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Influence of Food Intake and Eating Habits on Hypertension Control among Outpatients at a Government Health Clinic in the Klang Valley, Malaysia

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ABSTRACT

Introduction: In Malaysia, hypertension prevalence has increased from 13% in 1996 to 43% in 2006 based on the Third National Health and Morbidity Survey. **Methodology:** Recognising the importance of hypertension control to prevent cardiovascular morbidity and mortality, a cross-sectional study was carried out to assess factors influencing blood pressure among 74 hypertensive adults (22 men, 52 women, mean age 61.1 ± 8.8 years old) attending an outpatient clinic of a government health clinic in Klang Valley. Subjects were interviewed to obtain information on social and health, physical activity level and food intake using Diet History Questionnaire (DHQ) and Food Frequency Questionnaire (FFQ). Anthropometric measurements including weight, height, waist circumference and percentage of body fat were also conducted. **Results:** The majority of the subjects (71.6%) had poor hypertension control as determined using blood pressure. Women aged 30-59 years old had a higher mean diastolic blood pressure (87.3 ± 11.6 mmHg) than women aged ≥ 60 years old (78.5 ± 9.5 mmHg) (p<0.05). Most of the men (36.4%) achieved three out of six Medical Nutrition Therapy (MNT) for Hypertension Recommendations as outlined by the Malaysian Dietitians' Association. About one-third (30.8%) of the women achieved two out of six of the guidelines. High sodium intake (adjusted OR 3.501, 95% CI 1.116-10.985, p< 0.05), daily consumption of coffee (adjusted OR 0.302, 95% CI 0.093-0.983, p< 0.05) and less intake of milk (adjusted OR 3.328, 95% CI 1.055-10.493, p< 0.05) were associated with uncontrolled hypertension. **Conclusion**: Three quarters of the subjects had unsatisfactory hypertensive control and was related to food intake and eating habits including high salt diet, coffee consumption and inadequate milk intake were unsatisfactory. There is a need to implement a nutrition intervention programme based on MNT to achieve good hypertensive control among subjects.

Keywords: Blood pressure, food intake, health clinic, hypertensive, risk factors

INTRODUCTION

The World Health Organization (WHO) estimates that high blood pressure is the leading cause of death for every eight cases of death (Chobanian *et al*., 2003). This makes hypertension the third leading killer in the world. Individuals aged 55 years and above

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have a higher risk of suffering from hypertension (Chobanian *et al*., 2003). In Malaysia, the prevalence of hypertension has increased from 13% in 1996 to 43% in 2006 based on the Third National Health and Morbidity Survey (Institute for Public Health, 2008). According to Rampal *et al.* (2008), awareness, treatment and control of hypertension is still low (Rampal *et al*., 2008).

Food intake is an important factor in reducing a patient's blood pressure. Thus, low sodium intake (Appel *et al*., 2001), increased potassium intake and adherence to the Dietary Approach to Stop Hypertension (DASH) diet (Appel *et al*., 2006) would help reduce blood pressure. In addition, the intake of fat and carbohydrates, fruits and vegetables will also affect the level of blood pressure (Miura *et al*., 2004). Other influencing factors include sex, age, body mass index (BMI), family history, smoking, alcohol and education level (Mafauzy, Mokhtar & Wan Mohamad, 2003).

To our knowledge, there are limited studies on food intake assessment among Malaysian hypertensive patients. A study among adults in Kelantan (Mafauzy *et al*., 2003) showed that age, body mass index (BMI), glucose level, total cholesterol and LDL cholesterol were risk factors for hypertension. However, food intake was not assessed in that study. Thus, this study aimed to assess food intake and eating habits of hypertensive adult patients at a government health clinic in Klang Valley.

METHODOLOGY

Research design

A cross-sectional study was conducted among 74 hypertensive patients at a government health clinic in Klang Valley upon granting of approval by the Ministry of Health and the Medical Research Ethics Committee of Universiti Kebangsaan Malaysia (UKM). Verbal and written consent was also obtained from subjects. Subjects were selected using convenience sampling and the selection of the clinic was based on its location in the centre of the Klang Valley. Inclusion criteria were hypertensive patients aged 30 years old and above, on medical follow up of at least one year, able to communicate, were not deaf or mute, and had no mental health problems. The exclusion criteria for this study were patients with chronic terminal illness such as cancer, renal failure and mental problems.

Data collection

Subjects were interviewed to obtain information on socio-demographic, physical activity and food intake. Physical activity was assessed using International Physical Activity Questionnaires (IPAQ) (Hagstromer, Oja & Sjostrom, 2006) and food intake was assessed using a Diet History Questionnaire (Suzana, Earland & Suriah, 2000) and Food Frequency Questionnaire (Yap & Norimah, 2002) which consists of 33 food items that contribute to the sodium content in daily food intake. Anthropometric measurements including weight, height, percentage of body fat and waist circumference were also taken using the standard technique. Weight and height were measured using a SECA 703 High-Capacity Digital Column Scale (SECA, Germany) to the nearest 0.1 kg and 0.1 cm, respectively. Body Mass Index (BMI) of each subject was calculated using the following formula: weight (kg) / height (m^2) and classified based on WHO criteria (WHO Expert Consultation, 2004. In addition, percentage of body fat was also measured using Omron HBF 302 (Omron, Japan). Waist circumference was measured using a non-elastic measuring tape and was recorded to the nearest 0.1 cm. The cut-off point for waist circumference was compared to the WHO / IASO / IOTF (2000) recommendation. Blood pressure was taken by the medical physician and categorised using The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure (National

Table 1. Blood pressure classifications and nutrient intake recommendation

Classification/nutrient	*Criteria*	*Reference*
Classification of blood pressure		
Controlled	<140/90 mmHg for the patients diagnosed with hypertension only <130/80 mmHg for the patients diagnosed with hypertension, diabetes mellitus and/or renal failure.	National Heart, Lung and Blood Institute (2004)
Uncontrolled	>140/90 mmHg for the patients diagnosed with hypertension only >130/90 mmHg for the patients diagnosed with hypertension, diabetes mellitus and/or renal failure.	
Nutrient		
Energy	Maintain normal body weight for adults (BMI 18.5 – 24.9 kg/m^2)	Malaysian Dietitians' Association (2005)
Carbohydrate	50-60% of total daily energy intake	
Protein	15-20% of total daily energy intake	
Fat	25-30% of total daily energy intake	
Sodium	< 2400 mg per day	
Potassium	> 3500 mg per day	

Heart, Lung and Blood Institute 2004) and The Malaysian Clinical Practice Guidelines on the management of hypertension (CPG)(2008) (Table 1).

Food intake was computed using Nutritionist Pro to obtain estimated energy and nutrients values and compared to the Medical Nutrition Therapy (MNT) recommendations (Malaysian Dietitians' Association, 2005) (Table 1).

Statistical analysis

Statistical analysis was carried out using Statistical Package for Social Sciences (SPSS) version 17.0. Descriptive analyses were performed to show the demographic characteristics. An independent sample *t*-test was used to determine differences between continuous variables with hypertension control. Chi-square test was used to investigate the association between categorical variables with hypertension control. Multinomial logistic regression was used to determine factors that influence hypertension control at $p<0.05$, using the entry method.

RESULTS

Demographic and socio-economic characteristics

Of the 74 subjects who participated in this study, 39.2% were Malays, 54.1% Chinese and 6.8% Indians. Most of the subjects were married (68.9%), had completed primary school education (39.2%) and stayed with

Table 2. Socio-demographic profile of the subjects

Socio-demographic characteristics	*Men (n=22)*	*Women (n=52)*	*Total (n=74)*
Ethnic			
Malay	4(18.2)	25(48.1)	29(39.1)
Chinese	18(81.8)	22(42.3)	40(54.1)
Indian	0(0)	5(9.6)	5(6.8)
Age (years)			
30-59	9(40.9)	24(46.2)	33(44.6)
> 60	13(59.1)	28(53.8)	41(55.4)
Marital Status			
Single	1(4.5)	0(0)	1(1.4)
Married	18(81.8)	33(63.5)	51(68.9)
Divorced	1(4.5)	2(3.8)	3(4.1)
Widow / widower	2(9.1)	17(32.7)	19(25.6)
Education level:			
No formal education	2(9.1)	14(26.9)	16(21.6)
Primary school	10(45.5)	19(36.5)	29(39.2)
Secondary school	8(36.3)	19(36.6)	27(36.5)
Tertiary (Institute, university)	2(9.1)	0(0)	2(2.7)
Living arrangement:			
Alone	3(13.6)	4(7.7)	7(9.5)
Husband / wife	4(18.3)	5(9.6)	9(12.1)
Husband / wife / children / grandchildren	14(63.6)	37(71.2)	51(68.9)
Others	1(4.5)	6(11.5)	7(9.5)
Occupational Status			
Not working / housewife	3(13.6)	36(69.2)	39(52.7)
Retired	10(45.5)	5(9.6)	15(20.3)
Retired but still working	1(4.5)	0(0)	1(1.4)
Working	8(36.4)	11(21.2)	19(25.6)
Household income:			
< RM1000	8(36.4)	22(42.3)	30(40.5)
RM 1000-RM 2000	13(59.1)	27(51.9)	40(54.1)
> RM 2000	1(4.5)	3(5.8)	4(5.4)

their husband / wife / children / grandchildren (68.9%), were housewives and unemployed (52.7%) with a household income of around RM1000-RM2000 (54.1%) (Table 2).

Blood pressure

Among the women, diastolic blood pressure in the older age group (≥60 years) (78.5 ± 9.5mm Hg) was lower than in the younger age group (30-59 years) (87.3 ± 11.6mm Hg) (p<0.05) (Table 4). Most patients were prescribed two or more anti-hypertensive drugs. About 66.7% of subjects aged 30-59 years and 75.6% of subjects aged 60 years and above had uncontrolled blood pressure. According to National Heart, Lung and Blood Institute (2004), patients diagnosed with hypertension are classified as uncontrolled blood pressure when blood pressure is more than 140 / 90 mmHg, while for patients with multiple diagnoses of

Table 3. Mean for blood pressure and anthropometric profiles of the subject by age groups (n=74)

Parameters	*Men (n=22)*		*Women (n=52)*	
	30-59 years(n=9)	*≥ 60 years (n=13)*	*30-59 years (n=24)*	*≥ 60 years (n=28)*
Blood pressure				
Systolic (mmHg)	139.0±13.7	150.5±16.1	145.0±20.4	143.7±14.4
Diastolic (mmHg)	85.9±8.5	81.8±8.6	87.3±11.6	78.5±9.5*
Anthropometric profiles				
Weight (kg)	79.2±12.5	64.0±8.7*	72.1±11.2	61.1±7.3*
Height (cm)	166.2±6.8	163±6.3	153.8±5.2	151.7±5.5
BMI (kg / m^2)		30.7±4.0	24.8±4.2*	30.4±4.7
26.6±2.7*				
Waist circumference (cm)	97.1±8.7	87.0±8.2*	90.8±10.1	88.1±8.8
Body fat (%)	30.5±4.4	29.2±6.5	38.1±4.4	36.7±4.4
Physical activity level				
MET (min / week)	1682.1±1141.9	1034.9±601	1137.8±439.5	1114.2±677.8

*Significant differences ($p< 0.05$) based on independent sample *t*-test
BMI- Body Mass Index

hypertension, diabetes mellitus and / or renal failure, the reading for uncontrolled blood pressure is lower, i.e. 130 / 90 mmHg (Table 1). Only 28.4% of the subjects achieved optimal blood pressure which is defined as 130-139 mmHg for systolic and 80-89 mmHg for diastolic, which can improve mortality rates (Fletcher *et al*., 2010).

Anthropometric profiles

Table 3 shows that subjects from the younger age group were heavier than their older counterparts ($p<0.05$). Greater BMI was observed in men (30.7 ± 4.0kg / m^2) and women (30.4 ± 4.7kg / m^2) aged 30-59 years ($p <0.05$). The mean waist circumference for men (97.1 ± 8.7 cm, 87.0 ± 8.2 cm) and women (90.8 ± 10.1 cm, 88.1 ± 8.8 cm) were higher than the recommendations of WHO / IASO / IOTF (2000), with 50.0% of men and 82.7% of women having abdominal obesity.

Food intake and eating habits

Table 4 presents the relationship between hypertension control with nutrient intake, physical activity and eating habits. Only 13.5% of the subjects met the MNT recommendation for energy. A total of 29.7% subjects and 31.1% did not meet the MNT recommendations for protein and carbohydrate, respectively. Only 48.6% of the subjects achieved fat intake recommendation (25-30%). More than half of the subjects (68.9%) had an estimated sodium intake of more than the recommended value of 2400mg / day. None of the subjects were able to achieve the MNT recommendation for potassium (> 3500 mg). Thus, 27% of subjects met two or three out of six MNT recommendations. All subjects did not meet the six MNT recommendations. Based on the calculation of Energy Intake / Basal Metabolic Rate ratio (EI / BMR), 77.0% of subjects were under reporting their energy intake and 23.0% subjects reported normally.

There was no significant association between intake of energy, carbohydrate, protein, fat, potassium, physical activity and eating habit with hypertension control, except for sodium, coffee and milk. A higher percentage of individuals with uncontrolled

Table 4. Relationship between hypertension control with nutrient intake, physical activity and eating habit

	Blood pressure (mmHg)			
Nutrient intake	*N (%)*	*Controlled*	*Uncontrolled*	*P value*
Energy (kcal / d)				
Met	10 (13.5)	1 (10.0)	9 (90.0)	0.166
High	64 (86.5)	20 (31.3)	44 (68.8)	
Carbohydrate (% kcal / d))				
Met (50-60%)	51 (68.9)	13 (25.5)	38 (74.5)	0.412
Low or High (<50% or >60%)	23 (31.1)	8 (34.8)	15 (65.2)	
Protein (% kcal / d)				
Met (15%-20%)	52 (70.3)	14(26.9)	38 (73.1)	0.669
Low or High (<15% or >20%)	22 (29.7)	7 (31.8)	15 (68.2)	
Fat (% kcal / d)				
Met (25-30%)	36 (48.6)	10 (27.8)	26 (72.2)	0.911
Low or High (<25% or >30%)	38 (51.4)	11 (28.9)	27 (71.1)	
Sodium (mg / d)				
Met (<2400mg)	23 (31.1)	11 (47.8)	12 (52.2)	0.013*
High (>2400mg)	51 (68.9)	10 (19.6)	41 (80.4)	
Potassium (mg / d)				
Met (>3500mg)	0 (0.0)	0 (0)	0 (0)	
Low (<3500mg)	74 (100.0)	21 (28.4)	53 (71.6)	
MNT recommendations				
Met < 3out of 6	59 (79.7)	16 (27.1)	43 (72.9)	0.634
Met > 4 out of 6	15 (20.3)	5 (33.3)	10 (66.7)	
Physical activity level				
Low	13 (17.6)	3 (23.1)	10 (76.9)	0.641
Moderate and high	61 (82.4)	18 (29.5)	43 (70.5)	
Eating habit				
Add salt / soya sauce				
Yes	9 (12.2)	1 (11.1)	8 (88.9)	0.220
No	65 (87.8)	20 (30.8)	45 (69.2)	
Spices				
Yes	2 (2.7)	0 (0)	2 (100.0)	0.367
No	72 (97.3)	21 (29.2)	51 (70.8)	
Remove skin of chicken				
Yes	46 (62.2)	13 (28.3)	33 (71.7)	0.977
No	28 (37.8)	8 (28.6)	20 (71.4)	
Serving of fruits and vegetable				
< 3 servings / d	64 (86.4)	19 (29.7)	45 (70.3)	0.527
> 4 servings / d	10 (13.6)	2 (20.0)	8 (80.0)	
Eating outside				
< 3 times / week	50 (67.6)	15 (30.0)	35 (70.0)	0.655
> 4 times / week	24 (32.4)	6 (25.0)	18 (75.0)	
Fast food				
≤ 3 times / week	73 (98.6)	21 (28.8)	52 (71.2)	0.526
≥ 4 times / week	1 (1.4)	0 (0)	1 (100.0)	

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Nutrient intake	*N (%)*	*Blood pressure (mmHg)* *Controlled*	*Uncontrolled*	*P value*
Change eating habit				
Yes	51 (68.9)	14 (27.5)	37 (72.5)	0.792
No	23 (31.1)	7 (30.4)	16 (69.6)	
Read food label				
Yes	12 (16.2)	3 (25.0)	9 (75.0)	0.777
No	62 (83.8)	18 (29.0)	44 (71.0)	
Coffee				
Yes	36 (48.6)	6 (16.7)	30 (83.3)	0.030*
No	38 (51.4)	15 (39.5)	23 (60.5)	
Milk				
Yes	25 (33.8)	11 (44.0)	14 (56.0)	0.033*
No	49 (66.2)	10 (20.4)	39 (79.6)	
Supplement				
Yes	22 (29.7)	7 (31.8)	15 (68.2)	0.669
No	52 (70.3)	14 (26.9)	38 (73.1)	
Herbal				
Yes	10 (13.5)	2 (20.0)	8 (80.0)	0.527
No	64 (86.5)	19 (29.7)	45 (70.3)	

*significant differences (P<0.05) based on Chi-square test.

Table 5. Factors that influence hypertension control

Determinants	*B*	*SE*	*Adjusted OR*	*95% CI*	*P value*
Sodium >2400mg	1.253	0.583	3.501	1.116-10.985	0.032*
Daily intake of coffee	-1.196	0.602	0.302	0.093-0.983	0.047*
Not drinking milk regularly	1.202	0.586	3.328	1.055-10.493	0.040*

OR: odds ratio; CI confidence interval; SE - standard error; B - beta coefficient
*p<0.05, multinomial regression at 2-tailed significance

hypertension (80.4%) did not meet the MNT recommendation for sodium compared to those with controlled hypertension (19.6%) (p<0.05). Coffee intake was higher among uncontrolled hypertension group (83.3%) compared to the well controlled group (16.7%) (p<0.05). A higher percentage of uncontrolled hypertension subjects did not drink milk regularly (79.6%) compared to the well controlled hypertension group (20.4%) (p<0.05).

Factors influencing hypertension control

Table 5 presents the intake of high sodium (adjusted OR 3.501, 95% CI 1.116-10.985, p< 0.05), coffee (adjusted OR 0.302, 95% CI 0.093-0.983, p< 0.05) and milk (adjusted OR 3.328, 95% CI 1.055-10.493, p< 0.05) which

were important determinants in influencing hypertension control after adjustment for sex, age group and energy intake.

DISCUSSION

This study reported a low energy intake of approximately 1426 kcal for men and 1247 kcal for women among hypertensive patients. This may be due to the observation that 77.0% of the subjects had under-reported their energy intake. In both genders, the older age group exhibited lower energy intake compared to the younger age group. The study by Suriah *et al.* (1996) also showed that energy intake tended to decline with increasing age. The lower reported energy may be due to under-reporting of food intake by subjects as energy intakes as assessed using dietary records may underestimate the true habitual energy intake (Black *et al.*, 1991). Intake is often misreported using the diet history method since it is difficult to assess the individual's usual long-term intake. In order to overcome this matter, repeated dietary assessment and a combination of dietary methods are recommended (Amend *et al.*, 2007) . No subjects were able to achieve the MNT recommendation for potassium intake (> 3500 mg). This may due to the small quantity of vegetables and fruits consumed by the subjects.

This study also showed that sodium intake is one of the important determinants influencing hypertension control, with subjects consuming more than 2400mg / d of sodium being at risk of uncontrolled hypertension by three-fold. Physiologically, an increased intake of sodium would result in a higher excretion of sodium leading to simultaneously increased blood pressure, in order to restore sodium homeostasis through natriuresis (Guyton, 1987). Schroder, Schmelz & Marrugat (2002) also showed that dietary intake of sodium was directly related to blood pressure after adjusting for sex, age and energy consumption. In addition, moderate sodium intake in combination with a calcium intake of more than 800 mg / d reduced the risk of inadequate blood pressure control by 52 % in subjects undergoing drug treatment (Schroder *et al.*, 2002). This study also reported that dietary calcium intake was inversely associated with blood pressure.

The risk of uncontrolled hypertension increased two-fold in coffee drinkers among the studied subjects. According to Klag *et al.* (2002), after adjustment for parental incidence of hypertension and time-dependent body mass index, smoking, alcohol drinking, and physical activity, it is found that drinking coffee daily raised systolic blood pressure by 0.19 mmHg (95% CI, 0.02-0.35) and diastolic pressure by 0.27 mmHg (95% CI, 0.15-0.39). Furthermore, coffee drinkers had a greater risk of getting hypertension during follow-up (18.8% vs 28.3%; *P*=.03) compared with non drinkers at baseline.

However, other studies have reported no linear association between caffeine consumption and incident hypertension (Winkelmayer *et al.*, 2005). Thus, the precise nature of the relation between coffee and blood pressure remains unclear. Carlsson *et al.* (2009) reported that daily intake of fruit was independently associated with uncontrolled hypertension in men. High fruit and vegetable consumption of five servings or more is associated with lower blood pressure and a lower increase in blood pressure with age (Dauchet *et al.*, 2007). However, this study could not demonstrate this association, probably due to the fact that most of the subjects homogenously had low intake of fruits and vegetables.

The study also showed that not drinking milk regularly increased risk of uncontrolled hypertension by 3.5 fold. A study by Engberink *et al.* (2009) reported that dairy products have a good effect on blood pressure among early and middle-aged adults. Similarly, Jorde & Bonaa, (2000) found that there was a significant linear relationship with increasing dairy calcium

intake and decreasing systolic and diastolic blood pressure in both sexes ($P < 0.05$). A study by Wang *et al.* (2008) found that higher intakes of low-fat dairy products, calcium, and vitamin D correlated with a decreased risk of hypertension in middle-aged and older women, suggesting a beneficial effect on primary prevention of hypertension and cardiovascular complications. Nevertheless, the effects of dietary calcium on blood pressure regulation appear to be paradoxical, as increasing intracellular calcium increases vascular smooth muscle tone, peripheral vascular resistance, and blood pressure, while increasing dietary calcium exerts the opposite effect (Zemel, 2001). The protective effect of calcium on blood pressure can be explained in part by the influence of calcitrophic hormones on intracellular calcium which are expected to reduce vascular smooth muscle cell, intracellular calcium, peripheral vascular resistance and blood pressure (Zemel, 2001).

There are several limitations to this study. First, most of the subjects had difficulty remembering the frequency of food items that they usually consumed. Second, the patients were unable to provide accurate estimation of portion sizes resulting in under-reporting of the food intake. Third, follow-up blood pressure was measured only once which may result in certain patients being categorised into the blood pressure control group incorrectly. A longitudinal study with a larger sample size is needed to determine the influence of food intake and eating habits with hypertensive controls. Nevertheless, this study is able to highlight the dietary pattern associated with hypertension control among hypertensive adults attending an outpatient clinic of a government health clinic in the Klang Valley.

CONCLUSION

Only a third of the subjects in this study had achieved good hypertension control and none met the MNT recommendations for hypertension. High sodium intake, regular coffee intake and not taking milk increased the risk of uncontrolled hypertension among subjects. The high prevalence of uncontrolled hypertension is not acceptable as subjects were patients attending a public funded health clinic. Effective strategies should be incorporated in this primary health care setting in order to reduce the magnitude of uncontrolled hypertension that would lead to undesirable cardio-vascular morbid events and a higher mortality rate.

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