ORIGINAL ARTICLE

Prevalence of Hypertension Among Chinese Elderly and its Relationship to Behavioural and Nutritional Factors

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Summary

A cross-sectional study was carried out to determine the prevalence of hypertension in the Chinese elderly and to examine its relationship with various behavioural and nutritional risk factors. This study involved 243 Chinese aged 55 years and older in 2 randomly selected Chinese Villages in Seberang Prai Tengah, Penang. The study included an interview, anthropometric assessment and blood pressure measurement. The prevalence of hypertension was 48.1% and out of this, 65 (55.6%) were on anti-hypertensive treatment. There was a significant rise in the prevalence with age. Hypertension was found to be inversely related to per capita income and physical activity ($p < 0.05$). Hypertension was significantly more common in smokers than non-smokers. Alcohol intake in the elderly was low and not related to hypertension. Obesity was significantly associated with hypertension only among the elderly aged 55-64 years. The dietary intake of sodium, potassium and calcium did not differ significantly between the hypertensive and normotensive elderly.

Key Words: Hypertension, Chinese, Elderly, Risk factors

Introduction

Blood pressure was found to increase with age in many studies[1,2]. Hypertension as a health care problem in the elderly will increase as the population ages and the proportion as well as the numbers of old people increase. In Malaysia, the population of people aged 55 years and older are projected to increase from 8.1% of the population in 1980 to 10.4% in the year 2000[3].

Cardiovascular diseases has been the leading cause of death in Peninsular Malaysia since 1970s[4] and elevated blood pressure is a major risk factor for cardiovascular diseases[5]. The Framingham study showed that when individuals aged 65-94 years were classified according to hypertension status, the overall risk for cardiovascular events and death due to cardiovascular diseases was more than doubled in subjects with definite hypertension compared with normotensives[6]. Pharmacologic therapy in the elderly hypertensives have been shown to be beneficial in reducing mortality and morbidity[7]. Identifying the risk factors for hypertension is important for prevention and non-pharmacologic measures.

Socio-economic factors were found to be inversely related to hypertension in USA and this was partially explained by different lifestyles[8]. The factors that are important in predicting blood pressure and prevalence of hypertension, are smoking[9,10], excessive alcohol intake[11], physical inactivity[12,13], obesity[14] and sodium intake[15]. However, the factors associated with hypertension in the elderly may be different. The Framingham study[14] showed that positive correlations between weight or Quetelet Index and systolic blood pressure was the highest for those aged 35-39 years and then decreased with age. By the age 60, the correlation with blood pressure almost disappeared. Though many studies have shown that vigorous exercises in younger adults is associated with lower blood pressure[12], less studies were

done on lower levels of physical activities in the elderly[13]. Studies that simultaneously examine the risk factors for hypertension particularly in the elderly in Malaysia are few.

The aims of this study were to determine the prevalence of hypertension in the elderly Chinese aged 55 years and older in 2 Chinese villages in Seberang Prai Tengah, Penang and to examine the factors associated with the occurrence of the condition.

Methodology

Two Chinese villages, Perkampungan Berapit and Perkampungan Sungai Lembu were randomly selected from 5 Chinese villages in Seberang Prai Tengah for this cross sectional study which was conducted between December 1993 and January 1994. House to house visits were done to identify all the Chinese 55 years of age residing in the selected villages. New villages were created during the early period of the Emergency in Malaysia (1948-1960). As a means to cut off rural ties with the communists, about half a million rural villagers (mainly Chinese) were resettled in 480 new villages. The term 'new' was dropped since 1990[16].

The standard mercury sphymomanometer was used and all blood pressure measurements were done by one medical officer so as to remove interobserver variation. The mean of two readings was used. Based on WHO standards[17], the criteria for hypertension for this study was a systolic blood pressure of 160 mm Hg and or a diastolic pressure of 95 mm Hg and above or report of current usage of antihypertensive drug.

Height and weight were measured. Body mass index (BMI) was calculated as weight(kg)/height^2(m^2) and a cutoff of 25 kg/m^2 was used to indicate obesity.

Interviews were conducted by trained interviewers using a pre-tested guided questionnaire and personal details including sociodemographic profile, medical history and drug usage were obtained. Participants were asked if they currently smoked cigarettes and if so, how many cigarettes they smoked per day. Current smoker was defined as smoking at least 1 cigarette/ day in the past 1 year.

A 24-hour physical activity recall was recorded to the nearest 15 minutes. Activities were classified by their energy requirements, expressed in terms of MET. The MET or a ratio of working metabolic rate/resting metabolic rate is a convenient method of expressing energy expenditure that is independent of body size. Based on the physical activity assessment used in the Stanford five-city project[18], activity classification by estimated MET were as follows: Sleep = 1 MET, light activity = 1.0-2.9 MET, moderate activity = 3.0-5.0 MET and heavy activity = 5.1 MET or greater. The list of examples of sport activities, household and occupational tasks thus classified had been published[18,19]. The total energy expenditure for a day or a physical activity index (PAI) can be estimated by the following formula[18];

PAI = (1 x Numbers of hours/day spent sleeping)
+ (1.5 x Numbers of hours/day doing light activities)
+ (4 x Numbers of hours/day doing moderate activities)
+ (6 x Numbers of hours/day doing hard activities)

Alcohol intake data including the frequency of alcohol consumption, the type and amount of alcohol consumed per day were obtained. Drinkers were classified according to the frequency of consumption over the past 1 year. Dietary information was gathered by using the 24-hour dietary recall and food frequency questionnaire.

Statistical analysis was done with SAS statistical software. To compare groups according to hypertensive status, Chi-square tests and Student's t-tests were used. The criterion for significance was $p < 0.05$.

Results

Sociodemographic Profile

A total of 243 Chinese aged between 55-95 years old were included in the study. Response rate was 84.4%. The reasons for non-response were refusal to be interviewed, not at home, being bedridden, psychiatric illness and gross skeletal deformities.

There were 142 (58.4%) female and 101 (44.6%) male subjects. The age distribution in both sexes were

similar. The mean ages of male and female respondents were 66.2 ± 9.3 years old and 65.5 ± 9.3 years old. The majority of the elderly (63.8%) never had any formal education. About 25% of the elderly were still working either in cottage industries, business, farming or as rubber tappers. The mean gross monthly household income of the respondents was RM1372.30 ± 762.32 and the mean per capita income was RM 230.40 ± 124.60. The elderly from both villages were similar in distribution with respect to age, male : female ratio and per capita income.

Behavioural Characteristics

Majority of the elderly reported that they carried out their regular and habitual activities on the day prior to the interview. The remaining 11 subjects who were sick or away on tours or attended a social function on the day prior to the first visit were revisited and interviewed at a later date. The average time spent sleeping or lying down in a day increased with age while the time spent doing moderate activities decreased with age ($p < 0.05$). None of the elderly did any heavy activity. The physical activity index (PAI) decreased significantly with age (Table I). Fifty-nine (58.4%) of the male subjects and 10 (7%) of the female subjects smoked at least 1 cigarette per day (Table II). As regards to alcohol intake, more men than women drank alcohol daily (Table II). Beer, brandy and alcoholic herbal preparation were consumed. The mean alcohol intake by daily drinkers was 9.6 ± 4.7 gm/day.

BMI and Nutritional Intake

Sixty-six (46%) of the female respondents and 33 (32.7%) of the male respondents were obese. The proportion of obese elderly decreased with age. The rate of obesity in the elderly aged 55-64, 65-74 and 75 years and older were 44.7%, 42.4% and 26.7% respectively.

The range of sodium intake by the respondents was 1986.3 - 6484.4 mg/day with a mean of 3956.4 ± 710.3 mg/day. The means of potassium and calcium intake were 1207.63 ± 638.5 mg/day and 260.2 ± 119.3 g/day respectively.

Prevalence of Hypertension

Out of 243 respondents examined, 117 (48.1%) were found to be hypertensive. Of the hypertensives, 65 (55.6%) were previously diagnosed as hypertensives and currently were on anti-hypertensive treatment and 52 (44.4%) were detected during the study. There were 11 (9.4%) cases with heart disease among the hypertensives. There were 14 elderly with stroke in the villages during the survey.

Table I
Time spent in each daily physical activity category and the physical activity index

Daily activities and PAI	55-64 years mean (sd)	65-74 years mean (sd)	>75 years mean (sd)
Male			
Sleep/lie down (hours/day)	8.2 (1.4)	9.2 (2.9)	9.6 (2.3)
Light (hours/day)	13.1 (2.1)	12.8 (3.0)	13.6 (2.3)
Moderate (hours/day)	2.6 (2.2)	1.9 (2.5)	0.8 (0.8)
PAI	38.5 (5.7)	36.3 (6.9)	32.4 (2.5)
Female			
Sleep/lie down (hours/day)	8.1 (1.4)	9.4 (2.4)	9.9 (3.3)
Light (hours/day)	13.0 (2.3)	12.9 (2.4)	12.9 (3.0)
Moderate (hours/day)	2.8 (2.2)	1.7 (1.5)	1.2 (1.1)
PAI	39.1 (5.7)	35.6 (4.2)	33.9 (3.9)

Table II
Smoking habits and alcohol intake among the respondents

Characteristics	male (n=101)		female (n=142)	
	no.	%	no.	%
Smoking habits				
Non-smokers	42	41.5	132	93.0
Current smokers				
1-20 cigarettes/day	45	44.6	9	6.3
>20 cigarettes/day	14	13.9	1	0.7
Alcohol intake				
Daily drinkers	15	14.9	14	9.8
Occasional drinkers	33	32.6	20	14.1
Non-drinkers	53	52.5	108	76.1

Prevalence of hypertension according to sociodemographic variables

Table III showed the prevalence of hypertension according to sociodemographic factors. There was no significant difference in the prevalences in both sexes (X^2 = 0.02; $p < 0.05$). There was a significant rise in the prevalence with age and a significant inverse association with per capita income. Those with the lowest tertile of monthly per capita income (less than RM168.20) had the highest prevalence of hypertension, followed by those in the second tertile (RM168.20-243.75) and those in the highest tertile (more than RM243.75) had the lowest prevalence. The prevalence of hypertension was not significantly associated with education level.

Prevalence of hypertension according to behavioural factors

Preliminary analysis showed there was a change in the smoking habits, physical activity, alcohol intake and dietary intake among those previously diagnosed as hypertensive. Further analysis to examine the relationship between hypertension and various behavioural and nutritional variables were done after excluding those previously diagnosed as hypertensives.

The mean PAI of hypertensive elderly were lower significantly than the mean PAI of non-hypertensive elderly (Table V). The prevalence of hypertension were the highest among the most inactive elderly (in the first tertile of PAI) and the lowest among the most active elderly (in the third tertile of PAI) (Table IV). Similar findings were obtained after stratifying for age (55-64, 65-74 and 75 years or older) and the division into 3 tertiles were done separately in the 3 age groups.

There were significantly more hypertensive among smokers than non-smoker (Table IV). After stratifying for age and sex, it was found that the prevalence of hypertension was still significantly associated with smoking (X^2_{MH} = 13.75; $p < 0.05$).

The prevalence of hypertension was not associated significantly with alcohol intake (Table IV). The proportion of hypertensives among non-drinkers and daily drinkers were similar but were higher than the proportion of hypertensives among the occasional drinkers.

Prevalence of hypertension according to BMI and nutritional intake

There was no significant association between BMI and the prevalence of hypertension in the elderly (X^2 = 2.74; $p > 0.05$). Similar results were obtained when the analysis was repeated after excluding the respondents who were diagnosed to be hypertensive prior to the study (Table IV). After adjusting for age, BMI was found to be associated with hypertension only among those aged 55-64 years. (X^2 = 5.19; $p < 0.05$). There

Table III
Prevalence of hypertension according to sociodemographic factors

Demographic factors	Hypertensive no.	%	Total	Chi-square test
Sex				
Male	49	48.5	101	p>0.05
Female	68	47.9	142	
Age (Years)				
55-64	55	41.7	132	p<0.05
65-74	33	50.0	66	
75+	29	64.4	45	
Per capita income				
Tertile 1	47	58.0	81	p<0.05
Tertile 2	43	53.1	81	
Tertile 3	27	33.3	81	
Formal education				
Yes	39	44.3	88	p>0.05
No	78	50.3	155	

Table IV
Prevalence of hypertension according to behavioural factors and BMI (after excluding previously diagnosed hypertensives)

Behavioural factors and BMI	Hypertensive No	%	Total (n)	X^2
Physical activity				
tertile 1	35	58.3	60	p<0.05
tertile 2	11	18.6	59	
tertile 3	6	10.2	59	
Smoking				
Non-smoker	30	24.0	125	p<0.05
Light smoker (1-20/day)	12	30.8	39	
Heavy smoker (>20/day)	10	71.4	14	
Alcohol intake				
Non drinker	34	30.9	110	p>0.05
Occasional drinker	10	23.3	43	
Daily drinker	8	32.0	25	
BMI				
<= 25	34	29.6	115	p>0.05
> 25	18	28.6	63	

Table V
Physical activity index (PAI) of newly diagnosed hypertensives and non hypertensives

	Hypertensives Mean PAI (SD)	Non-hypertensives Mean PAI (SD)	t-test
Males	33.7 (4.8)	38.4 (5.9)	$p < 0.05$
Females	33.3 (4.2)	39.6 (5.3)	$p < 0.05$

Table VI
Intake of selected nutrients by the newly diagnosed hypertensives and non-hypertensives

Nutrients	Hypertensives Mean (SD)	Non-hypertensives Mean (SD)
Males		
Energy (kkal)	1506.3 (362.0)	1519.2 (391.1)
Sodium (mg)	4122.9 (674.5)	4073.4 (647.6)
Potassium (mg)	1264.7 (638.5)	1176.9 (601.9)
Calcium (gm)	249.9 (104.3)	245.9 (105.8)
Females		
Energy (kkal)	1532.2 (530.6)	1422.5 (288.4)
Sodium (mg)	3840.6 (935.4)	3844.0 (637.9)
Potassium (mg)	1247.9 (711.1)	1181.6 (618.1)
Calcium (gm)	280.3 (167.2)	238.1 (110.4)

were no significant difference between the hypertensives' and the non-hypertensives' intake of dietary fat, sodium, potassium and calcium (Table VI).

Discussion

Different time periods, techniques, age groups and cut-off points for prevalence estimate have been used in different studies and comparisons between prevalence of hypertension in different studies must be interpreted with caution. Using the same definition for hypertension, the Framingham study[6] showed that 39% of elderly white males and 48% of elderly white females had hypertension and in Singapore, the prevalence of hypertension among the elderly aged 60-69 years old was 40%[2]. The prevalence of hypertension among the elderly in this study is comparable with the American and Singapore figures. A study carried out in Selangor using cutoff 140/90 mm Hg, found the prevalence of hypertension among the elderly age 55-64 years old to be 37.5%[1].

Blood pressure and the prevalence of hypertension rise with age in many studies. However this increase is not seen among certain societies for example the Orang Asli in Malaysia[20] and Xhosa tribe in Africa[21]. The interaction of many factors such as race, heredity, diet, exercise, culture may all contribute to the development of raised pressures. Urbanisation, modernisation and socio-economic changes are rapidly affecting the lifestyle and well-being of the elderly in many developing countries like Malaysia.

The prevalence of hypertension in this study was inversely related to per capita income. In the Intersalt study[8], the inverse relationship between hypertension and socio-economic status was partially explained by the difference in lifestyle where those in the lower socio-economic strata consume more alcohol and salt.

Physical activity could be assessed from type of occupations, self-report of leisure activities or as an estimated energy expenditure. Direct observation through personal or mechanical means is impractical for population study[19]. In this study, the majority of the elderly were not working or involved in various sports. Estimated energy expenditure or the physical activity index was calculated and found to be inversely related to the prevalence of hypertension, independent of age and sex. Heavy activities reported using 7-days recall had been shown to be inversely related to blood pressure of young adults[12]. Blood pressure was also found to be inversely related to the intensity of leisure-time activities in elderly women[13].

There was a significant association between smoking

and hypertension in this study. Nicotine had been proven to cause acute increase in blood pressure in experimental studies[10].

The amount of alcohol consumed by the daily drinkers in this study was roughly equivalent to the lightest consumption category (< 30 gm/day) in studies done in the United States[22,23] and Australia[24] and there was no significant relationship between alcohol intake and hypertension. Many studies have consistently shown significant increase in both systolic and diastolic blood pressure at levels of consumption of more than 30 gm/day[11,23,24]. However evidence is still conflicting as to whether the blood pressure of persons consuming small amounts of alcohol is greater[24], less[22,23] or no different[11] than that of non-drinkers. The inconsistency could be due to under-reporting of alcohol intake or inadequate control of confounders such as obesity and smoking[11]. Many studies have shown that obesity is significantly associated with prevalence of hypertension[14,25]. In this study, BMI was associated with hypertension only in the 55-64 age group. Diseases and death at older age group may have affected the relationship between weight and hypertension[14].

In many unaccultured societies, the intake of sodium is extremely low (less than 3 gm/day) and blood pressure does not increase with age[21,26]. In contrast, blood pressure increases with age and the prevalence of hypertension is higher in populations with high intake of dietary sodium[15]. A salt intake of 5 mg/day is taken as a reasonable estimate of a safe upper limit by a WHO Study Group[27]. A sodium intake between 4-8 mg/day seems to preferred by those with unrestricted access to salt and diets containing extremely low sodium are not tolerated[28]. In this study, the mean of daily sodium intake was within recommended limit and there was no significant difference between the hypertensives' and non-hypertensives' intake of dietary sodium. Many cross sectional studies had failed to show a relationship between sodium intake and hypertension within a population[15,26,27,29]. It is commonly believed that sodium intake in industrialised population is high enough to increase the blood pressure only in genetically susceptible salt-sensitive individuals[15]. Furthermore within a population, the intraindividual variance of dietary sodium intake is usually greater than interindividual variance[29].

The amount of dietary calcium consumed daily by the respondents in this study was much lower than the recommended daily allowance of 450 mg/day[30] and there was no significant difference between the hypertensives' and non-hypertensives' intake of calcium. Other studies on the effect of dietary potassium and calcium on blood pressure had been inconclusive and two reviews concluded that an increase in the intake of potassium and calcium may be effective in reducing blood pressure only in certain hypertensive subpopulations[15,31]

The main concern in a study like this is recall bias and under-reporting of smoking and alcohol intake which is difficult to avoid. The interviewers were trained properly in similar manner and were blinded to the status of hypertension of the cases detected during this study. Another limitation was that the 24-hour physical and dietary recall might not be representative of long term activity or intake. For the majority of the elderly, there was not much variation of their daily activities and we had recorded only the habitual activities carried out on a usual day. The presence of illnesses might affect a person's activities. During analysis we excluded bedridden elderly and those with known heart ailments and skeletal abnormalities. Interviews were repeated at a later date for the few elderly who were sick on the first visit.

Conclusion

Hypertension is a major health care problem in the elderly. Smoking and physical inactivity were two important behavioural factors associated with hypertension. Alcohol in small amounts is not associated with hypertension. Prospective and intervention studies are needed to evaluate the benefits of behavioural and nutritional changes on blood pressure in the elderly which in turn would have important impact on cardiovascular diseases.

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