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Prevalence of Hypertension and its Associated Factors Among University Staff

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ABSTRACT

Introduction: In Malaysia, cardiovascular diseases (CVD) have been the leading cause of death for the past 40 years. Hypertension is the leading treatable risk factor for CVD mortality. **Objectives:** to determine the prevalence and factors associated with hypertension among University Putra Malaysia staff. **Methods:** A Cross sectional study design was used in this study. The sample was selected using table of random numbers. Two blood pressure measurements were taken from respondents aged 30 years and above. Data on socio-demographic variables and lifestyle-related risk factors were collected using a pre-tested structured questionnaire. Weight and height measurements were also taken. **Results:** Out of 517 respondents selected, 454 subjects agreed to participate, giving a response rate of 87.8%. The overall mean systolic blood pressure (SBP) and diastolic blood pressure (DBP) for 454 respondents was 126.2 mmHg and 80.17 mmHg respectively. The mean SBP was significantly higher in males (129.68 mmHg) as compared to the females (122.65 mmHg). The mean SBP and DBP significantly increased with age in both males and females ($p<0.05$). There was a significant relationship between SBP and BMI ($r = 0.55$, $r^2 = 0.30$ $p <0.001$) and diastolic blood pressure and BMI ($r = 0.53$, $r^2 = 0.28$, $p <0.001$). The overall prevalence of hypertension was 34.4% and 33.9% had pre hypertension. Hypertension was significantly associated with age, gender, family history of hypertension, BMI and alcohol consumption. **Conclusions:** Prevalence of hypertension and pre-hypertension is high. There is an urgent need for implementation of a comprehensive CVD prevention program. Routine blood pressure measurements should be taken to improve the detection, prevention and treatment of hypertension.

Keywords: Hypertension, Prevalence, Risk Factors, University Staff,

INTRODUCTION

Cardiovascular disease (CVD) is responsible for 30% of all deaths worldwide[1]. CVD mortality is likely to continue to increase in developing countries, if no appropriate action is taken[2]. In Malaysia, CVD has been the leading cause of death for the past 40 years[3]. The burden of mortality, morbidity and disability attributable to CVD is currently high and continues to grow. The most important risk factors for cardiovascular diseases are hypertension, obesity, high blood cholesterol, cigarette smoking, diabetes, physical inactivity and stress. Hypertension is the leading treatable risk factor for CVD mortality as it has been widely reported in various regions of the world[4-6]. It is ranked third as a cause of disability-adjusted life-years and is a leading risk factor for mortality and 1.56 billion people are expected to have hypertension by 2025[7]. It causes more than seven million deaths every year worldwide[5, 6]. In Malaysia, the prevalence of hypertension amongst adults aged 30 years and above has increased from 32.9% in 1996[8] to 40.5% in 2004[3] and to 42.6% in 2006[9]. In Malaysia, it has been estimated that there are 4.8 million Malaysian residents who have hypertension[10]. From an economic perspective, the costs attributed to hypertension are substantial. It was estimated that about 10% of global healthcare expenditures went on suboptimal blood pressure in 2001[10]. Valid information regarding the number of individuals affected by hypertension is the starting point for public health policy makers to direct the efforts to make the population aware of their condition and have them treated. Screening for hypertension is straightforward and not only detects hypertension but also provides an opportunity for patient learning and treatment[11]. The objective of this study was to determine the prevalence of hypertension and factors associated among university staff.

MATERIAL AND METHODS

Study location/study design

This cross sectional study was carried out in Universiti Putra Malaysia (UPM) which is situated 22 km south of

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Kuala Lumpur, the capital of Malaysia and 12 km from Putrajaya, the new and ultra modern administrative seat of the Malaysian government. The university was established in 1931 and consists of 16 faculties and 9 institutes.

Study Population/ Sampling Frame/ Sample Size/Sampling Technique

The study population of this study was all Malaysian UPM staff aged ≥30 years. The estimated sample size was 517. The complete lists of all staff of both genders aged ≥30 years served as sampling frame. Simple random selection techniques using the table of random numbers were used to select the sample.

Instruments and procedures

A pre-tested validated questionnaire was used to obtain data on age, gender, ethnicity, education, family history of hypertension, self history of hypertension, smoking status, physical activity, alcohol consumption, awareness of hypertension and antihypertensive treatment.

Blood pressure measurements

Blood pressure was measured after the respondents had rested for at least 5 minutes using a standard mercury sphygmomanometer. The respondents were examined in a seated position with the arm placed at the heart level. Two blood pressure measurements were taken for each respondent. Systolic blood pressure [SBP] was defined as the average of the two SBP readings and diastolic blood pressure [DBP] was defined as the average of the two DBP readings. The average of the two values was used in the analysis. Respondents were classified as having normal blood pressure if they had a mean SBP <120mmHg, and mean DBP <80, prehypertension if they had a mean SBP 120 to 139 mmHg or mean DBP 80 to 89 mmHg. and hypertensive if they had a mean SBP ≥140 mmHg, and/or mean diastolic blood pressure (DBP) ≥90 mmHg and/or by self-reports of a medical diagnosis of hypertension and current treatment for hypertension with antihypertensive medication. Hypertension awareness was defined as a positive answer to the question 'Have you ever been told by a doctor that you have high blood pressure (hypertension)'.

Body Mass Index (BMI)

Weight was measured using a digital bathroom scale (TANITA Model HD 319), calibrated before use. Height was measured using a SECA Body Meter Model 206. Height was measured to the nearest 0.1 cm with the subject without shoes and weight was measured to the nearest 0.5 kg with the subject in light clothing. Body mass index (BMI) was calculated as weight in kilograms divided by the square of height in meters (kg/m^2). Respondents were classified as obese if their BMI was 30 kg/m^2 or higher, in accordance with World Health Organization's recommendation[12].

Smoking status

Current cigarette smoking status was classified into three categories according to current, never smoker and ex-smokers (has smoked before but has not smoked in the past 1 month). The smokers were also classified as light smokers (less than 10 cigarettes/day), moderate smokers (10 – 20 cigarettes/day) and heavy smokers (>20 cigarettes/day).

Alcohol consumption

For alcohol consumption, persons were classified into three groups: never a drinker, former drinker and current drinker.

Statistical analysis

Statistical analysis was carried out using SPSS version 17. Categorical variables were presented as frequencies and percentages. The Pearson's chi-square test ($\chi 2$) test was used to determine the associations between categorical variables. Continuous variables were presented as means with their 95% confidence interval (CI) and standard deviation (SD). Pearson correlation coefficient was performed to determine the correlation between two continuous variables. Independent sample t-test was used to compare the means of two independent continuous variables. Multivariate analysis was performed using multiple logistic regressions. Result of logistic regression was expressed as odds ratio and 95% CI. A two-sided p value less than 0.05 was considered statistically significant.

Ethical Approval

Approval from the Faculty of Medicine and Health Science, University Putra Malaysia human research committee was

received before commencement of the study. Informed consent was also obtained from the each respondent before data was collected.

RESULTS

Table 1 shows the socio-demographic characteristics of the respondents. Out of the 517 subjects selected, 454 agreed to participate giving a response rate of 87.8%. The mean age of the respondents was 42.86 years (95% CI 41.97-43.74). The result shows that out of the 454 respondents 50.9% were males. The males had significantly ($p<0.001$) higher mean age (45.53 ± SD 10.13 years) as compared to the females (40.09 ± SD 8.20 years). The majority (86.3%) were Malays, 84.8% of the respondents were married, and 51.5% of the respondents reported that they had a positive family history of hypertension. Table 2 shows the life-style factors and body mass index of the respondents. The result indicates that 31.1% of the respondents were overweight and 11.9% were obese, 10.1% were current smokers, 93% had never taken alcohol and 55.3% had been sufficiently active.

Table 1: Socio-demographic characteristics of respondents

Factor	Frequency	Percentage
Age (yrs)		
30-39	205	45.2
40-49	127	28.0
50-59	100	22.0
60 and above	22	4.8
Gender		
Male	231	50.9
Female	223	49.1
Ethnicity		
Malay	392	86.3
Chinese	40	8.8
Indian	22	4.9
Marital Status		
Single	59	13.0
Married	385	84.8
Divorced/Widowed	10	2.2
Level of Education		
Primary	7	1.5
Secondary	113	24.9
Tertiary	334	73.6
Position at work		
Academic	244	53.7
Non academic	210	46.3
Monthly Family Income		
<3000	99	21.8
3000-4999	129	28.4
5000-6999	74	16.3
7000 and above	152	33.5
Family History of Hypertension		
Yes	234	51.5
No	176	38.8
Don't Know	44	9.7

Table 2: Life-style factors and body mass index of the respondents

Characteristics	Frequency	Percentage
Smoking status		
Never smoker	368	81.1
Former smoker	40	8.8
Current smoker	46	10.1
No of cigarettes/day		
<10 (Light)	20	43.5
10-20 (Moderate)	25	54.3
More than 20 (Heavy)	1	2.2
Body Mass Index (kg/m2)		
Underweight (< 18.5)	44	9.7
Normal (18.5-24.99)	215	47.3
Overweight (25-29.99)	141	31.1
Obese (30 and above)	54	11.9
Alcohol consumption		
Never a drinker	422	93.0
Former drinker	17	3.7
Current drinker	15	3.3
Currently drinking status		
Light	12	80.0
Moderate	1	6.7
Heavy	2	13.3
Physical activity		
Inactive	126	27.8
Insufficiently active	77	16.9
Sufficiently active	251	55.3

Blood pressure measurements

Systolic blood pressure

Table 3 shows the overall mean SBP by age and gender. The overall mean SBP for 454 respondents was 126.2 mmHg (95%CI 124.99, 127.46). The mean SBP was significantly (p = 0.001) higher in males (129.68 mmHg) as compared to the females (122.65 mmHg). The mean SBP significantly increased with age in both males and females. The increase in the mean SBP with age was significant both in males (One way ANOVA T-test (F= 32.17, p=0.001) and females (F= 53.08, p= 0.001). Using Post Hoc - Tukey test to perform multiple comparisons between all the age groups for males showed that there was a significant difference in the mean SBP levels between age groups 30-39 and 40-49 (p = 0.001), 30-39 and 50 -59 (p = 0.001), 30-39 and 60 and above (p = 0.001). Significant difference in the mean SBP levels were also noted between age groups 40-49 and 50 -59 (p = 0.001), 40-49 and 60 and above (p = 0.05). However there was no difference in the mean SBP levels between age groups 50 -59 and 60 and above. For females, there was

a significant difference in the mean SBP levels between age groups 30-39 and 40-49 (p = 0.001), 30-39 and 50 -59 (p = 0.001), 30-39 and 60 and above (p = 0.01). Significant difference in the mean SBP levels were also noted between age groups 40-49 and 50 -59 (p = 0.001). However there was no difference in the mean SBP levels between age groups 40-49 and 60 and above and 50-59 and 60 and above.

Table 3: Mean systolic blood pressure levels by age and gender

Gender / Age (Years)	Number of respondents	Systolic blood pressure (mmHg)		
		Mean	95% CI	Std. Deviation
Male				
30-39	79	121.26	119.00-123.52	10.09
40-49	69	130.33	127.72-132.93	10.85
50-59	63	137.15	134.45-139.84	10.69
60 and above	20	137.15	133.64-140.65	7.49
Total	231	129.68	128.09-131.26	12.22
Female				
30-39	126	115.36	113.62-117.10	9.87
40-49	58	128.37	125.40-131.33	11.26
50-59	37	137.60	133.93-141.28	11.02
60 and above	2	139.00	137.35-240.64	11.31
Total	223	122.65	120.85-124.45	13.64
Both Gender				
30-39	205	117.64	116.21-119.06	10.34
40-49	127	129.43	127.49-131.37	11.04
50-59	100	137.32	135.18-139.45	10.76
60 and above	22	137.31	133.96-140.67	7.56
Total	454	126.22	124.99-127.46	13.39

Diastolic blood pressure

Table 4 shows the overall mean DBP by age and gender. The overall mean DBP for 454 respondents was 80.17 mmHg (95%CI 79.32, 81.03). The mean DBP was significantly (p = 0.001) higher in males (82.64 mmHg) as compared to the females (77.62 mmHg). The mean DBP significantly increased with age in both males and females. The increase in the mean DBP with age was significant both in males (One way ANOVA T-test (F= 23.75, p =0.001) and females (F= 39.01, p= 0.001). Using Post Hoc - Tukey test to perform multiple comparisons between all the age groups for males showed that there was a significant difference in the mean DBP levels between age group 30-39 and 40-49 (p = 0.002), 30-39 and 50 -59 (p = 0.001), 30-39 and 60 and above (p = 0.003). Significant difference in the mean DBP levels were also noted between age groups 40-49 and 50 -59 (p = 0.001). However there was no difference in the mean DBP levels between age groups 40-49 and 60 and above and between age groups 50 -59 and 60 and above (p >0.05). For females, there was a significant difference in the DBP levels between age groups 30-39 and 40-49 (p = 0.001), 30-39 and 50 -59 (p = 0.001) and 40-49 and 50 -59 (p = 0.011). However there was no difference in the mean DBP levels between age groups 30-39 and 60, 40-49 and 60 and above and 50 -59 and 60 and above.

Table 4: Mean diastolic blood pressure levels by age and gender

Gender / Age (years)	Number of respondents	Diastolic blood pressure (mmHg)		
		Mean	95% CI	Std. Deviation
Male				
30-39	79	77.80	76.24-79.36	6.97
40-49	69	82.35	80.40-84.30	8.13
50-59	63	88.46	86.50-90.41	7.75
60 and above	20	84.42	81.22-87.62	6.84
Total	231	82.64	81.52-83.75	8.58
Female				
30-39	126	73.00	71.72-74.28	7.25
40-49	58	81.69	79.52-83.86	8.25
50-59	37	86.66	84.24-89.07	7.24
60 and above	2	83.50	62.62-229.62	16.26
Total	223	77.62	76.39-78.85	9.33
Both Gender				
30-39	205	74.85	73.82-75.88	7.50
40-49	127	82.05	80.62-83.48	8.16
50-59	100	87.79	86.29-89.29	7.58
60 and above	22	84.34	81.05-87.62	7.41
Total	454	80.17	79.32-81.03	9.29

Prevalence of hypertension

Table 5 shows prevalence of hypertension by age and gender. The overall prevalence of hypertension and prehypertension amongst the 454 staff aged 30 years and above was 34.4% and 33.9% respectively. The prevalence of hypertension and prehypertension amongst the 231 males was 45.5% and 33.3% respectively. For the 223 females, the prevalence of hypertension and prehypertension was 22.9% and 34.5% respectively. Table 6 shows prevalence of awareness, treatment and control of hypertension by gender. Among those 156 respondents classified as hypertensive, 100 (64.1%) were aware they had hypertension. However, out of these 100 respondents who were aware they had hypertension, 86 (86%) respondents stated that they were taking antihypertensive medication. Out of these 86 respondents who stated that they were being treated only 39 (45.3%) had their hypertension under control. The result shows that out of the 156 respondents who had hypertension, there were only 39 (25%) had their blood pressure under control. Although the blood pressure under control was low in both sexes, females (31.4%) had a higher proportion as compared to males (21.9%). Table 7 shows prevalence of hypertension and factors associated. Bivariate analysis showed that prevalence of hypertension was significantly associated with age, gender, marital status, level of education, family income, family history of hypertension, physical inactivity. Results of the Logistic model (Table 8) showed that prevalence of hypertension was significantly associated with age, gender, family history of hypertension, BMI and alcohol consumption (Nagelkerke $R^2 = 0.59$; Hosmer and Lemeshow Test, $p = 0.09$; the overall accuracy of this model to predict the subjects having hypertension is 83.2%; area under ROC curve = 0.90 (95%CI: 0.87 – 0.93); there is no multicollinearity and interaction between variables). Obese individuals (BMI $\geq$ 30) were eleven times more likely to have hypertension than individuals with a normal BMI (OR 11.37, 95% CI 4.36–29.62). Individuals with a family history of hypertension were five times as likely to have hypertension than those without a family history of hypertension (OR 5.25, 95% CI 2.80 - 9.85). Individuals who consume alcohol were seven times as likely to have hypertension than those without a family history of hypertension (OR 7.14, 95% CI 1.75 - 29.16).

Table 5: Prevalence of hypertension by age and gender

Gender /Age (years)	Prevalence of Hypertension			
	Normal	Pre-hypertension	Hypertension	Total
Male				
30-39	37 (46.8%)	32 (40.5%)	10 (12.7%)	79
40-49	9 (13.1%)	33 (47.8%)	27 (39.1%)	69
50-59	3 (4.8%)	9 (14.3%)	51 (80.9%)	63
60 and above	0 (0.0%)	3 (15.0%)	17 (85.0%)	20
Total	49 (21.2%)	77 (33.3%)	105 (45.5%)	231
Female				
30-39	82 (65.1%)	36 (28.5%)	8 (6.4%)	126
40-49	10 (17.3%)	31 (53.4%)	17 (29.3%)	58
50-59	3 (8.1%)	10 (27.1%)	24 (64.8%)	37
60 and above	0 (0.0%)	0 (0.0%)	2 (100.0%)	2
Total	95 (42.6%)	77 (34.5%)	51 (22.9%)	223
Both Gender				
30-39	119 (58.0%)	68 (33.2%)	18 (8.8%)	205
40-49	19 (15.0%)	64 (50.3%)	44 (34.7%)	127
50-59	6 (6.0%)	19 (19.0%)	75 (75.0%)	100
60 and above	0 (0.0%)	3 (13.6%)	19 (86.4%)	22
Total	144 (31.7%)	154 (33.9%)	156 (34.4%)	454

Table 6: Prevalence of Awareness, Treatment and Control of Hypertension by Gender

Status	Male	Female	Both sexes
	Frequency (%)	Frequency (%)	Frequency (%)
Hypertensive			
Aware	66 (62.9)	34 (66.7)	100 (64.1)
Aware and Treated	53 (80.3)	33 (97.1)	86 (86.0)
Treated and Controlled	23 (43.4)	16 (48.5)	39 (45.3)
Hypertensive			
Overall Control	23 (21.9)	16 (31.4)	39 (25.0)

Table 7: Prevalence of hypertension and factors associated

Variables	With Hypertension		Without Hypertension		Total	P value
	Number	%	Number	%		
Age (yrs)						
30-39	18	8.8	187	91.2	205	<0.001*
40-49	44	34.6	83	65.4	127	
50-59	75	75.0	25	25.0	100	
60 and above	19	86.4	3	13.6	22	
Gender						
Male	105	45.5	126	54.5	231	<0.001*
Female	51	22.9	172	77.1	223	
Ethnicity						
Malay	129	32.9	263	67.1	392	0.177
Chinese	19	47.5	21	52.5	40	
Indians	8	36.4	14	63.6	22	
Marital Status						
Single	8	13.6	51	86.4	59	<0.001*
Married	144	37.4	241	62.6	385	
Divorced/Widowed	4	40.0	6	60.0	10	
Level of Education						
Primary/Secondary	51	42.5	69	57.5	120	0.029*
Tertiary	105	31.4	229	68.6	334	
Family Income (RM)						
Low (<3000)	23	23.2	76	76.8	99	<0.001*
Medium (3000-5999)	45	27.0	122	73.0	167	
High (6000 and above)	88	46.2	100	53.1	188	
Family History						
Yes	112	47.9	122	52.1	234	<0.001*
No	38	21.6	138	78.4	176	
Don't Know	6	13.6	38	86.4	44	
Physical Inactivity						
Yes	57	45.2	69	54.8	126	0.003*
No	99	30.1	229	69.9	328	

*significant at $p < 0.05$

Table 8: Logistic regression analysis of the factors associated with hypertension

Variables	β	SE	OR	95% CI	*P* value
Gender					
Female			1		
Male	0.63	0.37	1.878	1.03 – 3.42	<0.039*
Age Group					
30 - < 40			1		
40 - < 50	1.71	0.37	5.55	2.68 -11.50	< 0.001*
50 - < 60	3.09	0.42	21.87	9.53 - 50.20	< 0.001*
60 and above	4.12	0.89	61.37	10.68 - 352.75	< 0.001*
Family History					
No			1		
Yes	1.70	0.32	5.25	2.80 - 9.85	< 0 .001*
Alcohol Consumption					
Never			1		
Former Drinker	0.80	0.77	2.23	0.50 – 10.00	0.290
Current Drinker	1.97	0.72	7.14	1.75 - 29.16	0.006*
BMI					
Normal/underweight			1		
Overweight	1.26	0.49	3.54	1.91 - 6.55	< 0.001*
Obese	2.43	0.47	11.37	4.362 - 29.62	< 0.001*

*significant at $p < 0.05$

Note: Nagelkerke $R^2 = 0.59$; Hosmer and Lemeshow Test, $p = 0.09$; the overall accuracy of this model to predict the subjects having hypertension is 83.2%; area under ROC curve = 0.90 (95%CI: 0.87 – 0.93); there is no multi-co linearity and interaction between variables.

DISCUSSION

The prevalence of hypertension amongst UPM staff aged 30 years and above in our study was 34.4% which is lower than the prevalence of 40.5% reported by Rampal *et al*.[3] and 42.6% reported by the third National Health Morbidity Survey[9]. The lower prevalence of hypertension recorded in this study could be due to the fact that university staff are among the highly educated part of the society and are exposed to more information than the general population. Thus, they are more likely to be concerned about their health by choosing a healthier lifestyle. In two surveys conducted among university populations in Nigeria, the prevalence of hypertension was 33% and 21%[13, 14]. Individuals with prehypertension have a two-fold risk of developing clinical hypertension compared with normotensive individuals[15]. Prehypertension is not categorized as a disease. However, by identifying these individuals with prehypertension both the patients and clinicians are alerted to this risk and encouraged to intervene and prevent or delay the disease from developing. Individuals with diabetes or kidney disease and also prehypertension should be considered for appropriate drug therapy if lifestyle modifications fails to bring down the blood pressure to 130/80 mmHg or less[16]. In addition to prevalence of hypertension of 34.4%, the overall prevalence of prehypertension in this study was high (33.9%). Lee *et al*.[17] recorded a prevalence of 28.5% and 18.7% for hypertension and pre-hypertension, respectively, among Singaporean population. Prospective studies strongly suggest that SBP rather than DBP is a better predictor of CVD risk especially in adults aged 55 years and above in whom most deaths from CVD occur[4]. In our study, the overall mean SBP in males was 129.68 mm Hg which is higher than the age-standardized mean SBP worldwide for males was 128.1 mm Hg[18]. For the females, in our study, the overall mean SBP was 122.65 mmHg which is lower than the age-standardized mean SBP worldwide (124.4 mm Hg) for females[18]. The overall mean SBP is higher than those from higher income countries such as the age-standardized mean SBP amongst females in Australasia (117.6 mm Hg), South Korea (116.9 mm Hg), North America (118.4 mm Hg) and those from Asia pacific (120.5 mm Hg)[18].

A key predictor of blood pressure in many populations is age. In our study, the mean SBP and DBP significantly increased with age in both males and females and prevalence of hypertension significantly increased with age in both sexes. Rampal *et al*.[3] reported similar results in their national study involving 16,440 subjects3. Numerous other studies have also reported that the prevalence of hypertension significantly increased with age [2, 16, 19, 20]. In our study, the prevalence of hypertension was higher in males compared to females for those aged less than 60 years. For those aged 60 years or more, the prevalence of hypertension was higher among the females. In a national study carried out by Rampal *et al.* in 2004[3], the prevalence of hypertension also increased with age in both sexes. The prevalence of hypertension was higher in males compared with females for those aged less than 50 years. For those aged 50 years or more, the prevalence of hypertension was higher among females. In a systematic review of data worldwide, at younger age men are more often affected by hypertension than women, whereas in older people hypertension was higher in women than in men[21]. It has been suggested that female sex hormones may contribute to the gender difference in blood pressure regulation[22]. However, the effect of oestrogen on blood pressure is still controversial[23]. In our study, hypertension was significantly associated with family history of hypertension. This result is consistent with several other studies[24, 25]. Our study also showed that hypertension was significantly associated with obesity. The prevalence of obesity amongst Malaysians 18 years and above has increased from 4.4% in 1996[8] to 12.3% in 2004[26] and 14.2% in 2006[9]. The rising problem of obesity is a cause of concern. Implications of this study are that the results show that prevalence of hypertension and pre-hypertension is high among the University staff. Only 25% have their blood pressure under control. Routine blood pressure measurements should be taken to improve the detection, prevention and treatment of hypertension. In conclusion, prevalence of hypertension and pre-hypertension is high. There is an urgent need for implementation of a comprehensive CVD prevention program.

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REFERENCES

[1] World Health Organization. World Health Report. Mental Health: New Understanding, New Hope. Geneva: WHO, 2001.

[2] Whelton PK, He J, Muntner P. Prevalence, awareness, treatment and control of hypertension in North America, North Africa and Asia. J Hum Hypertens 2004; 18(8): 545-51.

[3] Rampal L, Rampal S, Azhar MZ, Rahman AR. Prevalence, awareness, treatment and control of hypertension in Malaysia: A national study of 16,440 subjects. Publ Hlth 2008; 122: 11–18.

[4] Lewington S, Clarke R, Qizilbash N, Peto R, Collins R. Age-specific relevance of usual blood pressure to vascular mortality: A meta-analysis of individual data for one million adults in 61 prospective studies. Lancet 2002 ; 14(360) :1903-13.

[5] Ezzati M, Lopez AD, Rodgers A, Vander HS, Murray CJ, and the Comparative Risk Assessment Collaborating Group. Selected major risk factors and global and regional burden of disease. Lancet 2002; 360: 1347–60.

[6] World Health Organization. Global health risks: Mortality and burden of disease attributable to selected major risks. Geneva: World Health Organization; 2009.

[7] Whitworth JA. World Health Organization/International Society of Hypertension statement on management of hypertension. WHO, ISH Writing Group. J Hypertens 2003; 21: 1983–92.

[8] Ministry of Health. Second National Health and Morbidity Survey 1996. NHMS II Report 1997.

[9] Ministry of Health. Third National Health and Morbidity Survey 2006. NHMS III Report 2008.

[10] Gazianoa TA, Bitton A, Anand S, Weinstein MC, & for the International Society of Hypertension. The global cost of nonoptimal blood pressure 2009; 27(7): 1472–1477.

[11] Opie LH, Seedat YK. Hypertension in sub-Saharan African populations. Circulation 2005; 112: 3562–8.

[12] World Health Organization (WHO). Obesity: Preventing and Managing the Global Epidemic. WHO Technical Report Series 894. Geneva: WHO, 2000.

[13] Omorogiuwa A, Ezenwanne EB, Osifo C, Ozor, MO, Ekhator CN. Comparative study on risk factors for hypertension in a University setting in Southern Nigeria. Int J Biomed Health Sci 2009; 5(2):103-107.

[14] Erhun WO, Olayiwola G, Agbani EO, Omotoso NS. Prevalence of Hypertension in a University Community in South West Nigeria. Afr J Biomed Res 2005; 8:15-19.

[15] Qureshi AI, Suri MF, Kirmani JF, Divani AA. Prevalence and trends of prehypertension and hypertension in United States: National Health and Nutrition Examination Surveys 1976 to 2000. Med Sci Monit 2005; 11: CR403-CR409.

[16] Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL. The National High Blood Pressure Education Program Coordinating Committee. Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. Hypertension 2003; 42: 1206-1252.

[17] Lee J, Heng D, Ma S, Chew SK, Hughes K, Tai SE. Influence of pre-hypertension on all-cause and cardiovascular mortality: The Singapore Cardiovascular Cohort Study. Int J Cardiol 2009;135(3): 331–337.

[18] Danaei G, Finucane MM, Lin JK *et al.* National, regional, and global trends in systolic blood pressure since 1980: Systematic analysis of health examination surveys and epidemiological studies with 786 country-years and 5•4 million participants. *www.thelancet.com* Published online February 4, 2011 DOI:10.1016/ S0140-6736(10) 62036-3.

[19] Vasan RS, Larson MG, Leip EP, Kannel WB, Levy D. Assessment of frequency of progression to hypertension in non-hypertensive participants in the Framingham Heart Study: A cohort study. Lancet 2001; 358: 1682-1686.

[20] Tam CF, Nguyen L, Pe SS *et al.* 2005. The effects of age, gender, obesity, health habits, and vegetable consumption frequency on hypertension in elderly Chinese Americans. Nutr Res 2005; 25(1): 31-43.

[21] Kearney PM, Whelton M, Reynolds K *et al*. Global burden of hypertension: analysis of worldwide data. Lancet 2005; 365: 217-23.

[22] Reckelhoff JF. Gender differences in the regulation of blood pressure. Hypertension 2001; 37(5): 1199–1208.

[23] Ashraf MS, Vongpatanasin W. Estrogen and hypertension. Curr Hypertens Res 2006; 8:368–76.

[24] Dekkers JC, Treiber FA, Kapuku G, Snieder H. Differential Influence of Family History of Hypertension and Premature Myocardial Infarction on Systolic Blood Pressure and Left Ventricular Mass Trajectories in Youth. Pediatrics 2003; 111: 1387-1393.

[25] Aggarwal M, Khan IA. Hypertensive Crisis: Hypertensive Emergencies and Urgencies. Cardiol Clin. 2006; 24(1): 135-146.

[26] Rampal L, Rampal S, Khor GL, Azhar MZ, Ooyub S, Rahmat R, Noor Ghani S, Krishnan J. A national study on the prevalence of obesity among 16,127 Malaysians. Asia-Pacific J Clin Nutr 2007; 16 (3):561–566.