or extremely severe anxiety was 34.0% and 29.0%; and moderate and severe or extremely severe stress was 18.6% and 5.1% respectively¹².

Earlier studies have shown psychological factors associated with certain medical

conditions. The adjusted odd ratio for developing hypertension (systolic blood pressure $>160\text{mmHg}$, diastolic blood pressure $>95\text{mmHg}$, or taking antihypertensive medication) was more than two times higher in white men with high depression scores as compared to low depression scores¹⁴.

The association between psychological factors and blood pressure is inconsistent. In a previous study, anxiety and depression were associated with a decrease in blood pressure¹⁵. This contrasts to the results of a meta-analysis, which reported moderate anxiety and depression as the predictors of developing hypertension¹⁶. Since, previous studies more focuses on psychological determinants of hypertension and there has been no study on the association between these psychological factors with pre-hypertension. Hence, the aim of this study was to determine the association between psychological factors such as depression, anxiety and stress with pre-hypertension.

MATERIAL AND METHODS

Design and subject

This study was a cross-sectional study conducted among first year students of a Malaysian public university. The sample size was calculated using the two proportions formula by Lwanga and Lemeshow¹⁷. The estimated sample size was 575 respondents by using proportion of male with pre-hypertension as 0.507 and the proportion of female with pre-hypertension was 0.344¹⁸. The sample size was adjusted for design effect¹⁹ and 5% of non-respondent. Random cluster sampling method was used to select five out of fifteen faculties which offer undergraduate programmes and all students in the selected faculties were invited to participate in this study. Part-time students, those with mean systolic blood pressure of $\geq 140\text{mmHg}$ and/or mean

diastolic blood pressure of $\geq 90\text{mmHg}$, and non-Malaysians were excluded from the study. Ethics approval was obtained from the Ethic Committee for Human Research of the Universiti Putra Malaysia and permissions were obtained from the Deans of the respective faculties.

Data collection and study instrument

Data was collected from April, 2013 till June, 2013, using a self-administered questionnaire which consisted of sections on socio-demography and psychological factors. The psychological factors were measured using validated Malay version of Depression, Anxiety and Stress Questionnaire-21 (BM DASS-21)²⁰⁻²¹. The BM DASS-21 has an acceptable reliability value with Chronbach's alpha of the depression, anxiety and stress subscales was 0.84, 0.74 and 0.79 respectively. Respondents was asked to indicate the presence of various symptoms over the previous week and gave a scoring which ranged from 0 (did not apply to me at all over the last week) to 3 (applied to me very much or most of the time over the past week). The final scores obtained for each item groups on the DASS 21 were multiplied by 2 to calculate the final score since it is the short version of the long form with 42 items. Each respondent was then classified according to his/her level of depression, anxiety and stress. Respondents were classified as having normal, mild, moderate, severe, or extremely severe levels of depression according to total depression scores of 0-9; 10-13; 14-20; 21-27 and ≥ 28 respectively²⁰⁻²¹. For levels of anxiety, respondents were classified as having normal, mild, moderate, severe, or extremely severe according to their total anxiety scores of 0-7; 8-9; 10-14; 15-19 and ≥ 20 respectively²⁰⁻²¹. Respondents were classified as having normal, mild, moderate, severe, or extremely severe levels of stress according to their total stress scores of 0-14; 15-18; 19-25; 26-33 and ≥ 37 respectively²⁰⁻²¹. The blood

pressure was measured by sphygmomanometer. Blood Pressure (BP) measurement was taken as an average of two BP reading using the Perloff method²².

Data analyses

The data was analyzed using International Business Machines Corporation Statistical Product and Service Solutions (IBM SPSS) version 20. In descriptive analysis, all the categorical data was presented as frequency and percentage. While, for the continuous data i.e., age and income were both not normally distributed and were summarized using median and interquartile-range. Later, the age was categorized into two aged groups using the median age as a cut-off point; while for the total family income we used tertile cut-off points. Chi-square test was used to determine the association between two categorical variables.

For levels of depression and stress, those with severe and extremely severe levels were grouped together in view of the small numbers in the categories. Binary logistic regression was conducted to determine the predictors of pre-hypertension and to compute adjusted odds ratio and 95% confidence interval. Criteria for variable selection to include in the binary logistic regression model were variables with p value of <0.25 ²³ in the chi-square test; variables that clinically importance and/or significant predictors from previous studies. Forward LR method and Backward LR were used to identify the preliminary model. Both methods gave us the same significant variables. Significant variables in the preliminary model were then analysed using the 'Enter' method to obtain the final model. Level of significance was set at $\alpha = 0.05$.

RESULTS

Response rate

The response rate was 86.1% and a total of 495 respondents were participated in this study.

Characteristics of respondents

Table 1 shows the socio-demographic characteristics of respondents. Majority of the respondents were females (74.9%), and of Malay ethnicity (78.0%). The age of the respondents ranged between 18 to 26 years with the median (interquartile range) of 21.00 (2.00) years. More than half (54.9%) of the respondents had their ages within the range 18 to 21 years. The family income was ranged between RM200.00 to RM 30,000.00 with the median (interquartile range) of RM 2,000.00 (RM 2,000.00). About a third (30.1%) of the respondents had family income of RM 3,000.00 and above.

Level of depression, anxiety and stress

Table 2 shows the distribution of respondents according to their level of anxiety, depression, and stress. The highest overall percentage of psychological factor (moderate, severe and extremely severe) was anxiety (66.9%), while for depression and stress were 21.6% and 15.9%, respectively. The percentage of severe and extremely severe depression was 3.8% and 1.2% respectively; both severe and extremely severe anxiety was 16.4%; and severe and extremely severe stress was 4.2% and 0.2% respectively.

Prevalence of pre-hypertension

The overall prevalence of pre-hypertension among the first year students was 30.1% (95% CI 26.1, 34.1). The prevalence of pre-hypertension was higher among males (46.8%) than females (24.5%), and higher in the 22 year old and above age group (36.8%) as compared to 18-21 (24.6%).

Table 1 Distribution of respondents by socio-demographic characteristics

Socio-demographic characteristics	n	%
Gender		
Male	124	25.1
Female	371	74.9
Age group^a		
18-21	272	54.9
22 - 26	220	44.4
Ethnicity		
Malay	386	78.0
Chinese	85	17.2
Indian	13	2.6
Others	11	2.2
Family income(RM)^a		
<1500	129	26.1
1500 to <3000	114	23.0
≥3000	149	30.1

Note: (a) - the total was not equal to 100.0% because 3 respondents were not answer these variables

Association between socio-demographic characteristics, psychological factors and pre-hypertension

Table 3 presents the association between socio-demographic characteristics and the psychological factors (depression, anxiety and stress) with pre-hypertension. There was a significant association between gender, ethnicity and age group with pre-hypertension. However, there was no association between family income and pre-hypertension. An increasing trend in the prevalence of pre-hypertension was observed with increasing level of severity for depression, whereby highest in severe/extremely severe depression (56.0%) and lowest for no depression (27.0%). There was a significant association between depression and pre-hypertension. However, for anxiety, the highest prevalence was in extremely severe (42.0%) but the lowest was in moderate level of anxiety which was 24.3%. As depression, the prevalence of pre-hypertension was increasing in trend

with increasing level of stress. Severe/Extremely severe showed the highest prevalence (43.5%) as compared to without stress (27.3%).

Among these psychological factors studied only depression was significantly associated with pre-hypertension ($\chi^2=9.99$; $df=3$; $p=0.019$). Whereas, anxiety and stress had no significant association with pre-hypertension.

Predictors of pre-hypertension

Table 4 shows the results of multivariate binary logistic regression for the predictors of pre-hypertension. In this final logistic model, the Nagelkerke's R square showed that about 11.4% of the variation in pre-hypertension is explained by the variables in the model. There was no multicollinearity; and there was no significant interaction between the independent variables in the model. The Hosmer-Lomeshow test also showed that the model fits well as $p > 0.05$.

Table 2 Distribution of respondents according to their levels of anxiety, depression and stress

Psychological Factors	n	%
Depression		
Normal	307	62.0
Mild	81	16.4
Moderate	82	16.6
Severe	19	3.8
Extremely severe	6	1.2
Anxiety		
Normal	101	20.4
Mild	63	12.7
Moderate	169	34.1
Severe	81	16.4
Extremely severe	81	16.4
Stress		
Normal	348	70.3
Mild	68	13.7
Moderate	56	11.3
Severe	21	4.2
Extremely severe	2	0.4

The results indicated that male was more than 2 times higher in getting pre-hypertension as compared to female (Adj.

OR: 2.47; 95% CI: 1.59 - 3.84). For the age group those age of 22 and above had almost twice of getting pre-hypertension than age group of 18-21 year old (Adj. OR: 1.82; 95% CI: 1.21 - 2.73). In addition, Malay ethnicity had also almost twice in developing pre-hypertension as compared to non-Malay (Adj. OR: 1.95; 95% CI: 1.16 - 3.30). Respondents with severe/extremely severe depression was more than 3 times higher in getting pre-hypertension than no depression (Adj. OR: 3.45; 95% CI: 1.45 - 8.21).

DISCUSSION

The prevalence of pre-hypertension in this study was 30.1%, which is lower than the prevalence reported among undergraduates in a different university in Malaysia²⁴. The difference might be as a result of the higher proportion of females (79.4% versus 69.6%) and the younger

mean age (21.42±1.49 years versus 23.1±2.3 years) of the participants in this study. On the other hand, the percentage of depression in this study (38.9%) was slightly higher than a study being conducted among medical students in the same university which was 35.9%²⁵.

The prevalence of pre-hypertension was higher among males (46.8%) compared to females (24.5%) which was also similar with previous studies²⁶⁻²⁷. Gender was significantly associated with pre-hypertension in both bivariate and multivariate analysis. As reported by Grotto et al. among young Israelis, male gender was the most powerful non-modifiable predictor of pre-hypertension²⁷. The finding of this study also consistence with Grotto et al.²⁷ which showed that males were almost 2 times more likely to have pre-hypertension compared to females (Adj. OR: 1.93; 95% CI: 1.614-2.308). This can be explained by the protective effect of endogenous estradiol in females which is not exist in male. The mechanisms of action are

through the activation of vasodilator pathway mediated by the sympathetic

nervous system and angiotensin²⁸.

Table 3 Association between socio-demographic characteristics, depression, anxiety and stress with pre-hypertension

DASS Level	Pre-hypertension		χ^2	P- value
	Yes n (%)	No n (%)		
Gender			21.85	<0.001***
Male	58 (46.8)	66 (53.2)		
Female	91 (24.5)	280 (75.5)		
Ethnicity			4.34	0.037*
Malay	125 (32.4)	261 (67.6)		
Others	24 (22.0)	85 (78.0)		
Age Group			8.59	0.003**
18 - 21	67 (24.6)	205 (75.4)		
22 - 26	81 (36.8)	139 (63.2)		
Depression			9.99	0.019*
Normal	83 (27.0)	224 (73.0)		
Mild	24 (29.6)	57 (70.4)		
Moderate	28 (34.1)	54 (65.9)		
Severe/Extremely severe	14 (56.0)	11 (44.0)		
Anxiety			8.67	0.070
Normal	28 (27.7)	73 (72.3)		
Mild	20 (31.7)	43 (68.3)		
Moderate	41 (24.3)	128 (75.7)		
Severe	26 (32.1)	55 (67.9)		
Extremely severe	34 (42.0)	47 (58.0)		
Stress			5.16	0.160
Normal	95 (27.3)	253 (72.7)		
Mild	23 (33.8)	45 (66.2)		
Moderate	21 (37.5)	35 (62.5)		
Severe/Extremely severe	10 (43.5)	13 (56.5)		

Note: (*) - significant $P < 0.05$; (**) $P < 0.01$; (***) $P < 0.001$

In this study, more than half of the respondents were aged less than 22 years, and the maximum age reported was 26 years. The increased likelihood of pre-hypertension with increasing age observed in this study is most likely as a result of the relatively young age group of respondents compared to other studies among the general population. Previous study in India revealed that, the prevalence of pre-hypertension has been stable until about the fifth decade of life²⁹. Whereas, another study in China

reported that prevalence of pre-hypertension is decreasing with age, since pre-hypertension seems to be a transition phase from normal blood pressure to hypertension, it is likely that the respondents were caught in this stage of the transition³⁰.

Ethnicity was significantly associated with pre-hypertension in both bivariate and multivariate analysis. Malay ethnicity was almost twice likely of getting pre-hypertension as compared to non-Malay

ethnicity. In a study among adolescents, the results also supported the role of ethnicity as a predictor of pre-hypertension. In this study, Black and

Hispanic were more likely to have pre-hypertension than white adolescents³¹.

Table 4 Predictors Associated with pre-hypertension

Factors	B	SE	Wald	Adjusted OR	95% CI	P-value
Gender						
Female				1.00		
Male	0.91	0.23	16.25	2.47	1.59 - 3.84	<0.001***
Ethnicity						
Non-Malay				1.00		
Malay	0.67	0.27	6.24	1.95	1.16 - 3.31	0.012*
Age group						
18 to 21years				1.00		
22 to 26 years	0.60	0.21	8.15	1.82	1.21 - 2.73	0.004**
Depression						
Normal				1.00		
Mild	0.21	0.28	0.57	1.24	0.71 - 2.16	0.451
Moderate	0.30	0.28	1.13	1.34	0.78 - 2.32	0.289
Severe/extremely severe	1.24	0.44	7.87	3.45	1.45 - 8.21	0.005**

Note: (*) Significant $P < 0.05$; (**) Significant $P < 0.01$; (***) Significant $P < 0.001$

In addition of the above results, level of depression was also one of the predictor for pre-hypertension. However, only severe/extremely severe level of depression was more than three times higher in getting pre-hypertension as compared to no depression. The explanation for the association between prehypertension and depression could be indirectly due to low level of metabolite dopamine in depressed people. Low levels of cerebrospinal homovallinic acid (HVA) which is the major metabolite of dopamine in the central nervous system has been reported among depressed persons³² and mean 24-hour plasma dopamine levels were also lower in hypertensive elderly group compared to normotensives ($40 \pm 2 \text{pg/ml}$ versus $62 \pm 3 \text{pg/ml}$; $p < 0.01$)³³. Levels of anxiety and stress were not significantly associated with prehypertension in both bivariate and multivariate analysis. Even though both bivariate and multivariate analysis revealed no significant association

between levels of stress and anxiety, the dose-response relationship observed between the prevalence of pre-hypertension and these psychological factors points to the possibility of a likely association which could not be detected statistically.

Limitation of the study was the inability to specify the temporal relationship between depression and the occurrence of pre-hypertension since it was a cross-sectional study. Further case-control and cohort study should be conducted in order to establish the association between level of depression and the risk of pre-hypertension. Also due to financial constraints, biochemical profile could not be included in the study.

CONCLUSION

This study revealed a prevalence of pre-hypertension among first year university students was 30.1%. The modifiable

psychological determinant of pre-hypertension in this study was severe or extremely severe level of depression.

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