EFFECTS OF BODY MASS INDEX (BMI), EATING ATTITUDE AND PHYSICAL ACTIVITY ON BONE HEALTH AMONG UNDERGRADUATE STUDENTS IN MALAYSIA

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Abstract

Healthy and strong bones form the basis for a dynamic and energetic life. However, Malaysian university students still lack of knowledge towards positive bone health status and osteoporosis prevention and show a poor practice of healthy lifestyle. Therefore, this study was done to examine the relationship of eating attitude and physical activity on bone health among undergraduate students from the Faculty of Educational Studies in Universiti Putra Malaysia. A correlational study design was conducted to 281 undergraduate students aged 18 to 27 years old. The respondents were randomly chosen based on the stratified and cluster sampling technique. In this study, the eating attitudes were assessed using EAT-26 while, the physical activity level of the respondents was evaluated by using a shorter version of the International Physical Activity Questionnaire (IPAQ-SF). Bone Mineral Density (BMD) of the respondents was measured using calcaneal quantitative ultrasound (QUS) by using Sonost-3000 machine. From the Pearson correlation analysis, there was a negative and weak relationship of eating attitude and BMD (r= -.218) and strong relationship between physical activity and BMD (r=.731). Thus, the result of this study gives better information on how physical activities are essential to promote an improvement in BMD. A better understanding of the interactions of all these variables in this study will relate to positive bone health status and osteoporosis prevention among young adults, especially among the university students.

Keywords: Bone Mineral Density (BMD), Eating Attitude, Physical Activity, Osteoporosis.

1. INTRODUCTION

Healthy and strong bones form the basis for a dynamic and energetic life. Our skeletons convene flexibility, mobility and mechanical support and serve as a calcium reservoir, which the body draws upon to help sustain regular levels of calcium in the blood. According to Haskell, Lee, Pate, Powell, Blair, Franklin & Bauman (2007), although bones often are viewed as passive, they really are vigorous and living tissue where formed from calcium, matrix of collagen and other proteins. Therefore, when the level of calcium decreases and all the sources will contributes to the development of bone mass loss, osteopenia and finally osteoporosis. According to Keunn (2007), reduced bone density is defined in two ways. The first one is osteopenia refers to lower than the expected bone mineral density (BMD). Besides, osteopenia refers to a particular age, but not low enough to be classified as osteoporosis (Keunn, 2007). While, osteoporosis is a progressive disease characterized by low BMD and deterioration of bone tissue, leading to skeletal fragility and increases risk of fracture. Although it is generally granted that osteoporosis is considered as a disease that showed during old age, many previous evidence indicates that lowering of the BMD may have its origins

at an earlier stage in life by failure to achieve optimal peak bone mass during childhood and adolescence (Arabi, Nabulsi, Maalouf, Choucair, Khalife, Vieth & Fuleihan, 2004).

Based on previous studies, lifestyle such as balanced diet (good eating attitude) and active in physical activity have positive effects on bone health especially delaying in bone loss and osteoporosis (Alghadir, Gabr, & Al-Eisa, 2015; Barry & Kohrt, 2008). Besides that, the change in bone mass and contents are influenced by many other parameters such as genetic, peak bone mass and other lifestyle factors such as smoking, alcohol consumption and body weight maintenance (Alghadir, Gabr & Al Eisa, 2015).

According to Kruger, Todd, Schollum, Kuhn-Sherlock, Mclean & Wylie (2013), current statistic shows that Asians and Caucasians can be classified as those who are at high risk of getting osteoporosis. In addition, information or studies relating to the level of knowledge and awareness of bone health status and its risk factors are still very limited among young Malaysian adults (Wan, Mohd, Aziza & Foo, 2010).

Studies from Sham, Shdaifat, Majid, Khairudin, Zainol & Majid (2013) and Al Naggar, Bobryshev, & Mohd, Nor (2013), had stated that Malaysian university students still lack of knowledge towards positive bone health status and osteoporosis prevention and showed a poor practice of healthy lifestyle. Based on previous research, which examined self-presentation theory, has found that, the problem with Malaysian collegiate students was that they are more concerned with their physical appearance than their internal health (Kamarul, Ahmad & Loh, 2006). From the findings, those who are concerned with their appearance and how others perceive them are more likely to engage in excessive exercise behaviors. Besides that, Pon & Coly (2004) also reported that chronic dieting and habitually low total food intake will result in low levels of various essential nutrients that affect the development of bone.

Based on the previous argument, there is a gap in practice of the college students in maintaining healthy lifestyle in conjunction with bone health. Our hypothesis for the study are those who are highly engaged in physical activity and good eating attitude will have better bone health or in other words better bone mineral density. Hence, identifying the mechanisms that optimize BMD gain in college students may be the best response for osteoporosis prevention and other health parameters. Thus, this study aimed to determine the correlation among BMI, eating attitude and physical activity on BMD on undergraduates in the Faculty of Educational Studies in Universiti Putra Malaysia (UPM). Apart from that, mean of differences between genders was also determined for all the variables.

2. METHODS

2.1. Participants

A total of 281 undergraduates were recruited from Faculty of Educational Studies for this study. Their age ranges from 18 to 27 years old. Since the population of the study comprises six different departments of the faculty, characteristics of the sample should represent the whole population. Therefore, proportional stratified sampling was used where a proportion of each stratum or department were taken as subjects according to the percentage of the population of each departments.

2.2. Instrumentations

The instruments used in this study were self-administered questionnaires in the form of a booklet, weighing scale and Sonost 3000 machine, a device for bone densitometer which estimates the BMD of the calcaneus by ultrasound. All of the data collection was done quantitatively. The questionnaires consisted of three parts which were part A (Demographic profile), part B (Eating Attitude test-EAT-26) and part C (International Physical Activity Questioner-IPAQ).

2.3. Design and procedures

This study is quantitative in nature and adopts correlational study design. Approval letter to conduct the study was obtained from the university's Human Ethics Committee and the Faculty Educational Studies, UPM before actual study was carried out. Total number of the population was obtained from the faculty to get the number of the sample size. A pilot study was also conducted to verify the validity of the questionnaires that was used. The actual study was done following the same protocol with minor modifications.

2.4. Data analysis

Independent sample T-test was used to determine the differences of BMI, eating disorder attitudes, level of physical activity and BMD between male and female undergraduate students. Next, the Pearson correlation test was used to determine the relationship between BMI, eating disorder attitude and physical activity on bone health among undergraduate students in the Faculty of Educational Studies, UPM.

3. RESULT

The total number of participations in this study was 281, where 149 were females and 132 were males. Therefore, the frequencies and percentage of BMI, eating attitude, physical activity and BMD were measured as shown in Table 1.

Table1. Frequencies and Percentage of BMI, Eating attitude, physical activity and BMD

Item	Frequency	Percent (%)
BMI		
Underweight (<18)	13	4.6
Normal weight (18.5-22.9)	128	45.6
Overweight (23-24.9)	97	34.5
Obese (25- 29.9)	43	15.3
Eating attitude (EAT-26)		
<20 (Normal eating attitude)	209	74.4
>20 (Prone to eating disorder attitude)	72	25.6
Physical activity level (MET) level		
Vigorous (>3000 MET-min/week)	154	54.8
Moderate (600-2999MET-min/week)	43	15.3
Inactive or low (< 600 MET-min/week)	84	29.9
Bone mineral density (BMD) level		
T>-1.0 (Normal)	179	63.7
T-2.5 to -1.0 (Osteopenia)	94	33.5
T=<-2.5 (Osteoporosis)	8	2.8

Based on the table score of the frequency and percentage above, it was shown that most of the respondents were in the normal weight categories, with 45.6% of the population. Meanwhile, 209 of the respondents had EAT-26 test score of less than 20 and 72 of the respondents had EAT-26 test score of over than 20. The MET result showed that most of the respondents were at vigorous level and only 29.9% at the inactive or low level. Last but not least, the frequency and percentage of bone health level was higher at the normal level compared to those at risk of osteoporosis (low level)

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Table 2. Comparison of BMI, Eating attitude, Physical activity and BMD

Items	Gender	N	Mean	SD	df	t	P
BMI	Male	132	22.09	2.58	279	2.52	.022
	Female	149	22.78	2.60			
Eating attitude test (EAT-26)	Male	132	17.64	5.37	279	-2.00	.041
	Female	149	19.71	10.75			
Physical Activity level	Male	132	2133.95	940.36	279	-2.85	.013
	Female	149	2610.07	1194.01			
BMD level	Male	132	86.43	24.18	279	-1.27	.012
	Female	149	98.00	27.05			

Table 2 above showed that there was a significant difference between male and female respondents in the BMI, $t(279) = 2.52$; $p < 0.05$, eating attitude $(279) = -2.00$; $p < 0.05$, physical activity, $t(279) = -2.85$; $p < 0.05$ and BMD $t(279) = -3.27$; $p < 0.05$.

Table 3. Correlation analysis of BMI, Eating attitude and Physical activity on BMD

		BMD level
BMI	Pearson Correlation	.292**
	Sig. (2-tailed)	0.000
Eating attitude (EAT-26)	Pearson Correlation	-.218**
	Sig. (2-tailed)	0.000
Physical activity level (MET)	Pearson Correlation	.731**
	Sig. (2-tailed)	0.000

**. Correlation significant at the 0.01 level (2-tailed).*

Table 3 above showed the correlation value of BMI and BMD level which was at .292. Therefore, it showed that there was a weak relationship between the BMI and BMD levels, r=.292, p= <0.01. Next, is the correlation value of eating attitude and BMD level was at -.218. Therefore, it shows that there was a negative weak relationship between the EAT-26 and BMD levels, r=-2.18, p=<0.01. The correlation value between the MET or physical activity level and BMD level was at .731. This shows that the physical activity level and BMD have strong relationships which is r=0.731, p=<0.01. In conclusion, all of the independent variables: BMI, eating attitude and physical activity have a significant relationship on the dependent variable, BMD.

4. DISCUSSION

Analyses revealed that there was a significant difference in the BMI categories among male and female students *t* (279) = 2.52; p < 0.05). The result shows that male respondents tended to have a normal BMI than female respondent. This finding was in line with the studies by Kuan, Ho, Suhaili, Siti & Gudum (2011), Aslam, Saeed, Pasha & Altaf (2010) and Zalilah, Mirnalini, Khor, Merlin & Bahaman (2006), where they concluded that based on the three general categories of BMI, it showed that male respondents were more prevalent to have a normal BMI than female. Furthermore, many previous researches in Malaysia found out that Malaysians tend to practice poor diet in their daily meal where most foods are oily and fatty that has caused the obesity level to rise even among youngsters especially among females (Abdul Rahim, 2003).

Next, in term of eating disorder attitude, it seemed that females are at a higher risk compared to the male respondents. The finding of this present study was in line with the studies by Sue & Wan (2012), Birli, Zhang & McCoy (2012) and Kuan et al; (2011) where they indicated that eating disorder attitude among females have been a main problem in all ages. Moreover, this trend tends to be more prevalent in college age students. The reason being is that most appreciate outer look appearance with perfect body shapes and beautiful faces with restricted food intake, such as eating extremely small amounts of food (Sue & Wan, 2012).

However, in terms of participation in physical activity, female respondents were seen to frequently participate in physical activity during the last 7 days. This finding was supported by Abu Saad, Kalmi, Taib, Nasir, Yassin & Tabata (2014) and Buckley, Lange & Peterson (2014), where they indicated that engagement in physical activity among females was higher than males. The finding of this study also was consistent with the study by Kubaisy, Muhammad, Ismail & Abdullah (2015), which found that females showed a significantly higher rate in performing brisk walk compared to males. The reason may be due to the preference of walking compared to running or going to the gym as walking is easy to perform, safe, effective, less injury and does not require any training or equipments (Abadi, Muhammad & Salamuddin. 2010). However, level of physical activity among young adults, especially university students are still below recommended guideline. This is due to time constraint from busy lesson schedules and academic commitment (Irwin, 2004; Arzu, Tuzun, & Eker, 2006; Douglas, Collins, Warren, Kann, Gold, Clayton & Kolbe, 2007).

Results on bone density also showed that female respondents had higher BMD compared to males. These findings were supported by Sham, Shdaifat, Majid, Khairudin, Zainol & Majid (2013) and Wan, Arnida, Noorul, Mohd Novizar & Anuvat (2012), where they found that the majority of the female respondents had

normal bone status than male respondents. This is because male respondents have a higher perception of barrier to calcium intake compared to female respondents during this age. Besides that, female students are more knowledgeable regarding calcium intake compared to their counterparts (Sham et al., 2013). This was due to the lack of knowledge on calcium and bone health demonstrated by male respondents (Wan et al., 2010).

This study also showed that the BMI, eating attitude and physical activity have correlated on bone health status. Furthermore, Lim, Bae, Lee & Ahn (2008), indicated that BMI level of person is considered one the most powerful predictors of bone status and adipose tissue plays a substantial role in weight related protective effect on bone. Traditionally, the BMI level viewed to be valuable information to bone health because of the established positive effect of mechanical loading conferred by body weight on bone formation. In addition, the putative mechanism relevance of adipose tissue for skeletal integrity probably resides in the role of several adipokines in bone remodeling through effect on both formation and resorption (Salamat, Salamat, Abedi, & Janghorbani, 2013). Paniagua, Malphurs & Samos (2006), also stated that higher BMI level tends to be higher of estrogen level which is explained by increased aromatization of testosterone to estrogen in adipose tissue. Then, according to Elsawy & Header (2014) higher content of lipid of fat in our body seems to encourage of secretion of hormone in our body such as leptin, adiponectin, osteocalcin, testosterone, estrogens and systemic calcium regulating hormones like vitamin D and parathyroid hormone in maintaining healthy bone. However, contrary with the study by Oommen, AlZahrani, Shoro, Alruwaili & Aboalseelit (2014), was found that 50% of the obese patients had low BMD and shows that there was no significant association between BMI and BMD. This because their finding shows that obesity is not a protective factor for BMD in Saudi Arabia. This is also true cause with BMI of higher than 30 might not be a preventive factor for osteopenia or osteoporosis among those who are in their post menopausal period (Ashok et al., 2016).

Next, based on the negative relationship between the eating attitude and BMD explained that the lower score of the EAT-26 (eating disorder attitude) the higher the level of BMD. Although the majority of the respondents in this study was classified as asymptomatic or free of problematic eating, 72 participants had a score of 20 and above, indicating a risk for problematic or disordered eating. Bennell, Malcolm, & Thomas (1995), also indicated that abnormal dietary restraint behaviors or restricted caloric intake may lead to amenorrhea, increased bone desorption, low BMD, or maximised risk of stress fracture. Therefore, the result of this present study was consistent with the previous studies that also examined eating attitude disorder in relation to bone mineral density among university students found that bad eating attitude in male and female students independently predicts lower BMD and closely linked with an increase in endogenous cortisol production and decrease in BMD (Sokoloff, Eguiguren, Wargo, Ackerman, Baskaran, Singhal, & Misra, 2015; Schvey, Tanofsky-Kraff, Yanoff, Checchi, Shomaker, Brady & Yanovski, 2009).

The correlation value between physical activity level and BMD level in this study was .761. Therefore, it also showed that physical activity and BMD have a positively strong relationship, $r=.761$, $p=<0.01$. The result of this study was supported by Sham et al. (2013) where they stated that physical activity was effective to help minimize bone loss and osteoporosis. Other than that, the result of this study also was in line with the data from numerous cross-sectional studies demonstrate a positive association between BMD and physical activity (Barry and Kohrt, 2008). Furthermore, the effectiveness of weight bearing physical activity on bone growth during childhood and adolescent was linked and some examples of weight-bearing exercises include weight training, walking, jogging, hiking, climbing stairs, tennis and dancing.

5. CONCLUSION

This study found that BMI, eating attitude and physical activity have an effect on bone health status as well as minimizing bone loss. Therefore, by referring to this present study it is important to achieve and maintain an optimum bone health. Knowing about the bone health status among the university students will help by embracing life and maintaining the nutritional standards that will help to avoid disease such as bone diminishing disease. Furthermore, university students who have good knowledge about osteoporosis are key factors in raising the community awareness about this disease. In addition, optimum bone health also requires a mix of many modifiable and non-modifiable factors. Osteoporosis is a silent epidemic with enormous scope and public health effects for millions of women and men and now, it has become worse among Asians globally. Therefore, the researcher concludes that by considering these three parameters as well as modifiable risk factors will help to maintain and improve BMD as well as bone health among Malaysian university students.

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