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Artikel Asli/***Original Articles***

Association of Bone Mineral Density to Dietary Intake and Predictors of Breast Cancer in Premenopausal and Postmenopausal Malaysian Women

(Hubungan Ketumpatan Mineral Tulang terhadap Pengambilan Pemakanan dan Peramal Kanser Payudara di Kalangan Wanita Malaysia yang Belum dan Telah Putus Haid)

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ABSTRACT

Daily food intake of women may affect their bone health by altering their bone mineral density (BMD) as the lack of certain nutrients may affect bone integrity whilst, BMD also can be a predictor of breast cancer. To date, many studies have been conducted to discuss on association of BMD and mammographic breast density (MBD) and how both are related to breast cancer risks but no consideration has been made on dietary intake. Therefore, this study was designed to determine the association of dietary intake with BMD and other breast cancer risk factors. A cross-sectional study on 76 pre- and postmenopausal women above 40 years underwent mammogram screening and Dual Energy X-ray Absorptiometry (DEXA) was conducted in Hospital Kuala Lumpur (HKL) for the duration of 1 year. Purposive sampling method was used to choose the respondents. Women who are diagnosed with breast cancer and underwent cancer treatment were excluded from this study. DEXA unit (Hologic Discovery W, Hologic, Inc) were used to measure BMD at the femoral neck and lumbar spine in grams per centimetre squared (g/cm^2) and they were classified into normal and abnormal group based on the T-scores. The subjects were asked about their daily dietary pattern for a duration of three days using Diet History Questionnaire (DHQ). The mean of selected characteristics were compared between groups. Additionally, binary logistic regression was used to determine the association between diet intake with BMD and other risk factors of breast cancer. The total number of pre- and postmenopausal women who consented to participate in this study are equal. The mean age was 47.1 years and 54.9 years for premenopausal and postmenopausal women respectively. The results indicate only menopausal age of the women was statistically significant ($p < 0.05$). A number of 17% premenopausal and 9% of postmenopausal women showed to have family history of breast cancer, however, it was not statistically significant ($p = 0.12$). There was no significant difference in daily energy intake of food in both groups ($p = 0.22$). None of the nutrients in daily food intake showed to be statistically significant. Menstrual status showed an association with BMD with $p < 0.05$ and the remaining risk factors did not show any association. Logistic regression revealed that only menstrual status had correlation with BMD in both groups. This study provided the dietary pattern and the effects on bone health. The association of other risk factors of breast cancer with BMD were also analysed and most of it showed a negative association.

Keywords: Bone mineral density; breast cancer; diet pattern; premenopausal women; postmenopausal women

ABSTRAK

Pengambilan makanan harian seseorang wanita boleh menjejaskan kesihatan tulang mereka dengan mengubah ketumpatan mineral tulang (BMD) sepertimana kekurangan nutrien tertentu boleh menjejaskan integriti tulang, manakala, BMD juga boleh menjadi peramal kanser payudara. Setakat ini, banyak kajian telah dijalankan untuk membincangkan hubungan BMD dan kepadatan payudara menerusi mammografi (MBD) dan bagaimana kedua-dua berkaitan dengan risiko kanser payudara tetapi tiada keutamaan diberikan kepada pengambilan makanan. Oleh itu, kajian ini bertujuan untuk menentukan hubungan pengambilan makanan dengan BMD dan faktor-faktor risiko kanser payudara. Satu kajian keratan rentas terhadap 76 orang wanita belum dan telah putus haid berusia 40 tahun ke atas yang menjalani pemeriksaan mamogram dan Dual Energy X-ray absorptiometry (DEXA) telah dijalankan di Hospital Kuala Lumpur (HKL) untuk tempoh 1 tahun. Kaedah persampelan bertujuan digunakan untuk memilih responden. Wanita yang didiagnosis dengan kanser payudara dan telah menjalani rawatan kanser dikecualikan daripada kajian ini. Unit DEXA (Hologic Discovery W, Hologic, Inc) telah digunakan untuk mengukur BMD di leher femur dan tulang belakang dalam gram per sentimeter kuasa dua (g/cm2) dan mereka diklasifikasikan ke dalam kumpulan normal dan tidak normal berdasarkan jumlah-T. Subjek ditanya mengenai corak pemakanan harian mereka bagi tempoh minimum tiga hari menggunakan Borang Soal Selidik Sejarah Pemakanan (DHQ). Nilai purata bagi ciri-ciri tertentu dibandingkan antara kumpulan. Selain itu, regresi logistik binari digunakan untuk menentukan hubungan antara pengambilan pemakanan dengan BMD dan faktor-faktor risiko lain kanser payudara. Bilangan wanita yang belum dan telah putus haid yang bersetuju untuk mengambil bahagian dalam *kajian ini adalah sama. Purata umur adalah 47.1 tahun dan 54.9 tahun masing-masing untuk wanita belum dan telah putus haid. Keputusan menunjukkan hanya umur wanita ketika putus haid adalah signifikan secara statistik ($p < 0.05$). Sejumlah 17% wanita belum putus haid dan 9% wanita telah putus haid mempunyai sejarah keluarga yang menghidap kanser payudara, walau bagaimanapun, ia tidak ketara secara statistik ($p = 0.12$). Tidak ada perbezaan yang signifikan dalam pengambilan tenaga dari makanan harian pada kedua-dua kumpulan ($p = 0.22$). Tiada satu pun daripada nutrien dalam pengambilan makanan harian menunjukkan perbezaan ketara secara statistik. Status haid menunjukkan hubungan dengan BMD dengan $p < 0.05$ dan faktor-faktor risiko lain tidak menunjukkan apa-apa hubungan. Regresi logistik menunjukkan bahawa hanya status haid mempunyai hubungan dengan BMD dalam kedua-dua kumpulan. Kajian ini menyediakan maklumat mengenai jenis pemakanan yang biasa diambil oleh wanita di Malaysia dan bagaimana ia memberi kesan kepada kesihatan tulang. Hubungan faktor risiko lain kanser payudara dengan BMD juga dianalisis dan kebanyakannya menunjukkan hubungan negatif.*

Kata kunci: Ketumpatan mineral tulang; kanser payudara; corak pemakanan; wanita belum putus haid; wanita telah putus haid.

INTRODUCTION

The International Agency for Research in Cancer (GLOBOCAN) 2012, estimated the age standardised rate (ASR) of breast cancer in Malaysia as 38.7 per 100,000 with 5,410 new cases detected in 2012 and is increasingly common in Malaysia (Yip et al. 2014). Breast cancer is the most frequently diagnosed cancers among women in developing countries (Jemal et al. 2009; Farley et al. 2010) and Malaysia is one of the developing countries with a high number of breast cancer incidences every year.

A collaborative study between two tertiary academic hospitals in Malaysia and Singapore found that approximately 50% of women were diagnosed before the age of 50 years (Pathy et al. 2011), whereas in UK and Netherlands, only 20% are diagnosed before age 50 (Yip & Taib 2014). The presence of breast cancer at an early age leads to increase in the mortality rate of women at younger age.

Research indicated estrogen exposure of a woman has an influence on breast cancer occurrence. The prolonged duration of exposure to estrogen, reflected by reproductive history, young age at menarche, late menopausal age and the use of hormone replacement therapy are known to be risk factors of breast cancer (Burstein et al. 2011). Moreover, previous study has reported lifetime exposure to modestly increased estrogen levels could produce a large cumulative effect on hormone-dependent disease risk (Yong et al. 2009).

Mammographic breast density had been shown to be a strong risk factor for breast cancer, whereby there is a six fold increase from the highest to no density detected on mammogram (McCormack & Silva 2006). However, the effect of these risk factors on breast cancer varies due to the influence of other factors like environment and hormone-receptor status at different stages of life (Razif et al. 2011).

Another factor is bone mineral density (BMD), which is a reflection of endogenous and exogenous estrogen exposure is still being studied. Zambetti & Tartter (2011) reported women with high bone density are at significantly increased risk of developing breast cancer in contrast to lower bone density. An underlying common pathway involving endogenous estrogen exposure or responsiveness to estrogen may link mammographic breast density and bone mineral density (Crandall et al. 2007; Sung et al. 2011).

However, recent evidences suggested that the relationship between MBD and BMD are still unclear (Kerlikowske et al. 2005; Gupta et al. 2008; Sung et al. 2011). According to previous research, dietary factor were thought to be responsible for about 30% of all cancers in developed countries and for 20% in developing countries (Key et al. 2004; Linos et al. 2007; Nahleh et al. 2011). A positive association was shown between total energy intake and area of dense MBD (Mishra & Silva 2011).

As for BMD, many studies have proved that lack of dietary vitamin D and calcium may cause low BMD level (Tajik et al. 2014). Adequate calcium and vitamin D intake were shown to have important role in prevention of osteoporosis and osteopenia in women (Hejazi et al. 2009; Delavar et al. 2008). Other nutrients such as vitamin K, potassium, protein and food groups consisting of caffeine, fruit and vegetables have shown an effect on indices of bone health (Cockayne et al. 2006; Tucker et al. 2006; Macdonald et al. 2008) although clear relationships had not been elucidated (Hardcastle et al. 2011).

However, studies of diet and cancer are complicated by the fact that in case-control studies there is a large potential for recall bias, whereas in cohort studies, diet is often explored many years before onset of cancer (Qureshi et al. 2011). Besides, several studies have proven that physical activity is significantly associated with reduced risk of breast cancer (Wu et al. 2013) and amount of regular physical activity at a moderate level in which women take part each day can have a significant impact on the maintenance of bone density (Muir et al. 2013).

To date, many studies have been conducted to discuss on association of BMD and MBD and how both are related to breast cancer risk but no consideration has been made on dietary intake. Therefore, this study was designed to determine the association of dietary intake with BMD and other breast cancer risk factors.

EXPERIMENTAL METHODS

A cross-sectional study was conducted at Radiology Department, Hospital Kuala Lumpur (HKL) for a time period of a year. The commencement of study was after the approval from the Institutional Review Board at National Medical Research Register [NMRR-15-198-24414(IIR)] and University Kebangsaan Malaysia Medical Center (NN-017-2015). A total of 76 women aged 40 years and above were chosen using purposive sampling with exclusion of women who had cancer treatment. Upon giving informed consent they underwent mammography and Dual X-ray Absorptiometry (DEXA) examination.

The respondents were then interviewed regarding sociodemographic characteristics which are inclusive of age, race, menarche age, marital status, age at menopause, smoking habit, family history of breast cancer, alcohol consumption, breastfeeding experience, menses status, contraceptive usage, and hormone replacement therapy (HRT) usage. Diet History Questionnaire (DHQ) was used to determine the food intake pattern of the respondents. The questionnaire used in this study was previously validated and was suitable to be used for women in Malaysia (Shahar et al. 2000; Salleh et al. 2011).

Explanation was given by the interviewer about details of types of food, meal size and method used in preparing food that they consume each day for breakfast, morning tea, lunch, evening tea and dinner for a week duration and other information obtained were where, when and with whom they normally have their meal. Dietary components such as protein, carbohydrates, fat, calcium, vitamin K, phosphate and iron were included as the possible nutritional composition that could contribute to normal or abnormal BMD level. The data obtained from the interview were inserted in Nutritionist Pro ™ 2003 (Axxya System Stafford, United States of America) to determine the total amount of nutrient intake.

DEXA unit (Hologic Discovery W, Hologic, Inc) were used to measure BMD at the femoral neck and lumbar spine in grams per centimetre squared (g/cm^2) as shown in Figure 1 Besides, the BMD also were expressed as T-scores, using the World Health Organization (WHO): normal: T-score ≥ -1 standard deviation (SD); osteopenia: T-score between -1 and -2.5 SDs; osteoporosis: T-score ≤ -2.5 SDs. A BMD T-score of < -1 SD is considered abnormal (osteopenia and osteoporosis are grouped together) in this study. Mammograms were done using digital mammography system (General Electric Senographe Essential). The determination of breast composition was defined by the BIRADS categorization by an experienced radiologist. The breast density category were listed as BI-RADS 1: the breasts are almost entirely fatty, BI-RADS 2: there are scattered areas of fibroglandular density, BI-RADS 3: the breasts are heterogeneously dense, BI-RADS 4: the breasts are extremely dense.

The selected characteristics were compared between pre- and postmenopausal women using independent t-test and chi-square test for continuous and categorical data respectively. A logistic binary regression was used to determine the association of BMD, diet intake and other breast cancer risk factors. All analysis was performed using Statistical Packages for Social Science (SPSS) version 21.0 (SPSS Inc, Chicago IL, USA) with p-value less than 0.05 were considered with significant difference.

RESULTS

A total of 76 women consented to participate in this study. They were categorized into two groups consisting of pre- and postmenopausal women with 38 women in each group. The mean age was 47.1 years and 54.9 years for premenopausal and postmenopausal women respectively. Figure 1 shows the frequency distribution of BMD hip and spine T-score of both pre- and postmenopausal women. It showed that the number of women affected by osteopenia and osteoporosis is higher in postmenopausal women. Therefore, it can be concluded that bone density in women deteriorates during postmenopausal time with and risk of osteoporosis.

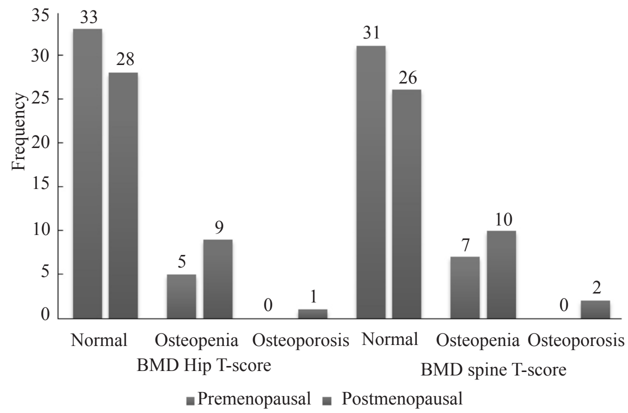

FIGURE 1. Frequency distribution of BMD Hip T-score and BMD Spine T-score of pre-and postmenopausal women

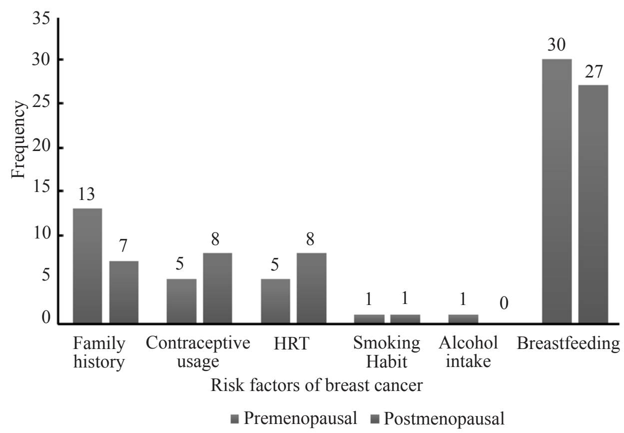

FIGURE 2. Frequency distribution of breast cancer risk factors among pre- and postmenopausal women

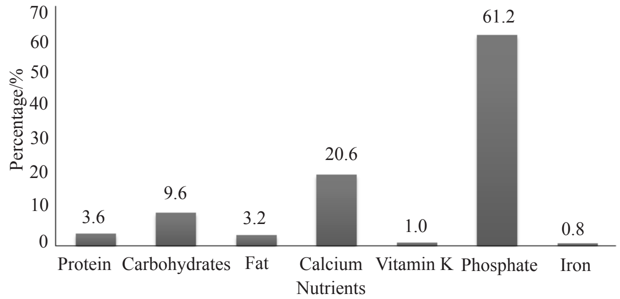

FIGURE 3. Percentage of daily nutrient intake for duration of 3 days

The frequency distribution of breast cancer risk factors among pre- and postmenopausal women is shown in Figure 2. The histogram showed that smoking habit and alcohol intake are relatively low in both groups. HRT (n = 13) and contraceptive usage (n = 12) is shown to be higher in postmenopausal women.

Figure 3 above shows the percentage distribution of micronutrients (vitamins and minerals) and macronutrients (carbohydrate, protein and fat) that was consumed by the women from the both group tested for the duration of three days. The result indicated the percentage of micronutrients taken (calcium and phosphate) is higher compared to macronutrients. Moreover, in macronutrient dietary components carbohydrate is shown to be more consumed than fat and protein.

Table 1 shows the demographic details of respondents involved. The results indicated only menopausal age of the women was statistically significant ($p < 0.05$). A number of 17% premenopausal and 9% of postmenopausal women showed to have family history of breast cancer, however, it was not statistically significant ($p = 0.12$). There was no significant difference in daily energy intake of food in both groups ($p = 0.22$). The dietary assessment revealed that the subjects had a mean (± SD) of 2,091.9(2,695.4) for premenopausal women and 1,547.9(404.1) for postmenopausal women. There were several risk factors analysed such as family history ($p = 0.12$), contraceptive usage ($p = 0.21$), HRT ($p = 0.36$), smoking habit ($p = 1.00$), alcohol intake ($p = 0.31$), breastfeeding ($p = 0.43$) and BMD of hip and spine ($p = 0.28$, $p = 0.23$ respectively) and none proved to be statistically significant.

None of the nutrients in daily food intake was statistically significant (Table 2). Mean calcium intake in premenopausal women with abnormal BMD hip and spine showed to be high (hip: 895.5, spine: 877.4). The association between BMD and daily dietary intake is shown in Table 3 and none of the nutrients showed to be associated with BMD. The results also showed that daily energy intake is not associated with BMD of both hip and spine ($p = 0.7$). Other risk factors of breast cancer were also analysed to find out the association with BMD (Table 4). Menstrual status showed an association with BMD with $p < 0.05$, however other risk factors did not show an association with BMD.

DISCUSSION

The purpose of this study is to determine the association of diet intake with BMD and other risk factors of breast cancer. Postmenopausal status is a major risk factor for low BMD there is a reduction in serum estrogen levels leading to bone loss (Waugh et al. 2009). Estrogen played an important role in skeletal maintenance due to its osteoprotective action (Imai et al. 2010). In addition, age is one of the non-modifiable risk factors of osteoporosis (Ahmad et al. 2015) and age was reported to be the main factor that contributes to osteoporosis, especially with the age of 70 years and above (Maria et al. 2008).

In this study, age showed a significant difference in both pre- and postmenopausal women and in contrast to this, BMD is not significantly different. However, increased BMD level can increase risk of breast cancer proven by several observational studies have suggested that a higher bone mass is associated with increased breast cancer risk and less favourable prognosis of an existing breast cancer (Chen et al. 2008; Grenier et al. 2011; Kalder et al. 2011).

The result also revealed that there is no significant difference in any of the tested nutrients in daily diet intake with BMD. Similar result were obtained in a study conducted by Yee et al. (2013) which concluded that none of the dietary factors had shown significant impact or effect on BMD at all sites. Classification of nutrients can be divided into two which are the macronutrient (grams of carbohydrates, proteins, lipids, and sugars) and also micronutrient (calcium, iron, vitamin B6, vitamin B12, vitamin A, vitamin C, and vitamin D) consumed (Roura et al. 2016).

In macronutrient dietary components, it is shown that intake of carbohydrate is the highest. It has been suggested in a study that low-CHO (carbohydrate) diets may impact negatively on bone health because of promotion of urinary calcium loss. This may be of importance to women and the elderly as they are prone to developing low bone mineral density and osteoporosis (Adam-Perrot et al. 2006). Whereas, effects of high carbohydrate intake on women's bone mass have been varied, depending on the type of carbohydrate (Karamati et al. 2014).

Moreover, despite the great importance of adequate phosphorus intakes for bone health and integrity (Nieves 2005), some evidence exists that high dietary phosphorus intake, by depressing ionized calcium, leads to an elevation in serum parathyroid hormone level and consequently increases bone resorption (Calvo et al. 1988). The subjects in this study consumed high amount of phosphorus in their diet but there is no evidence of association with BMD in this study which maybe the small sample size.

The present study also showed that the average daily energy intake of women was lower than the recommended nutrient intake (RNI) for Malaysian adult women all age groups (19-29 years: 2000 kcal/day; 30-59 years: 2180 kcal/day; ≥ 60 years: 1780 kcal/day) based on the National

TABLE 1. Characteristics of included respondents

Characteristics	Overall	Premenopausal	Postmenopausal	*p*-value
Number of patients (*n*)	76	38	38	
Age (SD)/years	76	47.1 (4.2)	54.9 (3.1)	0.00 [a]
BMI (SD)//kgm^{-2}	76	28.9 (5.9)	26.9 (5.4)	0.95[a]
Menarche age (SD)/years	76	13.1 (1.6)	13.0 (2.1)	0.90 [a]
Menopausal age (SD)/years	76	–	49.3 (5.5)	0.00 [a]
Daily energy intake (SD)/Kcal	76	2091.9 (2695.4)	1547.9 (404.1)	0.22 [a]
MBD BI-RADS	76	38 (2.4)	38 (2.0)	0.09 [b]
Fatty/%	12	3 (3.9)	9 (11.8)	
Scattered/%	38	18 (23.7)	20 (26.3)	
Heterogeneous/%	24	15 (19.7)	9 (11.8)	
Extreme dense/%	2	2 (2.6)	0 (0)	

[a]Independent t test, [b]Chi-square

TABLE 2. Classification of BMD and dietary intake (mean (SD)) for premenopausal and postmenopausal women

	BMD Hip Category				BMD Spine Category				
	Normal		Abnormal		Normal		Abnormal		*p*-value
	Premenopausal 1	Postmenopausal 1	Premenopausal 1	Postmenopausal 1	Premenopausal 1	Postmenopausal 1	Premenopausal 1	Postmenopausal 1	
Calcium/mg	443.7 (351.9)	396.4 (173.1)	895.5 (748.0)	462.2 (306.8)	433.0 (344.9)	442.2 (248.9)	877.4 (692.8)	351.9 (80.5)	0.34 [a]
Protein/g	90.9 (171.2)	611.9 (26.4)	129.9 (142.1)	68.7 (28.3)	90.4 (173.5)	67.3 (27.2)	126.1 (130.7)	55.9 (24.9)	0.98 [a]
Carbohydrate/g	194.2 (101.5)	191.1 (48.2)	500.8 (768.9)	201.6 (49.8)	194.1 (99.5)	195.8 (43.8)	450.6 (701.9)	189.8 (58.5)	0.14 [a]
Fat/g	75.8 (105.3)	57.1 (22.7)	158.6 (220.5)	58.6 (26.0)	74.6 (106.5)	58.3 (25.8)	150.8 (199.3)	55.6 (17.2)	0.42 [a]
Vitamin K/mico g	43.6 (137.6)	3.3 (3.7)	5.7 (7.6)	7.7 (6.9)	25.5 (89.9)	3.4 (4.2)	108.6 (255.5)	6.8 (6.1)	0.314 [a]
Phosphate/mg	1422.8 (2027.3)	1164.6 (644.2)	2248.4 (2113.1)	1287.2 (657.8)	1405.7 (2034.8)	1300.1 (691.2)	2201.9 (2038.9)	973.2 (465.6)	0.95 [a]
Iron/mg	17.2 (19.9)	15.3 (14.3)	38.1 (65.9)	14.9 (9.3)	15.5 (18.9)	16.9 (14.9)	43.7 (58.2)	11.6 (6.6)	0.32 [a]

[a]Independent t test

TABLE 3. Association of BMD with dietary intake (Mean (SD))

	BMD Hip Category			BMD Spine Category		*p*-value
	Normal	Abnormal	p-value	Normal	Abnormal	
Vitamin K/mico g	25.1(102.5)	7.1(6.9)	0.700[c]	15.6(67.3)	40.7(147.2)	0.39[c]
Iron/mg	16.3(17.5)	22.7(37.8)	0.519[c]	16.1(17.1)	22.3(35.6)	0.85[c]
Phosphate/mg	1304.3(1547.7)	1607.6(1331.8)	0.839[c]	1358.4(1569.7)	1382.7(1310.8)	0.46[c]
Carbohydrate/g	192.8(80.9)	301.4(438.0)	0.752[c]	194.8(78.9)	276.7(403.9)	0.70[c]
Protein/g	77.6(127.1)	89.1(84.7)	0.574[c]	80.0(129.7)	79.3(81.2)	0.57[c]
Fat/g	67.2(78.9)	91.9(129.2)	0.430[c]	67.3(80.8)	87.3(118.3)	0.85[c]
Calcium/mg	422.0(282.9)	606.6(514.8)	0.205[c]	437.1(303.2)	527.1(458.6)	0.30[c]
Daily energy intake/Kcal	1680.2(1463.7)	2388.2(3228.3)	0.416[c]	1699.1(1486.5)	2209.2(2979.8)	0.70[c]

[c]Binary logistic regression.

TABLE 4. Association of BMD with other risk factors (Mean (SD)) of breast cancer

	BMD Hip Category			BMD Spine Category		
	Normal	Abnormal	*p*-value	Normal	Abnormal	p-value
Family history	1.8(0.4)	1.7(0.5)	0.226[c]	1.7(0.4)	1.7(0.5)	0.58[c]
MBD BIRADS	2.2(0.7)	2.3(0.8)	0.370[c]	2.2(0.7)	2.3(0.8)	0.40[c]
BMI	27.4(5.9)	25.1(4.2)	0.176[c]	27.6(5.8)	24.7(4.4)	0.04[c]
Menarche age	13.1(1.8)	12.8(2.2)	0.849[c]	13.1(1.8)	12.8(2.2)	0.36[c]
Menopausal age	23.3(24.5)	33.1(23.9)	0.660[c]	22.9(24.6)	32.8(23.4)	0.07[c]
Menses status	1.5(0.5)	1.7(0.5)	0.000[c]	1.5(0.5)	1.7(0.5)	0.00[c]
Contraceptive	1.9(0.4)	1.8(1.9)	0.539[c]	1.8(0.4)	1.8(0.4)	0.57[c]
HRT	1.8(0.4)	1.8(0.4)	0.571[c]	1.8(0.4)	1.8(0.4)	0.89[c]
Smoking habit	1.9(0.1)	1.9(0.1)	0.511[c]	1.9(0.2)	2.0(0.0)	0.99[c]
Alcohol intake	1.9(0.1)	2.0(0.0)	1.000[c]	1.9(1.3)	2.0(0.0)	1.00[c]
Breastfeeding	1.2(0.4)	1.3(0.5)	0.577[c]	1.2(0.4)	1.3(0.5)	0.76[c]

[c]Binary logistic regression

Coordinating Committee on Food and Nutrition (2005). In relation to diet intake, BMD and breast cancer, the most commonly discussed nutrients are calcium and vitamin D because both are crucial in maintaining bone integrity and lack of these nutrients may increase the chances of breast cancer (Kruk 2015; Tajik et al. 2014; Ahmad et al. 2015).

Both vitamin D and calcium are related to each other as vitamin D is required to optimize the absorption of calcium, being essential for bone health (Quesada-Gómez et al. 2013). However, in this study we tested vitamin K and calcium with BMD and the result showed that both did not have positive correlation with BMD. Vitamin K is best known for its function in the blood coagulation pathway, but it also plays a role in bone metabolism (Hamidi et al. 2013), whereas, calcium is another vital nutrient that commonly related to the BMD level as calcium is the most important nutrient for preventing bone loss with aging (Quesada-Gómez et al. 2013).

According to RNI, Malaysia (2005) the total calcium intake should be 800 mg/day for women aged 19-50 and for women above 50 it should be 1000 mg/day. The result showed that the daily calcium intake is lower that the recommended value in both groups which may have contributed to the non-association with BMD or the smaller sample size.

The inability of the respondents to recall diet and portion sizes consumed was a limitation of the study. To overcome this, a Food Frequency Questionnaire would be more accurate in identifying amount of nutrients taken and can be used in future studies. Moreover, the present study was cross-sectional; therefore it cannot be evidence on cause and effect relationship as it is not able to assess the long term effect of nutrients on bone health status. In addition, the lifestyle of Malaysian was not suitable to predict risk factors such as HRT, alcohol intake and smoking as majority of the subjects do not use them.

CONCLUSION

There is no positive association between dietary intakes and BMD however there was baseline information on the dietary pattern. Logistic regression revealed that only menstrual status had a significant association with BMD in comparison to other risk factors. Hence postmenopausal women are more likely to be affected by low BMD leading to osteopenia or osteoporosis.

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