The Prevalence Of Hypertension And Its Associated Risk Factors In Two Rural Communities In Penang, Malaysia

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Background: Hypertension is estimated to cause 4.5% of the global disease burden. The prevalence of hypertension in Malaysia is 32.2%.

Objective: To determine the prevalence of hypertension and its associated risk factors in two rural communities in Penang, Malaysia.

Methods: This cross sectional study was conducted among all consenting residents aged 18 years and above from two villages in Penang. Besides the baseline demographic information, blood pressure was measured using a manual sphygmomanometer according to the American Heart Association Guidelines.

Results: 50 out of 168 people were hypertensive, giving a prevalence rate of 29.8%. 50.0% of those found with hypertension were undiagnosed and 48.0% of those who were diagnosed with hypertension had uncontrolled blood pressure. Logistic regression analysis showed that age, history of alcohol consumption and BMI were found to be independently associated with hypertension.

Conclusions: Age, education level, alcohol consumption and BMI are important risk factors associated with the prevalence of hypertension among the villagers. These risk factors are comparable to those reported in National Health and Morbidity Survery 2006 in Malaysia.

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Key Words: Blood pressure, Hypertension, Penang, Prevalence, Risk factor, Rural

Introduction

Hypertension is estimated to cause 4.5% of the global disease burden and is as prevalent in many developing countries as in developed countries.[1] Worldwide, seven million premature deaths have been attributed to hypertension.[2] In recent decades, it has become increasingly clear that the development of stroke, ischemic heart disease, and renal failure have been attributed by hypertension. Treating hypertension has been associated with a 40% reduction in the risk of stroke and about 15% reduction in the risk of myocardial infarctio.[1]

Various risk factors have been associated with hypertension, including age, sex, race, physical activity, and socioeconomic class. Vast majority of cases of uncontrolled hypertension are amongst individuals more than 60 years of age.[3] Population studies have also shown that blood pressure correlates with body mass index (BMI) and other anthropometric indices of obesity such as waist-hip ratio. In the Framingham Study, 70% of new cases of hypertension were related to excess body fat.[4]

The reported prevalence of hypertension varies around the world, with rates as low as 5.2% in rural North India and as high as 70.7% in Poland.[5] Blood pressure variations also exist from within communities in the same country depending upon the economic development and affluence. In economically developed countries, the prevalence of hypertension range between approximately 20 and 50%.[5] Prevalence of hypertension in the Asia-Pacific region ranges from 5 to 47% in men and from 7 to 38% in women.[6]

The national prevalence of hypertension in Malaysia based on the National Health and Morbidity Survey (NHMS) III in 2006 was 32.2% for residents aged 18 years and above.[7] Most were unaware that they had hypertension, while those who were aware and on treatment, most did not have controlled blood pressure.

The objectives of this study were to determine the prevalence of hypertension and its associated risk factors in two rural communities in Penang, Malaysia.

Methodology

Setting: This study was carried out in two villages (Kampung Mutiara and Kampung Belakang Masjid) located in the northwestern tip of Penang Island, Malaysia. The villagers were mainly Malays and Chinese, along with a small population of Indians and Indonesian

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immigrants. Most of the villagers worked in the tourism industry while some were hawkers and housewives.

Study design: This cross-sectional study was part of a health and morbidity survey conducted by a group of medical students to appraise the health status of the two communities. The study was conducted in March 2010.

Sampling: All villagers who were 18 years and above were eligible to participate in the study. The exclusion criteria included those who refused to participate and those who were unable to communicate effectively. All those who consented were interviewed and blood pressure measurements were taken at their homes.

Instruments and definitions: A questionnaire specially prepared for this study was used for data collection. Data on age, sex, race, marital status, education level, smoking, alcohol consumption, exercise level, body mass index (BMI), waist-hip ratio and income was collected. Blood pressure was measured based on a standardized procedure according to the American Heart Association guidelines.[8] Positive diagnosis of hypertension was made when the systolic blood pressure was ≥ 140mmHg and/or diastolic blood pressure ≥ 90mmHg on three occasions taken on different days. The weight was taken using a calibrated weighing scale and the height was measured using a portable measuring tape. Waist and hip measurements were made following a standardised procedure following the guidelines set by the International Society for the Advancement of Kinanthropometry.[9] BMI was calculated using a simple equation (body weight in kg divided by height in m^2). Only respondents who gave an informed verbal consent before starting the interview were included in the study. The anonymity of the respondents is assured.

Data analysis: Data was tabulated, cross tabulated and analyzed statistically using PASW version 18. Statistical analysis using chi squared test, t test and ANOVA was attempted. Appropriate post hoc tests were used to identify the group differences when ANOVA was found to be significant. A probability value of $P<0.05$ was considered to be significant. Binary logistic regression analysis was conducted with reporting of odds ratio to establish the risk for hypertension.

Results

Descriptive

Out of the total 318 residents of the two villages, 211 were 18 years old and above. A total of 168 respondents participated, giving the response rate of 79.6%. Reasons for incomplete response include unsuitable meeting arrangements as well as refusal to participate. Among the respondents, 75 were males and 93 were females. Most were within the age groups of 40-49, followed by 30-39. The mean age of the participants was 46.2 years. Most were Malays, married and had the highest level of education up to secondary school. More than half of the participants had household income below poverty line.

There were a total of 25 (14.9%) respondents who were known hypertensive and were on medication and there were an additional 25 (14.9%) newly diagnosed respondents who did not know they had hypertension and were not on treatment. Thus the prevalence of hypertension among those 18 years old and above in these two communities was 29.8%.

The mean systolic pressure of the villagers was 129.75 mmHg and the mean diastolic pressure was 81.19 mmHg. The mean systolic and diastolic pressure of the hypertensives was 151 mmHg and 92 mmHg respectively. As shown in table I and figure I, systolic pressure increased with increasing age. Elevated systolic pressure was noted among the widowed, illiterate, those with history of ever consuming alcohol and the obese (figure II). As seen in the same table, elevated diastolic pressure was noted among those separated and obese.

Inferential and Correlation analysis

There was a statistically significant difference in the means of the systolic pressure between different age groups, marital status, education levels, alcohol consumption, body mass index and waist hip ratio

(table I). As seen in table II the significant differences in the mean systolic pressure was noted between age groups of 18-29 and 60-69, between primary and secondary school levels of education, between emaciated and overweight group and the obese group. There was a statistically significant difference in the means of diastolic pressure between different age groups, body mass index and waist hip ratio. As shown in table II the significant differences in the mean diastolic pressure was between those emaciated and the overweight group and obese group. The statistically significant differences were found between age groups 40-49 and 18-29 and 30-39. As shown in figure III and IV there is a statistically significant correlation between systolic pressure and age (Pearson Correlation 0.397 $p<0.01$) and BMI (Pearson Correlation 0.292 $p<0.01$).

As shown in table III, age group, marital status, education level, alcohol consumption, and BMI (figure V) were found to be statistically significant. Sex, race, marital status, smoking, exercise, waist-hip ratio and income were not found to be statistically significant. The prevalence of hypertension increased with increasing age as shown in figure VI.

Risk analysis

As shown in table IV the known hypertensive's on treatment were more likely to have uncontrolled blood pressure (OR 4.36 95% CI 1.63;11.70)

Regression analysis

Table V shows the results of a binary logistic regression using sex, marital status, education, race, exercise, alcohol, smoking, age group, BMI, waist hip ratio, and income as the predictive covariates. Age group (OR 2.29 95% CI 1.53;3.43), BMI (OR 4.23 95% CI 2.21;8.08), and alcohol consumption (OR 3.47 95% CI 1.47;8.15) were found to be with significant predictor variables. The model had -2 likehood ratio of 138.862, Cox and Snell R squared 0.303 and Nagelkerke R square 0.431.

Discussion

Generally the prevalence of hypertension in urban adult population is between 15-35% but is lower in rural Asian populations.[8] Among countries in the Southeast Asian region, the prevalence of hypertension in Malaysia (32.2%)[7] is the highest compared to Singapore (26.6%), Indonesia (23.0%), and Thailand (20.5%).[5] Prevalence of hypertension in this study was comparable to the national prevalence of 32.2%,[7] and other studies conducted in north (33.6%)[9] and central (26.8%)[10] Malaysia.

Prevalence of hypertension increases with increasing age.[11] In central Malaysia the prevalence of hypertension among those aged 55 years and above living in a community was shown to be 25.6%[10,12] and 51.1% among those living in old folks home.[13] The prevalence of hypertension among the elderly in this study is comparable with the finding of another study which was conducted in northern Malaysia.[14] Similarly a health survey in England 2003[11] and in the United States also reported strong correlation between age and blood pressure.[15]

Higher level of education is associated with greater awareness regarding health and diseases. Multiple studies have shown that education significantly reduces the prevalence of illness. In this study, mean systolic blood pressure was highest among the illiterates. This finding is consistent with the results from a study done in northern Malaysia, where illiterates had the highest mean systolic and diastolic blood pressure.[9] Similarly, Yamori Y *et al.* demonstrated that subjects with the highest educational level had the lowest prevalence of hypertension.[16]

Obesity is a well-established risk factor for hypertension.[17-20] In this study the prevalence of hypertension increased with increasing weight. This finding concurs with another study conducted in northern Malaysia.[9] Elsewhere in Asia, the prevalence of overweight and hypertension was most common in

Japan, followed by Iran, urban India, Singapore, urban Sri Lanka, and urban Philippines.[8] Waist-hip ratio, which is another anthropometric measurement of obesity, has shown strong correlation with hypertension. In the Ansan Study conducted in Korea, BMI and abdominal circumference was found to be a risk factor for hypertension.[21] In this study however, there was no statistically significant finding between hypertension and waist-hip ratio.

Alcohol has been identified as a risk factor for global burden of disease, attributing an increased risk of cardiovascular problems, such as hypertension. However, despite numerous studies pointing to a causal relationship between alcohol consumption and hypertension,[22] some have concluded that there is a slight protective effect with minimal consumptions of alcohol.[23,24] In this study, alcohol was found to be a significant risk factor for hypertension.

Among those with hypertension, 50.0% were unaware they had hypertension. Hypertension is not usually detected due to lack of screening and due to its absence of overt symptoms.[25,26] Findings of NHMS III[7] and a study conducted in northern Malaysia,[9] only a third of hypertensive patients were aware of their status.

Control of blood pressure among those with hypertension was poor in this study. In the United States the control of blood pressure was 31%[15] and according to the NHMS III[7] only 26.3% of those diagnosed with hypertension had adequate control of their blood pressure. Blood pressure control was shown to range from 34.4% to 48.1% in central Malaysia[10,12] and 27.5% to 41.4% in northern Malaysia.[9,14] The reason for this could be due to poor compliance to treatment. Studies in Malaysia have shown that the compliance to hypertension medication is poor.[27,28]

Compliance to anti-hypertensive medication is an important factor in blood pressure control. The most common reasons for non-compliance include forgetfulness, busy schedule, and insufficient supply of medication. Other factors include unpleasant side effects of medication, unclear or inadequate instructions, cost of treatment, knowledge on hypertension and its complications, and traditional health belief.[28] Further studies to assess the level of compliance to anti-hypertensive medication in this population are therefore warranted to enable effective interventions to be carried out.

Conclusion

Among individuals with hypertension, half of them were undiagnosed. Among those who were diagnosed, almost half of them had uncontrolled blood pressure. A consistent effort should be made to screen for new cases and to educate people about the importance of being compliant to treatment.

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Tables

Table I: Risk factors associated with mean systolic and diastolic blood pressure

Factors		Mean Systolic BP (mmHg)	ANOVA (F-value/p-value) or (t-test value/ p-value)	Mean Diastolic BP (mmHg)	ANOV (F-value/p-value) or (t-test value/ p-value)
Hypertension status	Hypertension	150.54	-12.210/0.000	91.98	-8.792/0.000
	Normotension	120.94		76.62	
Age Group	18 – 29	119.55	5.078/0.000	76.74	2.755/0.014
	30 – 39	121.88		77.73	
	40 – 49	131.17		86.89	
	50 – 59	135.10		83.19	
	60 – 69	137.14		79.79	
	70 – 79	147.50		83.33	
	80 – 89	145.00		85.00	
Sex	Male	130.63	0.516/0.607	82.11	0.853/0.395
	Female	129.04		80.45	
Race	Malay	130.45	0.335/0.800	81.42	0.519/0.670
	Chinese	127.65		78.24	
	Indian	125.22		84.11	
	Others	126.00		79.60	
Marital Status	Single	122.97	2.894/0.024	78.03	1.441/0.223
	Married	130.03		82.11	
	Separated	130.00		90.00	
	Divorced	123.00		73.33	
	Widowed	142.24		82.88	
Education Level	Illiterate	141.82	4.871/0.003	79.64	0.082/0.970
	Primary	134.31		81.57	
	Secondary	124.18		81.25	
	Tertiary	127.40		79.80	
Smoke	Never	128.54	1.317/0.271	81.09	0.033/0.968
	Ever	138.08		81.92	
	Present	129.95		80.90	

Factors		Mean Systolic BP (mmHg)	ANOVA (F-value/p-value) or (t-test value/ p-value)	Mean Diastolic BP (mmHg)	ANOV (F-value/p-value) or (t-test value/ p-value)
Alcohol Consumption	Never	128.66	2.411/0.069	80.87	0.629/0.597
	Ever	145.30		85.10	
	Occasional	134.00		86.00	
	Present	121.00		74.50	
Exercise	None	130.47	0.118/0.833	81.51	0.336/0.715
	Moderate	129.75		80.44	
	Vigorous	129.69		83.23	
Body Mass Index (BMI)	Emaciation	115.55	4.893/0.001	68.09	9.394/0.000
	Underweight	127.26		78.86	
	Normal	126.82		79.36	
	Overweight	136.04		87.11	
	Obese	148.00		94.00	
Waist-Hip Ratio	Normal	126.13	-2.028/0.044	78.44	-2.720/0.007
	Central Obesity	132.26		83.66	

Table II: Groups which have statistically significant differences in the means of systolic and diastolic pressure

Dependant Variable	(i) Age Group	(j) Age Group	Mean Difference (i-j)	P-value
Systolic	18 – 29	30 – 39	-2.330	1.000
		40 – 49	-11.618	0.363
		50 – 59	-15.548	0.095
		60 – 69*	**-17.594**	**0.042**
		70 – 79	-27.952	0.079
		80 – 89	-25.452	0.519
Diastolic	40 – 49	**18 – 29***	**10.147**	**0.014**
		30 – 39*	**9.162**	**0.033**
		50 – 59	3.695	0.876
		60 – 69	7.103	0.238
		70 – 79	3.556	0.994
		80 – 89	1.889	1.000

Dependant Variable	(i) Education	(j) Education	Mean Difference (i-j)	P-value
Systolic	Primary	**Secondary***	**10.282**	**0.016**
		Tertiary	7.064	0.754
		Illiterate	-5.870	0.809
Dependant Variable	**(i) BMI**	**(j) BMI**	**Mean Difference (i-j)**	**P-value**
Systolic	Emaciation	Underweight	-11.712	0.512
		Normal	-11.275	0.488
		Overweight*	**-20.498**	**0.034**
		Obese*	**-32.455**	**0.023**
Diastolic	Emaciation	Underweight	-10.766	0.120
		Normal	-11.267	0.061
		Overweight*	**-19.018**	**0.000**
		Obese*	**-25.909**	**0.001**

Table III: Prevalence of hypertension with its associated risk factors

Factors		Hypertension n = 50 f (%)	Normotension n = 118 f (%)	Total N (%)	Chi-square	P-value
Age Group	18 – 29	3 (9.7)	28 (90.3)	31 (100)	20.937	0.002
	30 – 39	4 (12.1)	29 (87.9)	33 (100)		
	40 – 49	13 (36.1)	23 (63.9)	36 (100)		
	50 – 59	12 (38.7)	19 (61.3)	31 (100)		
	60 – 69	12 (42.9)	16 (57.1)	28 (100)		
	70 – 79	4 (66.7)	2 (33.3)	6 (100)		
	80 – 89	2 (66.7)	1 (33.3)	3 (100)		
Sex	Male	22 (29.3)	53 (70.7)	75 (100)	0.012	0.913
	Female	28 (30.1)	65 (69.9)	93 (100)		
Race	Malay	42 (30.7)	95 (69.3)	137 (100)	2.227	0.527
	Chinese	5 (29.4)	12 (70.6)	17 (100)		
	Indian	3 (33.3)	6 (66.7)	9 (100)		
	Others	0 (0)	5 (100)	5 (100)		

Factors		Hypertension n = 50 f (%)	Normotension n = 118 f (%)	Total N (%)	Chi-square	P-value
Marital Status	Single	4 (13.8)	25 (86.2)	29 (100)	8.113	0.088
	Married	36 (31.3)	79 (68.7)	115 (100)		
	Separated	1 (100)	0 (0)	1 (100)		
	Divorced	1 (20)	4 (80)	5 (100)		
	Widowed	8 (44.4)	10 (55.6)	18 (100)		
Education Level	Illiterate	4 (33.3)	8 (66.7)	12 (100)	9.881	0.020
	Primary	29 (42)	40 (58)	69 (100)		
	Secondary	16 (20.8)	61 (72.2)	77 (100)		
	Tertiary	1 (10)	9 (90)	10 (100)		
Smoke	Never	32 (28.1)	82 (71.9)	114 (100)	3.932	0.140
	Current	11 (26.8)	30 (73.2)	41 (100)		
	Ever	17 (32.1)	36 (67.9)	53 (100)		
Alcohol Consumption	Never	42 (27.3)	112 (72.7)	154 (100)	9.441	0.024
	Ever	7 (70)	3 (30)	10 (100)		
	Occasional	1 (50)	1 (50)	2 (100)		
	Present	0 (0)	2 (100)	2 (100)		
Exercise	No	24 (28.6)	60 (71.4)	84 (100)	0.168	0.682
	Yes	26 (31)	58 (69)	84 (100)		
Body Mass Index (BMI)	Emaciation	0 (0)	11 (100)	11 (100)	17.020	0.002
	Underweight	7 (20)	28 (80)	35 (100)		
	Normal	17 (24.6)	52 (75.4)	69 (100)		
	Overweight	21 (45.7)	25 (54.3)	46 (100)		
	Obese	5 (71.4)	2 (28.6)	7 (100)		
Waist-Hip Ratio	Normal	19 (23.7)	61 (76.3)	80 (100)	2.922	0.087
	Central Obesity	31 (35.2)	57 (64.8)	88 (100)		
Income	Below poverty line index	35 (34.3)	67 (65.7)	102 (100)	2.573	0.109
	Above poverty line index	15 (22.7)	51 (77.3)	66 (100)		

Table IV: Risk analysis of uncontrolled blood pressure among the known hypertensive

	Blood pressure ≥140/90 n = 37 f (%)	Normotension n= 131 f (%)	Total N (%)	Odds Ratio	Confidence Interval (95%)	P-value
Known HPT	12 (48)	13 (52)	25 (100)	4.36	1.63: 11.70	<0.001
Not known HPT	25 (17.5)	118 (82.5)	143 (100)			

Table V: Logistic regression

Factors	Category	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
								Lower	Upper
Sex	Female	.427	.667	.409	1	.523	1.53	.41	5.67
	Male								
Marital Status	Widowed	-.252	.324	.604	1	.437	.78	.41	1.47
	Divorced								
	Separated								
	Married								
	Single								
Education	Illiterate	.016	.274	.003	1	.954	1.02	.59	1.74
	Tertiary								
	Secondary								
	Primary								
Race	Others	-.255	.344	.551	1	.458	.78	.39	1.52
	Indian								
	Chinese								
	Malay								
Exercise	Yes	.357	.433	.682	1	.409	1.43	.61	3.34
	No								
Alcohol	Occasional	1.243	.436	8.125	1	.004	3.47	1.47	8.15
	Ever								
	Present								
	Never								

Factors	Category	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
								Lower	Upper
Smoke	Ever	.354	.408	.753	1	.385	1.43	.64	3.17
	Current								
	Never								
Age group	80 – 89	.830	.205	16.340	1	.000	2.293	1.53	3.43
	70 – 79								
	60 – 69								
	50 – 59								
	40 – 49								
	30 – 39								
	18 – 29								
BMI	Obese	1.442	.331	19.031	1	.000	4.23	2.21	8.08
	Overweight								
	Normal								
	Underweight								
	Emaciation								
Waist Hip Ratio	Central obesity	.188	.545	.120	1	.729	1.21	.42	3.51
	Normal								
Income	Above poverty line index	-.471	.537	.770	1	.380	.63	.22	1.79
	Below poverty line index								

Figures

Figure I: Mean blood pressure by age

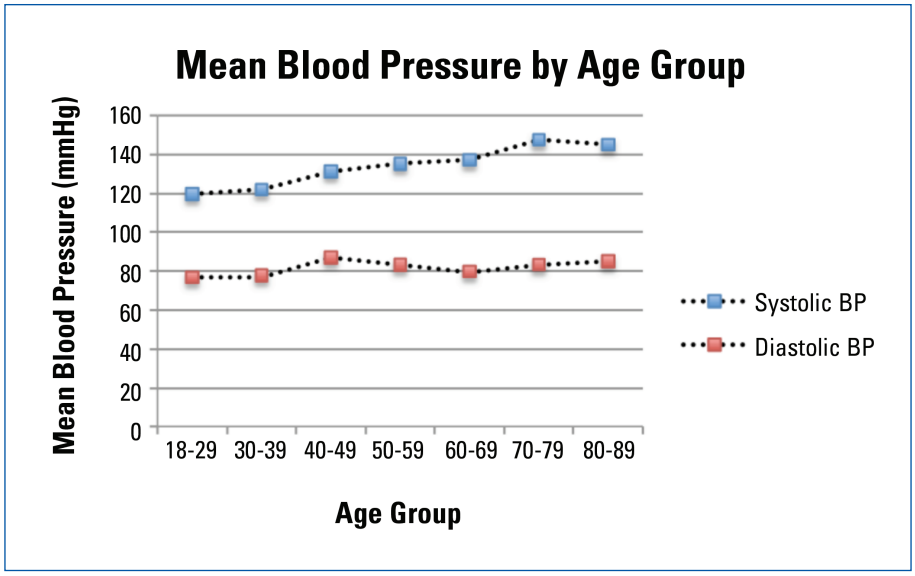

Figure II: Mean blood pressure by waist hip ratio

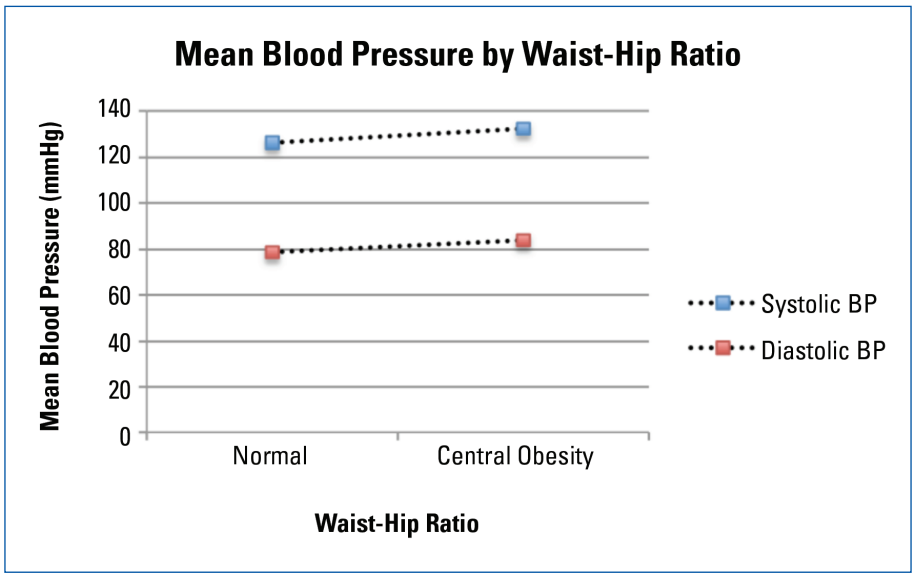

Figure III: Correlation between mean systolic pressure and age

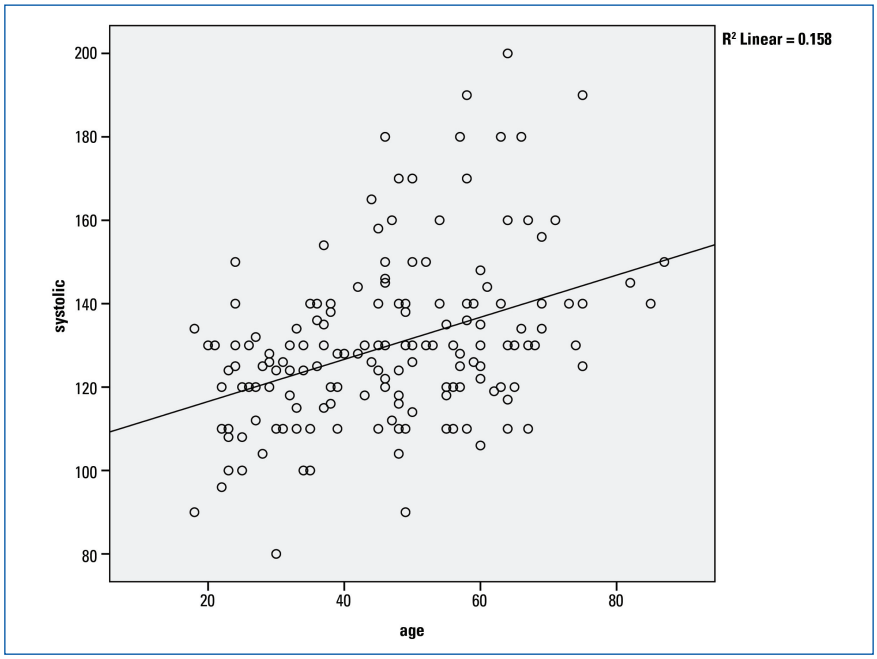

Figure IV: Correlation between mean systolic pressure and BMI

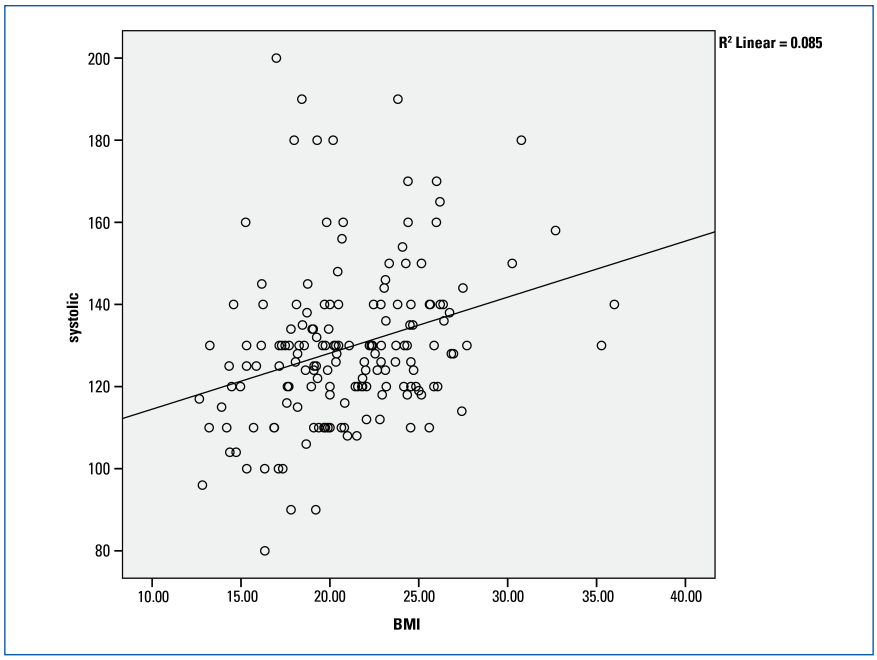

Figure V: Prevalence of hypertension with BMI

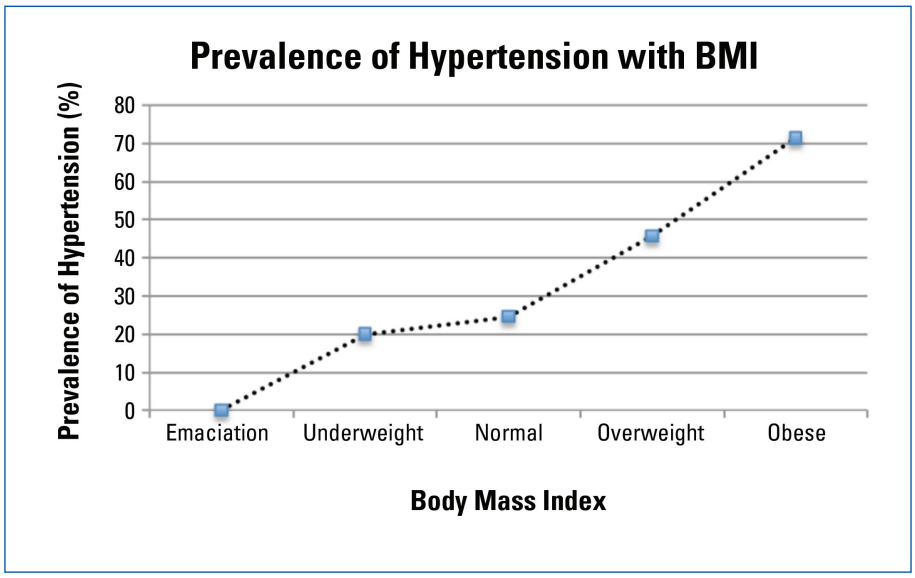

Figure VI: Prevalence of hypertension with age