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Bone Health Status and Lipid Profile among Post-menopausal Malay Women in Cheras, Kuala Lumpur

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ABSTRACT

Introduction: A cross-sectional study was conducted to determine bone health status and nutrient intakes among post-menopausal women residing in low cost houses in Cheras, Kuala Lumpur**. Methods:** A total of 125 subjects aged 60 ± 4 years who had attained menopause at age 50 ± 5 years participated in this study. Subjects' weight and height were measured and calculated for body mass index (BMI). They were also assessed for bone health status using the Quantitative Ultrasound (QUS). Nutrient intake was assessed using a dietary history Questionnaire. Fasting serum lipid and blood pressure measurements were also taken. **Results:** The majority of the subjects were overweight and obese (80%) based on BMI status. Calcaneal measurements using the QUS indicated that while 57% or the subjects had normal bone mineral density, 37% were osteopenic and 6% osteoporotic. Calcium intake of the subjects was 505 ± 263mg / day, which is only 50% of the Malaysian Recommended Nutrient Intake for calcium (1000 mg / d). About 74% of the subjects were hypercholesterolemic and 58% were hypertriglyceridemic. Two-thirds reported that they were taking medication for hypertension, diabetes mellitus and heart disease. **Conclusion:** The results showed low health and nutritional status among post-menopausal women living in low-cost flats in Kuala Lumpur. They have low bone mass which may be due to their predominantly non-milk based diets which places them at high risk of hip fractures. Apart from milk, other food sources of calcium, including soya bean products such as '*tempeh*' and healthy ways of cooking should be recommended to older people.

Keywords: Bone health, post-menopausal, Malay, osteoporosis, lipid profile.

INTRODUCTION

In Asia, osteoporosis is rapidly becoming a major public health problem with an increasing incidence of hip fracture and a rapidly aging population. By the year 2050, more than half of hip fractures around the world would occur in Asia, with the total number approaching 3.2 million (Lau, 2004). The rates are much lower in Malaysia and

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Thailand but are likely to increase with urbanisation and ageing (Lau *et al.*, 2001). Seven percent of the population in Malaysia was estimated to be over 60 years of age in 2005. This age group is expected to increase over time since life expectancy at birth for Malaysian females has increased from 66 to 76 years between 1980 and 2005 (Department of Statistics, 2000). Thus, it is anticipated that a large number of women in Malaysia will spend one-third of their lives in a post-menopausal state.

Osteoporosis will rapidly become a major public health problem in Malaysia if appropriate intervention is not taken. A recent study on urban midlife Malaysian women indicated that 24% of the subjects were post-menopausal women who were osteoporotic (predominantly at the hip). Post-menopausal women in the study had significantly lower mean bone mineral density with 42.1% of them being in osteoporosis state compared to the pre-menopausal women (Lim *et al.*, 2005). In order to ensure that an optimal quality of life is maintained among these menopausal women, prevention of osteoporosis is essential. Results from the Asian Osteoporosis Study suggested that lifestyle factors might be associated with osteoporosis such as low dietary calcium intake (<498 mg/d), sedentary lifestyle, smoking and alcoholism (Lau *et al.*, 2001). Thus, this study aimed to determine the bone health status and estimate nutrient intake among post-menopausal Malay women living in Cheras. This study represents the first part to a parent study (Hasnah *et al.*, 2010) to determinethe calcium absorption from milk and tempeh consumed by post-menopausal Malay women using the dual stable isotope technique.

METHODS

This study was a cross-sectioned study among post-menopausal Malay women. It was conducted in Cheras, Kuala Lumpur, Malaysia. Ethical approval was obtained from the Clinical Research Ethics Committee in Universiti Kebangsaan Malaysia Medical Centre (UKMMC).The screening started with completion of the screening questionnaire which was administered by interviewing the subjects followed by measurement of anthropometry, blood pressure and blood sampling (blood glucose and lipid profiling). This was followed by administering the dietary history questionnaire (DHQ) by interviewing the subjects.

Subjects

Samples were recruited through convenience sampling from the areas within 3 km radius of Universiti Kebangsaan Malaysia Medical Centre (UKMMC) which were Bandar Tun Razak, Taman Jaya, Kuala Lumpur City Hall flats of Sri Labuan, Sri Melaka and Sri Kota. Inclusion criteria for subjects to take part in this screening were Malay women, 50 to 65 years of age and menopaused for at least 2 years. Interested participants were told to fast for at least 12 hours prior to the free health check up on the day of the screening or data collection.

Anthropometric and bone health measurements

Weight and height measurements were taken to determine their body mass index (BMI) using the digital weighing scale (SECA, Germany) with a height attachment. BMI was classified according to WHO standard (WHO, 1995). BMI for underweight < 18.5 kg/m2, normal: 18.5 to 24.9 kg/m2 and overweight: 25 to 29.9 kg/m2. Bone health status of the post-menopausal Malay women was determined using a calcaneal ultrasonometer (QUS-2, Quidel Corp, San Diego, CA). Definition of normal, osteopenia and osteoporosis were based on T-score, as determined by World Health Organization (WHO, 1994). T-score for normal BMD: > -1, T-score for osteopenia: -1 to > -2.5 and T-score for osteoporosis: ≤-2.5.

Blood pressure measurement and blood sampling

Blood pressure measurement was carried out using the OMRON automatic blood pressure monitor (Omron T8, Omron Corporation, Kyoto, Japan). A medical assistant collected the fasting venous blood samples (4 ml) from each subject for blood glucose measurement and fasting serum lipid analysis. Blood glucose was measured using the glucose meter (Accutrends, Roche, Manheim, Germany). Blood samples for fasting serum lipid (FSL) analysis were kept in plain tubes for half an hour before they were centrifuged at 3000 rpm for 10 minutes. The upper layer (serum) was transferred from the plain tube to an eppendorf tube using polypropylene transfer sterile pipette. Eppendorf tubes containing serum were kept in an ice box until they were sent to the pathology laboratory of UKMMC for FSL analysis. Total cholesterol (TC), triglyceride (TG) and high density lipoprotein cholesterol (HDLC) assays were performed using the *in vitro* diagnostic reagent system, based on enzymatic- colorimetric method (Roche / Cobas Integra). Low density lipoprotein cholesterol (LDLC) was determined using the following formula: LDLC = TC – (TG / 2.2 + HDLC). Classification of hypertension and diabetes mellitus were based on WHO standard (WHO, 1999). The percentage of subjects who were hypercholesterolemic (TC>5.2 mmol / L), hypertriglyceridemic (TG> 1.4 mmol / L) and with high low density lipoprotein cholesterol (LDLC) values (> 3.8 mmol / L) were based on cut-off points by ATP I (NCEP, 1993).

Dietary intake assessment

Dietary history questionnaire (DHQ) based on Suzana *et al.* (2000) was used to quantify the subjects' nutrient intakes which were then analysed using nutrition database, Nutritionist ProTM (Version 3.1.10, Axxya System, Texas, USA) based on Malaysia Food Composition Table (Tee *et al.*, 1997), Singapore Food Composition Table (SFT, 1998) and United States Standard Reference Database (USDA). The Singapore Food Composition Table was used when the food was not listed in the Malaysian Food Composition Database. Under-reporting of dietary intake was determined based on the ratio of the energy intake (EI) and basal metabolic rate (BMR) of each subject. The ratio of EI to BMR which is less than 1.2 is not compatible with habitual intake and normally signifies under-reporting of energy intake (Golberg *et al.*, 1991).

Statistical analysis

The mean and standard deviation of the various parameters were determined by using descriptive statistics using SPSS version 15.0 for windows (SPSS Inc, Chicago, IL, USA). Pearson correlation, general linear model of univariate and multivariate analyses were used to assess the relationship between various indices such as calcium intake, calcaneal measurement, age, weight, body mass index, fasting blood glucose, systolic and diastolic blood pressure of the subjects.

RESULTS

A total of 125 post-menopausal Malay women from five low cost housing locations in Cheras, Kuala Lumpur participated in the study. The mean age of the subjects was 59 ± 4 years, ranging from 51 to 68 years of age (Table 1). The majority (42%) were in the age range of 60-64 years old. Two-thirds of the subjects were married while only 2% were never married before. The highest education achieved for more than 50% of the subjects was primary level while 30% received their highest education up to secondary school. About 75% were housewives while less than 10% were still working. Almost two-thirds of the subjects had household incomes of up to RM1000 while 60% of this category had incomes ranging from RM500-1000.

Table 1. Socio-demographic profile of subjects

	Number of subjects (n)	*Percent (%)*	*Mean ± SD*
Age (years)			
50-54	9	7.2	60 ± 4
55-59	49	39.2	
60-64	53	42.4	
65-69	14	11.2	
Marital status			
Married	84	67.2	
Widowed	34	27.2	
Divorcee	5	4.0	
Single	2	1.6	
Level of education			
Never go to school	13	10.4	
Primary school	73	58.4	
Secondary school	36	28.8	
University	3	2.4	
Occupation			
Housewife	93	74.4	
Pensioner	21	16.8	
Working	11	8.8	
Monthly household income			
<RM500	32	25.6	
RM501-1000	51	40.8	
RM1001-1500	27	21.6	
RM1501-2000	6	4.8	
RM2001-5000	9	7.2	

As shown in Table 2, the mean age for onset of menarche was 13 years while mean age for attaining menopause was 50 years with mean years since menopause being 10 years. More than 90% of the subjects menopaused naturally while 10% had surgically induced menopause. The mean reproductive years for these subjects were 37 years.

Health status of the subjects

Data on the health status of the subjects are shown in Table 3. The mean ± SD of weight, height and BMI for these subjects were 63.7 ± 10.1 kg, 1.5 ± 0.1 m and 28.1 ± 4.2 kg / $m^{2,}$ respectively. About 20% of the study group had normal BMI, nearly 50% were overweight and about 30% were obese. Mean ± SD of fasting blood glucose (FBG), systolic and diastolic blood pressure were 6.8 ± 3.4 mmol / L, 148.3 ± 24.6 mm Hg and 79.9 ± 10.9 mm Hg, respectively. Some 66% of subjects reported that they had been diagnosed with chronic diseases that included hypertension (HP), diabetes mellitus (DM) and heart disease (HD) and were receiving treatment. About 30% had HP, 14% a combination of HP and DM, 9% had DM, 5% a combination of HD and DM and 1% had HD. Pearson correlation (r) between age, weight, BMI, FBG, systolic and diastolic blood pressure (BP) are presented in Table 4. There was a significant correlation ($p<0.05$) between blood pressure and BMI of the subjects.

Table 2. Menstrual and reproductive history of the subjects

	Number of Subjects (n)	*Percent (%)*	*Mean ± SD*
Age of menarche (years)			
<11	5	4	13 ± 2
11-14	83	66	
>14	37	30	
Age of menopause (years)			
<45	15	12	50 ± 5
45-50	56	45	
>50	54	43	
Length of menopause (years)			
1-5	36	29	10 ± 7
6-10	47	38	
11-15	25	20	
16-20	9	7	
>20	8	6	
Reason of menopause			
Surgery	9	7	
Naturally	116	93	
Length of reproductive (years)			
20-25	5	4	37 ± 6
26-30	9	7	
31-35	30	24	
36-40	55	44	
41-45	22	18	
>45	4	3	

Based on WHO (1994) classification, 43% are osteoporotic and osteopenic with the rest (57%) having normal BMD. Pearson correlation analysis showed that subjects' weight was correlated (r=0.722, p=0.011) to the T-score generated from calcaneal measurements. The average lipid profiles were as follows: 5.97 ± 1.23mmol/L TC,1.40 ± 0.33 mmol/L HDLC, 3.84 ± 1.02mmol/L LDLC and 1.77 ± 0.96 mmol/LTG. Table 3 shows that about 74% of the subjects were hypercholesterolemic, 58% were hypertriglyceridemic and 48% had high LDLC values based on NCEP (1993). Multivariate analysis was carried out using stepwise method to determine the variables that significantly affected the systolic and diastolic blood pressure of the subjects. The dependent variables were systolic and diastolic blood pressure. Independent variables included were FBG, BMI, body weight, TG, HDLC and LDLC. The results showed that BMI affected systolic (p = 0.011) and diastolic (p = 0.036) of the blood pressure. LDLC only affected the systolic blood pressure (p = 0.006).

Nutrient intake

Table 5 shows that the average energy intake for subjects was 1654 kcal/day for those aged 50-59 years and 1551 kcal/day for those aged 60-69 years, which achieved 76% and 87% of the Recommended Nutrient Intake (RNI), respectively (NCCFN, 2005). Mean carbohydrate and fat intakes were 55% and

Table 3. Health status of the subjects during screening

	Number of subjects (n)	*Percent (%)*
Body mass index (kg/m^2)		
Underweight (< 18.5)	2	2
Normal (18.5 to 24.9)	27	22
Overweight (25 to 29.9)	57	46
Obese (> 30)	39	31
Fasting blood glucose (mmol/L)		
Normal (< 5.5)	59	47
High risk (5.6 – 6.1)	24	19
Diabetic (>6.1)	42	34
Blood pressure (mm Hg)		
Normal (Systolic BP≤140, diastolic BP≤90)	82	66
Hypertension (Systolic BP>140, diastolic BP>90)	43	34
Self reported health status		
Having no diseases	42	34
Having diseases		
a. Hypertension (HP)	34	27
b. Diabetes mellitus (DM)	11	9
c. Heart disease (HD)	2	1
d. HP & DM	18	14
e. HD & DM	6	5
f. Others	12	10
Heel Ultrasound (T-score)		
Normal (> -1)	71	57
Osteopenia (£-1 to > -2.5)	46	37
Osteoporosis (£ -2.5)	8	6
Fasting serum lipid(mmol/L)		
Triglycerides < 1.4	53	42
Triglycerides > 1.4	72	58
Total cholesterol < 5.2	33	26
Total cholesterol > 5.2	92	74
High density lipoprotein cholesterol< 1.2	35	28
High density lipoprotein cholesterol >1.2	90	72
Low density lipoprotein cholesterol < 3.8	65	52
Low density lipoprotein cholesterol > 3.8	6	48

Table 4. Pearson correlation (r) between age, weight, BMI, fasting blood glucose, systolic and diastolic blood pressure

	Age (r)	*Weight (r)*	*BMI (r)*	*FBG (r)*	*Systolic (r)*	*Diastolic (r)*
Age (r)	1.000	0.186*	0.044	0.008	0.295**	0.156
Weight (r)		1.000	0.887**	0.069	0.160	0.175
BMI (r)			1.000	0.095	0.246**	0.198*
FBG (r)				1.000	0.049	0.056
Systolic (r)					1.000	0.660**
Diastolic (r)						1.000

* Correlation is significant at $p < 0.05$ level (2-tailed).
** Correlation is significant at $p < 0.01$ level (2-tailed).

Table 5. Average nutrient intake of the subjects

Nutrients	*RNI*	**Mean ± S.D*	*Range*
Macronutrients			
Age 50-59 (n = 57)			
Energy (kcal / d)	2180	1654 ± 525	813 - 2812
Carbohydrate (g / d)		224 ± 66	76 - 420
% Energy	55-70	55 ± 8	35 - 77
Protein (g / d)	55	59 ± 20	22 - 114
% Energy	10-15	15 ± 3	10 - 22
Fat (g / d)		58 ± 29	9 - 137
% Energy	20-30	31 ± 8	9 - 46
Age 60-69 (n = 68)			
Energy (kcal / d)	1780	1551 ± 499	804 - 2953
Carbohydrate (g / d)		211 ± 57	83 - 378
% Energy	55-70	56 ± 9	28 - 79
Protein (g / d)	51	58 ± 24	23 - 146
% Energy	10-15	15 ± 3	10 - 23
Fat (g / d)		53 ± 28	8 - 146
% Energy	20-30	30 ± 9	8 - 50
Micronutrients			
Vitamin A (µg / d)	500	808 ± 480	76 – 2595
Vitamin C (mg / d)	70	88 ± 73	0.3 – 448
Thiamin (mg / d)	1.1	0.7 ± 0.3	0.1 – 3.0
Riboflavin (mg / d)	1.1	1.2 ± 0.5	0.2 – 3.0
Niasin (mg NE / d)	14	9 ± 3	2 – 21
Iron (µg / d)	11	13 ± 11	2 – 53
Calcium (mg / d)	1000	505 ± 263	96 – 1384

* Mean values ±standard deviations

30% of the total energy intake, respectively and were in the range recommended by RNI. Protein intake was 58-59 g / day which was adequate and achieved more than 100% of RNI. Vitamin A, C, riboflavin and iron intakes of subjects in this study were adequate, achieving more than 100% of RNI. Calcium (51%), thiamin (63%) and niacin (58%) were the micronutrients intakes that achieved less than 67% of the RNI. The mean for the ratio EI to BMR for these subjects was 1.60 ± 0.58 and only 19% of them were under reporters.

Calcium intake

The mean ± SD calcium intake of the subjects in this study was 505mg / day. Only 5% of the subjects met RNI for calcium, while 21% achieved 67-90% of RNI for calcium. About 44% achieved 30-66% of the RNI for calcium and 31% achieved less than 30% of the RNI. Sources of calcium for the subjects were vegetables (37%), dairy products (32%), meat and seafood (17%), cereal (7%), fruits (5%) and beverages (2%). Chinese mustard leaves, swamp cabbage and spinach were the types of vegetables that contributed to 37% of the calcium source for these subjects. Dairy products normally consumed by these subjects consisted of skimmed milk and full cream milk powder. They reported taking 2-3 tablespoons of milk powder daily. However, 40% of the subjects did not take milk.

DISCUSSION

The average age of the subjects was 59 years while menopause was attained at 50 years of age. This is similar to the average age of the post-menopausal Malay women reported by Rahman *et al.* (2004). Average BMI (28 kg / m^2) of the subjects in this study was slightly higher (BMI: 27 kg / m^2) than the figures reported by other studies (Lim *et al*., 2005; Rahman *et al*., 2004). About 80% were overweight and obese and had higher BMI which was significantly correlated (p<0.05) to their total calorie and fat intakes. Average fasting blood glucose of these subjects was high and they could be classified as having diabetes. Only about 10% of the subjects had reported receiving treatment for diabetes mellitus but the health assessment found that 34% could be classified as diabetic due to their high fasting blood glucose level, an indication that some of the subjects were not aware of their diabetic condition.

There was a significant correlation (p<0.05) between blood pressure and BMI of the subjects. This may be the reason as to why hypertension was the most prevalent chronic disease (27%) reported among these post-menopausal Malay women. It is consistent with another study on local elderly Malays (Shahar *et al.*, 2007) that reported hypertension as one of the most commonly reported chronic diseases. It is a major cardiovascular risk factor which may cause cardiovascular morbidity and mortality among the post-menopausal women (Cifkova *et al*., 2008). The prevalence of hypercholesterolemic (74%) and hypertriglyceridemic (58%) in this study was higher than in a previous local study (Damodaran *et al.*, 2000) that reported 62% and 31% of post-menopausal Malaysian women as hypercholesterolemic and hypertriglyceridemic, respectively. Menopause has a negative effect on women's lipid-lipoprotein profile where the increase in TC, LDLC and TG levels contributes substantially to atherogenesis (Creatsas, Christodoulakos & Lambrinoudaki, 2005). A high intake of fat in the diet and a sedentary lifestyle may also contribute to high levels of TC and TG (Damodaran *et al*., 2000). The fat intake of these subjects was within their RNI and it is suggested that the high TC and TG may be due to their sedentary lifestyle as most respondents were non-working women who spent much of their time in the house. The BMI and LDLC levels of these subjects had significantly (p<0.05) affected their blood pressure. This is in line with other studies that indicated

that BMI has a significant association with blood pressure values in the mid-aged group (Zanchetti *et al.*, 2005). These correlations may also be associated with the subjects, 50% of whom were overweight, 30% obese and 48% had high levels of LDLC. Elevated LDLC is a major cause of coronary heart disease (Fletcher *et al*., 2005).

In terms of their dietary intake, the subjects reported consuming 1551-1654 kcal / d with an energy distribution of 55% carbohydrate, 15% protein and 30% fat. These figures are typical of the dietary pattern of the post-menopausal Malaysian women, as reported in other studies (Rahman *et al*., 2004; Chee *et al*., 2002). The micronutrient intakes of calcium, thiamin and niacin among the subjects in this study were less than 67% of the RNI. Previous studies (Shahar *et al*., 2000; 2007) have also reported that rural elderly Malays were deficient in micronutrients like calcium, niacin, thiamin and vitamin A since more than 50% consumed less than two-thirds of the RNI. The elderly are particularly at risk of vitamin and mineral deficiencies due to a lower dietary intake or decreased absorption of the nutrients.

Average calcium intake among the subjects was 505 mg / d which is 50% of the RNI (1000 mg calcium / day). The main source of calcium for these subjects was from vegetables such as Chinese mustard leaves, swamp cabbage and spinach. This finding is similar to previous local studies which reported a calcium intake of less than 500 mg / day among urban post-menopausal Malaysia women (Chee *et al*., 2003). The calcium intake of a majority of the subjects in this study (74%) was less than 67% of the RNI. This may due to the observation that only about 40% of the respondents reported consuming milk while the remaining did not consume milk at all. The type of milk normally consumed is powdered milk. However, powdered milk may not be a regular item in their diet probably due to their low incomes. About 90% of this population earned less than RM1500 (USD 400) when compared to only 50% of their counterparts in areas of Klang Valley having the same level of income (Rani, 2002).

Diets containing insufficient amounts of calcium may lead to low bone mineral density which may have implications on bone health (Theobald, 2005). In this study, bone health assessment based on T-score generated from QUS indicated that 42% of the screened subjects were classified as osteopenic and osteoporotic. These post-menopausal Malay women living in suburban Kuala Lumpur were at risk of low bone mass. These findings are in line with another local study (Damodaran *et al*., 2000) which reported 50% of the urban post-menopausal women referred to a menopausal clinic in Kuala Lumpur had mild osteoporosis. Low calcium intake and low bone mass among these subjects put them at a high risk of hip fractures (Chee *et al.*, 2003). This study also found that subjects' weight was positively correlated with T-score generated from QUS. It has been reported in previous studies (Korpelainen *et al.*, 2003; Schöffl *et al*., 2008) that bone mineral density at different skeletal regions is positively correlated with body weight. It exerts a beneficial effect on bone in terms of osteoporosis risk. The skeleton responds to mechanical stress in a site specific and load dependent manner (Babaroutsi *et al.*, 2005). This may be an indication that osteoporotic fractures are likely to become a major health burden as Malaysia undergoes further urbanisation and population ageing (Lim *et al.*, 2005).

CONCLUSIONS

Health screening of the subjects in this study showed that this group of post-menopausal women had calcium intake of only up to half of the recommended calcium intake of 1000 mg. Based on calcaneal measurements, almost two-thirds of the subjects were osteopenic and osteoporotic. Low calcium

intake and low bone mass among these subjects place them at a high risk of hip fractures. About 74% of the subjects were hypercholesterolemic, 58% were hypertriglyceridemic and 48% had high LDLC.

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